



SIEMENS

SIEMENS

ODOUR CONTROL SYSTEM

ODOUR CONTROL UNITS FOR SEWAGE PUMP
STATIONS 01, 33 & 34

QUEENSLAND URBAN UTILITIES
Operation and Maintenance Manual



**ZABOCS BIOLOGICAL ODOUR CONTROL
SYSTEMS**

2 X ZB-5000

4 X ZB-4000

**PROVISION OF DESIGN, SUPPLY AND
INSTALLATION OF VENT GAS ODOUR CONTROL
UNITS FOR SEWAGE PUMP STATIONS 01, 33 & 34**

Operation and Maintenance Manual
Revision 0

Supplied to:
Queensland Urban Utilities
Contract No. I112-013

Congratulations on your selection of this Siemens Water Technologies product. In choosing Siemens Water Technologies, you have selected components and systems that are engineered to give you superior dependability and performance, combining advanced technology, functional design and high quality craftsmanship.

Our commitment to quality is equalled only by our commitment to the customer.

Customer Service Contact Information

Siemens continually strives to provide safe, efficient, trouble-free equipment using the optimum technology for your application. If problems should develop, Siemens' worldwide network of technical support will be available to provide assistance.

For customer service, please record your equipment and serial number details and direct your enquiry to:

Siemens Ltd, Water Technologies
ABN 98 004 347 880

160 Herring Road
Macquarie Park
NSW, 2113
Australia

Phone: +61 (02) 9491 5425

Fax: +61 (02) 9491 5144

Document Revision Status

Document Name	Issue	Date of Issue	Prepared	Checked
Operation Manual – First draft	0	15 th August 2012	Volun Pirom	Paul Curtis

This manual is copyright. Except as permitted under national Copyright Laws, no part of this publication may be reproduced by any process, electronic or otherwise, stored in a retrieval system or transmitted without the written permission of the copyright owner.

© Siemens 2012.

Intellectual Property Rights

Intellectual property includes patents, software licences, copyright, know-how and all other forms of intellectual property. Copyright and Intellectual Property remain with the supplier, Siemens Water Technologies.

The supplier grants a non-exclusive license to the customer to use the intellectual property provided or produced by the supplier in relation to this equipment or as is otherwise required to use the equipment for its intended purpose.

The license granted shall benefit the customer, its agents or contractors and any subsequent owners, lessees, occupiers or operators of the works. The customer shall only use such intellectual property for the execution of the works and the subsequent use and maintenance of the completed works.

In the event the content of this manual is altered or section/items are omitted during a reproduction, in whole or in part, and instructions or definitions within the reproduction result in personal injury to those who follow the altered instructions, the burden of responsibility for personal injury falls solely on the party who affects the reproduction.

Disclaimer Statement

The purpose of the Operation and Maintenance (O&M) Manual is to provide a single document, consolidating all the principal topics of process description, design and technical summaries, equipment details, safety and handling procedures, maintenance programs, vendor equipment manuals and drawings, which collectively define the Plant process and equipment.

The O&M manual is intended to be used with the information provided in the vendor literature manual. The manual should provide complete and accurate information to meet your operating and/or service requirements based on the information available at the time of publication. However, Siemens assumes no responsibility for the technical content of the vendor literature information.

The information in these manuals may not cover all operating details or variations or provide for all conditions in connection with installation, operation and maintenance. Should questions arise which are not answered specifically in this manual, contact Siemens.

Siemens reserves the right to make engineering refinements that may not be reflected in this manual. The material in this manual is for informational purposes and is subject to change without notice.

The O&M Manual should be used as backup support for adequately qualified and trained Operators in the correct operation of the equipment.

Siemens understands the operators will:

- Have a minimum level of education and training in technical fields recognised as meeting the standards necessary to be in control of such facilities.
- Maintain adequate training standards for new operating personnel assigned to the facilities.
- Operate, service and maintain the systems in accordance with the O&M Manual and good and safe engineering practice.

Finally, this manual supports a basic level of technical competence, skill and initiative present in the Operators, Maintenance and Supervisory staff responsible for the operation of the System, and does not presume to be exhaustive in all possible content nor to have covered all abnormal situations.

Manual User's Guide

This manual describes the procedures necessary to install, operate, and maintain your Siemens ZABOCS® biological odour control system. Please read this manual carefully before installing and operating your equipment. The equipment warranty may be voided if installation or operation instructions are not followed correctly.

This manual has been formatted for ease of use, combining the instruction for all Siemens subsystems into one comprehensive manual. Literature supplied with purchased components being used on Siemens equipment is also being provided in this manual.

This manual is divided into multiple sections, covering general system information and specific system components. The table of contents for these sections is located at the front of the manual. The pages within each section are numbered [section #]-[page #] with the page numbers starting at 1 and incrementing sequentially.

Page numbering will skip over any special documents and continue on the page following the document. Special documents will be noted with an introduction statement that is listed in the table of contents.

Warnings

Warnings, Hazards, Stop, and Notes are used to attract attention to essential or critical information in a manual. These will appear before or after associated text.

Use of the supplied equipment must be strictly in accordance with this manual. Users are especially alerted to any safety requirements herein.



Warning

Warnings related to safety hazards are placed in boxes like this. These indicate a situation that may cause damage or destruction of equipment or may pose a long-term health hazard.



Hazard

Biological hazard warnings are placed in boxes like this.



Stop

Very important safety warnings are placed in boxes like this. Serious injury or death, or damage to equipment will occur if this note is not heeded.



Note

Notes are used to add information, state exceptions, and point out areas that may be of greater interest or importance.

TABLE OF CONTENTS

<u>CHAPTER</u>	<u>DESCRIPTION</u>	<u>SECTION</u>
	<u>PREFACE PAGES</u>	
1.0	<u>INTRODUCTION</u>	
1.1	General System Description	1-1
1.2	Major Components Description	1-2
1.3	Performance Requirements.....	1-3
2.0	<u>SAFETY PRECAUTIONS</u>	
2.1	General Safety Guidelines	2-1
2.2	Material Safety Data Sheets (MSDS)	2-5
3.0	<u>EQUIPMENT INSTALLATION</u>	
3.1	Equipment Handling Procedures	3-1
3.2	Initial Equipment Receipt and Inspection	3-3
3.3	Equipment Storage	3-3
3.4	Equipment Site Pad.....	3-3
3.5	ZABOCS [®] System Assembly.....	3-3
3.6	Equipment Skid Placement	3-4
3.7	Electrical Connections.....	3-4
3.8	Media Installation.....	3-5
3.9	H2S Analyser Panel Installation	3-6
3.10	Vent Stack and Duct Work Installation	3-6
4.0	<u>SYSTEM CONTROLS</u>	
4.1	Electrical Control Panel	4-1
4.2	Water Control System	4-2
4.3	Sample Draw System –H2S Analyser	4-3
5.0	<u>START-UP AND OPERATION</u>	
5.1	General Information	5-1
5.2	Fan Start-Up	5-1
5.3	Irrigation	5-1
5.4	Nutrient Addition	5-2
5.5	Maintenance Checklist	5-2
5.6	Shut Down Procedures	5-3
5.7	Operating Instructions For H2s Analyser Panels.....	5-3

TABLE OF CONTENTS

<u>CHAPTER</u>	<u>DESCRIPTION</u>	<u>SECTION</u>
6.0	<u>TROUBLESHOOTING</u>	
6.1	High Hydrogen Sulfide Exhaust Levels	6-1
6.2	Liquid Leaks	6-1
6.3	Water Fluctuations	6-1
6.4	Lack of Nutrients	6-2
7.0	<u>REPLACEMENT PARTS</u>	
8.0	<u>EXHAUST FAN</u>	
8.1	Fan Specification Sheet	8-1
8.2	Fan Performance Curve and Drawing	8-3
8.3	Fan Operation and Maintenance Manual	8-8
8.4	Motor Operation and Maintenance Manual	8-17
8.5	Fan Belts Preventative Maintenance Guide	8-39
9.0	<u>NUTRIENT PUMP</u>	
9.1	Pump Specification Sheet	9-1
9.2	Pump Drawing	9-3
9.3	Pump Operation and Maintenance Manual	9-8
10.0	<u>INSTRUMENTATION</u>	
10.1	Instrumentation Specification Sheet	10-1
10.2	Pressure Regulating Valve Operation and Maintenance Manual	10-3
10.3	Pressure Gauge Operation and Maintenance Manual	10-12
10.4	Media Water Rotameter Operation and Maintenance Manual	10-15
10.5	Media Water Solenoid Valve Operation and Maintenance Manual ..	10-17
11.0	<u>SYSTEM DRAWINGS</u>	
11.1	Process Flow Diagram	11-1
11.2	General Arrangement Drawing	11-3
12.0	<u>ELECTRICAL CONTROL PANEL</u>	
12.1	Electrical Control Panel Face Drawing	12-1
12.2	Electrical Control Panel Ladder Logic Diagram	12-3
12.3	Timer Manual	12-5
12.4	Variable Frequency Drive Operation and Maintenance Manual	12-X

1.0 INTRODUCTION

This manual contains details for the following Odour Control Systems installed for Queensland Urban Utilities in the Ipswich area, west of Brisbane.

- SP01 - SP320 OLD TOOWOOMBA RD (LEICHHARDT)
- SP33 - SP343 MCAULIFFE ST (REDBANK)
- SP34 - SP344 BRISBANE RD (REDBANK)

This Operation and Maintenance Manual presents the operating instructions and background information needed to safely and reliably operate the odour control system. **Do not attempt to operate the system until the principles and procedures presented are completely understood.**

The purpose of this section is to provide a general description of the system and the major equipment.

1.1 GENERAL SYSTEM DESCRIPTION

Siemens' ZABOCS® biological odour control system uses proprietary media called "Biolite" to first capture, then eliminate odours from process air streams. The "Biolite" media is an inert, inorganic porous rock media that has been customized to provide an excellent substrate for biological growth, and is especially suitable for hydrogen sulfide removal. It is inert to the corrosive byproducts of the biological oxidation of hydrogen sulfide, and allows easy flushing of byproducts from the media without media degradation or compaction. The second stage uses coal based virgin media. The coal based virgin media is a carbon-based media that has been formulated to optimize biological growth while providing effective adsorption of odourous compounds. The unique combination of media enables the ZABOCS® system to effectively control odours immediately upon startup. Both inorganic media provide excellent resistance to compaction and media degradation, which extend their useful life beyond that of conventional organic biofilter media.

An FRP exhaust fan forces foul air into the ZABOCS® system. There are air distribution plates on the base of the treatment stage that provide a uniform air distribution. The air then flows upward sequentially through the "Biolite" and coal based virgin media beds, where odourous compounds absorbed by the moisture in the bed. The trapped odourous compounds then become the principal food source for the biological microbes growing on the surface of the media. The byproducts of the biological reaction are periodically flushed from the bed by the irrigation system. The irrigation system also maintains proper moisture levels in the bed, and delivers nutrients to the bed. The odour-free air leaves the media chamber and passes out the stack.

The ZABOCS® system is manufactured from premium vinylester fiberglass reinforced plastic (FRP) and is completely pre-assembled and skid-mounted for easy installation. The fan is located on the system deck. It forces foul odourous air from the plant processes into the pre-humidifier, then upward through the system media. The variable frequency drive, located in the Electrical Control Panel, can be used to enable adjustment of the fan speed. Automatic media irrigation and nutrient addition is provided, and may be adjusted through timers located in the control panel and control valves in the water feed piping.

The major system features and advantages are listed below:

- Non-Hazardous Biological Process
- 99+% H₂S Removal
- Compact Design & Factory Pre-assembled and skid-mounted
- Corrosion Resistant Premium FRP Construction
- Low Maintenance

1.2 MAJOR COMPONENTS DESCRIPTION

The general equipment layout drawing is shown in the layout drawings.

At each site, two identical ZABOCS® odour control units are installed to be operated in parallel on a duty/duty basis. Both are controlled from a common control panel and both are supplied by a common nutrient tank.

Ductwork is provided [within termination points] to convey the air to the treatment system. The system is equipped with an exhaust stack.

Each ZABOCS® systems consist of a FRP media chamber, exhaust fan, water panel including piping and controls, and dosing pump. The systems measure:

ZABOCS® System	Length	Width	Height	Shipping Weight	Operating Weight
2 x ZB-4000 (SP 33)	10'-2" [3,100 mm]	4'-0" [1,219 mm]	9'-5" [2,870 mm]	~ 5,844 lbs [2,652 kg]	~ 6,000 lbs [2,722 kg]
2 x ZB-4000 (SP 34)	11'-7" [3,530 mm]	4'-0" [1,219 mm]	9'-5" [2,870 mm]	~ 5,844 lbs [2,652 kg]	~ 6,000 lbs [2,722 kg]
2 x ZB-5000 (SP 01)	9'-4" [2,845 mm]	5'-0" [1,524 mm]	9'-6" [2,896 mm]	~ 7,850 lbs [3,562 kg]	~ 8,500 lbs [3,857 kg]

The **media compartment** is custom fabricated from premium vinylester FRP. It contains air distribution plates to support the Biolite media and to provide uniform air distribution. The second layer of coal based virgin media is supported by a 25 mm thick FRP grating and a polypropylene screen. A rectangular access manway is provided for media installation and removal. Five-inch [125 mm] polypropylene access ports are provided above the lower bed and on the access manway to facilitate media sampling, air sampling and nozzle removal. A 50 mm universal flange connection is provided for a drain connection at the bottom of the vessel.

The **Biolite** and **coal-based virgin medias** are pre-loaded at the factory.

The **exhaust fan** is located at the system deck, and is constructed of FRP to provide long, trouble free service. The fan speed is adjustable through the variable frequency drive in the Electrical Control Panel. It is set to the desired flow rate during start-up, and may be adjusted as needed to maintain the full design air flow rate against any increase in pressure drop that may occur over time. While the fan is capable of providing more than its pre-set, we do not recommend running the system above this volumetric flow rate. Higher flow rates will reduce the effectiveness of the biological process.

The **water panel** is located on the side of the media chamber and contains the nutrient pump, the piping and the instrumentation including pressure regulating valve, pressure gauge, make-up water rotameter and the solenoid valve.

The **nutrient pump** sits in the water panel and injects nutrient to the main water line each time the solenoid valve is activated.

Connections to the ZABOCS® unit include the following:

- PVC ductwork is from the wet well educt flange [by others] to the ventilation fan inlets
- PVC ductwork from ZABOCS outlet flanges to ventilation stack
- Incoming water piping to the 50 mm flange connection at the water control panel.
- Drain piping is to match the 50 mm Universal style flange drain fitting on the ZABOCS® unit. The system drain requires a 50 mm barometric P-trap to prevent odour leakage from the drain. Drain piping by others.

The common **nutrient tank** provides the nutrient and connects to the pump by rigid pipework and flexible tubing. The capacity for the tank at all sites is 1000 litres. The tank is fitted with a mechanical level float gauge and a low level float switch.

A 8m high FRP **vent stack**, **PVC interconnecting pipe** [300 mm diameter], together with PVC butterfly **isolation valves** forms the entire **air delivery ductwork**.

The **electrical control panel** is mounted on the side of the slab and contains the 2 x VSDs for fan speed control, timer for the irrigation controls, and manual test switch for the solenoid valve. The panel runs off 415 Volt three-phase AC power.

Two **H2S monitoring stations** are installed at each site, one for high level analysis upstream of the Odour Control Units, and one for low level analysis downstream of the Odour Control Units.

1.3 PERFORMANCE REQUIREMENTS

SP 01

Design air flow rate, [normal operation]	420 l/sec or 210 l/sec per unit
Design air flow rate, [maximum rate for wet well entry]	840 l/sec or 420 l/sec per unit
Average measured inlet H2S concentration	2.2 ppm
Peak measured inlet H2S concentration	10.5 ppm

For SP 01 Siemens will supply and install 2 x ZABOCS® Odour Control Units to be operated in parallel on a duty/duty basis.

SP 33

Design air flow rate, [normal operation]	280 l/sec or 140 l/sec per unit
Design air flow rate, [maximum rate for wet well entry]	560 l/sec or 280 l/sec per unit
Average measured inlet H2S concentration	6.8 ppm
Peak measured inlet H2S concentration	29.1 ppm

For SP 33 Siemens will supply and install 2 x ZABOCS® 4000 Odour Control Units to be operated in parallel on a duty/duty basis.

SP 34

Design air flow rate, [normal operation]	360 l/sec or 180 l/sec per unit
Design air flow rate, [maximum rate for wet well entry]	720 l/sec or 360 l/sec per unit
Average measured inlet H2S concentration	5.7 ppm
Peak measured inlet H2S concentration	19.6 ppm

For SP 33 Siemens will supply and install 2 x ZABOCS® 4000 Odour Control Units to be operated in parallel on a duty/duty basis.

Output air quality

Normal operation – both units on line at approximately 50% fan speed.

H2S concentration ≤0.1 ppm

2.0 SAFETY PRECAUTIONS

This section contains general safety guidelines that workers must follow when installing, operating, and maintaining Siemens equipment.

This section must be read and understood prior to the system's startup. The guidelines listed here must be followed at all times to prevent worker injury and equipment damage.

2.1 GENERAL SAFETY GUIDELINES

This subsection contains the safety precautions that are common to all Siemens equipment.

The ZABOCS® system has been engineered to provide safe and reliable service. However, as with any industrial equipment it is potentially dangerous if not operated properly and carefully.

2.1.1 Operator Training

Equipment operators must be trained in the operation of the equipment. Only experienced operators who have studied this entire manual should be allowed to operate the equipment.


2.1.2 First-Aid Equipment

First-aid equipment must be available in all areas. The equipment must consist of items needed to treat most common injuries and the items required by the Material Safety Data Sheets (MSDS) for the materials used by your system (see section 2.2).

2.1.3 Equipment Access

Workers must use caution when accessing the equipment. All measures must be taken to prevent falls and other accidents when equipment is being installed or serviced.

Use extreme caution when working around air filtration equipment. Valve handles, sample pipes, and other protruding components can cause severe injury to body parts that strike them. Workers should wear hard hats and safety glasses and should move cautiously when working under piping and around the equipment.

	<p>Warning</p> <p>Climbing on piping can cause worker injury or equipment damage due to falls and equipment tipping. Never climb on piping to reach equipment or components.</p>
---	---

If equipment to be installed or serviced is above an operator's normal reach, use safe, approved ladders or lifting devices to reach the required area.

Avoid using "extension" type or single-run ladders to access equipment, especially if there are no flat and stable surfaces for a single-run ladder to rest against.


Whenever possible, use a wide, stable, folding (free-standing) ladder and tie off safely to appropriately secured and stable equipment or piping.

2.1.4 Protective Personal Equipment (PPE)

Maintain the necessary clothing and equipment to protect operating personnel. For protection when handling materials, refer to section 2.2, MSDS.

Caution should be taken to protect yourself from gases and vapors whenever entering, or looking inside the ZABOCS® internal chambers. Note that hazardous concentrations of hydrogen sulfide may be present inside the media chambers even when the fan is turned off. If you are exposed to high concentrations of hydrogen sulfide you should get out of the enclosure to fresh air immediately. The human nose loses its sensitivity to hydrogen sulfide and many other gases rapidly which can give the false impression that the gas has dissipated. It is best to use detection equipment to check the enclosure before re-entry.

2.1.5 Pressures



Warning

The sudden release of pressure from pressurized components can cause severe injury to workers. Relieve all pressure from piping and components before performing service.

Extreme caution must be used when working with high air or liquid pressures. Pressure monitoring devices must always be installed and working properly.


2.1.6 Servicing System Components and Equipment

Before performing maintenance on system components and equipment, and especially when disassembling individual components, workers must be certain that the components are isolated from upstream process gases, pressure, fluids, and electricity. Spring-loaded devices, such as valves, must be in their "relaxed" state --that is, with no compression on the loading spring-- to avoid the sudden and accidental motion of individual parts. Upstream dampers must be closed to prevent exposure to process gases.

An accidental and sudden release of pressure or fluid, accidental contact with energized electrical components, or the sudden movement of equipment parts during maintenance procedures can result in severe injury to workers.

Keep all equipment guards in place. If the guards are moved to service the equipment, make sure that the guards are promptly replaced. Follow lock-out/tag-out procedures whenever working on the system equipment.

2.1.7 Electricity



Stop

Electricity can shock, injure, or cause death. Always disconnect, lock out, and tag out electrical power for panels or components before performing repairs or service.

Operators and workers must use caution when working with motors, control panels, and other electrical components. These components must be properly wired and grounded, and should not be allowed to come in contact with process fluids or other liquids.

Electrical control panels and instruments must be properly grounded.

2.1.8 Temperatures



Stop

High temperatures can cause severe burns to exposed skin.

Wear gloves and protective clothing when handling components that generate high temperatures, such as motors and bearings

Operators and workers must use caution when working with processes (steam cleaning) or components (heat exchangers, motors, pumps, etc.) that involve high temperatures.

2.1.9 Chemicals

The ZABOCS® media themselves are non-hazardous. However one of the byproducts of the biological oxidation of hydrogen sulfide is sulfuric acid, and once the system is in service the media and rinse solutions will be corrosive. Sulfuric acid can burn the skin, cause permanent eye damage, and can be harmful if ingested. Extreme care and proper protective gear should be used when handling the media or working inside the media chambers or around the drain piping.

Here are some basic chemical handling tips.

- Locate a nearby source of clean water for washing off chemicals in an emergency.
- Be sure the electric power is off before working on the ZABOCS® biological odour control system. This will reduce the risk of exposure to chemicals and mechanical injuries.
- Wear arm-length acid-resistant rubber gloves.
- Wear either safety glasses with side shields or safety goggles.

2.1.10 Automatic System Testing



Warning

Improper flows of liquids during a system test run can cause worker injury or equipment damage.

During a test run of a system, all hand valves must remain closed to prevent the accidental entry of process fluids.

An automatically controlled system must be test-run with water prior to the initial operation of the equipment. Operators must be sure that the entire system operates properly (without leaks) before using process chemicals and treating process air.

2.1.11 Servicing Automatically-Controlled Components



Stop

Accidental and unexpected operation of remote components can cause personal injury or death. If controller programming or program modification is performed while system components are being serviced, disconnect the controller output devices or the individual component tubing or wiring to avoid accidental operation.

Workers must use extreme caution when servicing automatically-controlled components. Sudden and unexpected operation of components being serviced can cause severe injury to the workers involved.

Before working on automatically controlled components, make sure that the automatic controller is disabled to the point that it can not be used to operate remote components. Close, lock, and tag valves and lockout and tag electrical motor starters and other electrical devices.

Finally, inform other operators and control room workers of repairs or servicing in progress.

2.2 MATERIAL SAFETY DATA SHEETS (MSDS)

This section contains typical Material Safety Data Sheets (MSDS) for the materials used with this equipment. MSDS contain important information about specific hazards and first aid procedures and must be reviewed by all operating personnel.

Also please note that the drain water will contain sulfuric acid as a byproduct of the biological reactions taking place in the bed. This drain water is expected to have an approximate pH of 2, and will be corrosive. Proper precautions should be taken.



EXPANDED SHALE AND CLAY

MATERIAL SAFETY DATA SHEET

Name TXI OPERATIONS, L.P.		Address 1341 W. MOCKINGBIRD LANE, DALLAS, TEXAS 75247	
Emergency Telephone Number (972) 647-6700	Person Responsible for Preparation NANCY GARNETT	Date OCTOBER 2003	
Common Name (used on label) EXPANDED SHALE OR CLAY		Chemical Family VITRIFIED SHALE OR CLAY	
Chemical Name DOES NOT APPLY		Formula DOES NOT APPLY	
Trade Name & Synonyms EXPANDED SHALE OR CLAY, LIGHTWEIGHT AGGREGATE			

<u>Hazardous Component</u>	<u>CAS #</u>	<u>% Typical</u>	<u>TLV (Units)</u>	<u>PEL (Units)</u>
EXPANDED SHALE AND CLAY	68334-37-2	100	3 mg/m ³ **	5 mg/m ³ **
CRYSTALLINE QUARTZ*	14808-60-7	20 - 50	10 mg/m ³ / %SiO ₂ +2	0.05 mg/m ³
CRYSTALLINE QUARTZ - TOTAL DUST				30 mg/m ³ / %SiO ₂ + 2
CRISTOBALITE	14464-46-1	0 - 3	5 mg/m ³ / %SiO ₂ +2	0.05 mg/m ³ *

* Respirable fraction only. ** Nuisance dust levels, with no quartz - respirable fraction only.

PEL: Permissible Exposure Limit established by the Occupational Safety and Health Administration (OSHA).
TLV: Threshold Limit Value established by the American Conference of Governmental Industrial Hygienists (ACGIH).

SECTION 3 - PHYSICAL DATA

Boiling Point DOES NOT APPLY	Specific Gravity (H ₂ O = 1) 0.9 - 1.3	Gravity of Water Saturated Product SURFACE=1.8 UNDER PRESSURE=2.4
Percent Volatile by Volume 0%	Vapor Density (Air = 1) DOES NOT APPLY	Vapor Pressure (mm = Hg) DOES NOT APPLY
Percent Soluble in Water NEGLECTIBLE (<0.1%)	Reactivity in Water WILL NOT EVOLVE FLAMMABLE OR TOXIC GASES	Evaporation Rate (n=Butyl Acetate) DOES NOT APPLY
Appearance and Odor FINE TO COARSE GRANULAR SOLID. DARK RED TO PURPLE TO BROWN IN COLOR. NO ODOR.		

Hazardous Material Information System Identifier (HMIS)
HEALTH = 2* FLAMMABILITY = 0 REACTIVITY = 0 PERSONAL PROTECTION = X

Flash Point WILL NOT IGNITE	Flammable Limits in Air (% by Volume) Lower: DOES NOT APPLY Upper: DOES NOT APPLY
Extinguishing Media DOES NOT APPLY	Auto Ignition Temperature DOES NOT APPLY
Unusual Fire and Explosion Hazards NONE	
Special Fire Fighting Procedures NONE	

TXI010

SECTION 5 - HEALTH INFORMATION

Signs and Symptoms of Exposure - (1) Acute Overexposure - CONGESTION OF NASAL PASSAGES AND RESPIRATORY SYSTEMS. EXCESSIVE DUST MAY CAUSE ABRASION OF CORNEA.

Signs and Symptoms of Exposure - (2) Chronic Overexposure - EXCESSIVE EXPOSURE, BY INHALATION, TO DUSTS OF THIS MATERIAL, OVER AN EXTENDED PERIOD OF TIME MAY RESULT IN THE DEVELOPMENT OF PULMONARY DISEASES INCLUDING PNEUMOCONIOSIS, SILICOSIS, OR LUNG CANCER. DUST CAN CAUSE INFLAMMATION OF THE LINING TISSUE OF THE INTERIOR OF THE NOSE AND INFLAMMATION OF THE CORNEA.

Medical Conditions Generally Aggravated by Exposure
RESPIRATORY DISORDERS OF DISEASES MAY BE AGGRAVATED BY EXPOSURE TO DUST OF THIS MATERIAL.

Chemical/Component Listed as Carcinogen
QUARTZ AND CRISTOBALITE

NTP
YES

IARC
YES

OSHA
NO

Other Exposure Limits
NONE

Emergency & First Aids Procedures for Indicated Routes of Entry
INHALATION: REMOVE FROM EXPOSURE. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN. CONSULT A PHYSICIAN. EYES: WASH EYES WITH RUNNING WATER. DO NOT RUB EYES! IF IRRITATION PERSISTS, OBTAIN MEDICAL MEDICAL ASSISTANCE.

SECTION 6 - REACTIVITY DATA

Stability
STABLE

Conditions to Avoid
DOES NOT APPLY

Incompatibility (Materials to Avoid)
NONE

Hazardous Decomposition or Combustion Products
NONE

Hazardous Polymerization
WILL NOT OCCUR

Steps to be Taken in Case Material is Leaked or Spilled
CLEAN-UP OF SPILLS MAY REQUIRE PERSONAL PROTECTIVE EQUIPMENT TO PREVENT DUST EXPOSURES. SEE SECTION 8.

Waste Disposal Method
IF THIS MATERIAL, AS PROVIDED BY THE MANUFACTURER, BECOMES A WASTE, IT DOES NOT MEET THE CRITERIA OF A HAZARDOUS WASTE AS DEFINED BY THE ENVIRONMENTAL PROTECTION AGENCY UNDER THE AUTHORITY OF THE RESOURCE CONSERVATION AND RECOVERY ACT (40 CFR 261). DISPOSE OF IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS.

SECTION 8 - PERSONAL PROTECTION INFORMATION

Respiratory Protection
NIOSH/MSHA APPROVED FOR PROTECTION AGAINST SILICA AND NUISANCE DUSTS.

Ventilation
GENERAL OR LOCAL EXHAUST TO MAINTAIN EXPOSURE BELOW TLV/PEL.

Protective Gloves
TO PROTECT FROM ABRASION

Eye Protection
SAFETY GLASSES, GOGGLES, OR FACE SHIELD,
WHEN NECESSARY TO PREVENT EYE CONTACT.

Other Protective Clothing or Equipment
NONE

SECTION 9 - SPECIAL PRECAUTIONS

Precautions to be Taken in Handling & Storing
SHOULD BE STORED IN A MANNER TO PREVENT ACCUMULATIONS OF AIRBORNE DUST.

Other Precautions
NONE DETERMINED

TXI010



Water Technologies

Material Safety Data Sheet

SECTION 1 – CHEMICAL PRODUCT AND COMPANY INFORMATION

Product Name: ACTIVATED CARBON, *AquaCarb™ Series, VOCarb™ Series, AC Series, VC Series, BevCarb™ Series, and UltraCarb™ Series*

Part Number: 100

Chemical Family: activated carbon

Manufacturer's Name: Siemens Water Technologies Corp.

Address: 181 Thorn Hill Road, Warrendale, PA 15086

Product/Technical Information Phone Number: (323) 277-1500

Medical/Handling Emergency Phone Number: CHEMTREC 1-800-424-9300

Transportation Emergency Phone Number: CHEMTREC 1-800-424-9300

Revision Date/Revision Number: August 28, 2002/Revision #2

SECTION 2 – COMPOSITION INFORMATION

<u>Chemical Name</u>	<u>Percent by Weight</u>	<u>CAS#</u>
Activated Carbon	100	7440-44-0

SECTION 3 – HAZARDS IDENTIFICATION

Appearance & Odor: black granules without taste or odor

Emergency Overview:

- ◆ Dust that contacts eyes may be irritating or cause mechanical injury.
- ◆ Dust may cause slight skin irritation.
- ◆ Dust may be irritating to the respiratory tract and cause coughing or sneezing.
- ◆ Ingestion of powder may be irritating to the gastrointestinal tract.

Warning: Wet activated carbon depletes oxygen from the air and therefore dangerously low levels of oxygen may be encountered. Whenever workers enter a vessel containing activated carbon, the vessel's oxygen content should be determined and work procedures for potentially low oxygen areas should be followed.

Fire & Explosion Hazards: When burned, hazardous products of combustion including carbon oxides can occur. Irritating and/or toxic gases due to decomposition of the product may be generated during a fire. Fight fire from a safe distance from a protected location. Contact with strong oxidizers such as ozone or liquid oxygen may cause rapid combustion.

Primary Route(s) of Exposure: Eye contact, skin contact, ingestion, or inhalation are all possible routes of entry.

Inhalation- Acute Effects: Dust may be irritating to the respiratory tract and cause coughing or sneezing.

Skin Contact-Acute Effects: Dust may cause slight skin irritation.

Eye Contact- Acute Effects: Dust that contacts eyes may be irritating or cause mechanical injury.

Ingestion- Acute Effects: Ingestion of powder may be irritating to the gastrointestinal tract.



Water Technologies

Material Safety Data Sheet

SECTION 4 – FIRST AID MEASURES

Inhalation First Aid: Remove affected person from area to fresh air and provide oxygen if breathing is difficult. Give artificial respiration ONLY if breathing has stopped and give CPR ONLY if there is no breathing and no pulse. Obtain medical attention.

Skin Contact First Aid: Wash skin for 5 minutes with flowing water and soap. Clothing should be discarded or washed before reuse. Obtain medical assistance if irritation develops. DO NOT instruct person to neutralize affected skin area.

Eye Contact First Aid: Immediately irrigate eyes with flowing water continuously for 15 minutes while holding eyes open. Contacts should be removed before or during flushing. Seek medical assistance if irritation develops. DO NOT instruct person to neutralize.

Ingestion First Aid: Vomiting may need to be induced if directed by a physician or poison control center. DO NOT have unqualified personnel induce vomiting. Obtain medical attention immediately.

Medical Conditions Aggravated: Respiratory ailments may be aggravated by exposure to this product. Note to Physician: No specific antidote, treat patient symptomatically.

SECTION 5 – FIRE FIGHTING MEASURES

Flash Point/Method: Nonflammable

Auto Ignition Temperature: 840 °C (1,710 °F)

Upper/Lower Explosion Limits: not applicable

Extinguishing Media: Water spray, carbon dioxide, foam or dry chemical

Fire Fighting Procedures: In the event of a fire, wear full protective clothing and NIOSH approved self-contained breathing apparatus with full face piece, operated in the positive pressure mode.

Fire & Explosion Hazards: When burned, hazardous products of combustion including carbon oxides can occur. Irritating and/or toxic gases due to decomposition of the product may be generated during a fire. Fight fire from a safe distance from a protected location. Contact with strong oxidizers such as ozone or liquid oxygen may cause rapid combustion.

Hazardous Products of Decomposition and /or Combustion: Carbon oxides.

NFPA Ratings:

HEALTH-1 FLAMMABILITY- 0 REACTIVITY-0 OTHER- none

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Spill/Leak Procedures: Clean up spills in a manner that does not disperse dust into the air.

Material Safety Data Sheet

Cleanup: Handle in accordance with good industrial hygiene and safety practices. These practices include avoiding unnecessary exposure, and removal of material from eyes, skin, and clothing.

Regulatory Requirements: All disposal methods must be in compliance with all Federal, State, Local and Provincial laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

Disposal: Dispose of virgin (unused) carbon (waste or spillage) in a facility permitted for non-hazardous wastes. Spent (used) carbon should be disposed of in accordance with applicable laws. Do not reuse empty bags. Dispose of in facility permitted for non-hazardous wastes. **DO NOT DUMP INTO ANY SEWERS, ON THE GROUND OR INTO ANY BODY OF WATER.** All disposal methods must be in compliance with all Federal, State, Local and Provincial laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

SECTION 7 – HANDLING AND STORAGE

Handling: Avoid dispersion into air. Keep containers dry and closed. Follow good handling and housekeeping practices to minimize spills, generation of airborne dusts, and accumulation of dusts on exposed surfaces. Use with adequate exhaust ventilation to draw dust away from workers' breathing zones. Prevent or minimize exposures to dusts by using appropriate respirators, gloves, and eye protection. Wash exposed skin areas thoroughly with soap and water. Use caution when pouring, using pneumatic transport, swirling, etc. as this material can become electrostatically charged.

Storage: Avoid breaking bags or spilling media so as to avoid possibly creating residual dust. Store in ambient atmospheric conditions. Product should be stored in a closed dry container. Maintain good housekeeping procedures. Store away from strong oxidizers such as ozone, liquid oxygen, chlorine, permanganate, etc.

General Comments: Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

SECTION 8 –PERSONAL PROTECTION/ EXPOSURE CONTROL

Respiratory Protection: Use NIOSH/MSHA approved respiratory protection equipment appropriate to the material and/or its concentration where airborne exposure is likely. If exposures cannot be kept to a minimum with engineering controls, consult manufacturer to determine appropriate type equipment for a given application. Observe respirator use limitations specified by NIOSH/MSHA or the manufacturer.

Skin Protection: Wear appropriate dust resistant clothing and gloves.

Eye Protection: Safety glasses with side shields are recommended for any type of handling. Where eye contact or dusty conditions may be likely, dust tight goggles are recommended.

Ventilation Protection: Provide ventilation if necessary to minimize exposure. Dilute ventilation acceptable, but local mechanical exhaust ventilation preferred, if practical, at sources of air

Material Safety Data Sheet

contamination such as open process equipment. The following publication offers ventilation guidelines and techniques: "INDUSTRIAL VENTILATION, A MANUAL OF RECOMMENDED PRACTICE" available from the ACGIH.

Other Protection: Safety showers, with quick opening valves which stay open, and eye wash fountains, or other means of washing the eyes with a gentle flow of cool to tepid tap water, should be readily available in all areas where this material is handled or stored. Water should be supplied through insulated and heat-traced lines to prevent freeze-ups in cold weather.

Exposure Limits:

OSHA PEL-TWA: 15 mg/m³ (total), 5 mg/ m³ (resp)

OSHA PEL-STEL: 10 mg/m³

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance & Odor: black granules without taste or odor

Vapor Pressure: zero

Vapor Density (Air=1): not applicable

Boiling Point: not applicable

Melting Point: not applicable

Specific Gravity: 0.25 - 0.60 g/cc

Solubility in Water: Insoluble

Volatile Percentage: 0%

pH: not determined

Flash Point/method: Nonflammable

Auto Ignition Temperature: 840 °C

Upper/Lower Explosion Limits: not applicable

Other: none

SECTION 10 – STABILITY AND REACTIVITY

Stability: This product is considered stable under the specified conditions of storage, shipment and use.

Incompatibilities: Contact with strong oxidizers such as ozone, liquid oxygen, chlorine, permanganate, etc. may result in rapid combustion. Avoid contact with strong acids.

Polymerization: Hazardous polymerization will not occur.

Decomposition: Hazardous decomposition will produce carbon oxides.

Conditions to avoid: Store away from strong oxidizers such as ozone, liquid oxygen, chlorine, permanganate, etc. Moist air will reduce the operating life.

SECTION 11 – TOXICOLOGICAL INFORMATION

Inhalation – Acute: Inhalation of carbon dust is mildly irritating to the lungs and can immediately give rise to an increased mucociliary transport and airway resistance mediated by the vagus. The inhalation LC50 (Rat) is > 64.4 mg/l.

**Material Safety Data Sheet**

Inhalation – Chronic: There are no known chronic inhalation effects.

Skin Contact – Acute: Skin contact is expected to be slightly irritating. The primary skin irritation index (rabbit) is 0.

Skin Contact – Chronic: There are no known chronic dermal effects.

Eye Contact – Acute: Eye contact can cause conjunctivitis, epithelial hyperplasia of the cornea, as well as eczematous inflammation of the eyelids.

Ingestion – Acute: Carbon is practically nontoxic. The probable oral lethal dose (human) is greater than 15 g/kg; more than one quart (2.2 lbs) for a 70 kg (150 lb) person.

Ingestion – Chronic: There are no known chronic ingestion effects.

Carcinogenicity/Mutagenicity: There are no known carcinogenic/mutagenic effects.

Reproductive Effects: There are no known reproductive effects.

Neurotoxicity: There are no known neurotoxic effects.

Other Effects: No other toxic effects of carbon are known.

Target Organs: Target organs include the respiratory system and the cardiovascular system.

SECTION 12 – ECOLOGICAL INFORMATION

This material, in its original state, is not harmful to the environment.

SECTION 13 – DISPOSAL CONSIDERATIONS

Spill/Leak Procedures: Clean spills in a manner that does not disperse dust into the air, preferably a wet-down procedure or vacuum.

Cleanup: If material is not contaminated, spilled media can be rebagged. Warning: Wet activated carbon depletes oxygen from the air and therefore dangerously low levels of oxygen may be encountered. Whenever workers enter a vessel containing activated carbon, the vessel's oxygen content should be determined and work procedures for potentially low oxygen areas should be followed.

Regulatory Requirements: Generators of waste material are required to evaluate all waste for compliance with RCRA and any local disposal procedures and regulations. NOTE: State and local regulations may be more stringent than federal regulations.

Disposal: Material that cannot be used or chemically reprocessed and empty containers should be disposed of in accordance with all applicable regulations. Product containers should be thoroughly emptied before disposal. Generators of waste material are required to evaluate all waste for compliance with RCRA and any local disposal procedures and regulations. NOTE: State and local regulations may be more stringent than federal regulations.



Material Safety Data Sheet

SECTION 14 – TRANSPORTATION INFORMATION

DOT Shipping Description: Not DOT Regulated

SECTION 15 – REGULATORY INFORMATION

CERCLA SECTION 103 (40CFR302.4): no RQ: none

SARA SECTION 302 (40CFR355.30): no

SARA SECTION 304 (40CFR355.40): no

SARA SECTION 313 (40CFR372.65): no

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40CFR370.21):

ACUTE: yes CHRONIC: no FIRE: no REACTIVE: no SUDDEN RELEASE: no

OSHA PROCESS SAFETY (29CFR1910.119): no

CALIFORNIA PROPOSITION 65: no

SECTION 16 – OTHER INFORMATION

Disclaimer: The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the user thereof. It is the buyer's responsibility to ensure that its activities comply with federal, state, provincial and local laws.

Material Safety Data Sheet

May be used to comply with
 OSHA's Hazard Communication Standard,
 29 CFR 1910.1200. This Standard must be
 consulted for specific requirements.

U.S. Department of Labor

Occupational Safety and Health Administration
 (Non-Mandatory Form)
 Form Approved
 OMB No. 1218-0072

IDENTITY*Bio-Filter Nutrient***Section I**

Manufacturer's Name USFilter RJ Environmental	Emergency Telephone Number (800) 525-0658
Address (Number, Street, City, State, and ZIP Code) 13100 Gregg Street, Suite B	Telephone Number for Information (858) 486-8500
Poway, CA 92064	Date Prepared 01-14-2005
	Prepared by: USFilter RJ Environmental

Section II - Hazard Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
DIPOTASSIUM PHOSPHATE ANHYDROUS	15 mg/m ³ (8 hrs.)	10 mg/m ³ (8 hrs.)		
MAGNESIUM SULFATE; EPSOM SALTS	Not Established	Not Established		
UREA	5 mg/m ³ (2 ppm)	10 mg/m ³ (3 ppm)	15 mg/m ³ (Nuisance dust)	
SPRINT 330	Not Established	Not Established		
TRACE NON HAZARDOUS ADDITIVES	Not Established	Not Established		

(425)889-4100

1/11/2005 3:38

PAGE 002/005

Fax Server

002_05/10/01 DIPOTASSIUM PHOSPHATE ANHYDROUS

PRODUCT NAME: DIPOTASSIUM PHOSPHATE ANHYDROUS

MSDS NUMBER: AS010077

EFFECTIVE DATE: 3/24/2001

SUPERSEDES: 8/24/2000

ISSUED BY: 002098

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: DIPOTASSIUM PHOSPHATE ANHYDROUS

Reference Number: AST10077 Date: March 24, 2001

Chemical Family: Phosphate Salts

Chemical Name: Phosphoric Acid, Dipotassium Salt

Company Information:

ASTARIS LLC

622 Emerson Road - Suite 500

St. Louis, Missouri 63141

Emergency telephone: In USA call CHEMTREC: 1-800-424-9300

In Canada call CANUTEC: 1-613-996-6666

General Information: 1-800-244-6169

2. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS No.	% by weight
Dipotassium Phosphate Anhydrous	7758-11-4	100

3. HAZARDS IDENTIFICATION**EMERGENCY OVERVIEW**

Appearance and Odor: White granules or powder with no odor

WARNING STATEMENTS

NO SIGNIFICANT HAZARDS ASSOCIATED WITH THIS MATERIAL

POTENTIAL HEALTH EFFECTS

Likely Routes of Exposure: Skin contact and inhalation

EYE CONTACT: No more than slightly irritating based on toxicity studies.

The dry powder may cause foreign body irritation in some individuals.

SKIN CONTACT: No more than slightly toxic or slightly irritating based on toxicity studies.

Prolonged contact with the dry powder may cause drying or chapping of the skin.

INHALATION: Inhalation of the dust may cause coughing and sneezing.

INGESTION: Is not toxic if swallowed based on toxicity studies. No significant adverse health effects are expected to develop if only small amounts (less than a mouthful) are swallowed.

Swallowing large amounts may cause abdominal discomfort and diarrhea.

Refer to Section 11 for toxicological information.

4. FIRST AID MEASURES

IF IN EYES OR ON SKIN, immediate first aid is not likely to be required. However, this material can be removed with water. Wash heavily contaminated clothing before reuse.

IF INHALED, immediate first aid is not likely to be required. However, if symptoms occur, remove to fresh air. Remove material from eyes, skin and clothing.

IF SWALLOWED, immediate first aid is not likely to be required. A physician or Poison Control Center can be contacted for advice. Wash heavily contaminated clothing before reuse.

5. FIRE FIGHTING MEASURES

FLASH POINT: Not combustible

HAZARDOUS PRODUCTS OF COMBUSTION: Not applicable

EXTINGUISHING MEDIA: Not applicable

UNUSUAL FIRE AND EXPLOSION HAZARDS: None

6. ACCIDENTAL RELEASE MEASURES

In case of spill, sweep, scoop or vacuum all material, contaminated soil and other contaminated material and place in clean, dry containers for removal. If possible, complete cleanup on a dry basis. After all practical dry cleanup has been done, residual contamination can be flushed with plenty of water. Refer to Section 13 for disposal information and Sections 14 and 15 for reportable quantity information.

7. HANDLING AND STORAGE

Handling:

HANDLE IN ACCORDANCE WITH GOOD INDUSTRIAL HYGIENE AND SAFETY PRACTICES. THESE PRACTICES INCLUDE AVOIDING UNNECESSARY EXPOSURE AND REMOVAL OF MATERIAL FROM EYES, SKIN, AND CLOTHING.

STORAGE: Product is slightly hygroscopic and should be stored in a dry area to prevent moisture pickup and caking.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

EYE PROTECTION: This product does not cause significant eye irritation or eye toxicity requiring special protection. Use good industrial practice to avoid eye contact.

SKIN PROTECTION: Although this product does not present a significant skin concern, minimize skin contamination by following good industrial practice. Wearing protective gloves is recommended. Wash hands and contaminated skin thoroughly after handling.

RESPIRATORY PROTECTION: Avoid breathing dust. Use NIOSH/MSHA approved respiratory protection equipment when airborne exposure is excessive. Consult the respirator manufacturer to determine appropriate type equipment for a given application. Observe respirator use limitations specified by NIOSH/MSHA or the manufacturer. Respiratory protection programs must comply with 29 C.F.R. 1910.134.

VENTILATION: Provide natural or mechanical ventilation to control exposure levels below airborne exposure limits (see below). The use of local mechanical exhaust ventilation is preferred at sources of air contamination such as open process equipment.

AIRBORNE EXPOSURE LIMITS:

OSHA and ACGIH have not established specific exposure limits for this material. However, OSHA and ACGIH have established limits for particulates not otherwise regulated (PNOR) and particulates not otherwise classified (PNOC) which are the least stringent exposure limits applicable to dusts.

OSHA PEL ACGIH TLV

15 mg/m³ (total dust) 8-hr. TWA 10 mg/m³ (inhalable) 8-hr. TWA

5 mg/m³ (respirable) 8-hr. TWA 3 mg/m³ (respirable) 8-hr. TWA

Components referred to herein may be regulated by specific Canadian provincial legislation.

Please refer to exposure limits legislated for the province in which the substance will be used.

9. PHYSICAL AND CHEMICAL PROPERTIES

Chemical Formula: K₂HPO₄

Appearance: White granules or powder

Odor: None

pH: 9.0 (as a 1% solution)

Solubility in Water: (g./100 g. H₂O): 63 @ 25 degrees C

NOTE: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

10. STABILITY AND REACTIVITY

STABILITY: Product is stable under normal conditions of storage and handling.

Store in a cool, dry place to maintain product performance.

MATERIALS TO AVOID: None known

HAZARDOUS DECOMPOSITION PRODUCTS: None

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION

Data from Astaris single-dose (acute) animal studies with this material are given below:

Oral - rat LD50: >500 mg/kg; no more than slightly toxic

Dermal - rabbit LD50: >300 mg/kg; no more than slightly toxic

Eye Irritation - rabbit: mildly irritating (unwashed eyes)

Eye Irritation - rabbit: nonirritating (washed eyes)

Skin Irritation - rabbit: mildly irritating 300 mg/kg

Skin Irritation - rabbit: nonirritating 20 mg/kg

12. ECOLOGICAL INFORMATION

The following data have been classified using the criteria adopted by the European Economic Community (EEC) for aquatic organism toxicity.

The following data have been classified using the criteria adopted by the European Economic Community (EEC) for aquatic organism toxicity. A legend summarizing the classification scheme appears below.

48-hr EC50 Daphnia magna: > 100 mg/l, Practically Nontoxic

96-hr LC50 Mysid Shrimp > 1,000 mg/l, Practically Nontoxic

96-hr LC50 Rainbow trout: > 100 mg/l, Practically Nontoxic

No biodegradation data was available for this material.

13. DISPOSAL CONSIDERATIONS

This material when discarded is not a hazardous waste as that term is defined by the Resource, Conservation and Recovery Act (RCRA), 40 CFR 261. Dry material may be landfilled or recycled in accordance with local, state and federal regulations. Consult your attorney or appropriate regulatory officials for information on such disposal.

14. TRANSPORT INFORMATION

The data provided in this section is for information only. Please apply the appropriate regulations to properly classify your shipment for transportation.

US DOT

Not regulated for transport

Canadian TDG

Not regulated for transport

15. REGULATORY INFORMATION

TSCA Inventory: Listed.

DSL Inventory: Listed

WHMIS Classification Not Controlled

SARA Hazard Notification

Hazard Categories Under Title III Rules (40 CFR 370): Not applicable

Section 302 Extremely Hazardous Substances: Not Applicable

Section 313 Toxic Chemical(s): Not Applicable

CERCLA Reportable Quantity: Not applicable

This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulation and the MSDS contains all the information required by the Canadian Controlled Products Regulation.

Refer to Section 11 for OSHA Hazardous Chemical(s) and Section 13 for RCRA classification.

16. OTHER INFORMATION

Health Fire Reactivity Additional Information

Suggested NFPA Rating 1 0 0

Suggested HMIS Rating 1 0 0 F

Reason for revision: New Company Supersedes MSDS dated: Not Applicable

Product Use: Specialty fertilizers, automotive antifreeze formulations,

(425)889-4100

1/11/2005 3:38

PAGE 005/005

Fax Server

nutrient for antibiotics, pharmaceuticals food ingredient.
Astaris(tm) is a trademark of Astaris LLC

----- FOR ADDITIONAL INFORMATION -----

CONTACT: MSDS COORDINATOR UNIVAR USA INC.
DURING BUSINESS HOURS, PACIFIC TIME (425)889-3400
----- NOTICE -----

***** UNIVAR USA INC ("UNIVAR") EXPRESSLY DISCLAIMS

ALL EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A

PARTICULAR PURPOSE, WITH RESPECT TO THE PRODUCT OR INFORMATION PROVIDED HEREIN,

AND SHALL UNDER NO CIRCUMSTANCES BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.**

DO NOT USE INGREDIENT INFORMATION AND/OR INGREDIENT PERCENTAGES IN THIS MSDS AS A PRODUCT SPECIFICATION. FOR PRODUCT SPECIFICATION INFORMATION REFER TO A PRODUCT SPECIFICATION SHEET AND/OR A CERTIFICATE OF ANALYSIS. THESE CAN BE OBTAINED FROM YOUR LOCAL UNIVAR SALES OFFICE.

ALL INFORMATION APPEARING HEREIN IS BASED UPON DATA OBTAINED FROM THE MANUFACTURER AND/OR RECOGNIZED TECHNICAL SOURCES. WHILE THE INFORMATION IS BELIEVED TO BE ACCURATE, UNIVAR MAKES NO REPRESENTATIONS AS TO ITS ACCURACY OR SUFFICIENCY. CONDITIONS OF USE ARE BEYOND UNIVARS CONTROL AND THEREFORE USERS ARE RESPONSIBLE TO VERIFY THIS DATA UNDER THEIR OWN OPERATING CONDITIONS TO DETERMINE WHETHER THE PRODUCT IS SUITABLE FOR THEIR PARTICULAR PURPOSES AND THEY ASSUME ALL RISKS OF THEIR USE, HANDLING, AND DISPOSAL OF THE PRODUCT, OR FROM THE PUBLICATION OR USE OF, OR RELIANCE UPON, INFORMATION CONTAINED HEREIN. THIS INFORMATION RELATES ONLY TO THE PRODUCT DESIGNATED HEREIN, AND DOES NOT RELATE TO ITS USE IN COMBINATION WITH ANY OTHER MATERIAL OR IN ANY OTHER PROCESS.

* * * E N D O F M S D S * * *

004 10/12/04 MAGNESIUM SULFATE

PRODUCT NAME: MAGNESIUM SULFATE
 MSDS NUMBER: MZM0234
 DATE ISSUED: 10/12/2004
 SUPERSEDES: 4/25/2002
 ISSUED BY: 008614

=====

MAGNESIUM SULFATE

=====

1. PRODUCT IDENTIFICATION

SYNONYMS: MAGNESIUM SULFATE (1:1) HEPTAHYDRATE; EPSOM SALTS;
 SULFURIC ACID, MAGNESIUM SALT (1:1), HEPTAHYDRATE;
 MAGNESIUM SULFATE, 7- HYDRATE
 CAS NO: 7487-88-9 (ANHYDROUS) 10034-99-8 (HEPTAHYDRATE)
 MOLECULAR WEIGHT: 246.47
 CHEMICAL FORMULA: $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$

Distributed by:
 Univar USA Inc.
 6100 Carillon Point
 Kirkland, WA 98033
 425-889-3400

=====

2. COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT	CAS NO	PERCENT	HAZARDOUS
MAGNESIUM SULFATE ANHYDROUS	7487-88-9	99 - 100%	YES

=====

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

CAUTION! MAY BE HARMFUL IF SWALLOWED.

POTENTIAL HEALTH EFFECTS

INHALATION:

DUST MAY BE SLIGHTLY IRRITATING. SORE THROAT OR COUGHING MAY OCCUR.

INGESTION:

SINCE MAGNESIUM SALTS ARE SLOWLY ABSORBED, ABDOMINAL PAIN, VOMITING AND DIARRHEA MAY BE THE ONLY SYMPTOMS. HOWEVER, IF ELIMINATION IS BLOCKED BY BOWEL BLOCKAGE OR OTHER REASONS, CNS DEPRESSION, LACK OF REFLEXES, HYPOCALCEMIA (DEFICIENCY OF CALCIUM IN THE BLOOD) MAY OCCUR.

SKIN CONTACT:

NO ADVERSE EFFECTS EXPECTED BUT MAY CAUSE MINOR SKIN IRRITATION.

EYE CONTACT:

NO ADVERSE EFFECTS EXPECTED BUT DUST MAY CAUSE MECHANICAL IRRITATION.

CHRONIC EXPOSURE:

NO INFORMATION FOUND.

AGGRAVATION OF PRE-EXISTING CONDITIONS:
NO INFORMATION FOUND.

=====

4. FIRST AID MEASURES

INHALATION:

REMOVE TO FRESH AIR. GET MEDICAL ATTENTION FOR ANY BREATHING DIFFICULTY.

INGESTION:

GIVE SEVERAL GLASSES OF WATER TO DRINK TO DILUTE. IF LARGE AMOUNTS WERE SWALLOWED, GET MEDICAL ADVICE.

SKIN CONTACT:

REMOVE ANY CONTAMINATED CLOTHING. WASH SKIN WITH SOAP AND WATER FOR AT LEAST 15 MINUTES. GET MEDICAL ATTENTION IF IRRITATION DEVELOPS OR PERSISTS.

EYE CONTACT:

WASH THOROUGHLY WITH RUNNING WATER. GET MEDICAL ADVICE IF IRRITATION DEVELOPS.

NOTE TO PHYSICIAN:

IV ADMINISTRATION OF CALCIUM GLUCONATE WILL PARTIALLY REVERSE THE EFFECTS OF ACUTE MAGNESIUM TOXICITY. VENTRICULAR SUPPORT WITH CALCIUM CHLORIDE INFUSION AND MANNITOL FORCED DIURESIS HAS ALSO BEEN SUCCESSFUL.

=====

5. FIRE FIGHTING MEASURES

FIRE:

NOT CONSIDERED TO BE A FIRE HAZARD.

EXPLOSION:

NOT CONSIDERED TO BE AN EXPLOSION HAZARD.

FIRE EXTINGUISHING MEDIA:

USE ANY MEANS SUITABLE FOR EXTINGUISHING SURROUNDING FIRE.

SPECIAL INFORMATION:

USE PROTECTIVE CLOTHING AND BREATHING EQUIPMENT APPROPRIATE FOR THE SURROUNDING FIRE.

=====

6. ACCIDENTAL RELEASE MEASURES

VENTILATE AREA OF LEAK OR SPILL. WEAR APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT AS SPECIFIED IN SECTION 8. SPILLS: SWEEP UP AND CONTAINERIZE FOR RECLAMATION OR DISPOSAL. VACUUMING OR WET SWEEPING MAY BE USED TO AVOID DUST DISPERSAL.

=====

7. HANDLING AND STORAGE

KEEP IN A TIGHTLY CLOSED CONTAINER, STORED IN A COOL, DRY, VENTILATED AREA. PROTECT AGAINST PHYSICAL DAMAGE. ISOLATE FROM INCOMPATIBLE SUBSTANCES. CONTAINERS OF THIS MATERIAL MAY BE HAZARDOUS WHEN EMPTY SINCE THEY RETAIN PRODUCT RESIDUES (DUST, SOLIDS); OBSERVE ALL WARNINGS AND PRECAUTIONS LISTED FOR THE PRODUCT.

=====

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

AIRBORNE EXPOSURE LIMITS:
NONE ESTABLISHED.

VENTILATION SYSTEM:

A SYSTEM OF LOCAL AND/OR GENERAL EXHAUST IS RECOMMENDED TO KEEP EMPLOYEE EXPOSURES AS LOW AS POSSIBLE. LOCAL EXHAUST VENTILATION IS GENERALLY PREFERRED BECAUSE IT CAN CONTROL THE EMISSIONS OF THE CONTAMINANT AT ITS SOURCE, PREVENTING DISPERSION OF IT INTO THE GENERAL WORK AREA. PLEASE REFER TO THE ACGIH DOCUMENT, "INDUSTRIAL VENTILATION, A MANUAL OF RECOMMENDED PRACTICES", MOST RECENT EDITION, FOR DETAILS.

PERSONAL RESPIRATORS (NIOSH APPROVED):

FOR CONDITIONS OF USE WHERE EXPOSURE TO DUST OR MIST IS APPARENT AND ENGINEERING CONTROLS ARE NOT FEASIBLE, A PARTICULATE RESPIRATOR (NIOSH TYPE N95 OR BETTER FILTERS) MAY BE WORN. IF OIL PARTICLES (E.G. LUBRICANTS, CUTTING FLUIDS, GLYCERINE, ETC.) ARE PRESENT, USE A NIOSH TYPE R OR P FILTER. FOR EMERGENCIES OR INSTANCES WHERE THE EXPOSURE LEVELS ARE NOT KNOWN, USE A FULL-FACE POSITIVE-PRESSURE, AIR-SUPPLIED RESPIRATOR.

WARNING: AIR-PURIFYING RESPIRATORS DO NOT PROTECT WORKERS IN OXYGEN-DEFICIENT ATMOSPHERES.

SKIN PROTECTION:

WEAR PROTECTIVE GLOVES AND CLEAN BODY-COVERING CLOTHING.

EYE PROTECTION:

USE CHEMICAL SAFETY GOGGLES. MAINTAIN EYE WASH FOUNTAIN AND QUICK-DRENCH FACILITIES IN WORK AREA.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:

TRANSPARENT CRYSTALS, OR WHITE POWDER.

BOILING POINT:

NOT APPLICABLE.

ODOR:

ODORLESS.

WATERS OF HYDRATION @ 250C (482F)

MELTING POINT:

1124C (2055F) DECOMPOSES. LOSES ALL

SOLUBILITY:

VERY SOLUBLE IN WATER.

VAPOR DENSITY (AIR=1):

NO INFORMATION FOUND.

DENSITY:

1.67 G/ML @ 4C

VAPOR PRESSURE (MM HG):

NO INFORMATION FOUND.

PH:

AQUEOUS SOLUTION IS NEUTRAL OR SLIGHTLY ACID.

EVAPORATION RATE (BUAC=1):

NO INFORMATION FOUND.

% VOLATILES BY VOLUME @ 21C (70F):

0

10. STABILITY AND REACTIVITY

STABILITY:

STABLE UNDER ORDINARY CONDITIONS OF USE AND STORAGE. LOSES SOME MOISTURE ON EXPOSURE TO DRY AIR AT ROOM TEMPERATURES.

HAZARDOUS DECOMPOSITION PRODUCTS:

OXIDES OF SULFUR AND THE CONTAINED METAL.

HAZARDOUS POLYMERIZATION:
WILL NOT OCCUR.

INCOMPATIBILITIES:
ETHOXY ETHYL ALCOHOLS, ARSENATES, PHOSPHATES, TARTRATES, LEAD, BARIUM,
STRONTIUM, AND CALCIUM

CONDITIONS TO AVOID:
HEAT, MOISTURE, INCOMPATIBLES.

11. TOXICOLOGICAL INFORMATION

NO LD50/LC50 INFORMATION FOUND RELATING TO NORMAL ROUTES OF OCCUPATIONAL
EXPOSURE. INVESTIGATED AS A MUTAGEN, REPRODUCTIVE EFFECTOR.

-----/CANCER LISTS/-----			
INGREDIENT	---NTP CARCINOGEN---		IARC CATEGORY
	KNOWN	ANTICIPATED	
MAGNESIUM SULFATE ANHYDROUS (7487-88-9)	NO	NO	NONE

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE:
NO INFORMATION FOUND.

ENVIRONMENTAL TOXICITY:
NO INFORMATION FOUND.

13. DISPOSAL CONSIDERATIONS

WHATEVER CANNOT BE SAVED FOR RECOVERY OR RECYCLING SHOULD BE MANAGED IN AN
APPROPRIATE AND APPROVED WASTE DISPOSAL FACILITY. PROCESSING, USE OR
CONTAMINATION OF THIS PRODUCT MAY CHANGE THE WASTE MANAGEMENT OPTIONS.
STATE AND LOCAL DISPOSAL REGULATIONS MAY DIFFER FROM FEDERAL DISPOSAL
REGULATIONS.

DISPOSE OF CONTAINER AND UNUSED CONTENTS IN ACCORDANCE WITH FEDERAL, STATE
AND LOCAL REQUIREMENTS.

14. TRANSPORT INFORMATION

NOT REGULATED.

15. REGULATORY INFORMATION

-----/CHEMICAL INVENTORY STATUS - PART 1/-----				
INGREDIENT	TSCA	EC	JAPAN	AUSTRALIA
MAGNESIUM SULFATE ANHYDROUS (7487-88-9)	YES	YES	YES	YES

-----/CHEMICAL INVENTORY STATUS - PART 2/-----			
INGREDIENT	---CANADA---		
	KOREA	DSL	NDSL PHIL.

MAGNESIUM SULFATE ANHYDROUS (7487-88-9) YES YES NO YES
-----/FEDERAL, STATE & INTERNATIONAL REGULATIONS - PART 1/-----
-----SARA 302-----SARA 313-----
INGREDIENT RQ TPQ LIST CHEMICAL CATG

MAGNESIUM SULFATE ANHYDROUS (7487-88-9) NO NO NO NO
-----/FEDERAL, STATE & INTERNATIONAL REGULATIONS - PART 2/-----
-----RCRA-----TSCA-----
INGREDIENT CERCLA 261.33 8(D)

MAGNESIUM SULFATE ANHYDROUS (7487-88-9) NO NO NO
CHEMICAL WEAPONS CONVENTION: NO TSCA 12(B): NO CDTA: NO
SARA 311/312: ACUTE: YES CHRONIC: NO FIRE: NO PRESSURE: NO
REACTIVITY: NO (PURE / SOLID)

AUSTRALIAN HAZCHEM CODE: NONE ALLOCATED.
POISON SCHEDULE: NONE ALLOCATED.

WHMIS: THIS MSDS HAS BEEN PREPARED ACCORDING TO THE HAZARD CRITERIA OF
THE CONTROLLED PRODUCTS REGULATIONS (CPR) AND THE MSDS CONTAINS
ALL OF THE INFORMATION REQUIRED BY THE CPR.

16. OTHER INFORMATION

NFPA RATINGS:

HEALTH: 1 FLAMMABILITY: 0 REACTIVITY: 0

----- FOR ADDITIONAL INFORMATION -----
CONTACT: MSDS COORDINATOR UNIVAR USA INC.
DURING BUSINESS HOURS, PACIFIC TIME (425) 889-3400
----- NOTICE -----

***** UNIVAR USA INC ("UNIVAR") EXPRESSLY DISCLAIMS

ALL EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A

PARTICULAR PURPOSE, WITH RESPECT TO THE PRODUCT OR INFORMATION PROVIDED HEREIN,

AND SHALL UNDER NO CIRCUMSTANCES BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL
DAMAGES. **

DO NOT USE INGREDIENT INFORMATION AND/OR INGREDIENT PERCENTAGES IN THIS MSDS
AS A PRODUCT SPECIFICATION. FOR PRODUCT SPECIFICATION INFORMATION REFER TO A
PRODUCT SPECIFICATION SHEET AND/OR A CERTIFICATE OF ANALYSIS. THESE CAN BE
OBTAINED FROM YOUR LOCAL UNIVAR SALES OFFICE.

ALL INFORMATION APPEARING HEREIN IS BASED UPON DATA OBTAINED FROM THE
MANUFACTURER AND/OR RECOGNIZED TECHNICAL SOURCES. WHILE THE INFORMATION IS
BELIEVED TO BE ACCURATE, UNIVAR MAKES NO REPRESENTATIONS AS TO ITS ACCURACY OR
SUFFICIENCY. CONDITIONS OF USE ARE BEYOND UNIVARS CONTROL AND THEREFORE USERS
ARE RESPONSIBLE TO VERIFY THIS DATA UNDER THEIR OWN OPERATING CONDITIONS TO
DETERMINE WHETHER THE PRODUCT IS SUITABLE FOR THEIR PARTICULAR PURPOSES AND THEY
ASSUME ALL RISKS OF THEIR USE, HANDLING, AND DISPOSAL OF THE PRODUCT, OR FROM
THE PUBLICATION OR USE OF, OR RELIANCE UPON, INFORMATION CONTAINED HEREIN.
THIS INFORMATION RELATES ONLY TO THE PRODUCT DESIGNATED HEREIN, AND DOES NOT

012 07/09/03 UREA, DRY

 PRODUCT IDENTIFICATION

PRODUCT NAME: UREA, DRY
 MSDS NUMBER: P10379VS
 DATE ISSUED: 06/28/03
 SUPERCEDES: 05/31/01
 ISSUED BY: 004988

MATERIAL SAFETY DATA SHEET

Revision Issued: JUNE 28, 2003 Supercedes: MAY 31, 2001 First Issued: JUL 1989

Section I - Chemical Product and Company Identification

Product Name: Urea, Dry PotashCorp

MSDS No.: 13

ERG No.: n/a

Skokie Blvd., Northbrook, IL 60062

Phone (800) 241-6908 * (847) 849-4200

Suite 500, 122 - 1st Avenue South

Saskatoon, Saskatchewan Canada S7K 7G3

Phone (800) 667-0403 from Canada * (800) 667-3930 from USA

Emergencies (800) 424-9300 (CHEMTREC)

Web Site www.potashcorp.com

Health Emergencies, Contact Your Local Poison Center

Flammability

0

Health 1 0 Reactivity

-

Specific Hazard

NFPA CODE

Urea Prills,

Industrial,
Agricultural,Common Name: Urea, Dry Formula: $\text{CO}(\text{NH}_2)_2$ Synonym: Urea Granular Use: Feed

Section II - Composition/Information On Ingredients

CHEMICAL NAME(s)	CAS No.	Exposure Limits				% by Weight
		OSHA PEL mg/m3 ppm	TLV - TWA mg/m3 ppm	STEL mg/m3 ppm	CEIL mg/m3 ppm	
Urea, Carbamide, Carbonyldiamide, 57-13-6	5(2)	10(3)			97.5- 99.7	
Carbamidic Acid (1)						
Alkalinity as Ammonia					150 PPM (Max)	
Urea					97.5-99.7	
Biuret					0.00- 1.50	
Methylenediurea(4)					0.00-2.42	
(1) Nuisance dust 15 Mg/M3 (Total)						
(2) 5 Mg/M3- Respirable (particulate) Fraction Urea.						
(3) 10 mg/m3 Inhalable particulate						
(4) Reagent and Chemical Grade Urea does not contain formaldehyde						

Section III - Hazard Identification

Potential Acute Skin: Repeated or prolonged contact may cause reddening,
 itching and inflammation. Ingestion: A single dose of Health Effects:

100 grams has reportedly caused mild symptoms of Central Nervous System depression e. g. drowsiness and slow reflexes.

Eyes and Skin: Eyes: Severe irritant. Contact with heated material may cause thermal burns Skin: Slightly irritating. Repeated or prolonged contact may cause reddening, itching and inflammation. Contact with heated material may cause thermal burns.

Inhalation: May cause respiratory tract irritation although no incidents of dust inhalation health effects have been reported

Ingestion: May cause gastrointestinal disturbances. Symptoms may include irritation, nausea, vomiting and diarrhea.

Potential Chronic Health Effects: None known. Urea is a naturally occurring chemical in the body. It is an end product of protein metabolism and is excreted in the urine.

Carcinogenicity Lists: IARC Monograph: No NTP: No OSHA: No

Section IV - First Aid Measures

Eyes:

Promptly flush with water, continuing for 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. If irritation persists, consult a physician immediately.

Skin:

Wash area of contact thoroughly with soap and water. For contact with molten product do not remove clothing. Flush skin immediately with cold water. Launder clothing before reuse.

Ingestion: Do not induce vomiting. Keep affected person warm and treat for shock. Get medical attention. A single dose of 100 grams has reportedly caused mild symptoms of Central Nervous System depression (drowsiness, etc.).
Inhalation: Remove affected person from source of exposure. If not breathing, ensure open airway and initiate CPR. If breathing is difficult, administer oxygen; if available get medical attention.

Section V - Fire Fighting Measures

Flash Point: Not Applicable **Autoignition Temperature:** Not Available
Lower Explosive Limit: Not Available **Upper Explosive Limit:** Not Available

Unusual Fire and Heating above 270 F decomposes to Biuret, Ammonia, and Nitrogen Oxides. Short-term exposures to smoke and

Explosion Hazards:

gases may lead to irreversible lung injury without early signs and symptoms.

Extinguishing Media: All standard agents are acceptable. Use extinguishing agent suitable for the surrounding fire. Material itself burns with difficulty. Urea becomes slippery when wet. - Guard against slips and falls

Special Firefighting Procedures and Equipment:

Irritating toxic substances may be emitted upon thermal decomposition. Exposed firefighters should wear NIOSH approved self contained breathing apparatus with full face piece and full protective clothing. May form explosive mixtures if mixed with strong acid (Nitric/Perchloric).

Ventilation: Provide local or general ventilation to keep below nuisance dust limit of 15 mg/m³.

Section VI - Accidental Release Measures

Small Spill: If uncontaminated, recover and reuses as product.

Large Spill: Prevent large quantities from contacting vegetation or waterways. Keep animals away from large spills.

Release Notes: If spill could potentially enter any waterway, including intermittent dry creeks, contact the local authorities. If in the U.S., contact the US COAST GUARD NATIONAL RESPONSE CENTER toll free number 800-424-8802. In case of accident or road spill notify: CHEMTREC IN USA at 800-424-9300; CANUTEC in Canada at 613-996-6666 CHEMTREC in other countries at (International code)+1-703-527-3887.

Comments: See Section XIII for disposal information and Section XV for regulatory requirements. Large and small spills may have a broad definition depending on the user's handling system. Therefore, the spill category must be defined at the point of release by technically qualified personnel.

Section VII - Handling and Storage

Ventilation:

Provide local or general ventilation to keep below nuisance dust limit of 15mg/m³.

Handling:

Avoid contact with the eyes. Avoid repeated or prolonged contact with the skin or clothing. Avoid dust inhalation.

Contact lenses should not be worn.

Storage:

Store in closed containers in cool, dry, isolated, well ventilated area away from heat, sources of ignition, and incompatibles. Avoid contamination with other "look alike" materials that may produce a fire or explosion. Special precautions! Procedures! Label instructions. Avoid containers, piping or fittings made of brass, bronze or other copper bearing alloys or galvanized metals.

Section VIII - Exposure Controls/Personal Protection

Engineering Controls:

Provide local or general ventilation to keep below nuisance dust limit of 15mg/m³. Personal Protection:

Eye Protection:

Wear safety glasses or chemical goggles to prevent eye contact. Do not wear contact lenses when working with this substance. Have eye wash facilities available where eye contact could occur.

Protective Clothing:

Wear impervious gloves and protective clothing to prevent skin contact

Respiratory Protection:

Normally none needed. Use NIOSH approved equipment when airborne dust exposure limits are exceeded. NIOSH approved breathing equipment must be available for non-routine and emergency use.

Other Protective Equipment:

Clothing or Normally not required

Section IX - Physical and Chemical Properties

Appearance/Color/Odor:

White solid, spherical or granular shape with slight ammonia odor.

Melting Point/Range:

271 F or 133 C Boiling Point: 135 C (decomposes)

Solubility in Water:

1,193 g/L at 25 C Boiling Point/Range: Not Applicable

Specific Gravity:

Not Applicable Vapor Pressure(mmHg): 80 Pa at 20 C (calculated)

Vapor Density:

Not Applicable Molecular Weight: 60.07

Bulk Density:

44 -49lbs/cu ft % Volatiles: Not Applicable

pH:

7.2 at 100 g/L Evaporation Rate: Not Applicable

Viscosity:

Not Applicable Density: 750 kg/m

Section X - Stability and Reactivity

Stability:

This product is stable under normal ambient conditions of temperature and pressure

Hazardous Polymerization: Will not occur

May slowly hydrolyze to Ammonium Carbamate after a long period of time which decomposes to Ammonia and

Conditions to Avoid: Carbon Dioxide.

Materials to Avoid:

Avoid contact with strong oxidizers, acids or bases. Avoid contact with Nitrates. Reacts with Sodium or Calcium, Incompatibilities): Hypochlorite to form explosive Nitrogen Trichloride.

Hazardous products:

Decomposition Decomposes to Ammonia, Biuret, Nitrogen Oxides, Carbon Oxides.

Section XI - Toxicological Information

Significant Routes of Exposure:

Eyes, Digestive Tract, Respiratory Tract, Skin

Toxicity to Animals:

Acute Oral Toxicity: (rat) LD50=14,300 - 15,000 mg/kg;

(mouse) LD50=11,500 - 13,000 mg/kg.; (cattle): LD50=510 mg/kg.

Repeated Dose: (rat) 24 weeks; dermal - NOAEL = 40% in ointment

Skin Irritation/Corrosion: Mouse - Not irritating (10% solution)

Eye Irritation/Corrosion: Rabbit - Not irritating (50% solution)

Not found to be toxic by oral exposure as defined by OSHA. Based on toxicity data for another compound (i.e., ammonium nitrate), not expected to be toxic by dermal and inhalation exposure as defined by OSHA.

Special Remarks on Toxicity to Animals:

Bacterial Genetic Toxicity in vitro: (Salmonella typhimurium) - Bacterial reverse mutation assay- Negative ;

Chinese Hamster -- Chromosomal aberration test -

Positive (very high dose); Mouse - Positive (very high dose).

Genetic Toxicity in vivo: Mouse - Bone marrow cytogenetic test - Positive (extremely high dose) :

Toxicity to Reproduction: No toxic effects on mouse gonads up to 6,750-mg/kg day. No toxic effects on rat gonads up to 2,250-mg/kg day. Developmental

Toxicity / Teratogenicity: Not teratogenic.

Other Effects on Humans:

Despite extensive medical use, no significant side effects on humans have

been noted.

Special Remarks on Chronic Effects on Humans:
chronic No effects known.

Special Remarks on Humans:

May be irritating at > 10% concentration; not a skin sensitizer. Other Effects on Despite extensive medical uses no significant side effects on humans has been noted.

Section XII - Ecological Information

Ecotoxicity: Acute Toxicity to Fish: 96 -h: (Barillius barna)
LC50= > 9,100 mg/L. Acute Toxicity Aquatic Invertebrates:
(Daphnia magna) : 24 - h EC50: > 10,000 mg/L. Toxicity to Aquatic Plants:
(Scenedesmus quadricauda) 192-hr cell multiplication inhibition
test-TT>10,000 mg/L. Toxicity to Other Non-Mammalian Terrestrial Species:
(Pigeon)-Subcutaneous-LDLe=16,000 mg/kg. Since Urea is a fertilizer, it may promote eutrophication in waterways. Non-toxic to aquatic organisms as defined by USEPA.

Environmental Fate:

Stability in water: T112 > 1 year. Transport: 0.16% in air; 99.84% in water

Toxicity: No known toxicity

Degradation Biodegradation: Ultimately biodegradable.

Products:

Section XIII - Disposal Considerations

Product Disposal:

Disposal of Urea may be subject to federal, state or local regulations.

General Comments:

Users of this product should review their operations in terms of applicable federal, state and local laws and regulations, then consult with appropriate regulatory agencies before discharging or disposing of waste material.

Section XIV - Transportation Information

Proper Shipping Name:	USDOT Not regulated	TDG -Canada Not regulated
Hazard Class:		
Identification Number:		
Packing Group (Technical Name):		
Labeling / Placarding:		
Authorized Packaging:		
Notes:		
European Transportation:		
If shipping internationally, notate Urea as Carbamidic Acid.		

Section XV - Regulatory Information I

UNITED STATES:

This product has been reviewed according to the EPA Hazard Categories promulgated under Section 311 SARA Hazard and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, Category: under applicable definitions, to meet the following categories:
Fire: No Pressure Generating: No Reactivity: No Acute: Yes Chronic: No
40 CFR Part 355 - Extremely Hazardous Substances: None
40 CFR Part 370 - Hazardous Chemical Reporting: Applicable
All intentional ingredients listed on the TSCA inventory.

SARA Title III Information:

This product contains the following substances subject to the reporting

(425)889-4100

1/11/2005 3:42

PAGE 007/008

Fax Server

requirements of Title III (EPCRA) of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

Chemical	CAS No.	Percent by Weight	CERCLA RQ (lbs)	SARA (1986) 311 312 313	Reporting
Urea	57-13-6	97.5-99.7	NA	Yes Yes NA	

If this product contains components subject to substances designated as CERCLA Reportable Quantity (RQ) CERCLA/Superfund, Substances, it will be designated in the above table with the RQ value in pounds. If there is a release of RQ 40 CFR Parts 117,302: Substance to the environment, notification to the National Response Center, Washington D.C. (1-800-424-8802) is required.

CANADA:

WHMIS HAZARD SYMBOL AND CLASSIFICATION: This product is not WHMIS controlled
INGREDIENT DISCLOSURE LIST: This product does contain ingredient(s) on this list.

ENVIRONMENTAL PROTECTION ACT: All intentional ingredients are listed on the DSL (Domestic Substance List).

EINECS#: (Urea) 200-315-5

California:

Prop 65: This is not a chemical known to cause cancer, nor is it listed.

Section XVI - Other Information

NFPA Hazard Ratings: Health: 1 Fire: 0 Reactivity: 0 Special Hazards:
0 =Insignificant 1 = Slight 2= Moderate 3 = High 4= Extreme

COMMENTS: This product is TSE/BSE (Transmissible Spongiform Encephalopathy/ Bovine Spongiform Encephalopathy) free. There are no animal constituents used in the manufacture of Urea, Dry for PCS Sales (USA) Inc. Our product is created through a chemical process.

----- FOR ADDITIONAL INFORMATION -----

CONTACT: MSDS COORDINATOR UNIVAR USA INC.
DURING BUSINESS HOURS, PACIFIC TIME (425)889-3400
----- NOTICE -----

***** UNIVAR USA INC ("UNIVAR") EXPRESSLY DISCLAIMS

ALL EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A

PARTICULAR PURPOSE, WITH RESPECT TO THE PRODUCT OR INFORMATION PROVIDED HEREIN,

AND SHALL UNDER NO CIRCUMSTANCES BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. **

DO NOT USE INGREDIENT INFORMATION AND/OR INGREDIENT PERCENTAGES IN THIS MSDS AS A PRODUCT SPECIFICATION. FOR PRODUCT SPECIFICATION INFORMATION REFER TO A PRODUCT SPECIFICATION SHEET AND/OR A CERTIFICATE OF ANALYSIS. THESE CAN BE OBTAINED FROM YOUR LOCAL UNIVAR SALES OFFICE.

ALL INFORMATION APPEARING HEREIN IS BASED UPON DATA OBTAINED FROM THE MANUFACTURER AND/OR RECOGNIZED TECHNICAL SOURCES. WHILE THE INFORMATION IS BELIEVED TO BE ACCURATE, UNIVAR MAKES NO REPRESENTATIONS AS TO ITS ACCURACY OR SUFFICIENCY. CONDITIONS OF USE ARE BEYOND UNIVARS CONTROL AND THEREFORE USERS ARE RESPONSIBLE TO VERIFY THIS DATA UNDER THEIR OWN OPERATING CONDITIONS TO DETERMINE WHETHER THE PRODUCT IS SUITABLE FOR THEIR PARTICULAR PURPOSES AND THEY

ASSUME ALL RISKS OF THEIR USE, HANDLING, AND DISPOSAL OF THE PRODUCT, OR FROM THE PUBLICATION OR USE OF, OR RELIANCE UPON , INFORMATION CONTAINED HEREIN. THIS INFORMATION RELATES ONLY TO THE PRODUCT DESIGNATED HEREIN, AND DOES NOT RELATE TO ITS USE IN COMBINATION WITH ANY OTHER MATERIAL OR IN ANY OTHER PROCESS.

* * * E N D O F M S D S * * *

003 06/11/03 SPRINT 330

PRODUCT IDENTIFICATION

PRODUCT NAME: SPRINT 330

MSDS NUMBER: P17502VS

DATE ISSUED: 12/13/02

SUPERCEDES: 01/26/01

ISSUED BY: 009110

MATERIAL SAFETY DATA SHEET

Product Name: SPRINT 330 HMIS Codes: H F R P

Product Code: BUI/SPRINT330 2 0 0 X

Section I - Manufacturer Identification

Manufacturer's Name: Becker Underwood, Inc.

Address: P.O. Box 667,801 Dayton Ave., Ames, IA 50010

Emergency Phone: Chemtrec (800) 424-9300

Information Phone: (515) 232-5907

Prepared By: MSDS Coordinator Date Revised: December 13, 2002

Section II - Hazardous Ingredients/SARA III Information

Hazardous Components Occupational Exposure Limits

Component	CAS Number	OSHA PEL	ACGIH TLV	Weight Percent
-----------	------------	----------	-----------	----------------

No reportable quantities of hazardous ingredients are present

No toxic chemical(s) subject to the reporting requirements of section 313 of Title III and of 40 CFR 372 are present

Section III - Physical/Chemical Characteristics

Melting Point:	NA	Specific Gravity: (H2O = 1):	-0.73 g/mL
----------------	----	------------------------------	------------

Vapor Density:	NA	Evaporation Rate:	NA
----------------	----	-------------------	----

Solubility In Water:	Soluble	Appearance and Odor:	Yellow
----------------------	---------	----------------------	--------

Crystalline Powder, odorless

Section IV - Fire and Explosion Hazard Data:

Flash Point: NA Method Used: NA

Flammable Limits in Air by Volume: NA Lower: NA Upper: NA

Extinguishing Media: Foam, alcohol foam, CO2, dry chemical, water fog

Fire Fighting Precautions & Hazards:

Fire fighters should wear butyl rubber boots, gloves, and body suit and a NIOSH/MSHA self-contained breathing apparatus.

Unusual Fire and Explosion Hazards:

Not a fire or explosion hazard when stored under normal conditions.

Section V - Reactivity Data

Stability: Stable

Conditions to Avoid: Extremes in temperature. High humidity.

Incompatibility (Materials to Avoid):

long term storage in direct contact with reactive metals such as aluminum, zinc, copper, nickel, magnesium, etc. Other materials to avoid include strong

oxidizing agents.

Hazardous Decomposition Products:

When involved in a fire, burning may evolve noxious fumes which may include carbon monoxide, carbon dioxide, nitrous oxides, acetic acid, or other toxic compounds depending on the chemical composition and combustion conditions. However, all of the water must be driven off first for this to occur.

Hazardous Polymerization: Will not occur.

Section VI - Health Hazard Data

Inhalation Health Risks and Symptoms of Exposure:

Prolonged inhalation may lead to respiratory tract irritation.

Skin and Eye Contact Health Risks and Symptoms of Exposure:

Prolonged or repeated contact may result in moderate to severe irritation.

Skin Absorption Health risks and Symptoms of Exposure: None expected.

Ingestion Health Risks and Symptoms of Exposure:

Ingestion of large quantities may be harmful.

Health Hazards (acute and chronic): None known.

Carcinogenicity NTP? Yes **IARC Monographs?** No

Existing Medical Conditions Generally Aggravated By Exposure:

May provoke asthmatic response in persons with asthma who are sensitive to airway irritants.

Section VI - Health Hazard Data (Continued)

Emergency and First Aid Procedures:

Eyes:

Flush with flowing water for at least 15 minutes. Call a physician.

Skin:

Wash affected area with soap and water. If irritation develops consult a physician. Remove and launder contaminated clothing before reuse.

Inhalation:

If difficulty in breathing occurs, move to fresh air. Get immediate medical attention.

Ingestion:

Get immediate medical attention. Unless advised otherwise, dilute with water or milk.

Section VII - Precautions for Safe Handling and Use

Steps to be Taken in Case Material is Released or Spilled:

Contain the spill to prevent a large discharge to surface streams or storm sewers. Vacuum or use wet clean-up techniques and place recovered product in a closable container.

Waste Disposal Method:

The environmental concern is discoloration of land or water. Disposal must be made in accordance with federal, state, and local regulation.

Precautions to be Taken in Handling and Storing:

Local exhaust. Do not freeze. Avoid unnecessary skin contact. Do not breathe fumes.

Other Precautions:

Eye wash fountains should be easily accessible. As with all chemicals, keep

out of the reach of children.

Section VIII - Control Measures

Respiratory:

If excessive dust is present, wear NIOSH/MSHA approved respirator.

Ventilation:

Local exhaust or containment.

Clothing:

Gloves, coveralls, apron, boots as necessary to prevent skin contact as needed.

Eye:

Safety glasses are recommended.

Other:

Open wounds or skin surface disruptions should be covered with a chemical resistant patch to minimize absorption risks. Clean clothing should be worn daily to avoid possible long-term build up of the product leading to chronic overexposure.

Section IX - Shipping and Labeling Information

D.O.T. Shipping Data: Not regulated.

D.O.T. Hazard Classification NA

D.O.T. Labels Required: NA

D.O.T. Identification NA

Section X - Disclaimer

----- FOR ADDITIONAL INFORMATION -----
CONTACT: MSDS COORDINATOR UNIVAR USA INC.
DURING BUSINESS HOURS, PACIFIC TIME (425)889-3400
----- NOTICE -----

***** UNIVAR USA INC ("UNIVAR") EXPRESSLY DISCLAIMS

ALL EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A

PARTICULAR PURPOSE, WITH RESPECT TO THE PRODUCT OR INFORMATION PROVIDED HEREIN,

AND SHALL UNDER NO CIRCUMSTANCES BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL
DAMAGES.**

DO NOT USE INGREDIENT INFORMATION AND/OR INGREDIENT PERCENTAGES IN THIS MSDS
AS A PRODUCT SPECIFICATION. FOR PRODUCT SPECIFICATION INFORMATION REFER TO A
PRODUCT SPECIFICATION SHEET AND/OR A CERTIFICATE OF ANALYSIS. THESE CAN BE
OBTAINED FROM YOUR LOCAL UNIVAR SALES OFFICE.

ALL INFORMATION APPEARING HEREIN IS BASED UPON DATA OBTAINED FROM THE
MANUFACTURER AND/OR RECOGNIZED TECHNICAL SOURCES. WHILE THE INFORMATION IS
BELIEVED TO BE ACCURATE, UNIVAR MAKES NO REPRESENTATIONS AS TO ITS ACCURACY OR
SUFFICIENCY. CONDITIONS OF USE ARE BEYOND UNIVARS CONTROL AND THEREFORE USERS
ARE RESPONSIBLE TO VERIFY THIS DATA UNDER THEIR OWN OPERATING CONDITIONS TO
DETERMINE WHETHER THE PRODUCT IS SUITABLE FOR THEIR PARTICULAR PURPOSES AND THEY
ASSUME ALL RISKS OF THEIR USE, HANDLING, AND DISPOSAL OF THE PRODUCT, OR FROM
THE PUBLICATION OR USE OF, OR RELIANCE UPON, INFORMATION CONTAINED HEREIN.
THIS INFORMATION RELATES ONLY TO THE PRODUCT DESIGNATED HEREIN, AND DOES NOT
RELATE TO ITS USE IN COMBINATION WITH ANY OTHER MATERIAL OR IN ANY OTHER

SIGMA-ALDRICH

MATERIAL SAFETY DATA SHEET

Date Printed: 01/11/2005

Date Updated: 04/04/2004

Version 1.3

Section 1 - Product and Company Information

Product Name	YEAST EXTRACT SPRAY DRIED, AUTOLYZED YEAST EXTRACT
Product Number	Y4000
Brand	SIGMA
Company	Sigma-Aldrich
Street Address	3050 Spruce Street
City, State, Zip, Country	SAINT LOUIS MO 63103 US
Technical Phone:	314 771 5765
Emergency Phone:	414 273 3850 Ext. 5996
Fax:	800 325 5052

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
YEAST EXTRACT	8013-01-2	No
Synonyms	Yeast, ext.	
RTECS Number:	ZF6610000	

Section 3 - Hazards Identification

HMIS RATING

HEALTH: 0

FLAMMABILITY: 0

REACTIVITY: 0

NFPA RATING

HEALTH: 0

FLAMMABILITY: 0

REACTIVITY: 0

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE

If swallowed, wash out mouth with water provided person is conscious. Call a physician.

INHALATION EXPOSURE

If inhaled, remove to fresh air. If breathing becomes difficult, call a physician.

DERMAL EXPOSURE

In case of contact, immediately wash skin with soap and copious amounts of water.

EYE EXPOSURE

In case of contact with eyes, flush with copious amounts of

water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section 5 - Fire Fighting Measures

FLASH POINT
N/A

AUTOIGNITION TEMP
N/A

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: Water spray. Carbon dioxide, dry chemical powder, or appropriate foam.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s): Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Exercise appropriate precautions to minimize direct contact with skin or eyes and prevent inhalation of dust.

METHODS FOR CLEANING UP
Sweep up, place in a bag and hold for waste disposal. Avoid raising dust. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Avoid inhalation. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep tightly closed.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Safety shower and eye bath. Mechanical exhaust required.

PERSONAL PROTECTIVE EQUIPMENT
Respiratory: Wear dust mask.
Hand: Protective gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES
Wash thoroughly after handling.

Section 9 - Physical/Chemical Properties

Appearance	Physical State: Solid	
Property	Value	At Temperature or Pressure

Molecular Weight	N/A
pH	N/A
BP/BP Range	N/A
MP/MP Range	N/A
Freezing Point	N/A
Vapor Pressure	N/A
Vapor Density	N/A
Saturated Vapor Conc.	N/A
SG/Density	N/A
Bulk Density	N/A
Odor Threshold	N/A
Volatile%	N/A
VOC Content	N/A
Water Content	N/A
Solvent Content	N/A
Evaporation Rate	N/A
Viscosity	N/A
Surface Tension	N/A
Partition Coefficient	N/A
Decomposition Temp.	N/A
Flash Point	N/A
Explosion Limits	N/A
Flammability	N/A
Autoignition Temp	N/A
Refractive Index	N/A
Optical Rotation	N/A
Miscellaneous Data	N/A
Solubility	N/A

N/A = not available

Section 10 - Stability and Reactivity

STABILITY

Stable: Stable.

Materials to Avoid: Strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS

Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide.

HAZARDOUS POLYMERIZATION

Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE

Skin Contact: May cause skin irritation.

Skin Absorption: May be harmful if absorbed through the skin.

Eye Contact: May cause eye irritation.

Inhalation: May be harmful if inhaled. Material may be irritating to mucous membranes and upper respiratory tract.

Ingestion: May be harmful if swallowed.

SIGNS AND SYMPTOMS OF EXPOSURE

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

TOXICITY DATA

Intraperitoneal

Rat

4500 MG/KG

LD50

Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Eye:Mydriasis (pupillary dilation).
Behavioral:Convulsions or effect on seizure threshold. Lungs, Thorax, or Respiration:Dyspnea.

Intraperitoneal

Mouse

>8 GM/KG

LD50

Remarks: Behavioral:Somnolence (general depressed activity).
Behavioral:Convulsions or effect on seizure threshold. Lungs, Thorax, or Respiration:Dyspnea.

Section 12 - Ecological Information

No data available.

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION

Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT

Proper Shipping Name: None

Non-Hazardous for Transport: This substance is considered to be non-hazardous for transport.

IATA

Non-Hazardous for Air Transport: Non-hazardous for air transport.

Section 15 - Regulatory Information

UNITED STATES REGULATORY INFORMATION

SARA LISTED: No

TSCA INVENTORY ITEM: Yes

CANADA REGULATORY INFORMATION

WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.

DSL: No

NDSL: No

Section 16 - Other Information

DISCLAIMER

For R&D use only. Not for drug, household or other uses.

WARRANTY

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any

guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale. Copyright 2005 Sigma-Aldrich Co. License granted to make unlimited paper copies for internal use only.

3.0 EQUIPMENT INSTALLATION

The purpose of this section is to provide general information on receipt and installation of new equipment. Additional procedures for the installation of specific components can be found in the Vendor Literature Manual.


All equipment must be installed as shown on the piping and layout drawings for this job. Refer to the drawings supplied with this equipment when reading and performing the procedures in this section.

3.1 EQUIPMENT HANDLING PROCEDURES

3.1.1 Handling Guidelines

The odour control scrubber is delivered to the owner with all internal components installed. If for any reason internal components need to be removed, please contact Siemens to obtain specific instructions.

1. All lifting and moving procedures must be performed by experienced crane operators using standard rigging methods.
2. Before beginning any equipment handling procedures, refer to any applicable literature and information for cranes, lift trucks, and other equipment used for lifting and moving.



Stop

Damaged lifting devices can cause failure in service and cause severe personal injury or equipment damage.

Never use slings or cables that are cut, frayed, or kinked. Refer to manufacturer's information on inspecting lifting devices for damage.

3. Make sure that all equipment used for lifting and moving is properly maintained and is in good repair.

Always inspect slings, cables, and other equipment prior to every lifting and moving event.

4. When moving a component with a crane or a lift truck, keep the load as low as possible at all times. This can minimize component damage if the load tips over, slips, or falls.

Also, keep hands and feet from under raised components. If operators must reach under a raised component to connect lifting devices or perform other work, place blocks under the component to support it.

If operators must reach under a raised component, place some type of heavy blocking under the component to support it if the lifting device fails.

5. When a component is connected to lifting devices and is ready to lift a foreman or lead person should verify that all workers are clear of the lifting devices, the object, and the immediate lift area before proceeding with the lift.

When a large component is to be lifted and moved, all workers in the general area should be warned of the lifting event and should be instructed to stand clear of the component and the lift area.

When a component is lifted with a crane or forklift, all workers must remain in the crane or forklift operator's view during the lifting operation.

6. If the equipment being unloaded is to be stored temporarily, follow the instructions given in subsection 3.3.

Always set and store vessels and skids on wooden blocks in the same manner in which they were shipped.

3.1.2 **Handling Smaller Components**

1. Many of the smaller components that are shipped loose for this job can be moved using forklifts or small cranes and woven straps.

Workers must be sure that any equipment used for moving loose components is properly maintained and is in good repair. Refer to OSHA manual #2206 for more information on material handling and handling equipment.

2. When moving components with a forklift, be careful not to damage the components.

Avoid "ramming" the lifting forks under pieces; use a crane or pry bar to lift the piece up enough to drive the forks under.

Be careful not to damage tubing, indicators, and other delicate devices or parts attached to larger components.

Make sure that any load on the forks is secure and balanced. When carrying pipe or pipe spools on the forks, keep the forks tilted all the way back and avoid sudden stops.

Be aware of the weight capacity of the forklift being used; do not overload the forklift. When carrying long or wide pieces, watch carefully when making turns.



Note

Do not position the bio-filter without using the positioning eyes located on the equipment. These are for positioning purposes only.

3. When moving lengths of pipe or long spools with woven straps, use two straps equally spaced from the balance point of the piece; this will prevent tipping and loss of control of the piece when it is lifted.

When lined pipes and spools are being moved, avoid striking the ends on other components. Keep the end caps in place until the pipe or spool is ready to be installed.

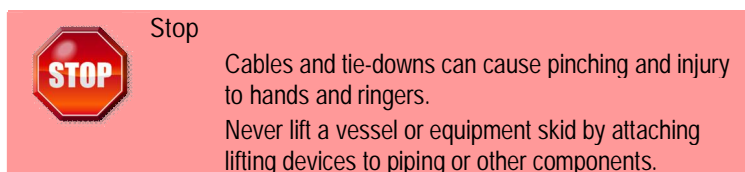
Also, be careful not to damage tubing, indicators, and other delicate devices or parts attached to the valves.

3.1.3 Handling Vessels

1. Before attempting to lift and move large vessels, verify that the proper lifting equipment is available.

All cranes, cables, slings, and other equipment must have a rated weight capacity that exceeds the weight of an individual component being lifted. Refer to the Siemens Equipment Layout drawing for the vessel weights. This drawing was supplied separately with the rest of the engineering drawings.

2. While lifting and moving vessels, adhere to the guidelines given in subsection 3.1.1.



Make sure that workers' hands are clear of the cables and tie-downs before taking up slack.

3.2 INITIAL EQUIPMENT RECEIPT AND INSPECTION

Inspect the ZABOCS® unit for damage in shipment. If there is damage, report it within 48 hours of receipt of the scrubber. Minor scratches in the paint are acceptable. They can be touched-up on site after installation. If there is no damage, proceed with the installation.

3.3 EQUIPMENT STORAGE

All equipment shall be stored under shelter, indoors. Protect equipment from weather. See respective component O&M manuals for details on equipment storage.

3.4 EQUIPMENT SITE AND/OR PAD

Elevations and dimensions have been based on the best information available at the time of design and must be verified in the field by the contractor. The installer is responsible for verifying all dimensions and elevations before proceeding with any work. The ground should be prepared with a sloped concrete pad. The concrete pad for the equipment should have a slope of 5.5 mm per meter from fan to drain. Section 13.2 shows the general arrangement of the ZABOCS® system. Individual installations may have different platform requirements. Consult the specific layout drawing for the ZABOCS® system if one is available.

3.5 ZABOCS® SYSTEM ASSEMBLY

Once the concrete pad preparation is completed, place the equipment in the proper location per the site plan. This pad location should be smooth and level with the rest of the floor. Make sure that the pad is clean and any pebbles or imperfections in the concrete have been removed before placing the neoprene pad. The neoprene pad should be installed on the concrete pad before placing the system. Section 13.2 shows general the arrangement of the ZABOCS® unit.

3.5.1 Base Piping Connections

Three external connections for power, supply water, and drain lines will have to be connected to the ZABOCS® bio-filter prior to start-up. All plumbing, electrical, and ductwork connections were assembled prior to shipping. Some piping or other components may be partially disassembled to prevent damage during shipping. Re-attach all connections as shown on the site plan. Connection to external power is made through the control panel. All wires will be numbered and pre-wired. Make all connections as shown on the ladder diagram.

The main water service connection is made to a 50 mm universal flange located on the side of the ZABOCS® unit. A pressure regulator is attached directly after the connection to maintain a constant supply pressure. The incoming water pressure should be at a minimum of 30 psi [207 kPa]. A rotameter is connected after the pressure regulator to verify the proper flow to the irrigation lines. The rotameter will be factory set to assure good liquid distribution over the bed. Water irrigation duration is controlled by the timers located in the control box.

This ZABOCS® system drain should be connected to an external 50 mm (minimum) gravity drain with a barometric P-trap.

3.6 EQUIPMENT SKID PLACEMENT

The equipment module should be placed on level ground at the elevation and location indicated on the shop drawings. Electrical connections to the unit will be made in the field at the time of installation.

3.7 ELECTRICAL CONNECTIONS

Electrical power lines should be brought via conduit to the control panel located on the equipment skid. Connections from the control panel to the solenoid valves and blower will be installed prior to shipping. Consult the respective component manuals prior to connection of electrical power. Refer to Section 10.1 (Electrical Control Panel External & Internal Layout) and Section 10.2 (Electrical Control Panel Ladder Logic Diagram) for detail.

Insure proper rotation of blower prior to start-up of the system. The system should not be started prior to verifying rotation.

3.8 **MEDIA INSTALLATION**

The biolite and carbon media is pre-installed in the vessel. If it ever needs to be replaced, follow the steps listed. To install the carbon media, please begin with Step 5.

STEP 1: Lockout motors, dampers, and valves to prevent the system from starting and to keep process gases from entering the vessel.

STEP 2: Remove the exhaust stacks from the vessel. Move the media support grating (in the upper bed) to allow for access to the bottom media bed.

STEP 3: Install the black polypropylene screen into the vessel (on top of the lower bed media supports). It is important to secure the screen down in such a way that no Biolite media rock can get underneath the screen. To accomplish this feat, Siemens recommends using a hot glue gun (or other adhesive) to fasten the edges of the screen to the interior vessel walls above the media supports.

STEP 4: Install 3'-6" [1,067 mm] of Biolite media in to the vessel using a shovel. (Please note that there are two different types of Biolite media for the bottom bed, ½" [12 mm] and ¼" [6 mm] rock. The first layer of Biolite media will be comprised of ½" [12 mm] rock and will only be ~3" [76 mm] in height. Once the 3" [76 mm] layer has been installed and leveled, the remaining 3'-3" [990 mm] of media will be comprised of ¼" [6 mm] rock. The different types of Biolite media are labeled on the ~3,000 lb [1,361 kg] super-sacks as either ¼" [6 mm] or ½" [12 mm].) It is important to rake and spread the Biolite media to level out the bed after installation.

STEP 5: Re-install the upper media bed support grating for the top bed and fasten down the (white) polypropylene screen above the grating. In lieu of using any sort of adhesive to secure the screen, Siemens recommends placing a shovel full of carbon media against the inside wall all around the vessel to hold the screen in place. *Sealant is not required for the installation of the upper media bed support screen.*

STEP 6: Transfer the carbon onto the top bed by using a shovel. Rake and spread the carbon to level out the bed. The use of dust collection equipment is recommended.

STEP 7: Verify that the bed is to the correct depth (typically 1'-0" [305 mm]). Do not overfill the bed.

STEP 8: Fasten and secure exhaust stack covers to the flanges on top of the vessel shell, and remove lockout tags and locks.

3.9 H2S ANALYSER INSTALLATION

Each site has two H2S analyser panels; one installed at the inlet ductwork [Dräger Polytron 7000] for high range analysis and the other at the outlet ductwork [Thermofisher Odalog 0-2ppm] for low range analysis.

Analysers are supplied in cabinets with sample conditioning; including air filtering, flowrate control and pumping.

Each analyser has two small air tubing connections to the 300mm PVC duct work; one for air sampling, and the other for sample air return.

3.10 VENT STACK AND DUCT WORK INSTALLATION

The ductwork at each site consists of the following:

- uPVC interconnecting ductwork [300 mm diameter] from OC Vendor limit of contract to odour control system inlets and from odour control system outlets to stack;
- Isolation dampers [300mm] on odour control vessel inlet and outlet and in emergency by-pass [5 in total]
- FRP Ventilation stack [300 mm diameter 8 m height]
- Vandalite with PE cell to illuminate the Control Panel.

4.0 SYSTEM CONTROLS

4.1 ELECTRICAL CONTROL PANEL

The electrical control panel is installed on the side of the concrete slab. It is rated IP55, and constructed of Stainless Steel. The ZABOCS® controls for both units are located inside the control box on an escutcheon plate behind the front door. Please refer to Electrical Drawings for details.

The control panel is fitted with two VSD's for fan speed control each with a BOP (Basic Operating Panel). Details for setting up the VSD is found in the Appendix.

4.1.1 Switches

The top left corner of the control panel contains the "MAIN ISOLATOR" switch. By turning the switch to "OFF", the power will be turned off to the entire control panel. By turning the switch to "ON", the power will be turned on to the entire control panel.

The two Odour Control Units are designated as 1 & 2. Looking from the Control Panel, Unit 1 is on the left, and Unit 2 is on the right. This also corresponds to the Control Panel layout where switches for Odour Control Unit 1 grouped together are on the left of the Panel and switches for Odour Control Unit 2 are grouped on the right of the Panel. Refer to Control Panel drawing layout.

For Odour Control Unit 1, the top row of indicator lights has two (2) lights. Scanning in a left-to-right fashion, the labels read as follows:

- "PUMP RUNNING – PMP L1" – When the nutrient pump selector switch "PMP-S1" is turned to the "AUTO" or "MAN" position, the light illuminates to indicate the nutrient pump is running. "AUTO" position indicates that the pump will run when the solenoid valve is open. The pump will always run when the selector switch is turned to the "MAN" position.
- "SOLENOID OPEN – SOL-L1" – The ZABOCS® unit is actively receiving water in the media beds.

The bottom row on the control panel front has one (1) push button and one (1) three-position selector switch. Scanning in a left-to-right fashion, the labels read as follows:

- "SELECTOR SWITCH PUMP-S1 - MAN/OFF/AUTO" – This switch turns the power to the nutrient pump "MAN", "OFF" or "AUTO".
- "SOLENOID TEST – SOL-S1" – Pressing this button opens the solenoid valve. The valve remains open as long as the button is depressed. This is used to test the solenoid valve, manually irrigate the media beds, and to relieve pressure in the water and nutrient feed piping when the incoming water supply valve is closed.

An "HOURS RUN INDICATOR" sums up the total hours of fan operation.

For Odour Control Unit 2, the above is repeated on the right side of the Panel.

Lastly, a "NUTRIENT TANK LOW LEVEL" light indicator in the middle of the Panel illuminates to indicate nutrient level is low and should be replenished.

4.2 WATER CONTROL SYSTEM

The water control system is mounted on the ZABOCS®. It is composed of a solenoid valve to automatically turn the irrigation water on and off, a rotameter to control the water feed rate to the media beds, a nutrient metering pump to dose the irrigation water with nutrient, and a pressure regulator and gauge to control the incoming water pressure.

4.2.1 Solenoid Valve

A solenoid valve is supplied to control the water flow rate into the ZABOCS® media beds. The Solenoid Valve controls the irrigation lines. The irrigation lines are used to irrigate the media beds, and to provide nutrients as necessary. An adjustable timer located in the control panel controls the cycling of the irrigation line.

The solenoid valve may also be operated manually by depressing the “Solenoid Test” button on the control panel. Depressing this button will open the solenoid valve. Releasing the button will return the solenoid valve to automatic control.

4.2.2 Rotameter

The solenoid valve turns the irrigation water on and off. The rotameter controls the rate at which water is fed to the media beds. The rotameter is factory set to ensure good liquid distribution across the top of the media beds.

4.2.3 Pressure Regulator

The pressure regulator controls the pressure of the water to prevent excessive pressure damaging the piping, and to ensure proper liquid flow to the nozzles. The pressure regulator is set at minimum of 30 psi [207 kPa].

4.2.4 Nutrient Feed System

Nutrient is fed to the media beds every time irrigation water comes on. Liquid nutrient is placed in the nutrient tank. Each time the irrigation water comes on nutrient is injected to the water line by a solenoid-metering pump. A small amount of liquid nutrient is pumped from the nutrient reservoir and added to the water in the bottom line.

The 1000 litre nutrient tank needs to be filled with liquid fertilizer at 5% concentration. Alternatively, dry nutrient can also be used once its thoroughly mixed. Typical concentration for dry nutrient is 0.012 kg/litre. To make up 1000 litre, 12 kg of dry nutrient will need to be added.

The 1000 litres of nutrient will typically last 3 to 4 months. Monthly monitoring is recommended to ensure nutrient is free flowing to the pumps.

The nutrient tank is fitted with a mechanical pulley and float level indicator to provide visual indication of tank level. In addition, a liquid level switch is mounted on tank top. When the non-floating solid PP displacer, suspended from the switch, is immersed in the liquid, the weight change causes the switch to activate on low tank level (approx 20%). An alarm at the control panel will be triggered when this low level condition occurs.

4.3 **SAMPLE DRAW SYSTEM –H2S ANALYSER**

Two H2S analyser panels are installed at each site, one for high level analysis upstream of the Odour Control Units, and one for low level analysis downstream of the Odour Control Units.

Each panel consist of an air filter for removal of any water droplets from the sample air stream, an air rotameter for flow rate monitoring, H2S analyser, an air pump for maintaining adequate air flow rates and associated electrical power supply, isolators and terminations.

For the inlet air stream, the analyser panel includes a Dräger Polytron 7000 analyser, fitted with a high range H2S sensor (100ppm).

For measurement of H2S in the outlet air stream, the analyser panel includes a App-tek Odialog analyser, suitable for low range monitoring (2ppm).

5.0 START-UP AND OPERATION

5.1 GENERAL INFORMATION

Proper ZABOCS® unit start-up is essential to develop a healthy microbial population and reduce possible future operational problems. Siemens recommends that start-up be performed by a technician familiar with the operation of the ZABOCS® system.

The ZABOCS® unit will capture 99% of the odors immediately upon system startup. This capture is achieved through adsorption and absorption of odors in the media beds. Concurrently during the first several weeks of operation, the biological microbe population will develop and grow in the media beds. After a few weeks, the microbial population will be well established. During the first few weeks as the microbial population is building the following parameters should be monitored:

- Volumetric flow rate.
- Inlet and outlet concentrations of hydrogen sulfide.
- Timer and rotameter settings for irrigation.
- Nutrient pump settings.

5.2 FAN START-UP

The Variable Frequency Drives located in the Electrical Control Panel of the ZABOCS® unit will be set during start-up to provide the specified volumetric flow rate of air to the system. The fan speed may be adjusted on the VFD.

The VFD will be set during start-up to provide the given flow rate of airflow through the dry bed. This setting should be adjusted as needed in the field to maintain the proper airflow in a wet bed and to account for actual upstream pressure losses. As the biological microbe colonies grow in the bed, the VFD may need to be adjusted to maintain optimum airflow. We recommend checking this setting weekly for the first four weeks of operation and monthly thereafter. Using a Pitot tube, hot wire anemometer or other flow-measuring instrument, measure the airflow rate in the fan exhaust stack. Adjust the VFD as needed to produce the desired flow rate.

5.3 IRRIGATION

The ZABOCS® system must be irrigated sufficiently to maintain over 90% relative humidity. The solenoid valve attached to the irrigation system control the moisture level in the bed. The 90% relative humidity of the exhaust gas should maintain a 75% moisture level in the media.

Solenoid Valve controls the irrigation line. This irrigation line is used to add water to the media beds, and to provide future nutrients as necessary. An adjustable timer located in the control panel controls the cycling of the irrigation line. The timer is set to run for 4 minutes every hour, which is equal to running 96 minutes every day. Timer setting can be adjusted as required.

The solenoid button on the control panel temporarily opens the solenoid valve. The solenoid valve will remain open as long as the button is depressed. The feature is used for system testing and initial setting of the irrigation rotameter.

5.4 **NUTRIENT ADDITION**

A metering pump is provided to intermittently dose nutrient to the unit. Each time the solenoid valve is open, nutrient pump will inject nutrient into the irrigation piping system. The nutrient pump settings should be kept at the desired flow rate (see below table) and adjusted based on the nitrate readings in the drain water. The nitrate level in the drain should be detectable but may be as low as 0.1 ppm.

ZABOCS® System	Nutrient Pump Flow Rate Required
ZB-4000	1.9 L/day
ZB-5000	3.0 L/day

The amount of nutrient fed to the bed can be adjusted in several ways.

- 1) Adjusting the pump settings.
- 2) Increasing the concentration of nutrient in the reservoir.

5.5 **MAINTENANCE CHECKLIST**

MEASUREMENT	FREQUENCY	TARGET RANGE
Air Flow Rate	Weekly – Monthly	See Specs
Water Flow rate	Weekly – Monthly	See Section 5.3
Inlet Concentrations	Weekly – Monthly	Site Specific
Outlet Concentrations	Weekly – Monthly	< 99% of Inlet

Sampling frequency may be adjusted as appropriate after the first few weeks. We recommend weekly monitoring for the first 4 weeks, then monthly monitoring thereafter. All readings should be recorded in a logbook. Actual installations may vary from the typical ranges cited above.

Check Airflow

The airflow rate indicates whether the fan is operating properly. The airflow rate (ft³/min [m³/hr]) can be determined by measuring the air velocity (ft/min [m/hr]) using a Pitot tube or other air velocity instrument. Multiplying the result by the cross-sectional area (ft² [m²]) of the location where the velocity was measured will give an airflow rate.

Check Makeup Water

Check the makeup water flow rate at the rotameter to verify that makeup water is being provided at the correct rate.

Check Inlet and Outlet H₂S Concentrations

If suitable analysers are available, check the inlet and outlet H₂S concentrations to document that the system is working properly. Removal efficiency should be greater than 99.0%.

5.6 **SHUT-DOWN PROCEDURES**

The system is normally shut down by turning OFF each switch individually. The recommended shut-down procedure is as follows:

1. Turn **OFF** the nutrient pump switch.
2. Turn **OFF** the fan switch.
3. Turn **OFF** the system mains switch.

In an emergency, the entire system can be immediately shut down by turning **OFF** the main system disconnect breaker.

5.7 **OPERATING INSTRUCTIONS FOR H2S ANALYSER PANELS**

Note: This procedure is to be read in conjunction with the analyser panel component manuals found in the appendix.

1. Main Circuit Breaker and all Fused Terminals should be “open” (no power to system).
2. Open Sample Inlet and outlet Isolation Valves at main duct.
3. Close Main Circuit Breaker – this applies 240VAC to the Power Circuits into which are plugged the 240VAC to 24VDC / 5VDC Power Supply, and the H2S Air Sample Pump.
4. Wait 30 seconds until the Power Supply has stabilised. Confirm DC is present at the DC “live” side.
5. Confirm that the Air Pump is operational.
6. Confirm sample flow is present via Flow Rotameter. Actual flow rate is not critical, however this will typically be 1.5 to 1.8 litres / minute.
7. Confirm that the Analysers completes the initialisation sequence and then displays a live H2S reading.
8. Confirm that no “Faults” are present.
9. Sample Draw H2S Monitoring System is now fully operational.

6.0 TROUBLESHOOTING

6.1 HIGH HYDROGEN SULFIDE EXHAUST LEVELS

If excessive odours are present at the system exhaust the following items need to be checked for improper operation.

6.1.1 Media Too Dry

Little to no moisture in and on the media can limit the unit's efficiency. Add a quart of fertilizer/water mixture to the system. Then check the system flow rate for proper operation. It may be necessary to adjust the timers to increase the irrigation frequency.

6.1.2 Media Too Wet

If the media is overly wet, or moist, it will not perform well. Reduce the water flow to the internal irrigation system. It will be necessary to adjust the timers to optimize the unit's efficiency. The water lines may be turned off for a period of time to allow the media to dry out.

6.1.3 High Loading Levels

Abnormally high hydrogen sulfide loading may overwhelm the unit's ability to remove the hydrogen sulfide. Check the incoming hydrogen sulfide level. Levels higher than the design conditions may cause an "over loading condition" on a typical ZABOCS® unit.

Excessive hydrogen sulfide loading may damage the microbes and may require replacement of the media. If the loading exceeds the design limits stated above for a prolonged period, dilution air will need to be provided to the inlet side of the unit until the loading is reduced to within the design limits.

6.2 LIQUID LEAKS

The most probable point for a leak to occur is at a threaded fitting. The fitting should be tightened or replaced as necessary. Contact Siemens should FRP repairs be needed. Note that the liquid in the drain may be very corrosive, and proper safety precautions should be followed.

6.3 WATER FLUCTUATIONS

Fluctuations in water delivery pressure can cause the water rate to vary. Lower the setting of the pressure regulator so that it is below the lowest fluctuation in pressure.

6.4 **LACK OF NUTRIENTS**

Excessive odours may be caused by a shortage of nutrient in the bed. Using nitrate test strips, check the nitrate level in the drain liquid. The minimum recommended nitrate level is approximately 0.1 mg/liter.

Check the nutrient reservoir to make sure there is still an adequate supply of liquid nutrient present. Add an additional nutrient supply as required.

7.0 REPLACEMENT PARTS

For current pricing and delivery on replacement parts, please contact:

Siemens Ltd

Tel: (02) 9491 5425

8.0 EXHAUST FAN

8.1 FAN SPECIFICATION SHEET

SIEMENS

ZABOCS[®]
PRODUCT SPECIFICATION SHEET

FRP EXHAUST FAN (B1001, B2001)

CUSTOMER

Siemens Industry, Inc.
SAN DIEGO, CA

PROJECT

**ZB-5000 ODOR CONTROL SYSTEM
TYPICAL OF 2X SYSTEMS**

FAN PERFORMANCE:

890 CFM @ 10.00" S.P.; DIRECT DRIVE @ 3187 RPM; 2.99 BHP

HARTZELL Fan Inc. Model 42-14-FL2, BAD-CW, ARRGT. 4 complete with:

- Epoxy coated Steel motor base
- Monel motor shaft sleeve
- Special Double Lip type Shaft Seal
- Slip Inlet
- Flanged Outlet
- Direct Drive
- 7.5 HP, 3 Ph / 50 Hz / 400 VAC, 3600 RPM, TEFC, Motor suitable for Inverter Duty

**MOTOR DATA [@460 V]:
SEE MOTOR DATA SHEETS**

FAN SHALL BE AMCA CERTIFIED FOR PERFORMANCE AND BEAR THE AMCA LABEL

SIEMENS

ZABOCS[®]
PRODUCT SPECIFICATION SHEET

FRP EXHAUST FAN (B3001, B4001)

CUSTOMER

Siemens Industry, Inc.
SAN DIEGO, CA

PROJECT

**ZB-4000 ODOR CONTROL SYSTEM
TYPICAL OF 2X SYSTEMS**

FAN PERFORMANCE:

1008 M³/hr @ 1.2 kPa S.P.; DIRECT DRIVE @ 2807 RPM; 0.9 kW

HARTZELL Fan Inc. Model 42-12-FL2, BAD-CW, ARRGT. 4 complete with:

- Epoxy coated Steel motor base
- Monel motor shaft sleeve
- Special Double Lip type Shaft Seal
- Slip Inlet
- Flanged Outlet
- Direct Drive
- 3.73 kW, 3 Ph / 50 Hz / 400 VAC, 3000 RPM, TEFC, Motor suitable for Inverter Duty

MOTOR DATA [@400 V]:
SEE MOTOR DATA SHEETS

FAN SHALL BE AMCA CERTIFIED FOR PERFORMANCE AND BEAR THE AMCA LABEL

SIEMENS

ZABOCS[®]
PRODUCT SPECIFICATION SHEET

FRP EXHAUST FAN (B5001, B6001)

CUSTOMER

Siemens Industry, Inc.
SAN DIEGO, CA

PROJECT

**ZB-4000 ODOR CONTROL SYSTEM
TYPICAL OF 2X SYSTEMS**

FAN PERFORMANCE:

1,296 M³/hr @ 2.94 kPa S.P.; DIRECT DRIVE @ 2938 RPM; 2.54 kW

HARTZELL Fan Inc. Model A43-0-16--F100FGOPL3, DB-CCW, ARRG. 10 complete with:

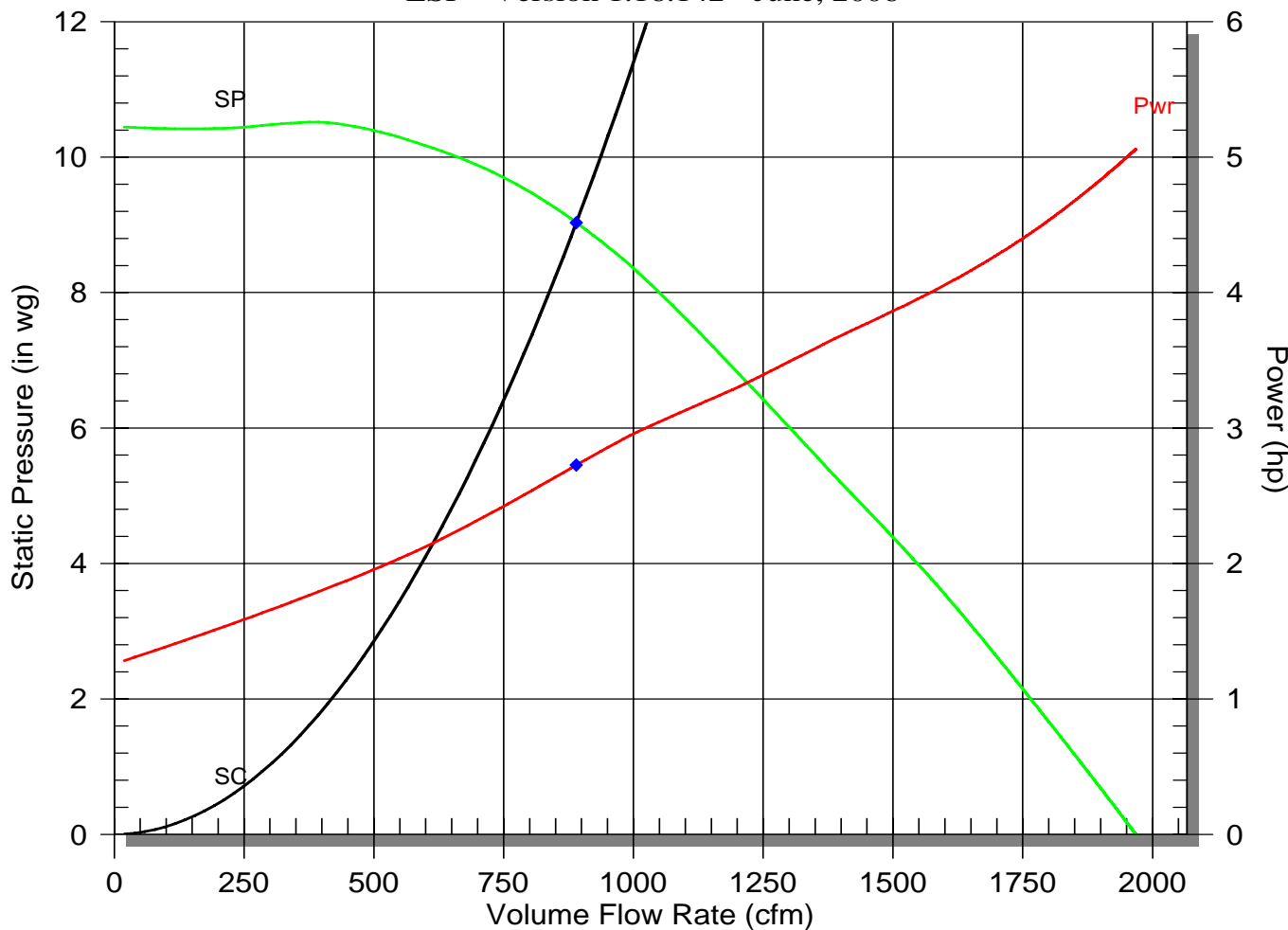
- Epoxy coated Steel motor base
- Monel motor shaft sleeve
- Special Double Lip type Shaft Seal
- Slip Inlet
- Flanged Outlet (Outlet flange not to extend more than 1" below fan base)
- Belt Drive
- 5.6 kW, 3 Ph / 50 Hz / 400 VAC, 1500 RPM, TEFC, Motor suitable for Inverter Duty

**MOTOR DATA [@400 V]:
SEE MOTOR DATA SHEETS**

FAN SHALL BE AMCA CERTIFIED FOR PERFORMANCE AND BEAR THE AMCA LABEL

8.2 FAN PERFORMANCE CURVE AND DRAWING

Job Ref:
Tag #:
Proposal #:
Rep. Name: Hartzell Fan, Inc.
Phone #: 1-800-336-3267
Fax #: 1-937-773-8994



Fan Selected:
A42-0-14--F100FGOPK3
42 - Fiberglass Pressure Blower
Vol Flow Rate 890.
Static Pressure 9.03
Density .075
Operating Temp 70 F
Fan RPM 3060
Max Safe RPM 3592
Operating Power 2.726
Standard Power 2.726
Static Efficiency 0.464
Outlet Velocity 4272

Power [BHP] excludes drives

Discharge Sound Power Levels
referred to 10⁻¹² watts

1	2	3	4	5	6	7	8
108	109	112	108	95	89	85	81

Radiated Sound Power Levels
referred to 10⁻¹² watts

1	2	3	4	5	6	7	8
104	102	102	97	83	76	72	68

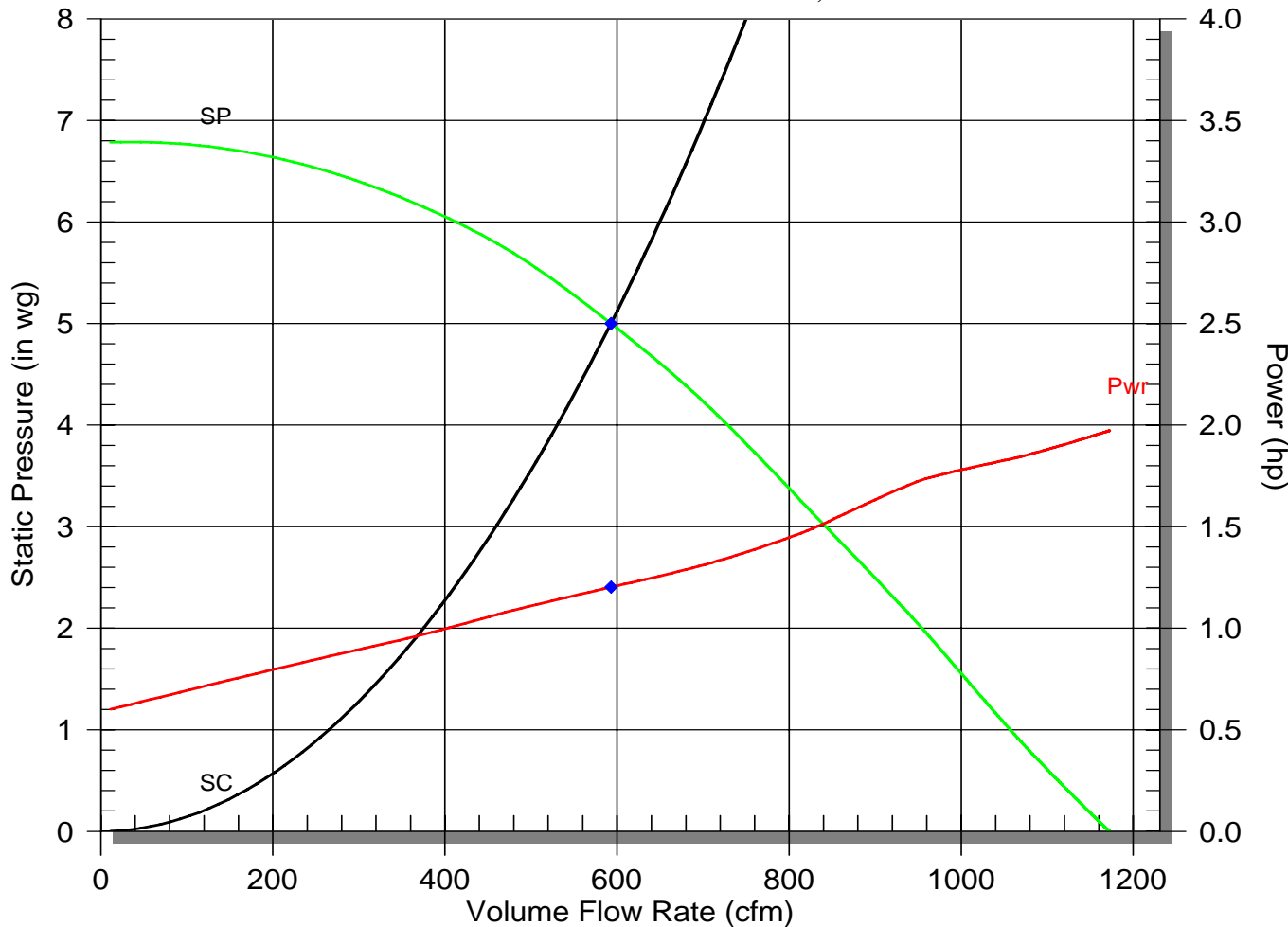


See page 2 for sound information,
including dBA and LwA.

Hartzell Fan, Inc. certifies that the model shown is licensed to bear the AMCA Seal.
The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211
and comply with the requirements of the AMCA Certified Ratings Program.
The AMCA Certified Ratings Seal applies to air performance ratings only.

Performance shown is for Installation Type D: Ducted Inlet, Ducted Outlet.
Power [BHP] excludes drives.
Performance Ratings do not include the effects of appurtenances in the airstream.
Sound ratings are based on sound power level data obtained in accordance with AMCA Standard 300.
The sound power level ratings shown are in decibels, referred to 10⁻¹² watts, calculated per AMCA Standard 301.
Fan Outlet Sound Testing. Values shown are for outlet Lwo sound power levels for: Installation Type D: ducted inlet, ducted outlet.
Ratings include the effects of duct end correction.

Job Ref:
Tag #:
Proposal #:
Rep. Name: Hartzell Fan, Inc.
Phone #: 1-800-336-3267
Fax #: 1-937-773-8994



Fan Selected:
A42-0-12--F100FGOPI3
42 - Fiberglass Pressure Blower
Vol Flow Rate 593.
Static Pressure 5.
Density .075
Operating Temp 70 F
Fan RPM 2807
Max Safe RPM 4167
Operating Power 1.202
Standard Power 1.202
Static Efficiency 0.388
Outlet Velocity 3795

Power [BHP] excludes drives

Discharge Sound Power Levels
referred to 10⁻¹² watts

1	2	3	4	5	6	7	8
107	103	99	97	87	81	78	80

Radiated Sound Power Levels
referred to 10⁻¹² watts

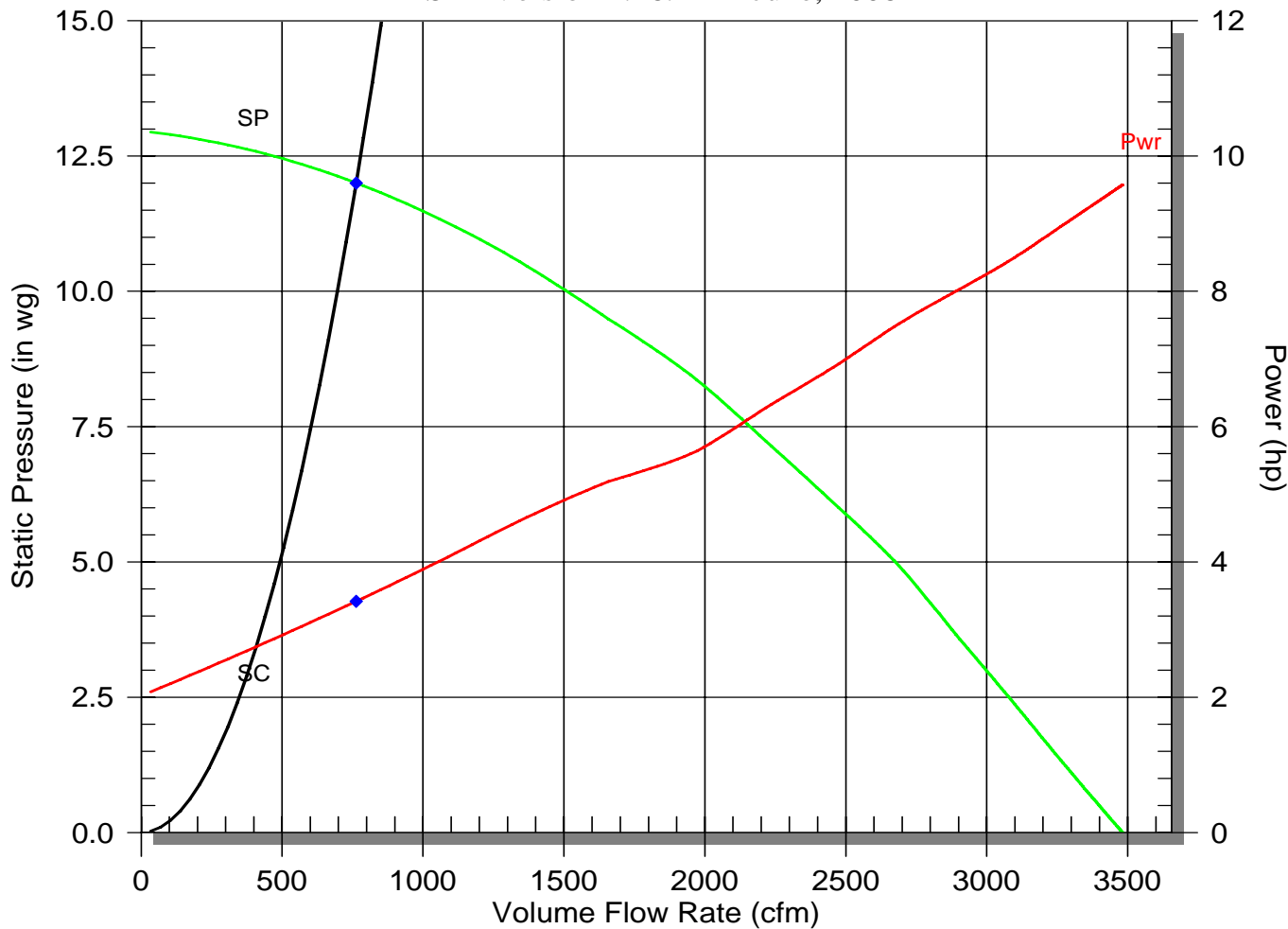
1	2	3	4	5	6	7	8
103	96	89	86	75	68	65	67



See page 2 for sound information,
including dBA and LwA.

Hartzell Fan, Inc. certifies that the model shown is licensed to bear the AMCA Seal.
The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211
and comply with the requirements of the AMCA Certified Ratings Program.
The AMCA Certified Ratings Seal applies to air performance ratings only.

Performance shown is for Installation Type D: Ducted Inlet, Ducted Outlet.
Power [BHP] excludes drives.
Performance Ratings do not include the effects of appurtenances in the airstream.
Sound ratings are based on sound power level data obtained in accordance with AMCA Standard 300.
The sound power level ratings shown are in decibels, referred to 10⁻¹² watts, calculated per AMCA Standard 301.
Fan Outlet Sound Testing. Values shown are for outlet Lwo sound power levels for: Installation Type D: ducted inlet, ducted outlet.
Ratings include the effects of duct end correction.



Fan Selected:
A43-0-16--F100FGOPL3
 43 - Fiberglass Radial Blower
 Vol Flow Rate 763.
 Static Pressure 12.
 Density .075
 Operating Temp 70 F
 Fan RPM 2938
 Max Safe RPM 3704
 Operating Power 3.417
 Standard Power 3.417
 Static Efficiency 0.422
 Outlet Velocity 1720

Power [BHP] excludes drives

Discharge Sound Power Levels
 referred to 10⁻¹² watts

1	2	3	4	5	6	7	8
110	116	118	114	101	88	82	85

Radiated Sound Power Levels
 referred to 10⁻¹² watts

1	2	3	4	5	6	7	8
106	109	108	103	89	75	69	72



See page 2 for sound information,
 including dBA and LwA.

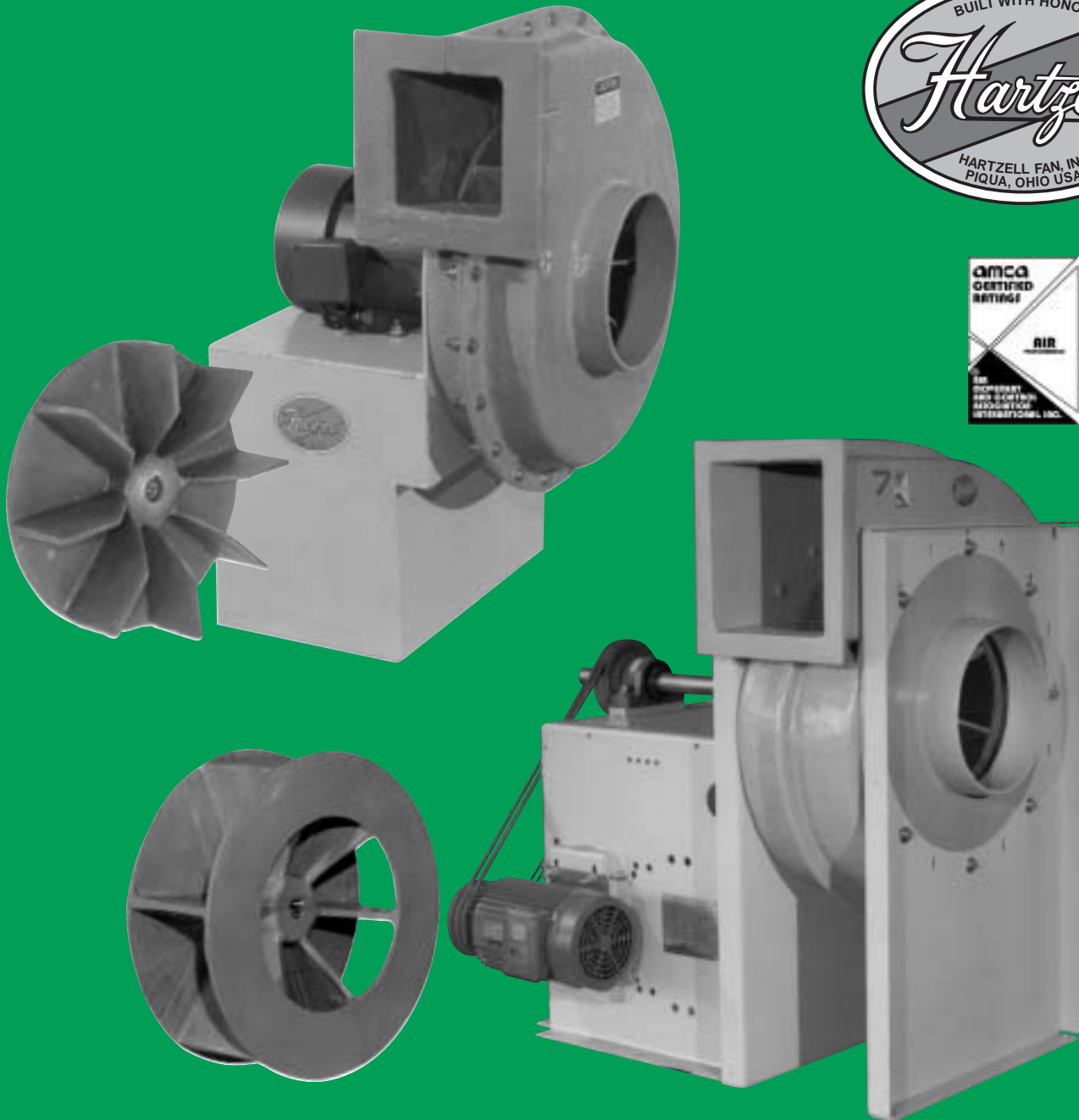
Hartzell Fan, Inc. certifies that the model shown is licensed to bear the AMCA Seal.
 The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211
 and comply with the requirements of the AMCA Certified Ratings Program.
 The AMCA Certified Ratings Seal applies to air performance ratings only.

Performance shown is for Installation Type D: Ducted Inlet, Ducted Outlet.
 Power [BHP] excludes drives.
 Performance Ratings do not include the effects of appurtenances in the airstream.
 Sound ratings are based on sound power level data obtained in accordance with AMCA Standard 300.
 The sound power level ratings shown are in decibels, referred to 10⁻¹² watts, calculated per AMCA Standard 301.
 Fan Outlet Sound Testing. Values shown are for outlet Lwo sound power levels for: Installation Type D: ducted inlet, ducted outlet.
 Ratings include the effects of duct end correction.

Fiberglass Radial Blowers

Series 42

Series 43



HARTZELL®

Hartzell Fan, Inc., Piqua, Ohio 45356
www.hartzellfan.com

Construction Features

A variety of corrosion problems plague industry today. Fans and blowers made of coated steel or metals such as stainless and monel can handle some problem areas. Please refer to the corrosion resistance table on page 13 of this bulletin. Fiberglass centrifugal blowers can be used in most applications where corrosive elements exist in fume and vapor form. The resistance to corrosive elements is a major advantage, but the physical properties of fiberglass equipment offer these additional advantages:

- Fiberglass equipment is corrosion resistant.
- Fiberglass equipment weighs 25% less than comparable equipment made of carbon steel.
- Fiberglass has an extremely high strength-to-weight ratio, stronger than steel on a per-pound basis.
- Dimensional stability of fiberglass is excellent.
- Fiberglass air moving equipment will not become brittle at low temperatures and at 0°F the laminated fiberglass will be stronger than at room temperature.

Hartzell Fan, Inc. conforms to ASTM D4167-97, Standard Specification for fiber-reinforced plastic fans and blowers, when optional surfacing veil, electrical grounding, and dynamic balancing to ASTM D4167-97 levels, are added to the fan.

The following are standard Hartzell fiberglass construction features:

- Corrosion resistant polyester resin, having a class I flame spread rate of 25 or less is used for all housings. Vinylester resin having a class I flame spread rate of 30 or less is used for all wheels.

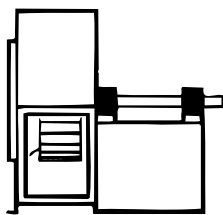
- All structural parts in the airstream are fiberglass and resin. All fiberglass surfaces are protected with a minimum 10-mil thickness of chemical, flame, and ultraviolet resistant resin.
- Shafts are turned, ground, polished, and keyed at both ends with a fiberglass sleeve in the airstream. Shafts are sized to operate well below critical speed. 304 or 316 Stainless steel or monel shafting is available as an option at extra cost.
- Internal hardware (airstream) is Type 304 stainless steel. All internal hardware (airstream) is encapsulated. All external hardware (out of airstream) is zinc plated as standard. Where metal is subject to attack by the corrosive elements being handled, all metal parts can be resin-coated after assembly.
- A fiberglass and neoprene shaft seal is placed where the shaft leaves the housing along with a neoprene shaft slinger between the seal and wheel on belt drive units. (Seal is not gas tight.)
- Bearings on belt drive units are heavy duty, deep row radial ball or double row spherical roller type self-aligning and shielded in cast iron housings. Long inner races insure even load distribution, providing a high radial and thrust load capacity. Bearings are relubricable for continuous service with lubrication tubes extended to the exterior of fan base as necessary.
- V-Belt Drives are oversized for long life and continuous duty as standard. Fixed pitch or variable pitch drives are available upon request. Belts are oil, heat, and static resistant type.

Centrifugal Fan Arrangements

Arrangement 1

Unit furnished with shaft and bearings, less motor and drive.

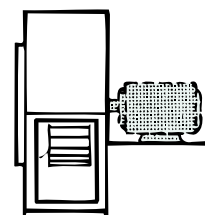
Designed to be driven by a separately mounted motor. Impeller is overhung – two bearings on base. Temperature limitations: 250°F Series 42 or 43.



Arrangement 4

Direct drive packaged unit, wheel

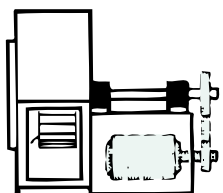
is overhung and attached to the shaft of the electric motor. No bearings on fan. Temperature limitations: 200°F Series 42 only.



Arrangement 9

Belt drive configuration with motor mounted on outside of bearing base support. Packaged unit, wheel

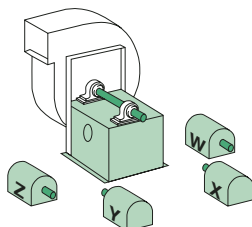
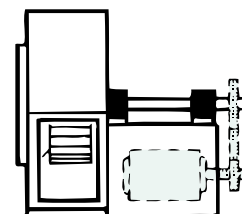
is overhung, slide rail motor base permits easy adjustment of belt tension. Available on either left or right hand side of base (when facing drive end of shaft). Temperature limitations: 250°F Series 43 only.



Arrangement 10

Belt drive configuration with motor

mounted inside base. Packaged unit, wheel is overhung. Temperature limitations: 250°F Series 42 or 43.



Motor Position Designation

Motor position designation is necessary when ordering the following for Arrangement 1 fans –

- 1 - V Belt Drive.
- 2 - Vibration Bases.
- 3 - Belt Guards.

Note: Location of motor is determined by facing the drive side of the fan and designating the motor position by letters W, X, Y or Z.

Adapted from AMCA Standard 99-2404-03, *Drive Arrangements for Centrifugal Fans*, and AMCA Standard 99-2407-03, *Motor Positions for Belt or Chain Drive Centrifugal Fans*, with written permission from Air Movement and Control Association International, Inc.



Fiberglass Pressure Blower

Series 42



Arrangement 4



Hartzell Fan, Inc. certifies that the Series 42, Fiberglass Pressure Blower, shown hereon is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program.



**Type F Wheel
(Series 42)**

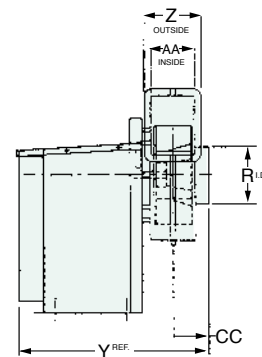
Blowers available in SWSI only

Particularly suited for lab hood installations, the corrosive resistant direct drive pressure blower moves air at static pressures up to 12". The housing is constructed with a special corrosion resistant polyester resin having a Class I flame spread rate of 25 or less. The wheel is made using a special corrosion resistant vinylester resin having a Class I flame spread rate of 30 or less. There are no metal parts exposed in the airstream. All internal hardware is 300 series stainless steel encapsulated.

Features

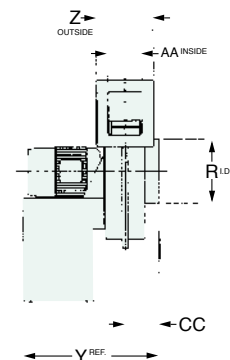
- **Sizes** – 10", 12" and 14" wheel diameters.
- **Arrangement** – available in Arrangements 4 or 10.
- **Temperature Limitations** – suitable for temperatures up to 200° F. See Table 3, page 12 for maximum safe speed correction factors at high temperatures.
- **FRP Materials** – solid fiberglass wheel molded with Dow Derakane 510-A vinylester resin. Other standard FRP components constructed of fiberglass and Ashland Hetron 693 resin. See Corrosion Resistance Guide on page 13 for resin characteristics. Other resins are available.
- **Rotation** – clockwise rotation standard. Counterclockwise rotation available.
- **Discharges** – available discharges shown on page 5. **Rotatable in field.**
- **Easy installation and maintenance** – motors are readily accessible for ease in wiring, installation, adjustment and lubrication.
- **Wheel** – flat blade radial design of one-piece construction, die formed of individual laminations of fiberglass. **Wheel Type F.**
- **Motors** – are available to your specifications, mounted and test run at the factory prior to shipment.
- **Drive Assembly (Belt Drive Fans)** – belts are oil, heat and static resistant type, oversized for continuous duty. Shafts are turned, ground and polished, keyed at both ends.
- **Bearings (Belt Drive Fans)** – heavy-duty, self-aligning, pillow block bearings are standard.
- **Shafts (Belt Drive Fans)** – turned, ground and polished. Fiberglass enclosed in the airstream. Stainless steel (304 or 316) or monel shafting is available as an option at extra cost.
- **Shaft Seal (Belt Drive Fans)** – a fiberglass and neoprene shaft seal is placed where the shaft leaves the housing along with a neoprene shaft slinger between the seal and wheel on belt drive units. Seal is not gas tight.
- **Flanged outlets are standard.** Inlet flanges are optional. Drilling of flanges is optional.
- **Bases** – heavy gauge hot rolled steel, epoxy coated.
- **All units are test run and electronically balanced** before shipment.
- **Accessories** – See pages 14 and 15.





Fan Size	A	B	C	D	E	F	G	H	J	L	M	N	P	R
10	18 ^{1/16}	10 ^{5/8}	9	9 ^{5/8}	10 ^{1/8}	13 ^{7/8}	9 ^{1/8}	8 ^{5/8}	8 ^{1/8}	21 ^{1/4}	6 ^{15/16}	3/4	9 ^{7/8}	6
12	18 ^{1/16}	11 ^{5/8}	10	10 ^{5/8}	11 ^{1/8}	15 ^{5/16}	10 ^{1/8}	9 ^{5/8}	9 ^{1/8}	21 ^{1/4}	7 ^{9/16}	3/4	9 ^{7/8}	7
14	18 ^{1/16}	12 ^{5/8}	11	11 ^{5/8}	12 ^{1/8}	16 ^{3/4}	11 ^{1/8}	10 ^{5/8}	10 ^{1/8}	21 ^{1/4}	7 ^{9/16}	3/4	9 ^{7/8}	8

Series 42 - Arrangement 4



Fan Size	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R
10	12 ^{1/8}	10 ^{5/8}	9	9 ^{5/8}	10 ^{1/8}	13 ^{7/8}	9 ^{1/8}	8 ^{5/8}	8 ^{1/8}	17 ^{1/8}	13	5 ^{3/8}	1	5 ^{1/2}	6
12	14 ^{7/8}	11 ^{5/8}	10	10 ^{5/8}	11 ^{1/8}	15 ^{5/16}	10 ^{1/8}	9 ^{5/8}	9 ^{1/8}	13 ^{3/8}	14 ^{1/2}	5 ^{3/4}	1	6 ^{1/4}	7
14	16 ^{1/8}	12 ^{5/8}	11	11 ^{5/8}	12 ^{1/8}	16 ^{3/4}	11 ^{1/8}	10 ^{5/8}	10 ^{1/8}	7 ^{1/8}	15 ^{1/2}	5 ^{3/8}	1	6 ^{3/4}	8

Fan Discharges



Performance Data

Size 10, A42-_-10--F100FG_ _ _

Outlet Area – 0.102 sq. ft. inside
Wheel Diameter – 10.5 in.
Wheel Circumference – 2.75 ft.

CFM	Outlet Velocity FPM	Static Pressure																	
		1"		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
100	980	1348	0.06	1863	0.14	2264	0.25												
150	1471	1424	0.08	1918	0.17	2309	0.28	2643	0.41	2939	0.56	3208	0.71						
200	1961	1522	0.11	1993	0.20	2371	0.33	2696	0.46	2987	0.62	3252	0.78	3726	1.14	4147	1.55	4528	1.99
250	2451	1645	0.15	2085	0.25	2449	0.38	2765	0.53	3049	0.69	3309	0.86	3775	1.24	4190	1.66	4568	2.12
300	2941	1793	0.20	2190	0.34	2541	0.45	2848	0.60	3123	0.78	3377	0.96	3835	1.35	4244	1.79	4617	2.26
350	3431	1955	0.27	2317	0.43	2644	0.58	2942	0.71	3210	0.87	3457	1.06	3905	1.49	4307	1.94	4675	2.42
400	3922	2126	0.35	2461	0.52	2762	0.72	3044	0.87	3306	1.02	3547	1.20	3985	1.63	4379	2.11	4741	2.61
450	4412	2300	0.45	2617	0.63	2898	0.85	3159	1.06	3409	1.23	3645	1.40	4074	1.79	4460	2.28	4815	2.82
500	4902	2477	0.56	2782	0.77	3045	0.99	3291	1.23	3524	1.47	3750	1.66	4170	2.02	4549	2.49	4898	3.03
550	5392	2658	0.71	2952	0.93	3202	1.16	3434	1.41	3655	1.68	3866	1.95	4271	2.36	4644	2.77		
600	5882	2843	0.87	3126	1.11	3366	1.36	3585	1.62	3795	1.91	3997	2.20	4381	2.73	4744	3.16		
650	6373	3032	1.06	3300	1.32	3535	1.59	3745	1.86	3944	2.15	4137	2.47	4502	3.10	4851	3.62		
700	6863	3224	1.28	3477	1.56	3708	1.84	3911	2.13	4101	2.43	4284	2.75	4634	3.44				
750	7353	3418	1.54	3657	1.83	3881	2.13	4080	2.44	4264	2.75	4439	3.08	4775	3.79				
800	7843	3615	1.82	3841	2.13	4055	2.45	4252	2.78	4431	3.11	4600	3.45	4922	4.17				

Size 12, A42-_-12--F100FG_ _ _

Outlet Area – 0.148 sq. ft. inside
Wheel Diameter – 12.5 in.
Wheel Circumference – 3.27 ft.

CFM	Outlet Velocity FPM	Static Pressure																	
		1"		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
180	1216	1137	0.08	1563	0.18	1893	0.29	2174	0.43										
240	1622	1179	0.10	1599	0.21	1926	0.34	2202	0.48	2447	0.64	2670	0.81	3069	1.20				
300	2027	1239	0.13	1637	0.25	1962	0.39	2238	0.55	2480	0.71	2700	0.89	3093	1.29	3443	1.73	3761	2.21
360	2432	1310	0.16	1686	0.30	1999	0.45	2274	0.62	2518	0.80	2736	0.99	3126	1.40	3471	1.86	3785	2.35
420	2838	1390	0.21	1747	0.35	2046	0.52	2312	0.70	2553	0.89	2773	1.10	3162	1.53	3505	2.01	3816	2.52
480	3243	1478	0.26	1816	0.42	2103	0.60	2358	0.79	2592	0.99	2809	1.21	3199	1.67	3542	2.17	3852	2.70
540	3649	1572	0.33	1893	0.50	2168	0.69	2414	0.89	2640	1.11	2849	1.33	3234	1.82	3578	2.35	3889	2.91
600	4054	1671	0.41	1975	0.60	2239	0.80	2477	1.01	2696	1.24	2899	1.47	3273	1.98	3614	2.53	3925	3.12
660	4459	1774	0.50	2062	0.70	2316	0.92	2546	1.15	2758	1.38	2956	1.63	3319	2.16	3652	2.73	3960	3.34
720	4865	1878	0.61	2154	0.83	2398	1.06	2620	1.30	2825	1.55	3018	1.81	3372	2.36	3696	2.95	3999	3.58
780	5270	1984	0.73	2250	0.97	2484	1.21	2698	1.47	2898	1.73	3085	2.00	3431	2.58	3747	3.19	4042	3.84
840	5676	2090	0.87	2349	1.13	2573	1.39	2781	1.66	2974	1.93	3156	2.22	3494	2.82	3804	3.46	4092	4.13
900	6081	2197	1.02	2451	1.30	2666	1.58	2867	1.86	3055	2.16	3232	2.46	3561	3.08	3864	3.74	4147	4.43
960	6486	2305	1.20	2555	1.50	2763	1.79	2956	2.09	3139	2.40	3311	2.72	3632	3.37	3929	4.05		
1020	6892	2414	1.39	2660	1.72	2863	2.03	3049	2.34	3226	2.67	3394	3.00	3707	3.68	3997	4.39		

Size 14, A42-_-14--F100FG_ _ _

Outlet Area – 0.198 sq. ft. inside
Wheel Diameter – 14.5 in.
Wheel Circumference – 3.80 ft.

CFM	Outlet Velocity FPM	Static Pressure																	
		1"		2"		3"		4"		5"		6"		8"		10"		12"	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
240	1212	982	0.08	1348	0.17	1638	0.29	1887	0.42										
320	1616	1037	0.11	1379	0.21	1660	0.34	1901	0.47	2117	0.63	2313	0.79	2670	1.16				
400	2020	1110	0.15	1426	0.27	1693	0.40	1928	0.55	2139	0.71	2331	0.88	2676	1.26	2985	1.69	3269	2.15
480	2424	1193	0.20	1489	0.34	1740	0.48	1964	0.64	2169	0.81	2358	0.99	2697	1.39	2999	1.82	3276	2.30
560	2828	1281	0.26	1564	0.42	1800	0.58	2013	0.75	2209	0.93	2392	1.12	2724	1.54	3023	1.99	3294	2.48
640	3232	1372	0.34	1647	0.51	1871	0.69	2073	0.88	2261	1.08	2436	1.28	2759	1.71	3051	2.18	3320	2.69
720	3636	1466	0.43	1732	0.62	1950	0.82	2143	1.03	2322	1.25	2490	1.46	2801	1.92	3086	2.41	3350	2.93
800	4040	1563	0.53	1821	0.75	2034	0.97	2220	1.20	2391	1.43	2553	1.67	2853	2.15	3129	2.66	3387	3.21
880	4444	1664	0.66	1912	0.90	2120	1.14	2302	1.38	2468	1.63	2623	1.89	2912	2.41	3180	2.95	3430	3.51
960	4848	1769	0.81	2004	1.07	2208	1.33	2387	1.59	2549	1.86	2699	2.14	2978	2.70	3238	3.27	3481	3.86
1040	5253	1877	0.98	2099	1.26	2299	1.55	2474	1.83	2633	2.11	2780	2.40	3051	3.01	3301	3.62	3538	4.24
1120	5657	1986	1.19	2196	1.47	2390	1.78	2563	2.09	2719	2.39	2864	2.70	3128	3.34	3371	3.99		
1200	6061	2097	1.42	2296	1.71	2483	2.04	2653	2.38	2807	2.70	2949	3.03	3210	3.70	3447	4.39		
1280	6465	2209	1.68	2400	1.99	2578	2.33	2745	2.69	2896	3.04	3037	3.39	3293	4.09	3526	4.81		
1360	6869	2322	1.97	2505	2.30	2675	2.65	2837	3.03	2988	3.41	3125	3.78	3378	4.52				

Performance shown is for belt drive fans, installation Type D: ducted inlet/ducted outlet. Power ratings (BHP) do not include drive losses. Performance ratings do not include the effects of appurtenances in the airstream. **MOST EFFICIENT FAN SELECTION APPEARS IN SHADED PRINT.** To complete the model code, add arrangement, motor enclosure code, motor horsepower code and motor speed code. See page 2 for the complete Hartzell Model Code Explanation and example.

A42-4-_-F100FG_ _ _ (Direct Drive)

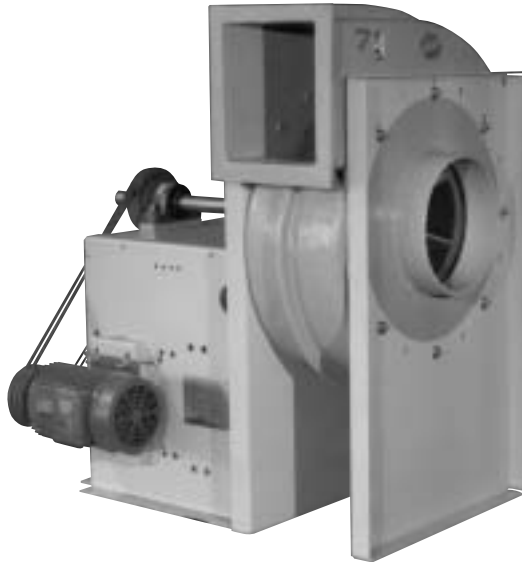
Size	Model	Motor HP	Motor (Fan) RPM	Peak Fan BHP	Cubic Feet Per Minute AT Static Pressure																	
					0"	1/2"	1"	1½"	2"	2½"	3"	4"	5"	6"	7"	8"	9"	10"	11"	12"	13"	
10	A42-4-10--F100FG_F3	½	1725	0.20	408	346	278	173														
	A42-4-10--F100FG_L2	1½	3450	1.60		788	758	726	692	658	625	556	469	346								
12	A42-4-12--F100FG_F3	½	1725	0.57	837	731	632	530														
	A42-4-12--F100FG_K2	3	3500	3.38					399	158												
	A42-4-12--F100FG_L2	5	3500	3.38										1094	979	846	675	411				
14	A42-4-14--F100FG_H3	1	1725	0.91	1109	1020	927	822	713	602	457											
	A42-4-14--F100FG_L2	5	3500	5.45												1579	1472	1364	1255	1135		
	A42-4-14--F100FG_M2	7½	3500	5.45												1579	1472	1364	1255	1135		
																			988	780		

Performance shown is for installation Type D: ducted inlet/ducted outlet. Performance ratings are based on standard air conditions (0.075 lbs/cu. ft.). Performance ratings do not include the effects of appurtenances in the airstream. **CFM exceeds 8,000 FPM outlet velocity, please contact factory. MOST EFFICIENT FAN SELECTION APPEARS IN SHADED PRINT.** Bold type information provided in the Rating Table above is needed when preparing a model code. See page 2 for the complete Hartzell Model Code Explanation and example.



Fiberglass Radial Blower (Belt Drive)

Series 43



Hartzell Fan, Inc. certifies that the Series 43, Fiberglass Radial Blower, shown hereon is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program.



**Type F Wheel
(Series 43)**

Blowers available in SWSI only

This versatile corrosive resistant air moving blower is suited for installation where air flows at static pressures up to 16". The housing is constructed with a special corrosive resistant polyester resin having a Class I flame spread rate of 25 or less. The wheel is made using a special corrosion resistant vinylester resin having a Class I flame spread rate of 30 or less. No metal parts are exposed in the airstream. All internal hardware is 300 series stainless steel encapsulated.

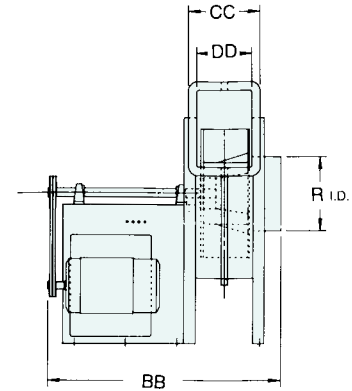
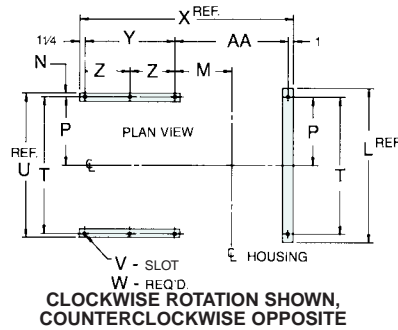
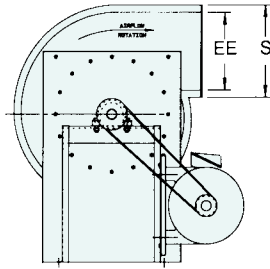
Features

- **Sizes** – 16", 19", 23", 26", 30", and 33" wheel diameters.
- **Arrangements** – available in Arrangements #1, #9 or #10.
- **Temperature Limitations** – suitable for temperatures up to 250°F. See Table 3, page 12 for maximum safe speed correction factors at high temperatures.
- **FRP Materials** – solid fiberglass wheel molded with Dow Derakane 510-A vinylester resin. Other standard FRP components constructed of fiberglass and Ashland Hetron 693 resin. See Corrosion Resistance Guide on page 13 for resin characteristics. Other resins are available.
- **Rotation** – clockwise rotation standard. Counterclockwise rotation available.
- **Discharges** – available discharges shown on page 8. **Rotatable in field.**
- **Easy installation and maintenance** – motor, drive and bearings are readily accessible for ease in wiring, installation, adjustment and lubrication.
- **Wheel** – a multi-piece radial design is of solid fiberglass construction bonded together with resin and fiberglass material. **Wheel Type F.**
- **Motors** – are available to your specifications, mounted and test run at the factory prior to shipment.
- **Drive Assembly (Belt Drive Fans)** – belts are oil, heat and static resistant type, oversized for continuous duty. Shafts are turned, ground and polished, keyed at both ends.
- **Bearings** – heavy-duty, self-aligning, pillow block bearings are standard.
- **Shafts** – turned, ground and polished. Fiberglass enclosed in the airstream. Stainless steel (304 or 316) or monel shafting is available as an option at extra cost.
- **Shaft Seal** – a fiberglass and neoprene shaft seal is placed where the shaft leaves the housing along with a neoprene shaft slinger between the seal and wheel on belt drive units. Seal is not gas tight.
- **Flanged outlets are standard.** Inlet flanges are optional. Drilling of flanges is optional.
- **Bases** – heavy gauge hot rolled steel, epoxy coated.
- **All units are test run and electronically balanced** before shipment.
- **Accessories** – See pages 14 and 15.



Series 43 - Arrangement 1, 9 or 10

Sizes 16 through 26



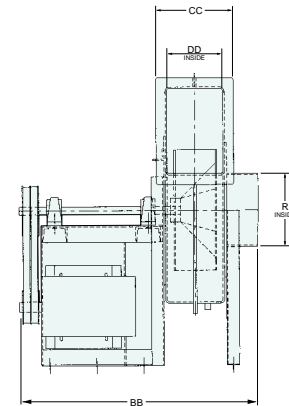
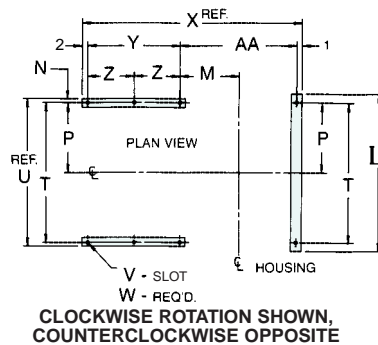
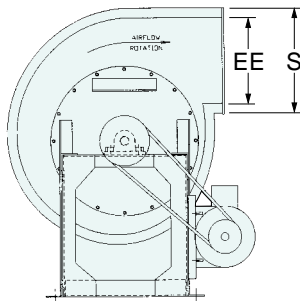
Principal Dimensions

Fan Size	A	B	C	D	E	F	G	H	J	L	M	N	P	R	S	T
16	21 ¹ / ₂	14 ⁷ / ₈	12 ¹ / ₈	13 ¹¹ / ₁₆	14 ¹ / ₄	19 ¹ / ₁₆	13 ³ / ₁₆	12 ¹ / ₂	11 ⁷ / ₈	20 ³ / ₄	6 ¹ / ₄	1	9 ¹ / ₈	9	12 ¹ / ₁₆	18 ¹ / ₄
19	24 ¹ / ₄	18	15	16 ¹ / ₂	17 ¹ / ₄	23 ³ / ₈	15 ³ / ₄	15	14 ¹ / ₄	27 ³ / ₄	8 ¹¹ / ₁₆	15 ¹⁵ / ₁₆	12 ¹¹ / ₁₆	11	14	25 ³ / ₈
23	30	20 ⁷ / ₈	18 ¹ / ₄	19 ¹ / ₈	20	27 ¹¹ / ₁₆	18 ¹ / ₄	17 ³ / ₈	16 ¹ / ₂	28 ¹ / ₈	7 ¹⁵ / ₁₆	1	12 ¹¹ / ₁₆	13	16	25 ³ / ₈
26	30	23 ¹³ / ₁₆	20 ¹ / ₄	21 ¹³ / ₁₆	22 ¹³ / ₁₆	31 ¹ / ₈	20 ¹³ / ₁₆	19 ¹³ / ₁₆	18 ¹³ / ₁₆	28 ¹ / ₈	8 ¹³ / ₁₆	1	12 ¹¹ / ₁₆	15	18	25 ³ / ₈

Fan Size	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	Max. Motor Frame	Max. Wgt. is Less Motor Wgt. & Accessories
16	20 ¹ / ₄	11 ¹ / ₁₆ x 1 ¹ / ₁₆	6	29 ¹ / ₂	15 ³ / ₄	—	11 ¹ / ₂	34 ¹ / ₈	10 ¹ / ₂	7 ¹ / ₄	8 ¹³ / ₁₆	215T	315
19	27 ¹ / ₄	11 ¹ / ₁₆ x 1 ¹ / ₁₆	8	35 ⁷ / ₈	18 ³ / ₄	9 ³ / ₈	14 ⁷ / ₈	41 ¹ / ₂	12 ¹ / ₈	8 ⁷ / ₈	10 ³ / ₄	256T	394
23	27 ³ / ₈	11 ¹ / ₁₆ x 1 ¹ / ₁₆	8	37 ⁵ / ₈	20 ¹ / ₄	10 ¹ / ₈	15 ¹ / ₈	45	13 ³ / ₄	10 ¹ / ₂	12 ³ / ₄	286T	485
26	27 ³ / ₈	11 ¹ / ₁₆ x 1 ¹ / ₁₆	8	39 ⁷ / ₁₆	20 ¹ / ₄	10 ¹ / ₈	16 ¹⁵ / ₁₆	47 ¹³ / ₁₆	15 ³ / ₈	12 ¹ / ₈	14 ³ / ₄	286T	560

Dimensions and specifications are subject to change. Certified prints are available.

Sizes 30 and 33



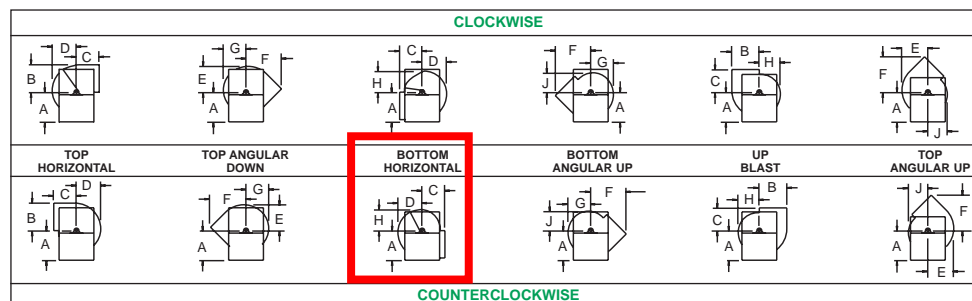
Principal Dimensions

Fan Size	A	B	C	D	E	F	G	H	J	L	M	N	P	R	S	T
30	37	26 ⁷ / ₈	22 ³ / ₄	24 ⁹ / ₁₆	25 ³ / ₄	35 ¹ / ₁₆	23 ⁷ / ₁₆	22 ⁵ / ₁₆	21 ³ / ₁₆	35 ³ / ₄	12 ⁹ / ₁₆	2 ¹ / ₈	16 ⁷ / ₈	17	20	33 ³ / ₄
33	37	29 ⁹ / ₁₆	25 ¹ / ₂	27 ¹ / ₁₆	28 ⁵ / ₁₆	39	25 ⁷ / ₈	24 ⁹ / ₁₆	23 ⁵ / ₁₆	35 ³ / ₄	13 ³ / ₈	2 ¹ / ₈	16 ⁷ / ₈	19	21 ⁷ / ₈	33 ³ / ₄

Fan Size	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	Max. Motor Frame	Max. Wgt. is Less Motor Wgt. & Accessories
30	38	13 ¹ / ₁₆ x 1 ¹ / ₄	8	47 ⁵ / ₁₆	22 ³ / ₄	11 ³ / ₈	21 ⁹ / ₁₆	56	17	13 ³ / ₄	16 ³ / ₄	286T	646
33	38	13 ¹ / ₁₆ x 1 ¹ / ₄	8	49 ¹⁵ / ₁₆	22 ³ / ₄	11 ³ / ₈	23 ³ / ₁₆	58 ¹ / ₈	18 ⁹ / ₁₆	15 ⁵ / ₁₆	18 ⁵ / ₈	286T	710

Dimensions and specifications are subject to change. Certified prints are available.

Fan Discharges



Note:
For angular and/or down blast, contact factory when discharge flanges are required.



Performance Data

Size 16, A43- -16 - - F100FG _ _ _

SWSI
Outlet Area – 0.444 sq. ft. inside
Wheel Diameter – 15.625 in.
Wheel Circumference – 4.091 ft.
Inlet Diameter – 9 in. I.D.

CFM	Outlet Velocity FPM	Static Pressure																									
		1"		2"		3"		4"		5"		6"		7"		8"		10"		12"		14"		16"			
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
500	1126					1498	0.51			1898	0.93	2068	1.16														
600	1351							1737	0.81	1922	1.04	2091	1.29	2247	1.55	2393	1.82										
700	1577	1025	0.24							1950	1.17	2117	1.43	2272	1.71	2417	2.00	2682	2.60	2924	3.25						
800	1802	1079	0.31											2299	1.89	2442	2.19	2706	2.83	2946	3.51	3167	4.23				
900	2027	1135	0.38	1407	0.60													2732	3.08	2970	3.79	3191	4.54	3396	5.32		
1000	2252	1193	0.46	1455	0.70													2760	3.34	2997	4.09	3216	4.87	3420	5.69		
1100	2477	1253	0.56	1508	0.82	1722	1.10															3242	5.22	3446	6.07		
1200	2703	1316	0.67	1564	0.96	1769	1.24																	3473	6.48		
1300	2928	1384	0.81	1621	1.11	1822	1.42	2002	1.75																		
1400	3153	1455	0.95	1679	1.28	1877	1.62	2050	1.94																		
1500	3378	1528	1.12	1738	1.47	1933	1.83	2103	2.18	2260	2.55																
1600	3604	1600	1.31	1799	1.68	1989	2.06	2158	2.45	2310	2.82	2455	3.23														
1700	3829	1674	1.52	1863	1.91	2048	2.31	2214	2.73	2364	3.12	2503	3.52	2639	3.99												
1800	4054	1748	1.75	1931	2.17	2107	2.59	2270	3.03	2419	3.46	2556	3.87	2686	4.30	2813	4.82										
1900	4279	1823	2.01	2001	2.45	2167	2.89	2328	3.35	2475	3.81	2610	4.25	2737	4.69	2859	5.17										
2000	4505	1898	2.29	2073	2.72	2229	3.22	2386	3.69	2531	4.18	2665	4.66	2790	5.12	2910	5.59	3140	6.68								
2100	4730	1975	2.60	2145	3.10	2294	3.58	2445	4.07	2588	4.58	2721	5.09	2845	5.58	2962	6.06	3186	7.11								
2200	4955	2052	2.94	2217	3.46	2362	3.97	2506	4.48	2647	5.00	2778	5.54	2901	6.07	3017	6.58	3234	7.61	3444	8.83						
2300	5180	2130	3.32	2290	3.86	2432	4.39	2568	4.92	2705	5.46	2835	6.01	2957	6.58	3072	7.13	3287	8.18	3489	9.34						
2400	5405	2208	3.72	2364	4.28	2503	4.84	2632	5.39	2765	5.95	2893	6.52	3014	7.11	3128	7.69	3340	8.80	3538	9.93						
2500	5631	2286	4.15	2438	4.73	2575	5.33	2699	5.90	2826	6.48	2952	7.07	3071	7.67	3184	8.28	3395	9.47	3590	10.60						
2600	5856	2365	4.62	2512	5.22	2647	5.85	2769	6.44	2889	7.04	3012	7.65	3130	8.27	3241	8.90	3451	10.20	3643	11.40						
2700	6081	2444	5.13	2587	5.75	2720	6.40	2839	7.02	2954	7.64	3072	8.27	3189	8.90	3299	9.55	3507	10.90								
2800	6306	2524	5.67	2663	6.31	2793	6.98	2911	7.64	3021	8.28	3135	8.92	3248	9.58	3358	10.20										
2900	6532	2603	6.25	2739	6.92	2866	7.61	2983	8.29	3091	8.95	3198	9.62	3308	10.30	3417	11.00										
3000	6757	2683	6.87	2816	7.56	2940	8.27	3055	8.98	3161	9.67	3264	10.40	3370	11.10												
3100	6982	2763	7.53	2893	8.25	3014	8.97	3128	9.71	3232	10.40	3332	11.10														
3200	7207	2844	8.24	2971	8.97	3089	9.72	3200	10.50	3304	11.20																
3300	7432	2924	8.98	3049	9.75	3164	10.50	3274	11.30																		
3400	7658	3005	9.77	3127	10.60	3239	11.30																				
3500	7883	3086	10.60	3205	11.40																						
3600	8108	3167	11.50																								

Size 19, A43- -19 - - F100FG _ _ _

SWSI
Outlet Area – 0.663 sq. ft. inside
Wheel Diameter – 19.125 in.
Wheel Circumference – 5.007 ft.
Inlet Diameter – 11 in. I.D.

CFM	Outlet Velocity FPM	Static Pressure																																									
		1"		2"		3"		4"		5"		6"		7"		8"		10"		12"		14"		16"																			
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP																		
700	1056					1217	0.73	1391	1.02	1544	1.33																																
850	1282					1411	1.16	1564	1.50	1702	1.86															1830	2.24																
1000	1508					824	0.34																			1585	1.69	1723	2.07	1849	2.48	1968	2.90	2185	3.79								
1150	1735					867	0.43																			1745	2.31	1871	2.74	1988	3.19	2204	4.13	2401	5.13							2582	6.19
1300	1961					912	0.53																			2011	3.49	2225	4.49	2420	5.54	2600	6.65	2769	7.80								
1450	2187	959	0.65	1175	0.99																																						
1600	2413	1008	0.79	1218	1.17																				1432	1.79	1624	2.54	1834	3.71	1994	4.72	2145	5.84	2248	4.87	2441	5.97	2620	7.13	2788	8.34	
1750	2640	1058	0.95	1263	1.37																				1474	2.04	1662	2.81	1874	4.08	2032	5.13	2182	6.29	2324	7.57	2464	6.44	2642	7.65	2808	8.91	
1900	2866	1113	1.14	1309	1.59																				1564	2.64	1704	3.15	1834	3.71	1994	4.72	2145	5.84	2248	4.87	2441	5.97	2642	7.65	2808	8.91	
2050	3092	1170	1.36	1356	1.84																				1519	2.33	1662	2.81	1834	3.71	1994	4.72	2145	5.84	2248	4.87	2441	5.97	2642	7.65	2808	8.91	
2200	3318	1229	1.60	1405	2.11	1564	2.64	1704	3.15	1834	3.71	1994	4.72	2145	5.84	2248	4.87	2441	5.97	2642	7.65	2808	8.91																				
2350	3544	1289	1.87	1454	2.41	1611	2.98	1749	3.54	1874	4.08	1994	4.72	2145	5.84	2248	4.87	2441	5.97	2642	7.65	2808	8.91																				
2500	3771	1348	2.17	1506	2.75	1658	3.35	1794	3.96	1917	4.53	2032	5.13	2145	5.84	2248	4.87	2441	5.97	2642	7.65	2808	8.91																				
2650	3997	1409	2.51	1560	3.13	1706	3.75	1840	4.39	1962	5.02	2074	5.63	2182	6.29	2324	7.57	2464	6.44	2642	7.65	2808	8.91																				
2800	4223	1470	2.88	1617	3.54	1755	4.19	1887	4.86	2008	5.54	2118	6.19	2223	6.84	2324	7.57	2464	6.44	2642	7.65	2808	8.91																				
2950	4449	1532	3.30	1675	3.99	1805	4.67	1935	5.37	2053	6.09	2163	6.79	2266	7.47	2364	8.16	2464	6.44	2642	7.65	2808	8.91																				
3100	4676	1594	3.75	1734	4.49	1858	5.20	1983	5.92	2100	6.67	2209	7.43	2311	8.15	2407	8.86	2591	10.40	2672	12.00	2839	13.80																				
3250	4902	1657	4.25	1793	5.02	1912	5.76	2032	6.52	2147	7.29	2255	8.09	2356	8.87	2451	9.61	2630	11.10	2672	12.00	2839	13.80																				
3400	5128	1720	4.79	1853	5.59	1969	6.38	2082	7.16	2196	7.96	2302	8.79	2402	9.62	2496	10.40	2672	12.00	2672	12.00	2839	13.80																				
3550	5354	1784	5.38	1913	6.21	2027	7.04	2134	7.86	2244	8.69	2349	9.54	2448	10.40	2542	11.30	2715	12.90	2878	14.60	2920	15.60																				
3700	5581	1848	6.02	1973	6.88	2086	7.76	2188	8.60	2294	9.46	2397	10.30	2495	11.20	2588	12.10	2760	13.90	2920	15.60	2963	16.70																				
3850	5807	1913	6.71	2034	7.60	2145	8.52	2245	9.40	2345	10.30	2446	11.20	2542	12.10	2634	13.00	2806	14.90	2963	16.70	2963	16.70																				
4000	6033	1977	7.45	2095	8.37	2204	9.33	2302	10.30	2397	11.20	2495	12.10	2591	13.00	2681	14.00	2851	16.00	3008	17.80	3008	17.80																				
4150	6259	2042	8.25	2157	9.20	2264	10.20	2360	11.20	2452	12.10	2546	13.10	2639	14.00	2729	15.00	2897	17.10	3091	19.40	3091	19.40																				
4300	6486	2107	9.10	2219	10.10	2324	11.10	2419	12.10	2508	13.10	2597	14.10	2688	15.10	2777	16.10	2944	18.20	3091	19.40	3091	19.40																				
4450	6712	2173	10.00	2282	11.00	2384	12.10	2479	13.10	2565	14.20	2650	15.20	2738	16.20	2825	17.30	2991	19.40	3091	19.40	3091	19.40																				
4600	6938	2238	11.00	2345	12.00	2444	13.10	2538	14.20	2623	15.30	2706	16.30	2790	17.40	2875	18.50	2976	21.10	3091	19.40	3091	19.40																				
4750	7164	2304	12.00	2408	13.10	2505	14.20	2597	15.40	2682	16.50	2763	17.60	2843	18.60	2925	19.70	2976	21.10	3091	19.40	3091	19.40																				
4900	7391	2370	13.10	2472	14.30	2567	15.40	2657	16.60	2741	17.70	2820	18.80	2897	20.00	2976	21.10	2976	21.10	3091	19.40	3091	19.40																				
5050	7617	2436	14.30	2536	15.50	2628	16.60	2717	17.80	2801	19.00	2878	20.20	2953	21.30	2976	21.10	2976	21.10	3091	19.40	3091	19.40																				
5200	7843	2502	15.50	2600	16.70	2690	17.90	2777	19.20	2860	20.40	2937	21.60	3010	22.80	2976	21.10	2976	21.10	3091	19.40	3091	19.40																				
5350	8069	2568	16.80	2664	18.10	2753	19.30	2838	20.60	2919	21.90	2976	21.10	3010	22.80	2976	21.10	2976	21.10	3091	19.40	3091	19.40																				
5500	8295	2634	18.10	2728	19.50	2809	20.70	2894	21.90	2975	23.10	3010	22.80	3010	22.80	2976	21.10	2976	21.10	3091	19.40	3091	19.40																				

8.3 FAN OPERATION AND MAINTENANCE MANUAL



INSTALLATION, OPERATION, & MAINTENANCE MANUAL

HARTZELL FAN, INC., Piqua, Ohio
Phone# 937-773-8494
Fax# 937-773-8994

Safety Accessories, Application and Use Warning

The safe installation and operation of equipment supplied by Hartzell Fan, Inc. is the responsibility of the system installer, maintainer, and user. Since the application and use of its equipment can vary greatly, Hartzell Fan, Inc. offers various product types, optional safety accessories, and sound performance data per laboratory tests. The need for safety accessories will frequently depend upon the type of system, fan location and operating procedures being employed. The proper protective safety accessories to meet company standards, local codes, and the requirements of the Occupational Safety and Health Act must be determined by the user since safety requirements may vary depending on the location and application of the equipment. If applicable local conditions, standard, codes or OSHA rules require the addition of the safety accessories, the user should specify and obtain the required safety accessories from Hartzell Fan, Inc. and should not allow the operation of the equipment without them. Owners, employers, users, and installers should read "RECOMMENDED SAFETY PRACTICES FOR USERS AND INSTALLERS OF INDUSTRIAL AND COMMERCIAL FANS" published by the Air Movement Control Association, Inc., 30 West University Drive, Arlington Heights, Illinois 60004. A copy of this publication is enclosed with each fan shipped from Hartzell Fan, Inc., and is available upon request at Hartzell's office in Piqua, Ohio 45356 (937-773-7411).

Please contact Hartzell Fan, Inc. or your local Hartzell representative for more information on product types, safety accessories, and sound performance estimates.

Remember, the selection of safety accessories and the safe installation, application and operation of equipment supplied by Hartzell Fan, Inc. is your responsibility. This warning supersedes all previous editions.

INSTALLATION, OPERATION, & MAINTENANCE MANUAL

INTRODUCTION:

The purpose of this manual is to aid in the proper installation and operation of fans manufactured by **HARTZELL FAN, INC.** These instructions are intended to supplement good general practices and are not intended to cover detailed instruction procedures, because of the wide variety and types of fans manufactured by **HARTZELL FAN, INC.**

The safe installation and operation of fans is the responsibility of the user. From the initial system design through the life of the equipment, safety should be a foremost consideration. Handling and installation should always be performed by experienced and trained personnel who are aware of the hazards associated with rotating equipment. Failure to comply with these practices may result in death or serious bodily injury. Contact your local Hartzell representative for further assistance.

SHIPMENT AND RECEIVING:

All equipment shipped from Hartzell Fan, Inc. is prepared for shipment in accordance with the requirements of the commercial carrier and/or any special considerations required by the nature of the product. The Bill of Lading or Express Receipt is an acknowledgement by the Transportation Company of the receipt in GOOD CONDITION, meeting the above requirements for the shipment covered by our invoice. Our responsibility for this shipment has now ceased. We will not be responsible for loss or damage when you give the Transportation Company a clear receipt.

Thoroughly inspect all shipments as soon as received. Keep a record of all equipment received, including inspection details and date of receipt, because of the possibility of partial shipments. If any of the items called for in this Bill of Lading or Express Receipt are short or damaged, do not accept them until the Freight or Express Agent makes a Damage or Short Shipment Notification on your freight bill or express receipt.

If any concealed loss or damage is discovered, **NOTIFY YOUR FREIGHT OR EXPRESS AGENT AT ONCE** and request an inspection. This is absolutely necessary. Unless you do this, the transportation companies will not entertain any claim for loss or damage. If the agent will not make an inspection, then you should make An Affidavit to the effect that you notified the agent on that particular date and the agent failed to show up. This, with your aforementioned documentation, will properly support your claim. We will assist you in every possible manner in collecting claims for loss or damage, however this does not make us responsible for collection of claims or replacement of material.

HANDLING:

Handle your equipment with care. Some fans are provided with lifting lugs or holes for easy handling. Others must be handled using nylon straps or well-padded chains and cables, which protect the fan's coating and housing. Spreader bars should be used when lifting large parts. Centrifugal fans are best lifted using one strap under the fan's scroll and another strap around the bearing base. **DO NOT LIFT CENTRIFUGAL FANS BY THE FAN SHAFT, WHEEL, FLANGES OR INLET SUPPORT.**

STORAGE:

If fans are stored for any length of time, they should be stored in a clean, dry location to prevent rust and corrosion. Outdoor storage is not recommended. When outdoor storage is necessary, they should be protected from the elements. Cover the fan inlet and outlet, grease the bearings, and keep motors dry and clean.

EXTENDED STORAGE:

Fans are to be stored in their original containers or equivalent protection and should be kept in a clean, dry, protected warehouse where exercised control over temperature, dust, dew point, shock, and vibration is reasonably maintained. Temperatures between 50 °F and 120 °F. Maximum relative humidity of 60%. Shock or vibration: 2 mils maximum to prevent bearings from brinelling. Exceeding this limit will require vibration-dampening material under the units.

Motor bearings (and fan bearings on belt drive units) are to be greased at the time of going into extended storage. Motor shaft (and fan shaft on belt drive units) are to be manually rotated every month and additional grease added, purging some of that in the bearing cavity every six (6) months, *Grease in bearings is to be purged at time of removal from storage, making sure that an ample supply of fresh grease is in each grease cavity. Grease used must be compatible with that already in motor and fan bearings. (See Page 22).* All motors with space heaters are to have the heaters connected if storage conditions exceed 60% relative humidity and/or if temperatures are below 50 degrees F.

Motor windings should be meggered at the time the equipment is put in storage. At the time of removal from storage, the resistance reading must not have dropped more than 50% from the initial reading. Contact Hartzell Fan, Inc., Warranty and Service Department, if the motor resistance is less than 50% of the initial reading. **NOTE:** *Motors in storage may absorb moisture in their windings resulting in a significant loss of insulation resistance. THE APPLICATION OF POWER TO A MOTOR WITH INSUFFICIENT INSULATION RESISTANCE MAY RESULT IN DAMAGE TO THE MOTOR OR OTHER EQUIPMENT.* Storage records complying with the above requirements should be maintained.

INSTALLATION:

Centrifugal Fans should always be mounted to a flat, level, and rigid structure. The fan base should be shimmed and leveled. Gaps between the foundation and fan base should be grouted. This will ensure permanent alignment and a smooth running, vibration-free fan, as well as minimize maintenance costs. Failure to properly install the fan base can contribute to excessive vibration. Poured concrete foundations are recommended, wherever practical, for floor mounted fans. If vibration isolators are required, they should be installed between the fan and the foundation. Tighten all mounting bolts securely with lock washers and lock nuts.

Inlet and outlet ducts should be independently supported, and never supported by the fan flanges. Flexible duct connections are recommended. These connections will also minimize noise. The independent mounting of stacks and ducts to the fan flanges will assure that the fan will not be subjected to external forces which may twist or deform fan housing. This also will ensure that the impeller will not strike the housing or cause misalignment of the sheaves and bearings.

No turns in duct should be closer than two and one half fan diameters away from the inlet or outlet of a fan. Walls or flat surfaces should also not be closer than one fan diameter from the inlet side.

Branch entries into the main duct should be spaced such that they do not directly opposite each other. A maximum of 45 degree angle between main branch and entering branch should be used as a guideline. *Avoid sudden changes in duct size.* Use a 14 degree included angle, or less, in reducing a duct to a fan, and not more than 30 degrees included angle to the discharge. Elbow turns should be kept to a centerline radius of at least one and one-half diameters of the duct.

A qualified electrician, conforming to the National Electrical code and local codes and practices must connect electrical connections for the fan motor. When making electrical connections, the motor must be connected following electrical characteristics as indicated by the motor nameplate, and must adhere to the wiring diagram on the motor nameplate or in the motor terminal box. *Motors may fail immediately if improperly connected.* It is also recommended that an overload device to protect the motor be installed between the current supply and the motor. Recommended tolerances for overload devices should be plus 10% of the motor full load amperage rating, including the allowance for the motor service factor.

NOTE: *It is common for motors to draw several times full load amperage during startup, for approximately fifteen seconds. Larger sized fans may require twenty seconds or longer.*

STARTUP:

- Lock out the primary and all secondary power sources.
- A complete inspection should be made of all ductwork and the fan interior. Make certain there is no foreign material, which can be drawn into or blown through the fan or ductwork. Appropriate protective measures and safety practices should be observed when entering or working within these areas. These measures may include the use of goggles, respirators, or other personal protective devices.
- Make sure the foundation or mounting arrangement and the duct connections are adequately designed and installed per drawings and in accordance with recognized acceptable engineering practices.
- Check and tighten all bolts, fasteners, and set screws as necessary. **NOTE:** *Forces encountered during shipment, handling and rigging can disturb factory settings.*
- Check the fan assembly for proper grounding to prevent static electrical discharge. **NOTE:** *Especially important when using FRP fans.*
- Ensure power and drive components such as motor starter, variable frequency drive, or hydraulic power unit are properly sized, matched, and connected to the fan.
- Clearance should be checked between the impeller and fan housing. Spin the impeller to determine whether it rotates freely, without hitting anything, and is not grossly out of balance. **NOTE:** *Prior to shipment, all fans have been thoroughly inspected and have passed stringent operation and balance test.*
- Inspect impeller for proper rotation for fan design. Arrows to show direction of rotation and airflow are attached to the fan housings.
- Check alignment of drives and all other components.
- Properly secure all safety guards.
- Assure that all appropriate warnings have been put in place.
- Secure all access doors to the fan and ductwork.
- Restore power and momentarily energize the fan to check the direction of rotation. Listen as the fan coasts to a stop for any unusual noise, identify the source, and take corrective action as necessary.

Switch on the electrical supply and allow the fan to reach full speed. Check carefully for: (1) Excessive vibration (2) Unusual noise (3) Proper lubrication (4) Proper amperage, voltage, or power values. If any problem is indicated, **SWITCH OFF IMMEDIATELY**. Lock out power supply. Secure the fan impeller if there is a potential for windmilling. Check carefully for cause of the trouble, correct as necessary and repeat check list procedure. (Ref. Page 15 Trouble shooting chart)

NOTE: *The fan should not need balancing, as it was balanced at the factory to be within stringent vibration levels before shipment. However, there are several things that may cause vibration, such as rough handling in shipment and erection, weak foundations, and alignments. It is recommended that the vibration levels be checked with a vibration analyzer to verify that the vibration is within levels recommended later in this manual. (See Page 21, Table 1.)*

Even if the fan appears to be operating satisfactorily, shut it down after a brief period, lock out the power supply, and recheck startup procedures, as the initial start-up may have loosened the bolts, fasteners, and set screws.

The fan may now be put into operation, however during the first eight hours of operation, it should be closely observed and checked for excessive vibration and noise. At this time checks should be made of motor input current and motor and bearing temperatures to ensure that they do not exceed manufacturer's recommendations. After eight hours of operation, the fan should be shut down and the power locked out. Recheck startup procedures and adjust, as necessary.

MAINTENANCE:

Periodic inspection of all the fan parts is the key to good maintenance and trouble-free fan operation. Frequency of inspection must be determined by the user and is dependent upon the severity of the application. Prepare a maintenance schedule and make sure it is strictly adhered to.

NEVER SERVICE OR ADJUST ROTATING EQUIPMENT WHILE IT IS IN OPERATION. LOCK OUT THE POWER SOURCE BEFORE PERFORMING MAINTENANCE.

Regular fan maintenance should include the following:

- 1). Check the fan impeller for any buildup of foreign material or wear from abrasion. Both can cause excessive vibration which will lead to damage of the impeller and other fan components. Replace the impeller if excessive wear is noticed. Carefully clean the impeller of any foreign material.
- 2). Lubricate motor bearings.
- 3). Consult the trouble-shooting guide for excessive vibration or noise, insufficient performance, or when the fan does not operate.
- 4). Tighten all bolts and setscrews.

BEARINGS AND LUBRICATION:

The motor bearings on the direct drive fans should be greased at regular intervals. Motor manufacturers' greasing instructions and recommendations should be followed closely. Avoid the use of a pressure greasing system which tends to fill the bearing chamber completely. Do not over-grease. Use only 1 or 2 shots with a hand gun in most cases. Maximum hand gun rating 40 P.S.I. Rotate bearings during lubrication where good safety practice permits. NOTE: On motors with non-regreasable sealed bearings, no lubrication is required for the life of the bearings.

The most frequent cause of bearing failure is not greasing often enough or using incompatible greases. Excessive vibration, especially if the bearing is not rotating, will also cause bearings to fail. Bearings must also be protected from water and moisture to avoid internal corrosion.

NOTE: *It is typical for some anti-friction bearings to exhibit a running surface temperature in excess of 140 °F. This surface will be too hot to touch, but is not cause for alarm.*

MOTORS:

The fundamental principle of electrical maintenance is **KEEP THE MOTOR CLEAN AND DRY**. This requires periodic inspection of the motor, the frequency of which depends upon the type of motor and the service.

Periodic checks of voltage, frequency, and current of a motor while in operation is recommended. Such checks assure the correctness of frequency and voltage applied to the motor, and yield an indication of the fan load. Comparison of this data with previous data will give an indication of the fan performance. Any serious deviations should be investigated and corrected.

Lubricate integral horsepower motors per the motor manufacturer's recommendations. Lubrication frequency depends on the motor horsepower, speed, and service. Use compatible greases. Do not over grease.

If the motor is totally enclosed fan cooled (TEFC), it is recommended that the condensation drain plugs be removed. This is not necessary with motors equipped with automatic drains, which should be left in place as received.

VIBRATION:

Excessive fan vibration can be caused by many things. **ALL POSSIBLE SOURCES OF THE EXCESSIVE VIBRATION MUST BE CHECKED OUT AND CORRECTIVE ACTION TAKEN IMMEDIATELY TO CORRECT THE PROBLEM.** See the fan trouble-shooting chart (Table 2) for possible causes of excessive fan vibration.

A vibration analyzer will be of great assistance in determining the amount of vibration. The following values give an indication of the fan vibration condition. Vibration readings should be taken on the fan bearings (if possible, on belt drive fans), or motor (on direct drive fans, Horizontal, vertical, and axial readings should be taken).

TABLE 1
Vibration displacement in mils, "Double Amplitude"

FAN RPM	GOOD	FAIR	SLIGHTLY ROUGH	ROUGH
870	1.7	3.3	6.5	above 6.5
1160	1.2	2.5	5.0	above 5.0
1750	.75	1.5	3.5	above 3.5
3450	.5	0.9	-2.0	above 2.0

Interpolate for fan speeds other than shown above. The fan should not be operated unless the maximum vibration reading is in at least the "fair" range.

TABLE 2
FAN TROUBLE-SHOOTING CHART

PROBLEM	POSSIBLE CAUSES
EXCESSIVE VIBRATION	<ul style="list-style-type: none"> -Accumulation of material on impeller -Worn or corroded impeller -Bent shaft -Impeller loose on shaft -Motor out of balance -Impeller out of balance -Drive misalignment -Loose fan mounting bolts -Weak or resonant foundation -Foundation not flat and level -Structures not crossbraced -System pulsation (DANGER) - Fan operation in a stall -Blades at different angles on adjustable pitch fans
HORSEPOWER TOO HIGH	<ul style="list-style-type: none"> -Fan speed higher than design -Air density higher than design -Impeller rotating in the wrong direction -Angle set too high in adjustable pitch fans
AIRFLOW TOO LOW	<ul style="list-style-type: none"> -Impeller rotating in the wrong direction -Fan speed lower than design -Actual system is more restrictive (more resistance to flow) than expected. -Dampers or registers closed -Leaks or obstructions in duct work -Filters or coils are dirty or clogged -Inlet or outlet screens clogged -Restricted fan inlet or outlet -No straight duct at fan outlet -Sharp elbows near fan inlet or outlet -Improperly designed turning vanes
AIRFLOW TOO MUCH	<ul style="list-style-type: none"> -Actual system is less restrictive (less resistance to flow) than expected -Fan speed higher than design -Filter not in place -Registers, grilles and/or dampers not installed
FAN DOES NOT OPERATE	<ul style="list-style-type: none"> -Blown fuses -Electricity turned off or not wired properly -Wrong voltage -Motor too small and <u>overload protector</u> has broken <u>circuit</u>
EXCESSIVE NOISE	<ul style="list-style-type: none"> -Accumulation of material on impeller -Worn or corroded impeller -Bent shaft -Impeller loose on shaft -Impeller hitting housing -Impeller out of balance -Drive misalignment -Loose fan mounting bolts -System pulsation or surge

- Electrical noises
- Noise from high velocity air system
 - Duct work too small
 - Registers or grilles too small for application
- Fan in stall condition (DANGER)
- Rattle of components in high velocity airstream
- Leaks in duct work
- Vibrating duct work
- Vibrating parts not isolated from building

It is recommended that the users and installers of this equipment familiarize themselves with AMCA publication #201, "Fans and Systems", and publication #202 "Trouble-Shooting", which are published by Air Movement and Control Association, 20 West University Drive, Arlington Heights, Illinois 60004.

8.4 MOTOR OPERATION AND MAINTENANCE MANUAL

INSTALLATION AND MAINTENANCE MANUAL FOR NEMA LOW VOLTAGE ELECTRIC MOTORS



***T**he electric motor is the item of equipment most widely used by man in his pursuit of progress, as virtually all machines and many renowned inventions depend upon it.*

By virtue of the prominent role the electric motor plays in the comfort and welfare of mankind, it must be regarded and treated as a prime power unit embodying features that merit special attention, including its installation and maintenance.

This means that the electric motor should receive proper attention.

Its installation and routine maintenance require specific care to ensure perfect operation and longer life of the unit.

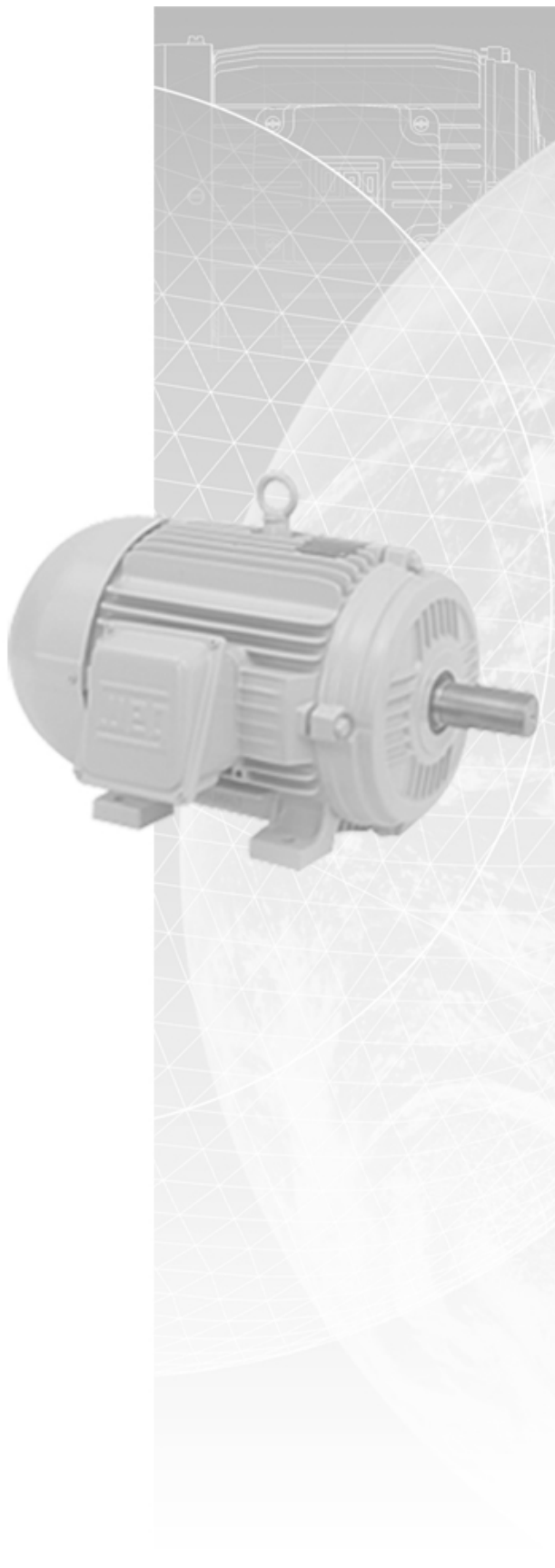
THE WEG ELECTRIC MOTOR INSTALLATION AND MAINTENANCE MANUAL provides the necessary information to properly install, maintain and preserve the most important component of all equipment:

THE ELECTRIC MOTOR!

WEG

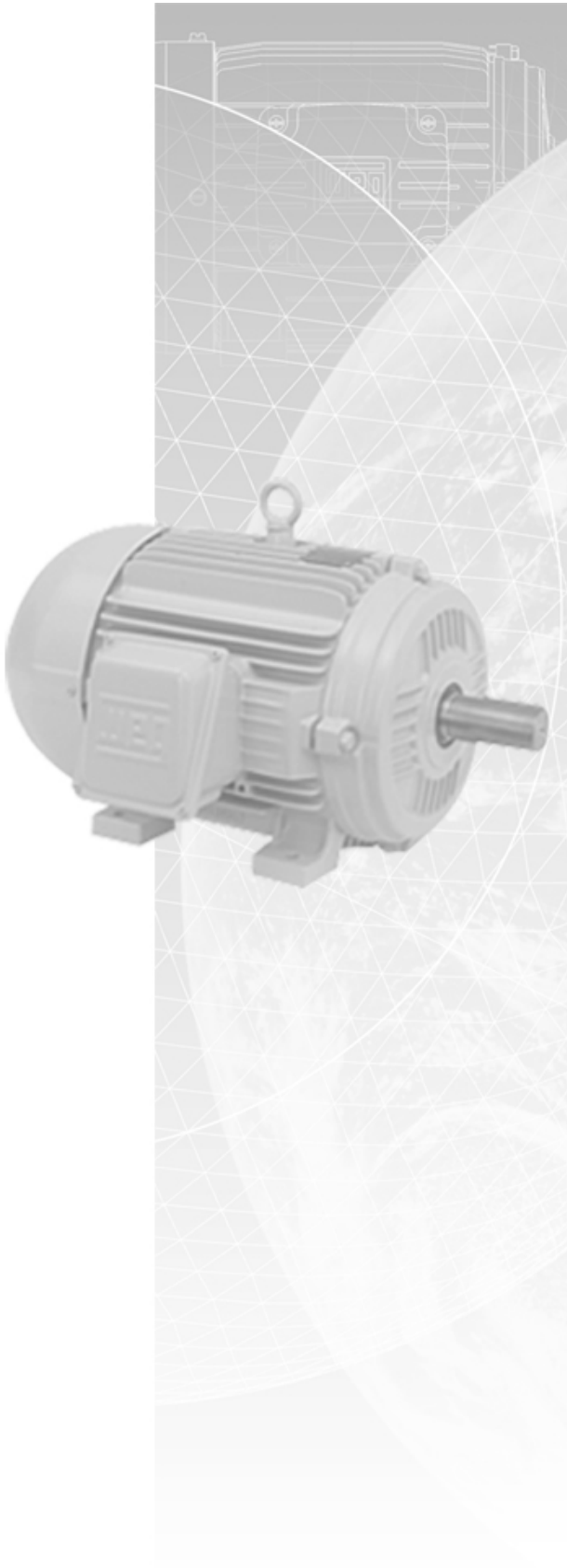


Contents



1 - Introduction	03
2 - Basic Instructions	05
2.1 Safety Instructions	05
2.2 Delivery	05
2.3 Storage	05
2.3.1 Drying the Windings	06
3 - Installation	07
3.1 Mechanical Aspects	07
3.1.1 Foundation	07
3.1.2 Types of bases	07
3.1.3 Alignment	08
3.1.4 Coupling	09
3.1.5 Bearing Load (Stresses on the bearings)	10
3.2 Electrical Aspects	16
3.2.1 Feed System	16
3.2.2 Starting of Electric Motors	16
3.2.3 Motor Protection	18
3.3 Start-up	19
3.3.1 Preliminary Inspection	19
3.3.2 The First Start-up	21
3.3.3 Operation	21
3.3.4 Stopping	21
4 - Maintenance	25
4.1 Cleanliness	25
4.2 Lubrication	25
4.2.1 Periodical Lubrication	25
4.2.2 Quality and Quantity of Grease	25
4.2.3 Lubricating Instructions	25
4.2.4 Replacement of Bearings	26
4.3 Air Gap Checking	26
4.4 Explosion Proof Motor Repair Steps	27
4.4.1 Objective	27
4.4.2 Repair Procedure and Precautions	27
4.4.3 Miscellaneous Recommendations	27
5 - Malfunctioning	28
5.1 Standard Three-phase Motor Failures	28
5.1.1 Short Circuits Between Turns	28
5.1.2 Winding Failures	28
5.1.3 Rotor Failures	29
5.1.4 Bearing Failures	29
5.1.5 Shaft Fractures	29
5.1.6 Unbalanced V-Belt Drives	29
5.1.7 Damage Arising from Poorly Fitted Transmission Parts or Improper Motor Alignment	29
5.2 Troubleshooting Chart	30
6 - Spare Parts and Component Terminology	31

1. Introduction



This manual covers all the three-phase and single-phase asynchronous squirrel-cage induction motors, from 140T to 580T frame sizes.

The motors described in this manual are subject to continuous improvement and all information is subject to change without notice.

For further details, please consult WEG.

2. Basic Instructions

2.1 Safety Instructions

All personnel involved with electrical installations, either handling, lifting, operation and maintenance, should be well-informed and up-to-date concerning the safety standards and principles that govern the work and carefully follow them.

Before work commences, it is the responsibility of the person in charge to ascertain that these have been duly complied with and to alert his personnel of the inherent hazards of the job in hand.

It is recommended that these tasks be undertaken only by qualified personnel and they should be instructed to:

- avoid contact with energized circuits or rotating parts,
- avoid by-passing or rendering inoperative any safeguards or protective devices,
- avoid extended exposure in close proximity to machinery with high noise levels,
- use proper care and procedures in handling, lifting, installing, operating and maintaining the equipment, and
- follow consistently any instructions and product documentation supplied when they do such work.

Before initiating maintenance procedures, be sure that all power sources are disconnected from the motor and accessories to avoid electric shock.

Fire fighting equipment and notices concerning first aid should not be lacking at the job site; these should be visible and accessible at all times.

2.2 Delivery

Prior to shipment, motors are factory-tested and balanced. They are packed in boxes or bolted to a wooden base.

Upon receipt, we recommend careful handling and a physical examination for damage which may have occurred during transportation.

In the event of damage and in order to guaranty insurance coverage, both the nearest WEG sales office and the carrier should be notified without delay.

2.3 Storage

Motors should be raised by their eyebolts and never by their shafts. It is important that high rating three-phase motors be raised by their eyebolts. Raising and lowering must be steady and joltless, otherwise bearings may be harmed.

When motors are not immediately installed, they should be stored in their normal upright position in a dry even temperature place, free of dust, gases and corrosive atmosphere.

Other objects should not be placed on or against them.

Motors stored over long periods are subject to loss of insulation resistance and oxidation of bearings.

Bearings and lubricant deserve special attention during prolonged periods of storage. Depending on the length and conditions of storage it may be necessary to regrease or change rusted bearings. The weight of the rotor in an inactive motor tends to expel grease from between the

bearing surfaces thereby removing the protective film that impedes metal-to-metal contact.

As a preventive measure against the formation of corrosion by contact, motors should not be stored near machines which cause vibrations, and every 3 month their shafts should be rotated manually.

Insulation resistance fluctuates widely with temperature and humidity variations and the cleanliness of components. When a motor is not immediately put into service it should be protected against moist, high temperatures and impurities, thus avoiding damage to insulation resistance.

If the motor has been in storage more than six month or has been subjected to adverse moisture conditions, it is best to check the insulation resistance of the stator winding with a megohmmeter.

If the resistance is lower than ten megohms the windings should be dried in one of the two following ways:

- 1) Bake in oven at temperatures not exceeding 194 degrees F until insulation resistance becomes constant.
- 2) With rotor locked, apply low voltage and gradually increase current through windings until temperature measured with thermometer reaches 194 degrees F. Do not exceed this temperature.

If the motor is stored for an extensive period, the rotor must be periodically rotated.

Should the ambient conditions be very humid, a periodical inspection is recommended during storage. It is difficult to prescribe rules for the true insulation resistance value of a machine as resistance varies according to the type, size and rated voltage and the state of the insulation material used, method of construction and the machine's insulation antecedents. A lot of experience is necessary in order to decide when a machine is ready or not to be put into service. Periodical records are useful in making this decision.

The following guidelines show the approximate values that can be expected of a clean and dry motor, at 40°C test voltage in applied during one minute.

Insulation resistance R_m is obtained by the formula:

$$R_m = V_n + 1$$

Where: R_m - minimum recommended insulation resistance in M W with winding at 40°C

V_n - rated machine voltage in kV

In case the test is carried out at a temperature other than 40°C, the value must be corrected to 40°C using an approximated curve of insulation resistance v.s temperature of the winding with the aid of Figure 2.1; it's possible verify that resistance practically doubles every 10°C that insulating temperature is lowered.

Example:

Ambient temperature = 50°C

Motor winding resistance at 50°C = 1.02 MΩ

Correction to 40°C

$$R_{40^{\circ}\text{C}} = R_{50^{\circ}\text{C}} \times K_{50^{\circ}\text{C}}$$

$$R_{40^{\circ}\text{C}} = 1.02 \times 1.3$$

$$R_{40^{\circ}\text{C}} = 1.326 \text{ MΩ}$$

The minimum resistance R_m will be:

$$R_m = V_n + 1$$

$$R_m = 0.440 + 1$$

$$R_m = 1.440 \text{ MΩ}$$

On new motors, lower values are often attained due to solvents present in the insulating varnishes that later evaporate during normal operation. This does not necessarily mean that the motor is not operational, since insulation resistance will increase after a period of service.

On motors which have been in service for a period of time much larger values are often attained. A comparison of the values recorded in previous tests on the same motor under similar load, temperature and humidity conditions, serves as a better indication of insulation condition than that of the value derived from a single test. Any substantial or sudden reduction is suspect and the cause determined and corrective action taken.

Insulation resistance is usually measured with a MEGGER.

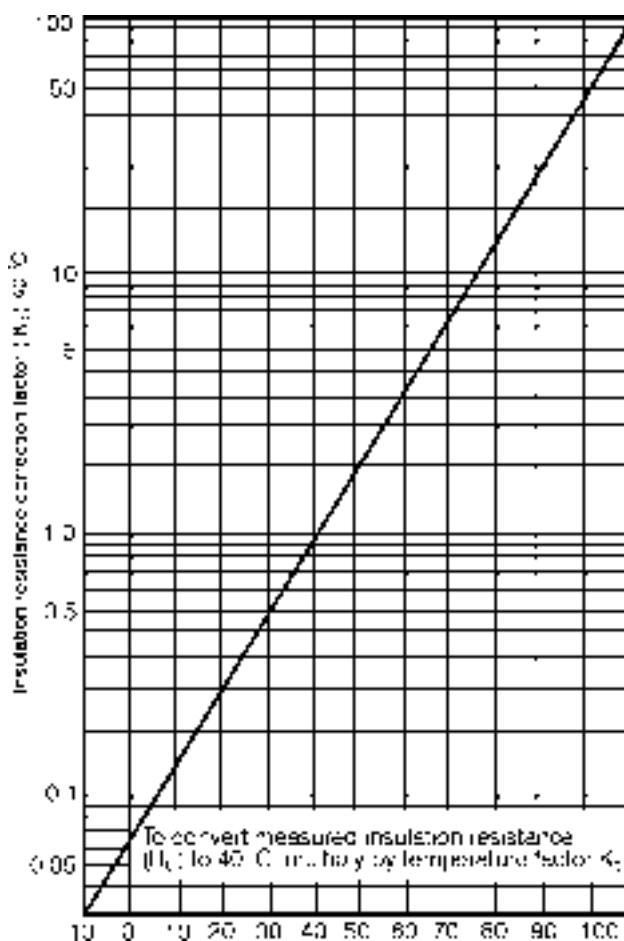
In the event that insulation resistance is inferior to the values derived from the above formula, motors should be subjected to a drying process.

This operation should be carried out with maximum care, and only by qualified personnel. The rate of temperature rise should not exceed 5°C per hour and the temperature of the winding should not exceed 105°C. An overly high final temperature as well as a fast temperature increase rate can each generate vapour harmful to the insulation.

Temperature should be accurately controlled during the drying process and the insulation resistance measured at regular intervals.

During the early stages of the drying process, insulation resistance will decrease as a result of the temperature increase, but the resistance will increase again when the insulation becomes dryer. The drying process should be extended until successive measurements of insulation resistance indicate that a constant value above the minimum acceptable value has been attained. It is extremely important that the interior of the motor be well ventilated during the drying operation to ensure that the dampness is really removed.

Heat for drying can be obtained from outside sources (an oven),



energization of the space heater (optional), or introducing a current through the actual winding of the motor being dried.

Winding Temperature (°C)

$$R_{40^{\circ}\text{C}} = R_t \times K_{t40^{\circ}\text{C}}$$

Figure 2.1.

3. Installation

Electric machines should be installed in order to allow an easy access for inspection and maintenance. Should the surrounding atmosphere be humid, corrosive or contain flammable substances or particles, it is essential to ensure an adequate degree of protection.

The installation of motors in environments where there are vapours, gases or dusts, flammable or combustible materials, subject to fire or explosion, should be undertaken according to appropriate and governing codes, such as NEC Art. 500 (National Electrical Code) and UL-674 (Underwriters Laboratories, Inc.) Standards.

Under no circumstances can motors be enclosed in boxes or covered with materials which may impede or reduce the free circulation of ventilating air. Machines fitted with external ventilation should be at least 50cm from the wall to permit the passage of air. The opening for the entry and exit of air flow should never be obstructed or reduced by conductors, pipes or other objects. The place of installation should allow for air renewal at a rate of 700 cubic feet per minute for each 75 HP motor capacity.

3.1 Mechanical Aspects

3.1.1 Foundation

The motor base must be levelled and as far as possible free of vibrations. A concrete foundation is recommended for motors over 100 HP. The choice of base will depend upon the nature of the soil at the place of erection or of the floor capacity in the case of buildings.

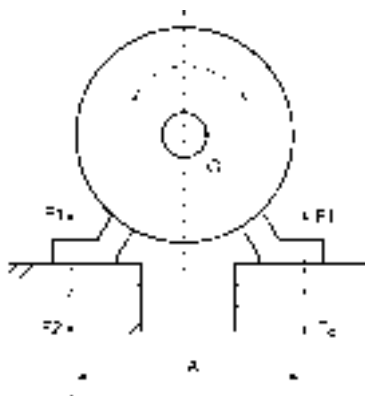
When dimensioning the motor base, keep in mind that the motor may occasionally be run at a torque above that of the rated full load torque.

Based upon Figure 3.1, foundation stresses can be calculated by using the following formula:

$$F1 = 0.2247 (0.009 \times g \times G - 213 \text{ Tmax}/A)$$

$$F2 = 0.2247 (0.009 \times g \times G + 213 \text{ Tmax}/A)$$

Figure 3.1 - Base stresses



- F1 and F2 - Lateral stress (Lb)
- g - Force of gravity (32.18 ft/s²)
- G - Weight of motor (Lb)
- Tmax - Maximum torque (Lb . Ft)
- A - Obtained from the dimensional drawing of the motor (in)

Sunken bolts or metallic base plates should be used to secure the motor to the base.

3.1.2 Types of Bases

a) Slide Rails

When motor drive is by pulleys the motor should be mounted on slide rails and the lower part of the belt should be pulling. The rail nearest the drive pulley is positioned in such a manner that the adjusting bolt be between the motor and the driven machine. The other rail should be positioned with the bolt in the opposite position, as shown in Figure 3.2.

The motor is bolted to the rails and set on the base. The drive pulley is aligned such that its center is on a plane with the center of the driven pulley and the motor shaft and that of the machine be parallel.

The belt should not be overly stretched, see Figure 3.11. After the alignment, the rails are fixed.

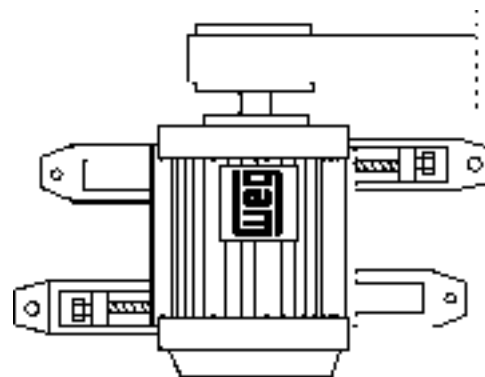


Figure 3.2 - Positioning of slide rails for motor alignment

b) Foundation Studs

Very often, particularly when drive is by flexible coupling the motor is anchored directly to the base with foundation studs.

It is recommended that shim plates of approximately 0.8 inches be used between the foundation studs and the feet of the motor for replacement purposes. These shim plates are useful when exchanging one motor for another of larger shaft height due to variations allowed by standard tolerances.

Foundation studs should neither be painted nor rusted as both interfere with to the adherence of the concrete, and bring about loosening.

After accurate alignment and levelling of the motor, the foundation studs are cemented and their screws tightened to secure the motor.

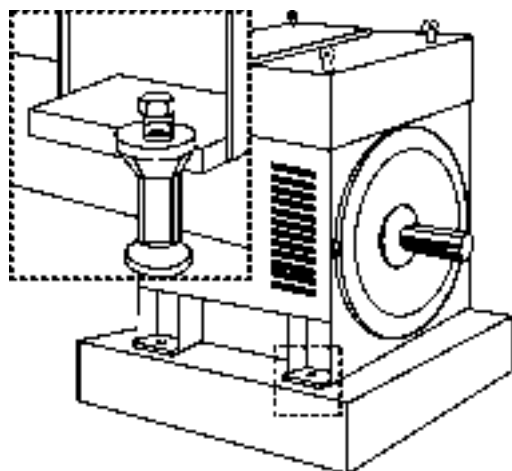


Figure 3.3 - Motor mounted on a concrete base with foundation studs

3.1.3 Alignment

The electric motor should be accurately aligned with the driven machine, particularly in cases of direct coupling. An incorrect alignment can cause bearing failure vibrations and even shaft rupture.

The best way to ensure correct alignment is to use dial gauges placed on each coupling half, one reading radially and the other axially - Figure 3.5.

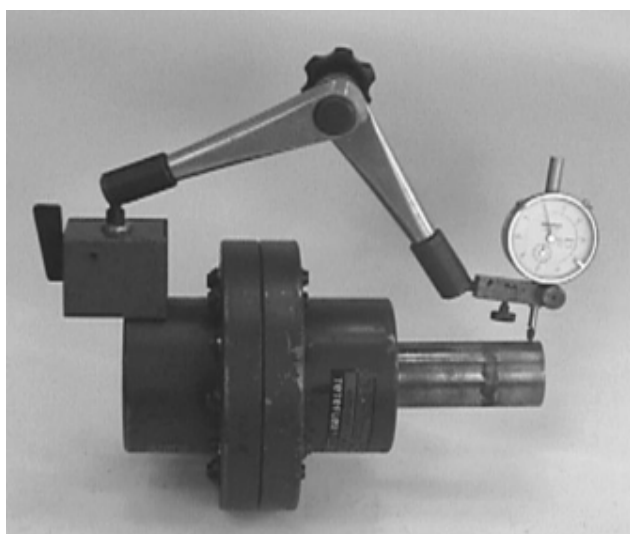


Figure 3.5 - Alignment with dial gauges

Thus, simultaneous readings are possible and allow for checking for any parallel (Figure 3.6a) and concentricity deviations (Figure 3.6b) by rotating the shafts one turn.

Gauge readings should not exceed 0.02 inches. If the installer is sufficiently skilled, he can obtain alignment with feeler gauges and a steel ruler, providing that the couplings are perfect and centered -

Figure 3.6c.

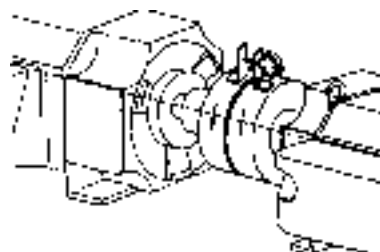


Figure 3.6a - Deviation from parallel

Figure 3.6b - Deviation from concentricity

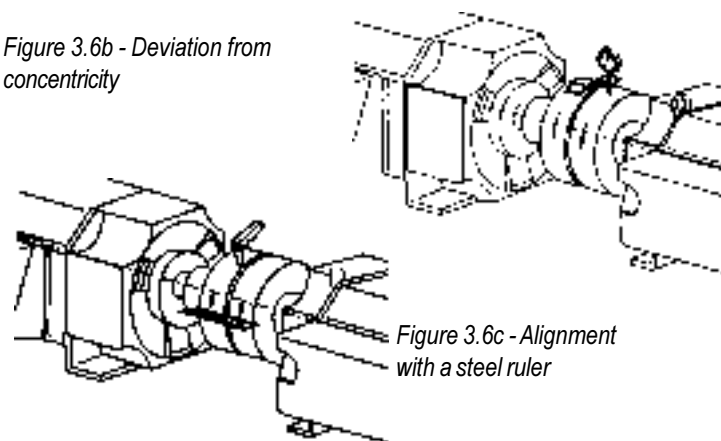


Figure 3.6c - Alignment with a steel ruler

3.1.4 Coupling

a) Direct Coupling

Direct coupling is always preferable due to its lower cost, space economy, no belt slippage and lower accident risk. In the case of speed ratio drives, it is also common to use a direct coupling with a reducer (gear box).

CAUTION: Carefully align the shaft ends using, whenever feasible, a flexible coupling.

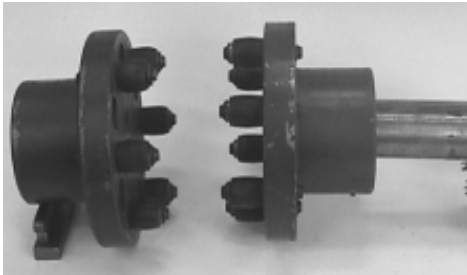


Figure 3.7 - A type of direct coupling

b) Gear Coupling

Poorly aligned gear couplings are the cause of jerking motions which bring about the vibration of the actual drive and vibrations within the motor.

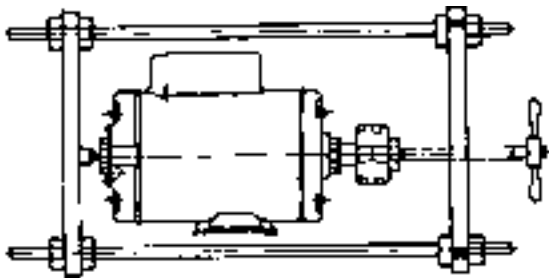
Therefore, due care must be given to perfect shaft alignment: exactly parallel in the case of straight gears, and at the correct angle for bevel or helical gears. Perfect gear engagement can be checked by the insertion of a strip of paper on which the teeth marks will be traced after a single rotation.

c) Belt and Pulley Coupling

Belt coupling is most commonly used when a speed ratio is required.

Assembly of Pulleys: To assemble pulleys on shaft ends with a keyway and threaded end holes the pulley should be inserted halfway up the keyway merely by manual pressure.

On shafts without threaded end holes the heating of the pulley to about 80°C is recommended, or alternatively, the devices illustrated



in Figure 3.8 may be employed.

Figure 3.8 - Pulley mounting device

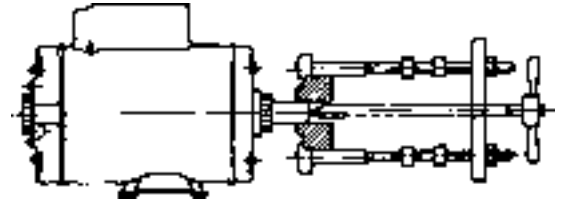


Figure 3.8a - Pulley extractor

Hammers should be avoided during the fitting of pulleys and bearings. The fitting of bearings with the aid of hammers leaves blemishes on the bearing races. These initially small flaws increase with usage and can develop to a stage that completely impairs the bearing.

The correct positioning of a pulley is shown in Figure 3.9.

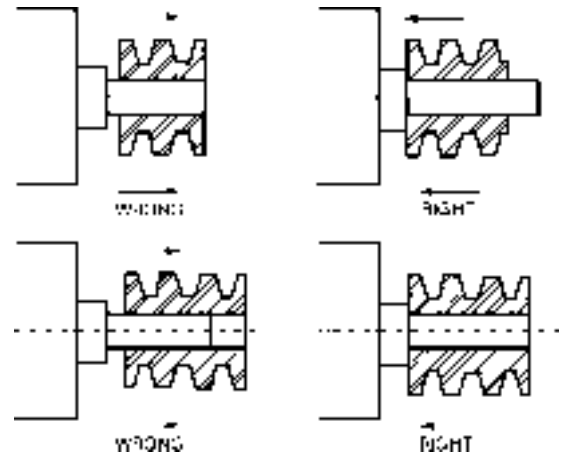


Figure 3.9 - Correct positioning of pulley on the shaft

RUNNING: To avoid needless radial stresses on the bearings it is imperative that shafts are parallel and the pulleys perfectly aligned. (Figure 3.10).

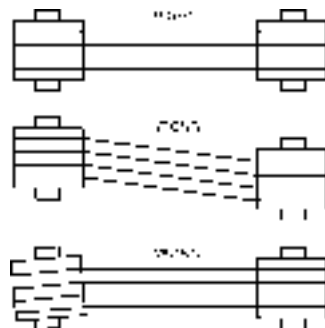
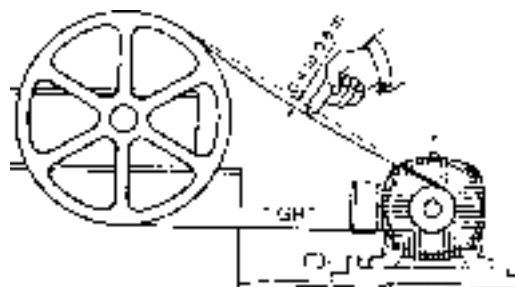


Figure 3.10 - Correct pulley alignment

Laterally misaligned pulleys, when running, transmit alternating knocks to the rotor and can damage the bearing housing. Belt slippage can be avoided by applying a resin (rosin for example). Belt tension should be sufficient to avoid slippage during operation

(Figure 3.11).

Pulleys that are too small should be avoided; these cause shaft flexion because belt traction increases in proportion to a decrease in the pulley size. Table 1 determines minimum pulley diameters, and Tables 2 and 3 refer to the maximum stresses acceptable on motor bearings up to frame 580. Beyond frame size 600, an

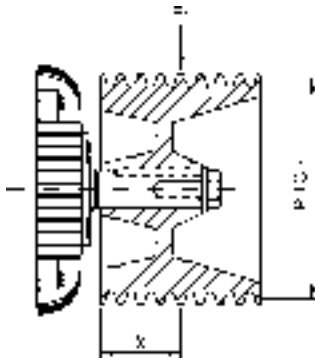


analysis should be requested from the WEG engineering.

Figure 3.11 - Belt tensions

Table 1 - Minimum pitch diameter of pulleys

Frame	Ball bearings						
	Bearing	Size X Inches					
		0.79	1.57	2.36	3.15	3.94	4.72
140	6205-Z	1.7	1.85	2			
W 180	6206-Z	3.03	3.23	3.46			
180	6307-Z	1.69	1.81	1.93			
W 210	6308-Z		2.86	3.00	3.16		
210	6308-Z		2.90	3.06	3.22		
W 250	6309 C3		4.37	4.54	4.72	4.92	
250	6309 C3		4.41	4.59	4.77	4.97	
280	6311 C3			5.08	5.19	5.47	5.65
320	6312 C3			7.44	7.76	7.94	8.18
360	6314 C3			8.73	9.00	9.28	9.57



A technical cross-sectional drawing of a ball bearing. The drawing shows the outer ring, inner ring, balls, and cage. Dimensions are labeled: 'd' for the outer diameter, 'D' for the inner diameter, 'B' for the bearing width, and 'x' for the distance from the inner ring to the balls. The balls are shown in cross-section, and the cage is depicted as a series of curved lines holding the balls in place.

Frame	Poles	Bearing	Ball Bearing				Bearing	Roller Bearing					
			Size X Inches					Size X Inches					
			1.97	3.15	4.33	5.51		1.97	3.15	4.33	5.51	6.69	8.27
400	II	6314 C3	7.3	7.62	7.94	8.24		-	-	-	-	-	-
	IV-VI-VII	6314 C3					NU 316	4.13	4.31	4.49	4.67	4.85	-
440	II	6314 C3	11.75	12.16	12.61	13.08		-	-	-	-	-	-
	IV-VI-VIII	6319 C3					NU 319	4.02	4.17	4.32	4.47	4.62	4.82
500	II	6314 C3	23.54	24.34	25.12	25.87		-	-	-	-	-	-
	IV-VI-VIII	6319 C3					NU 319	6.52	6.73	6.95	7.17	7.39	7.67
5008	II	6314 C3	44.66	45.79	46.98	48.23		-	-	-	-	-	-
	IV-VI-VIII	6322 C3					NU 322	8.73	8.95	9.96	11.34	12.87	14.82
580	II	6314 C3	57	58	59	60		-	-	-	-	-	-
	IV-VI-VIII	6322 C3					NU 322	10.72	10.91	11.11	11.31	11.50	11.76

- Important:
- 1) Peripheral speeds for solid grey cast iron pulleys FC 200 is $V = 115 \text{ ft/s}$
 - 2) Use steel pulleys when peripheral speed is higher than 115 ft/s
 - 3) V-belt speed should not exceed 115 ft/s .

Table 2 - Maximum acceptable radial load (Lbf)

Nema 56 Motors				
Frame	Radial Force (Lbf)			
	Poles	Distance X		
		1	1,18	2
56A	II	88	-	59
	IV	88	-	59
56B	II	88	-	59
	IV	86	-	59
56D	II	127	-	70
	IV	141	-	70

Saw Arbor Motors				
80 LMS	II	-	355	-
80 MMS	II	-	359	-
80 SMS	II	-	357	-
90 LMS	II	-	427	-
	IV	-	555	-

Table 3 - Maximum acceptable axial load (Lbf)

IP55 Totally Enclosed Motors - 60Hz Position / Construction Form																
F R A M E																
	II	IV	VI	VIII	II	IV	VI	VIII	II	IV	VI	VIII	II	IV	VI	VIII
140	103	141	167	187	112	152	185	207	99	132	158	178	105	143	174	198
W 180	108	145	180	202	154	209	255	286	94	130	165	183	141	194	240	269
180	149	207	249	286	269	370	443	500	136	189	229	266	253	352	421	480
W 210	196	264	326	368	329	447	544	610	176	238	297	339	310	421	518	582
210	189	257	315	357	324	443	533	599	160	220	275	310	295	405	493	553
W 250	282	372	443	485	471	620	734	811	240	317	394	414	430	564	685	743
250	273	368	436	485	463	615	727	813	220	310	379	421	410	557	672	749
280	355	480	551	624	621	826	959	1,082	275	388	427	502	540	736	838	961
320	374	498	588	668	703	930	1,091	1,232	266	366	432	511	597	793	937	1,078
360	890	1,181	1,144	1,323	890	1,181	1,375	1,552	745	985	1,144	1,323	745	985	1,144	1,323
400	877	1,148	1,347	1,521	877	1,148	1,347	1,521	705	890	1,060	1,241	705	890	1,060	1,241
440	842	1,303	1,563	1,821	842	1,303	1,563	1,821	568	884	1,109	1,488	568	884	1,109	1,488
500	769	1,250	1,481	1,728	769	1,250	1,481	1,728	355	721	844	1,190	355	721	844	1,109
5008	791	1624	1909	2137	791	1624	1909	2137	728	1548	1808	2029	728	1548	1808	2029
580	679	1,406	1,649	1,865	679	1,406	1,649	1,865	033	474	549	597	033	474	549	597

Open Motors - NEMA 56 Frames - 60Hz Position / Construction Form								
F R A M E								
	II	IV	II	IV	II	IV	II	IV
56 A	68	90	83	112	63	85	79	108
56 B	66	90	81	110	63	83	77	105
56 D	63	88	105	145	59	81	101	138

The maximum radial load for each frame are determined, by graphs.

INSTRUCTIONS ON HOW TO USE THE GRAPHS

- 1 - Maximum radial load on shaft.
- 2 - Maximum radial load on bearings.

Where: X - Half of pulley width (inches)

Fr - Maximum radial load in relation to the diameter and pulley width.

Example:

Verify whether a 2HP motor, II Pole, 60Hz withstands a radial load of 110Lb, considering a pulley width of 4 inches.

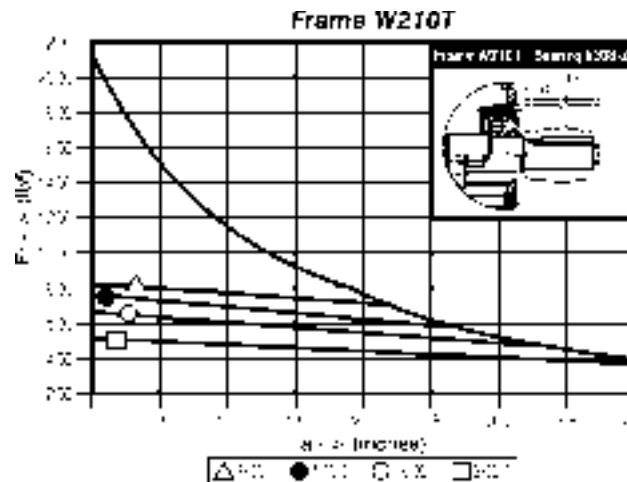
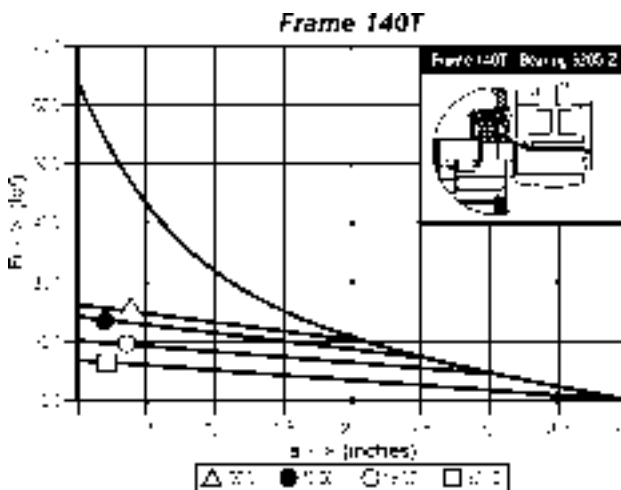
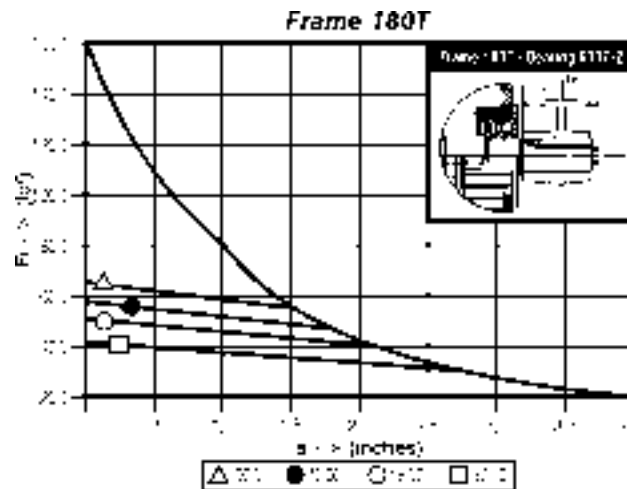
Frame : 145T

Fr : 110Lb

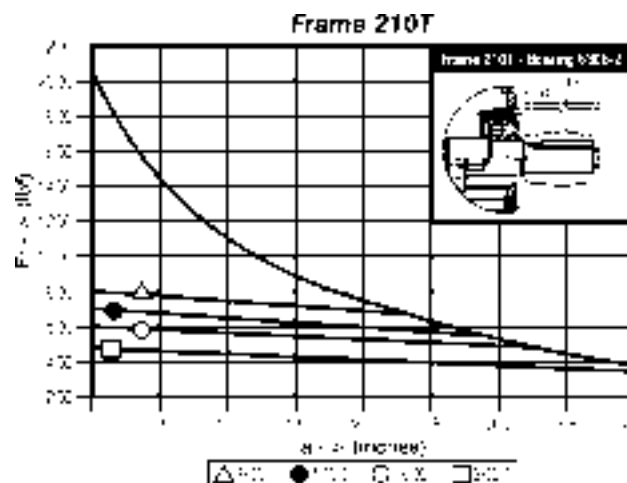
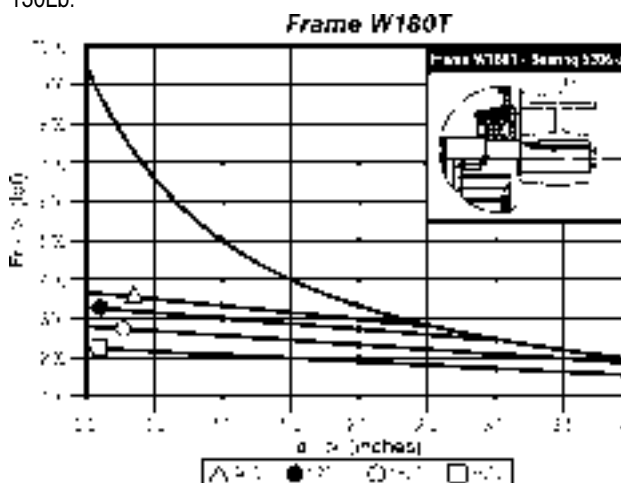
X : 2 inches

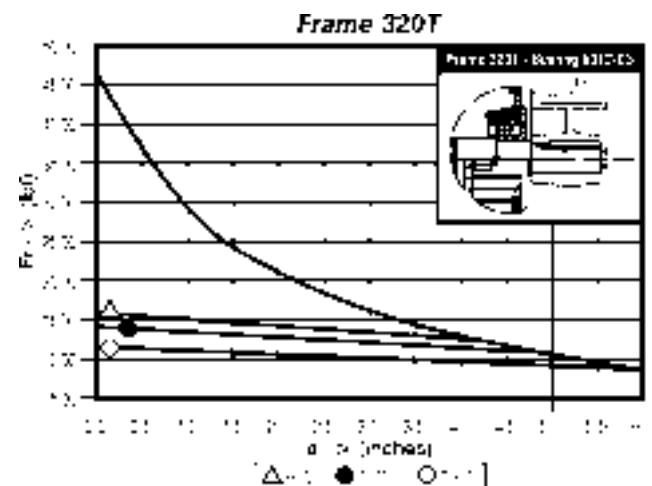
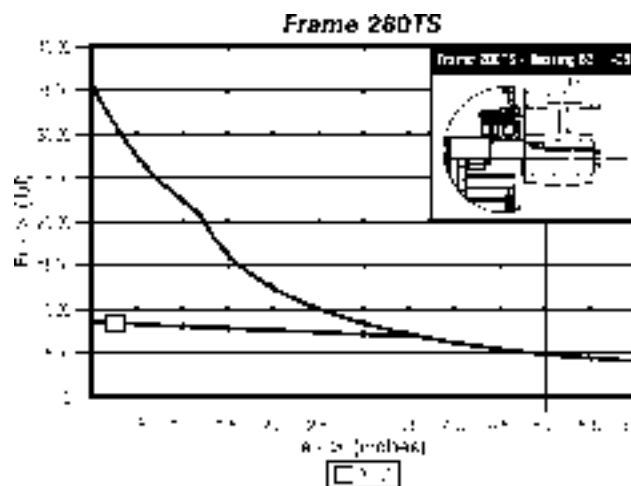
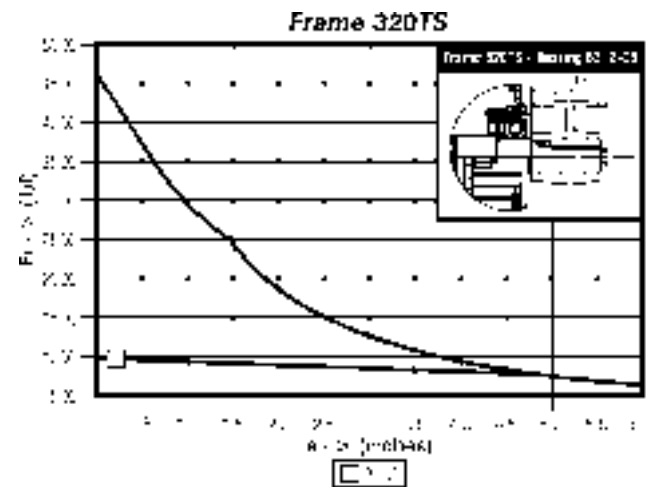
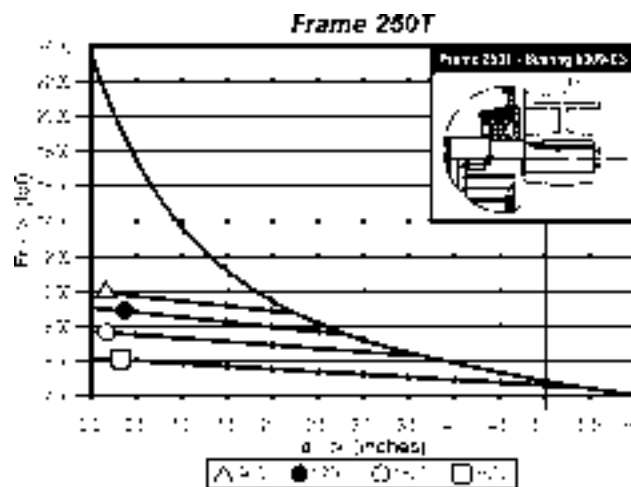
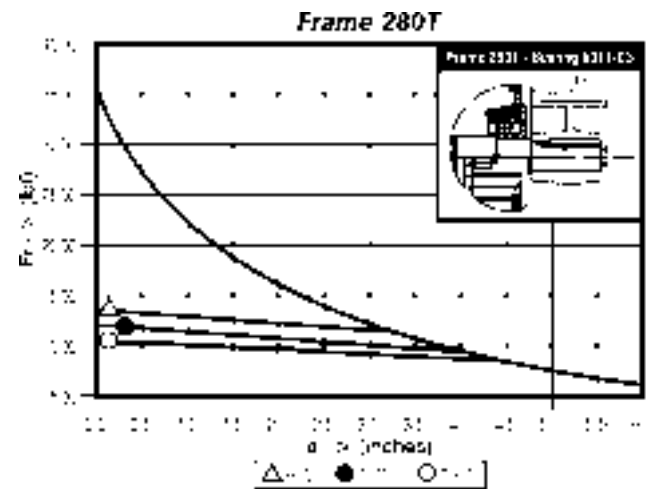
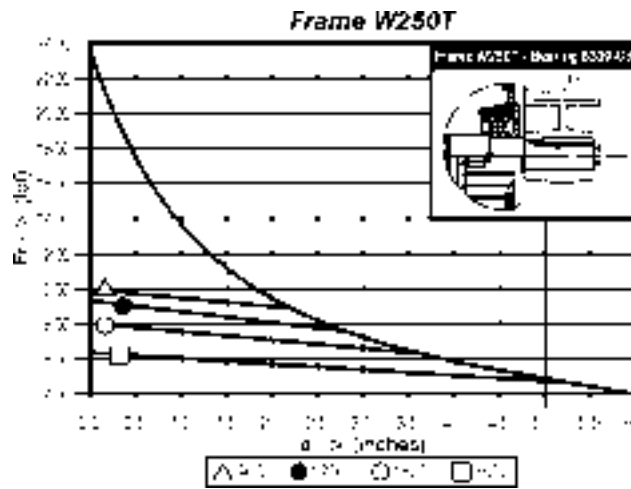
1 - Mark the distance X

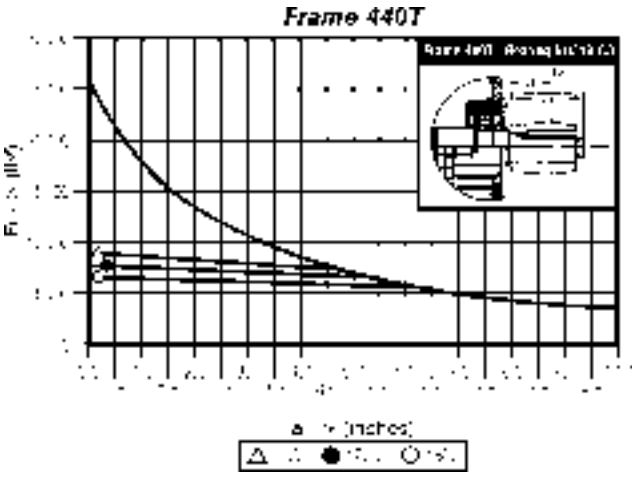
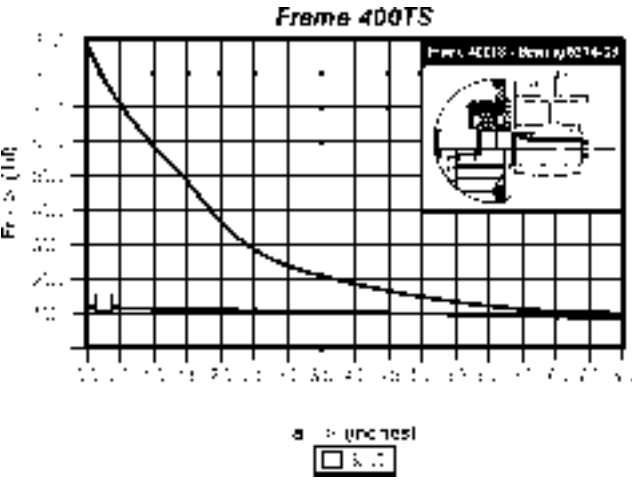
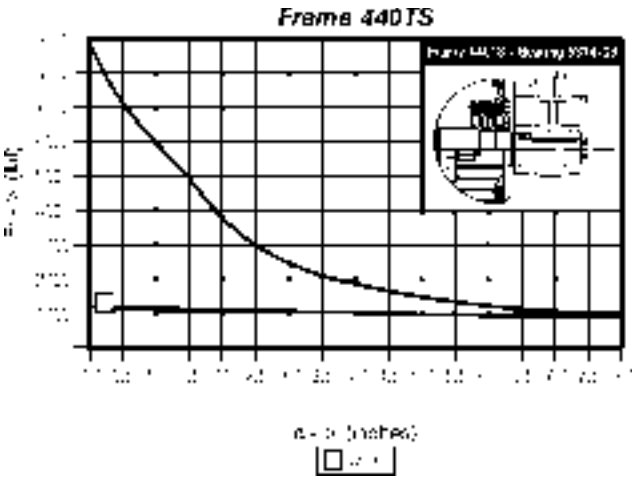
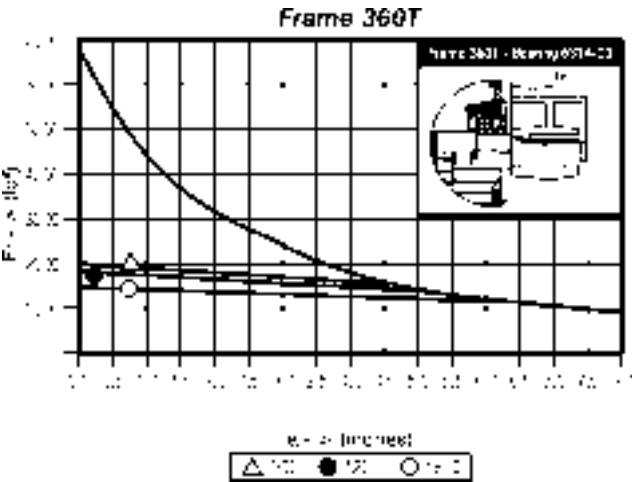
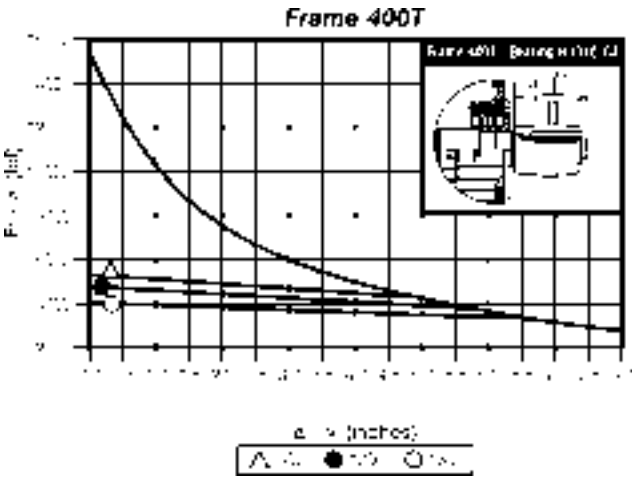
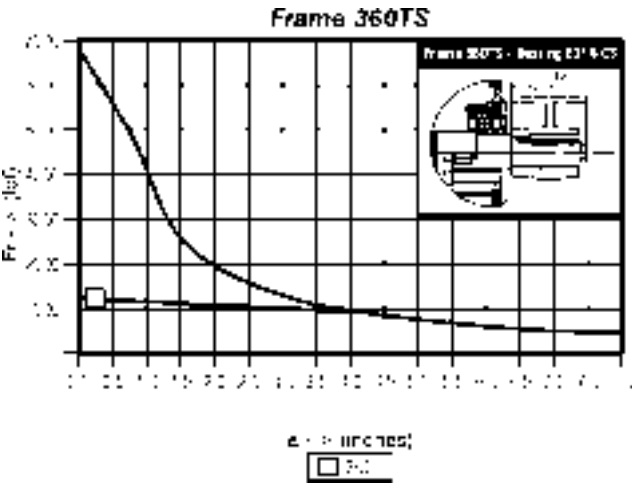
2 - Find out line N = 3600 for bearing

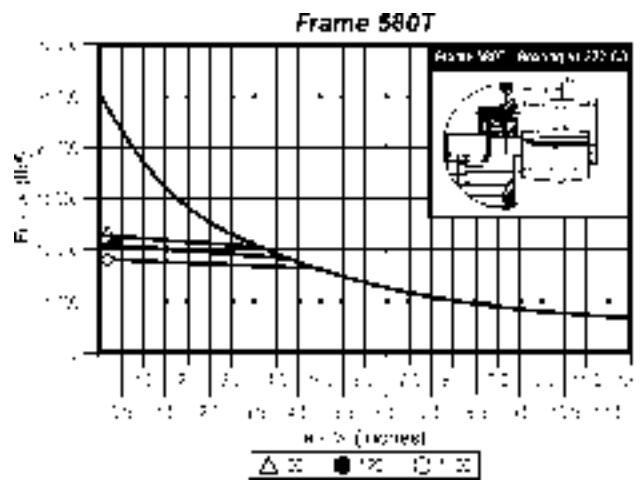
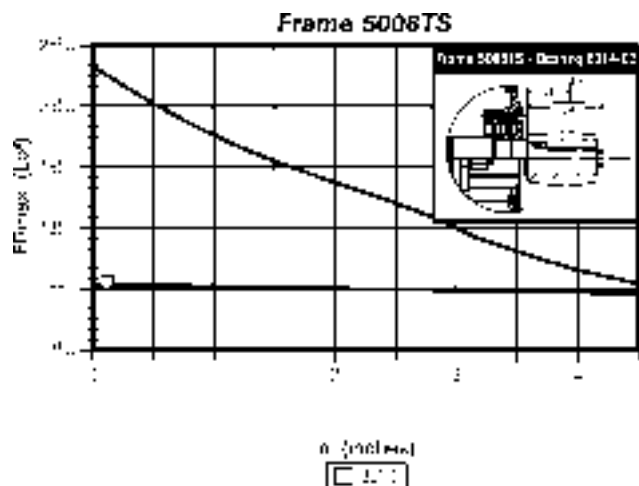
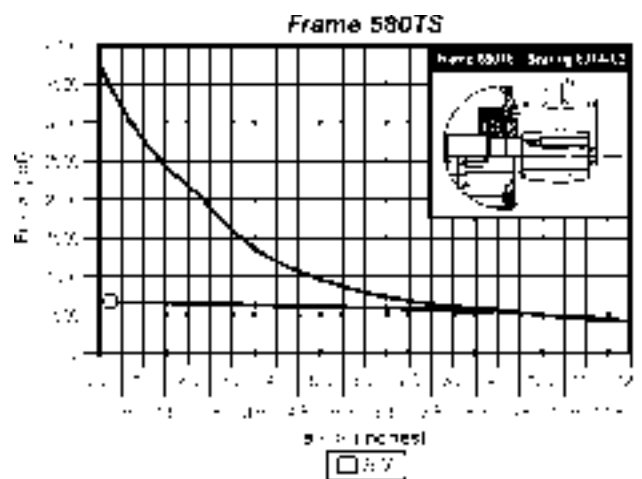
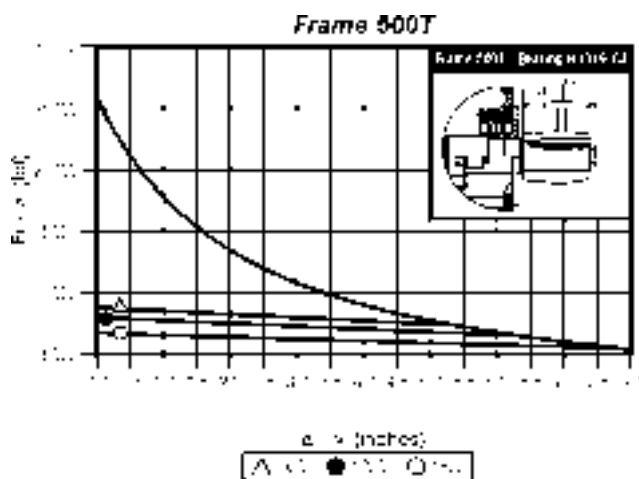
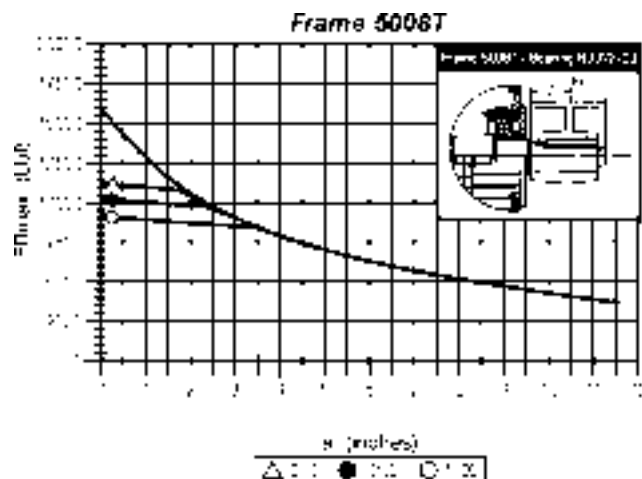
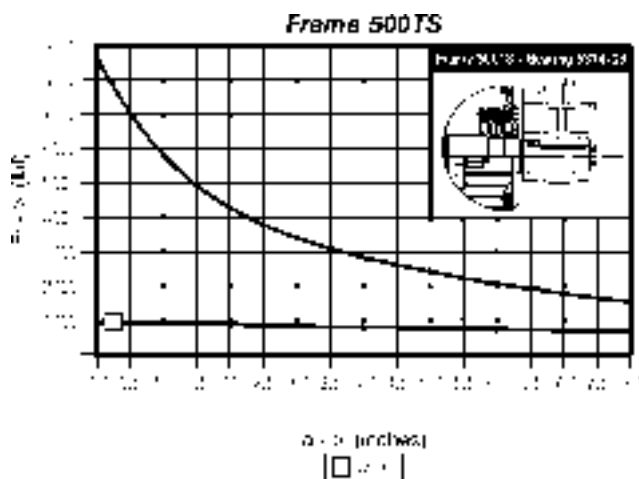


Based on the above, this bearing withstands a radial load of 130Lb.









Note: For frames 600 and above, consult your engineering representative.



3.2 Electrical Aspects

3.2.1 Feed System

Proper electric power supply is very important. The choice of motor feed conductors, whether branch or distribution circuits, should be based on the rated current of the motors as per NFPA-70 Standard article 430.

Tables 4, 5 and 6 show minimum conductor gauges sized according to maximum current capacity and maximum voltage drop in relation to the distance from the distribution center to the motor, and to the type of installation (Overhead or in ducts).

To determine the conductor gauge proceed as follows:

a) Determine the current by multiplying the current indicated on the motor nameplate by 1.25 and then locate the resulting value on the corresponding table.

If the conductor feeds more than one motor, the value to be sought on the table should be equal 1.25 times the rated current of the largest motor plus the rated current of the other motors.

In the case of variable speed motors, the highest value among the rated currents should be considered.

When motor operation is intermittent, the conductors should have a current carrying capacity equal or greater, to the product of the motor rated current times the running cycle factor shown on Table 7.

Table 7 - Running cycle factor

Duty Classification	Motor short time rating			
	5min	15min	30 at 60min	Continuous
Short (operating valves, activating contacts etc)	1.10	1.20	1.50	-
Intermittent (passenger or freight elevators, tools, pumps, rolling bridges etc)	0.85	0.85	0.90	1.40
Cyclic (rolling mills, mining machines etc)	0.85	0.90	0.95	1.40
Variable	1.10	1.20	1.50	2.00

b) Locate the rated voltage of the motor and the feed network distance in the upper part of the corresponding table. The point of intersection of the distance column and the line referring to current will indicate the minimum required gauge of the conductor.

Example:

Size the conductors for a 15 HP, three-phase, 230V, 42A, motor located 200 feet from the main supply with cables laid in conduits.

a) Current to be located: $1.25 \times 42A = 52.5A$

b) Closest value on table 6: 55A

c) Minimum gauge: 6 AWG

3.2.2 Starting of Electric Motor

Induction motors can be started by the following methods:

Direct Starting

Whenever possible a three-phase motor with a squirrel cage rotor should be started directly at full supply voltage by means of a contactor (Connection diagram a). This method is called Direct-on-Line (DoL) starting.

Table 4 - Wire and cable gauges for single-phase motor installation (voltage drop < 5%) (in conduits)

Supply Voltage	Distance of motor from distribution centre (feet)													
115	34	51	69	85	102	137	171	205	240	273	308	342	428	514
230	69	102	138	170	204	274	342	410	480	546	616	684	856	1028
460	138	204	276	340	408	548	684	820	960	1092	1232	1368	1712	2056
575	170	250	338	420	501	670	840	1010	1181	1342	1515	1680	2105	2530
Current (A)	Cable gauge (conductor)													
5	14	14	14	14	14	14	14	12	12	12	12	10	10	8
10	14	14	14	14	12	12	10	10	10	8	8	8	6	6
15	12	12	12	12	12	10	8	8	6	6	6	6	4	2
20	12	12	12	10	10	8	8	6	6	6	4	4	4	2
30	10	10	10	8	8	6	6	6	4	4	2	2	2	1/0
40	8	8	8	8	6	6	4	4	2	2	2	2	1/0	2/0
55	6	6	6	6	6	4	4	2	2	1/0	1/0	1/0	1/0	2/0
70	4	4	4	4	4	2	2	2	1/0	1/0	2/0	2/0	2/0	2/0
95	2	2	2	2	2	2	1/0	1/0	1/0	2/0	3/0	3/0	4/0	250M

Table 5 - Wire and cable gauges for three-phase motor installation - aerial conductors with 25cm spacing (voltage drop < 5%)

Supply Voltage	Distance of motor from distribution centre (feet)													
115	51	69	85	102	137	171	205	240	273	308	342	428	514	685
230	102	138	170	204	274	342	410	480	546	616	684	856	1028	1370
460	204	276	340	408	547	684	820	960	1092	1232	1368	1712	2056	2740
575	250	338	420	501	670	840	1010	1181	1342	1515	1680	2105	2530	3350
Current (A)	Cable gauge (conductor)													
15	14	14	14	12	12	10	10	10	8	8	8	6	6	4
20	14	14	12	12	10	10	8	8	8	6	6	4	4	2
30	14	12	10	8	8	8	6	6	4	4	4	2	2	1/0
40	12	10	10	8	8	6	4	4	4	2	2	2	1/0	2/0
55	10	10	8	8	6	4	4	2	2	2	1/0	2/0	3/0	--
70	8	8	6	6	4	2	2	2	1/0	1/0	2/0	3/0	--	--
100	6	6	4	4	2	2	1/0	2/0	3/0	4/0	4/0	--	--	--
130	4	4	4	2	1/0	1/0	2/0	4/0	--	--	--	--	--	--
175	2	2	2	1/0	2/0	3/0	--	--	--	--	--	--	--	--
225	1/0	1/0	1/0	2/0	3/0	--	--	--	--	--	--	--	--	--
275	2/0	2/0	2/0	4/0	--	--	--	--	--	--	--	--	--	--
320	3/0	3/0	3/0	4/0	--	--	--	--	--	--	--	--	--	--

Table 6 - Wire and cable gauges for three-phase motor installation (voltage drop < 5%) (in conduits)

Supply Voltage	Distance of motor from distribution centre (feet)											
115	85	102	120	137	171	205	240	273	308	342	428	514
230	170	204	240	274	342	410	480	546	616	684	856	1028
460	340	408	480	548	684	820	960	1092	1232	1368	1712	2056
575	420	501	590	670	840	1010	1181	1342	1515	1680	2105	2530
Current (A)	Cable gauge (conductor)											
15	12	12	12	10	10	8	8	8	6	6	6	4
20	12	10	10	10	8	8	6	6	6	6	4	4
30	10	8	8	8	6	6	6	4	4	4	2	2
40	8	8	6	6	6	4	4	4	2	2	2	1/0
55	6	6	6	4	4	4	2	2	2	1/0	1/0	1/0
70	4	4	4	4	2	2	2	1/0	1/0	1/0	2/0	2/0
95	2	2	2	2	2	1/0	1/0	1/0	1/0	2/0	3/0	4/0
125	1/0	1/0	1/0	1/0	1/0	1/0	2/0	2/0	3/0	3/0	4/0	250M
145	2/0	2/0	2/0	2/0	2/0	2/0	2/0	3/0	3/0	4/0	250M	300M
165	3/0	3/0	3/0	3/0	3/0	3/0	3/0	3/0	4/0	4/0	250M	350M
195	4/0	4/0	4/0	4/0	4/0	4/0	4/0	4/0	250M	250M	300M	350M
215	250M	250M	250M	250M	250M	250M	250M	250M	250M	300M	350M	400M
240	300M	300M	300M	300M	300M	300M	300M	300M	300M	300M	400M	500M
265	350M	350M	350M	350M	350M	350M	350M	350M	350M	350M	500M	500M
280	400M	400M	400M	400M	400M	400M	400M	400M	400M	400M	400M	--
320	500M	500M	500M	500M	500M	500M	500M	500M	500M	500M	500M	--

Note: The above indicated values are orientative. For guaranteed values, contact the Local Power Company.



There are DOL starter assemblies available combining a three-pole contactor, a bimetal relay (overload protection device), and a fuse (short circuit protection on branch circuit).

DOL starting is the simplest method, only feasible however, when the locked rotor current (LRC) does not influence the main electric supply lines.

Initial locked rotor current (LRC) in induction motors reach values six to eight times the value of the full load current. During starting by the DOL method, starting current can reach these high levels. The main electrical supply should be rated sufficiently, such that during the starting cycle no supply disturbance to others on the power network is caused by the voltage drop in the main supply.

This can be achieved under one of the following situations:

- The rated main supply current is high enough for the locked rotor current not to be proportionally high;
- Motor locked rotor current is low with no effect on the networks.
- The motor is started under no-load conditions with a short starting cycle and, consequently, a low locked rotor current with a transient voltage drop tolerable to other consumers.

Starting with a compensating switch (auto-transformer starting)

Should direct on line starting not be possible, either due to restrictions imposed by the power supply authority or due to the installation itself, reduced voltage indirect starting methods can be employed to lower the locked rotor current. The single line connection diagram (C) shows the basic components of a compensating switch featuring a transformer (usually an auto-transformer) with a series of taps corresponding to the different values of the reduced voltage. Only three terminals of the motor are connected to the switch, the other being interconnected as per diagram, for the indicated voltage.

Star-Delta starting

It is fundamental to star-delta starting that the three-phase motor has the necessary numbers of leads for both connections:

6 leads for Y/ Δ
or 12 leads for YY/ $\Delta\Delta$

All the connections for the various voltages are made through terminals in the terminal box in accordance with the wiring diagram that accompanies the motor. This diagram may be shown on the nameplate or in the terminal box.

The star-delta connection is usually used only in low-voltage motors due to normally available control and protection devices. In this method of starting the locked rotor current is approximately 30% of the original LRC. The locked rotor torque is reduced proportionally as well. For this reason, it is very important before deciding to use star-delta starting to verify if the reduced locked rotor torque in "STAR" connection is enough to accelerate the load.

3.2.3 Motor Protection

Motor circuits have, in principle, two types of protection: motor overload, locked rotor and protection of branch circuit from short circuits. Motors in continuous use should be protected from overloading by means of a device incorporated into the motor, or by an independent device, usually a fixed or adjustable thermal

relay equal or less than to the value derived from multiplying the rated feed current at full load by:

- 1.25 for motors with a service factor equal or superior to 1.15 or;
- 1.15 for motors with service factor equal to 1.0.

Some motors are optionally fitted with overheating protective detectors (in the event of overload, locked rotor, low voltage, inadequate motor ventilation) such as a thermostat (thermal probe), thermistor (PTC), RTD type resistance which dispense with independent devices.

THERMOSTAT (THERMAL PROBE): bimetallic thermal detectors with normally closed silver contacts. These open at pre-determined temperatures. Thermostats are series connected directly to the contactor coil circuit by two conductors.

THERMISTORS: Semi-conductor heat detectors positive temperature coefficient (PTC) that sharply change their resistance upon reaching a set temperature. Thermistors, depending upon the type, are series or parallel-connected to a control unit that cuts out the motor feed, or actuates an alarm system, in response to the thermistors reaction.

Resistance temperature detectors (RTD) - PT 100

The resistance type heat detector (RTD) is a resistance element usually manufactured of copper or platinum.

The RTD operates on the principle that the electrical resistance of a metallic conductor varies linearly with the temperature. The detector terminals are connected to a control panel, usually fitted with a temperature gauge, a test resistance and a terminal changeover switch.

Subject to the desired degree of safety and the client's specification, three (one per phase) or six (two per phase) protective devices can be fitted to a motor for the alarm stems, circuit breaker or combined alarm and circuit breaker, with two leads from the terminal box to the alarm or circuit breaker system and four for the combined system (alarm and circuit breaker).

Table 9 compares the two methods of protection.


3.3 Start-up

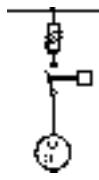
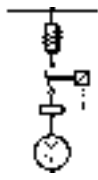
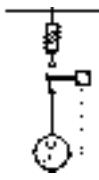

































3.3.1 Preliminary Inspection

Before starting a motor for the first time, it will be necessary to:

- Remove all locking devices and blocks used in transit and check that the motor rotates freely;
- Check that the motor is firmly secured and that coupling elements are correctly mounted and aligned.;
- Ascertain that voltage and frequency correspond to those indicated on the nameplate. Motor performance will be satisfactory with main supply voltage fluctuation within ten per cent of the value indicated on the nameplate or a frequency fluctuation within five per cent or, yet, with a combined voltage and frequency variance within ten per cent;

Table 9 - Comparison between motor protection system

- d) Check that connections are in accordance with the connection diagram shown on the nameplate and be sure that all terminal screws and nuts are tight;
- e) Check the motor for proper grounding. Providing that there are no specifications calling for ground-insulated installation, the motor must be grounded in accordance with prevalent standard for grounding electrical machines. The screw identified by the symbol  should be used for this purpose. This screw is generally to be found in the terminal box or on one foot of the frame;
- f) Check that motor leads connecting with the mains, as well as the control wires and the overload protection device, are in accordance with Nema Standards;
- g) If the motor has been stored in a damp place, or has been stopped for some time, measure the insulating resistance as recommended under the item covering storage instructions;
- h) Start the motor uncoupled to ascertain that it is turning in the desired direction. To reverse the rotation of a three-phase motor, invert two terminal leads of the mains supply. High voltage motors bearing an arrow on the frame indicating rotation direction can only turn in the direction shown;

Causes of overheating	Current-based protection		Protection with probe thermistor in motor
	Fuse only	Fuse and thermal protector	
			
1. Overload with 1.2 times rated current			
2. Duty cycles S1 to S8 IEC 34, EB 120			
3. Brakings, reversals and frequent starts			
4. Operating with more than 15 starts p/hour			
5. Locked rotor			
6. Fault on one phase			
7. Excessive voltage fluctuation			
8. Frequency fluctuation on main supply			
9. Excessive ambient temperature			
10. External heating caused by bearings, belts, pulleys etc.			
11. Obstructed ventilation			

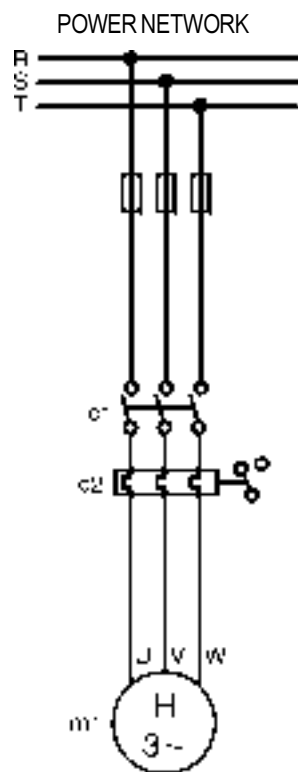
Caption:  unprotected

 partially protected

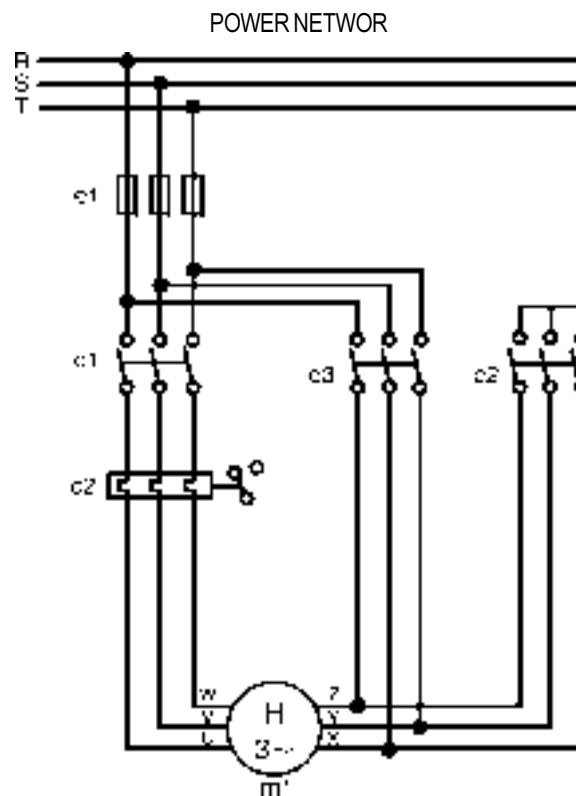
 totally protected

CONNECTION DIAGRAMS

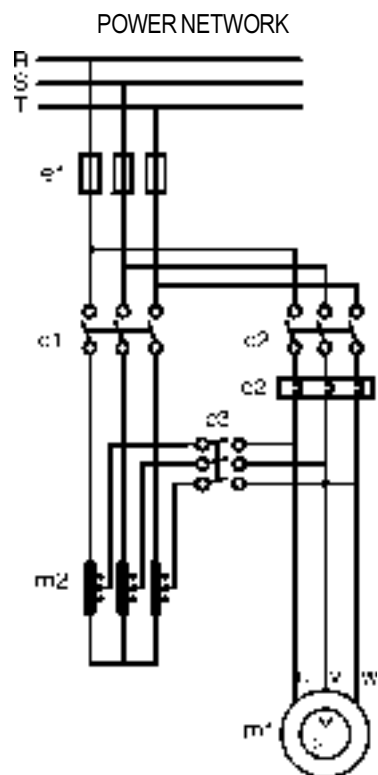
a) Direct starting



b) Star-Delta starting



c) Auto-transformer starting



3.3.2 The First Start-up

Three-Phase Motor with Cage Rotor

After careful examination of the motor, follow the normal sequence of starting operations listed in the control instructions for the initial start-up.

3.3.3 Operation

Drive the motor coupled to the load for a period of at least one hour while watching for abnormal noises or signs of overheating. Compare the line current with the value shown on the nameplate. Under continuous running conditions without load fluctuations this should not exceed the rated current times the service factor, also shown on the nameplate.

All measuring and control instruments and apparatus should be continuously checked for anomalies, and any irregularities corrected.

3.3.4 Stopping

Warning:

To touch any moving part of a running motor, even though disconnected, is a danger to life and limb.

- a) Three-phase motor with cage rotor:
Open the stator circuit switch. With the motor at a complete stop, reset the auto-transformer, if any, to the "start" position;



Table 11 - Bearing specifications by type of motor

NEMA Frames	Mounting	Bearings	
		Front (D.E.)	Rear (O.D.E.)
Open drip proof motors			
B48 and C48	ALL FORMS	6203 Z	6202 Z
56 and A56		6203 Z	6202 Z
B56 and C56		6203 Z	6202 Z
D56 and F56H/G56H		6204 Z	6202 Z / 6203 Z
Totally enclosed fan cooled motors			
143 T	ALL FORMS	6205 ZZ	6204 ZZ
145 T		6205 ZZ	6204 ZZ
182 T		6307 ZZ	6206 ZZ
184 T		6307 ZZ	6206 ZZ
W 182 T		6206 ZZ	6205 ZZ
W 184 T		6206 ZZ	6205 ZZ
213 T		6308 ZZ	6207 ZZ
215 T		6308 ZZ	6207 ZZ
W 213 T		6308 ZZ	6207 ZZ
W 215 T		6308 ZZ	6207 ZZ
254 T		6309-C3	6209 Z-C3
256 T		6309-C3	6209 Z-C3
W 254 T		6309-C3	6209 Z-C3
W 256 T		6309-C3	6209 Z-C3
284 T and TS		6311-C3	6211 Z-C3
286 T and TS		6311-C3	6211 Z-C3
324 T and TS		6312-C3	6212 Z-C3
326 T and TS		6312-C3	6212 Z-C3
364 T and TS		6314-C3	6314-C3
365 T and TS		6314-C3	6314-C3
404 T		NU 316-C3	6314-C3
404 TS		6314-C3	6314-C3
405 T		NU 316-C3	6314-C3
405 TS		6314-C3	6414-C3
444 T		NU 319-C3	6316-C3
444 TS		6314-C3	6314-C3
445 T		NU 319-C3	6316-C3
445 TS		6314-C3	6314-C3
447 T		NU 319-C3	6316-C3
447 TS		6314-C3	6314-C3
449 T		NU 322-C3	6319-C3
449 TS		6314-C3	6314-C3
504 T		NU 319-C3	6316-C3
504 TS		6314-C3	6314-C3
505 T		NU 319-C3	6316-C3
505 TS		6314-C3	6314-C3
5008 T		NU 322-C3	6319-C3
5008TS		6314-C3	6314-C3
586 T		NU 322-C3	6319-C3
586 TS		6314-C3	6314-C3
587 T		NU 322-C3	6319-C3
587 TS		6314-C3	6314-C3
Saw Arbor motor frame	Mounting	Bearings	
		Front (D.E.)	Rear (O.D.E.)
80 S MS	B3	6307 ZZ	6207 ZZ
80 M MS		6307 ZZ	6207 ZZ
80 L MS		6307 ZZ	6207 ZZ
90 L MS		6308 ZZ	6208 ZZ

ODP Motors Nema-T frames	Mounting	Bearings	
		Front (D.E.)	Rear (O.D.E.)
E143/5T	HORIZONTAL MOUNTING ONLY	6205 ZZ	6204 ZZ
F143/5T		6205 ZZ	6204 ZZ
182 T		6206 ZZ	6205 ZZ
184 T		6202 ZZ	6205 ZZ
213/5T		6208 ZZ	6206 ZZ
254 T		6309 Z-C3	6209 Z-C3
256 T		6309 Z-C3	6209 Z-C3
284 T		6311 Z-C3	6211 Z-C3
284 TS		6311 Z-C3	6211 Z-C3
286 T		6311 Z-C3	6211 Z-C3
286 TS		6311 Z-C3	6211 Z-C3
324 T		6312 Z-C3	6212 Z-C3
324 TS		6312 Z-C3	6212 Z-C3
326 T		6312 Z-C3	6212 Z-C3
326 TS		6312 Z-C3	6212 Z-C3
364 T		6314 C3	6314 C3
364 TS		6314 C3	6314 C3
365 T		6314 C3	6314 C3
365 TS		6314 C3	6314 C3
404 T		NU 316 C3	6314 C3
404 TS		6314 C3	6314 C3
405 T		NU 316 C3	6314 C3
405 TS		6314 C3	6314 C3
444 T		NU 319 C3	6316 C3
444 TS		6314 C3	6314 C3
445 T		NU 319 C3	6316 C3
445 TS		6314 C3	6314 C3

IEC frame	Mounting	Bearings	
		Front (D.E.)	Rear (O.D.E.)
Totally enclosed fan cooled motors			
63	B3	6201 ZZ	6201 ZZ
71		6203 ZZ	6202 ZZ
80		6204 ZZ	6203 ZZ
90 S - L		6205 ZZ	6204 ZZ
100 L		6206 ZZ	6205 ZZ
112 M		6307 ZZ	6206 ZZ
132 S - M		6308 ZZ	6207 ZZ
160 M - L		6309-C3	6209 Z-C3
180 M - L		6311-C3	6211 Z-C3
200 M - L		6312-C3	6212 Z-C3
225 S/M		6314-C3	6314-C3
250 S/M		6314-C3	6314-C3
280 S/M		6314-C3	6314-C3
		6316-C3	6316-C3
315 S/M		6314-C3	6314-C3
		6319-C3	6316-C3
355 M/L		6314-C3	6314-C3
		NU 322-C3	6319-C3

Table 12 - Bearing lubrication intervals and amount of grease

1 - SINGLE-ROW FIXED BALL BEARINGS

Bearings		Lubrication intervals (running hours)												
		II Pole		IV Pole		VI Pole		VIII Pole		X Pole		XII Pole		Amount of grease (oz)
		60Hz 3600 rpm	50Hz 3000 rpm	60Hz 1800 rpm	50Hz 1500 rpm	60Hz 1200 rpm	50Hz 1000 rpm	60Hz 900 rpm	50Hz 750 rpm	60Hz 720 rpm	50Hz 600 rpm	60Hz 600 rpm	50Hz 500 rpm	
Characteristics Ref.														
62	6200	12500	13800										0,07	
	6201	11700	13000	16600	18400								0,07	
	6202	10500	11900	15400	17100	19500							0,07	
	6203	9800	11200	14500	16200	18500							0,11	
	6204	8700	10100	13300	14800	17100	19100				> 20000		0,14	
	6205	8000	9400	12600	14100	16200	18200	19300					0,14	
	6206	7300	8700	12000	13400	15400	17200	18300					0,18	
	6207	6600	8100	11400	12700	14500	16300	17300	19200				0,25	
	6208	5900	7400	10800	12000	13700	15300	16300	18200				0,29	
	6209	5300	6900	10400	11600	13400	15000	16000	17800				0,29	
	6210	4900	6400	9700	11000	12900	14600	15600	17300				0,32	
	6211	4300	5900	9500	10900	12700	14400	15300	17000				0,39	
	6212	3800	5400	9300	10300	12400	14300	15200	16500				0,46	
	6213	3100	4900	8900	10100	12200	14000	14800	16100				0,50	
	6214	1100	2000	4100	5000	5900	6500	6900	7600				0,54	
	6215	1000	1800	4400	5000	5600	6300	6700	7600				0,61	
6216	700	1600	4100	4700	5700	6500	6800	7500				0,68		

63	6304	8700	10100	13300	14800	17100	19100							0,14
	6305	8000	9400	12600	14100	16200	18200	19300						0,21
	6306	7300	8700	12000	13400	15400	17200	18300				> 20000		0,25
	6307	6600	8100	11400	12700	14500	16300	17300	19200					0,32
	6308	5900	7400	10800	12000	13700	15300	16300	18200	18600				0,39
	6309	5300	6900	10400	11600	13400	15000	16000	17800	18200	19900			0,46
	6310	4900	6400	9700	11000	12900	14600	19500	17300	17700	19500	19500		0,54
	6311	4300	5900	9500	10900	12700	14400	15300	17000	17400	19000	19000		0,64
	6312	3800	5400	9300	10300	12400	14300	15200	16500	16800	18200	18200		0,75
	6313	3100	4900	8900	10100	12200	14000	14800	16100	16400	17900	17900	19700	0,86
	6314	1100	2000	4100	5000	5900	6500	6900	7600	7700	8600	8600	9600	0,96
	6315	1000	1800	4400	5000	5600	6300	6700	7600	7900	8900	8900	9900	1,07
	6316	700	1600	4100	4700	5700	6500	6800	7500	7700	8500	8500	9500	1,22
	6317	800	1300	3900	4700	5600	6300	6700	7400	7500	8300	8300	9300	1,32
	6318	-	1000	3800	4600	5500	6200	6600	7200	7400	8200	8200	9100	1,47
	6319	-	800	3700	4500	5400	6100	6500	7100	7300	8000	8000	8900	1,61
	6320	-	-	3600	4300	5300	6000	6300	7000	7100	7900	7900	8800	1,82
	6321	-	-	3400	4200	5100	5800	6200	6800	7000	7800	7800	8700	2,00
	6322	-	-	3100	4000	5000	5700	6100	6700	6900	7700	7700	8600	2,14

- 1) Lubrication periodicity valid for NLG 1 and lithium based bearing lubricant.
2) Bearings for motors of X and XII poles - Lubrication Intervals > 20,000.



Table 13 - Bearing lubrication intervals and amount of grease

2 - CYLINDRICAL ROLLER BEARINGS

Bearings		Lubrication intervals (running hours)												
		II Pole		IV Pole		VI Pole		VIII Pole		X Pole		XII Pole		Amount of grease (oz)
		60Hz 3600 rpm	50Hz 3000 rpm	60Hz 1800 rpm	50Hz 1500 rpm	60Hz 1200 rpm	50Hz 1000 rpm	60Hz 900 rpm	50Hz 750 rpm	60Hz 720 rpm	50Hz 600 rpm	60Hz 600 rpm	50Hz 500 rpm	
Characteristics Ref.														
N U 3 S E R I E S	NU309	2800	4000	8300	9500	10700	11800	12500	14100	14500	16300	16300	18200	0,46
	NU310	2400	3600	7900	9100	10300	11400	12200	13700	14000	15800	15800	17700	0,54
	NU311	2000	3200	7400	8700	10000	11000	11800	13300	13600	15400	15400	17200	0,64
	NU312	1600	2700	6900	8300	9600	10700	11400	12800	13200	14900	14900	16800	0,75
	NU313	1500	2500	6600	8100	9400	10500	11200	12700	13000	14700	14700	16500	0,86
	NU314	700	1100	3100	3900	4600	5200	5500	6200	6400	7200	7200	8100	0,96
	NU315	-	900	2900	3800	4500	5100	5500	6200	6300	7100	7100	7900	1,07
	NU316	-	800	2800	3600	4400	5000	5400	6100	6200	7000	7000	7800	1,22
	NU317	-	600	2600	3500	4300	4900	5300	6000	6100	6900	6900	7700	1,32
	NU318	-	-	2100	3300	4300	4900	5300	5900	6000	6700	6700	7500	1,47
	NU319	-	-	2300	3200	4100	4700	5100	5800	6000	6700	6700	7500	1,61
	NU320	-	-	2000	3000	4000	4700	5000	5700	5900	6600	6600	7300	1,82
NU321	-	-	1900	2800	4000	4600	4900	5600	5700	6500	6500	7200	2,00	
NU322	-	-	1900	2600	3900	4400	4800	5500	5600	6400	6400	7100	2,14	

1) Lubrication periodicity valid for NLG 1 and 2 lithium based bearing lubricant.



4. Maintenance

A well-designed maintenance program for electric motors can be summed up as: periodical inspection of insulation levels, temperature rise, wear, bearing lubrication and the occasional checking of fan air flow. Inspection cycles depend upon the type of motor and the conditions under which it operates.

4.1 Cleanliness

Motors should be kept clean, free of dust, debris and oil. Soft brushes or clean cotton rags should be used for cleaning. A jet of compressed air should be used to remove non-abrasive dust from the fan cover and any accumulated grime from the fan and cooling fins.

Oil or damp impregnated impurities can be removed with rags soaked in a suitable solvent.

Terminal boxes fitted to motors with IP55 protection should be cleaned; their terminals should be free of oxidation, in perfect mechanical condition, and all unused space dust-free.

Motors with IPW 55 protection are recommended for use under unfavourable ambient conditions.

4.2 Lubrication

Proper lubrication extends bearing life.

Lubrication Maintenance Includes:

- Attention to the overall state of the bearings;
- Cleaning and lubrication;
- Critical inspection of the bearings.

Motor noise should be measured at regular intervals of one to four months. A well-tuned ear is perfectly capable of distinguishing unusual noises, even with rudimentary tools such as a screw driver, etc., without recourse to sophisticated listening aids or stethoscopes that are available on the market.

A uniform hum is a sign that a bearing is running perfectly. Bearing temperature control is also part of routine maintenance. The temperature of bearings lubricated as recommended under item 4.2.2 should not exceed 70°C.

Constant temperature control is possible with the aid of external thermometers or by embedded thermal elements. WEG motors are normally equipped with grease lubricated ball or roller bearings. Bearings should be lubricated to avoid metallic contact of the moving parts, and also for protection against corrosion and wear. Lubricant properties deteriorate in the course of time and mechanical operation: furthermore, all lubricants are subject to contamination under working conditions.

For this reason lubricants must be renewed and any lubricant consumed needs replacing from time to time.

4.2.1 Periodical Lubrication

WEG motors are supplied with sufficient grease for a long running

period. Lubrication intervals, the amount of grease and the type of bearing used in frames 140T to 580T are to be found in Tables 11, 12 and 13.

Lubrication intervals depend upon the size of the motor, speed, working conditions and the type of grease used.

4.2.2 Quality and Quantity of Grease

Correct lubrication is important!

Grease must be applied correctly and in sufficient quantity as both insufficient or excessive greasing are harmful.

Excessive greasing causes overheating brought about by the greater resistance encountered by the rotating parts and, in particular, by the compacting of the lubricant and its eventual loss of lubricating qualities.

This can cause seepage with the grease penetrating the motor and dripping on the coils.

A lithium based grease is commonly used for the lubrication of electric motor bearings as it has good mechanical stability, is insoluble in water and has a drip point of approximately 200°C.

This grease should never be mixed with sodium or calcium based greases.

GREASES FOR MOTOR BEARINGS

For operating temperatures from - 20 to 130°C			
Frame	Supplier	Grease	Temperature range
143T-215T	Shell	Alvania R3	-20 to 130°C
254T to 586/7	Esso	Unirex N2	-30 to 165°C
Substitutes			
Supplier		Grease	Temperature Range
Mobil		Mobilith SHC100	-40 to 177°C
ESSO		Beacon 2	-20 to 130°C
Atlantic		Litholine 2	-20 to 130°C
Texaco		Multifak 2	-20 to 130°C
Molikote		BG 20	-45 to 180°C
Inisilikon		L5012	-20 to 200°C

Note: When changing lubricant, please follow manufacturers instructions

4.2.3 Lubricating Instructions

a) Frame 140T to 210T motors

Frame 140T to 210T size motors are not fitted with grease nipples. Lubrication is carried out during periodical overhauls when the motor is taken apart.

Cleaning and Lubrication of Bearings

With the motor dismantled and without extracting the bearings from the shaft, all existing grease should be removed and the bearings cleaned with Diesel oil, kerosene or other solvent, until thoroughly clean.

Refill the spaces between the balls or rollers and the bearing cages with grease immediately after washing. Never rotate bearings in their dry state after washing.

For inspection purposes apply a few drops of machine oil. During these operations maximum care and cleanliness is recommended to avoid the penetration of any impurities or dust that could harm the bearings. Clean all external parts prior to reassembly.

b) Frame 360T to 580T Motors

Motors above 360T frame size are fitted with regreaseable bearing system.

The lubrication system from this frame size upwards was designed to allow the removal of all grease from the bearing races through a bleeder outlet which at the same time impedes the entry of dust or other contaminants harmful to the bearing.

This outlet also prevents injury to the bearings from the well-known problem of over-greasing.

It is advisable to lubricate while the motor is running, to allow the renewal of grease in the bearing case.

Should this procedure not be possible because of rotating parts in the proximity of the nipple (pulleys, coupling sleeves, etc.) that are hazardous to the operator the following procedure should be followed:

- Inject about half the estimated amount of grease and run the motor at full speed for approximately a minute; switch off the motor and inject the remaining grease.

The injection of all the grease with the motor at rest could cause penetration of a portion of the lubricant through the internal seal of the bearing case and hence into the motor.

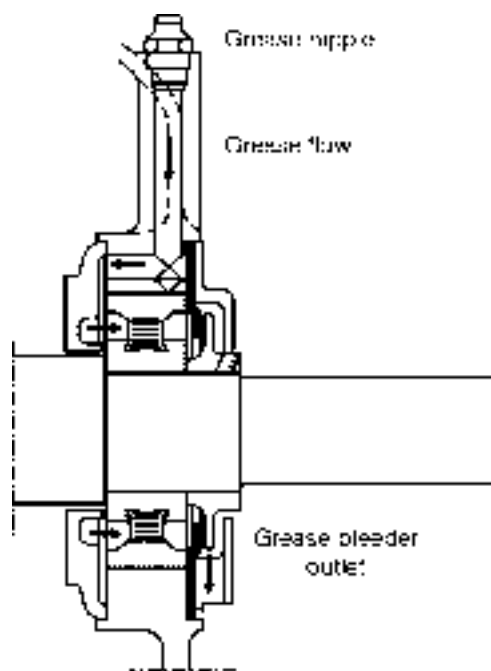


Figure 4.1 - Bearings and lubrication system

Nipples must be clean prior to introduction of grease to avoid entry of any alien bodies into the bearing.

For lubricating use only a manual grease gun.

Bearing Lubrication Steps

1. Cleanse the area around the grease nipples with clean cotton fabric.
2. With the motor running, add grease with a manual grease gun until the lubricant commences to be expelled from the bleeder outlet, or until the quantity of grease recommended in Tables 12 or 13 has been applied.
3. Allow the motor to run long enough to eject all excess grease.

4.2.4 Replacement of Bearings

The opening of a motor to replace a bearing should only be carried out by qualified personnel.

Damage to the core after the removal of the bearing cover can be avoided by filling the gap between the rotor and the stator with stiff paper of a proper thickness.

Providing suitable tooling is employed, disassembly of a bearing is not difficult.

The extractor grips should be applied to the sidewall of the inner ring to be stripped, or to an adjacent part.

To ensure perfect functioning and to prevent injury to the bearing parts, it is essential that the assembly be undertaken under conditions of complete cleanliness and by competent personnel. New bearings should not be removed from their packages until the moment of assembly.

Prior to fitting a new bearing, ascertain that the shaft has no rough edges or signs of hammering.

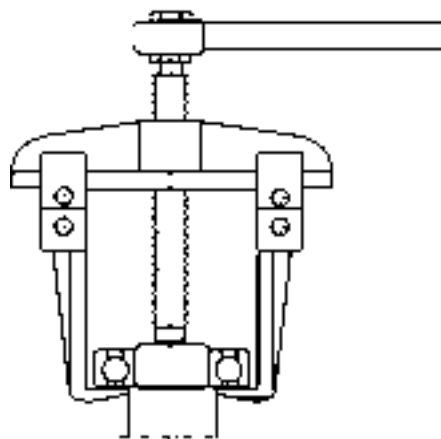


Figure 4.2 - A bearing extractor

During assembly bearings cannot be subjected to direct blows.

The aid used to press or strike the bearing should be applied to the inner ring.

4.3 Air Gap Checking (Large Rating Open Motors)

Upon the completion of any work on the bearings check the gap measurement between the stator and the rotor using the appropriate gages.

The gap variation at any two vertically opposite points must be less than 10% of the average gap measurement.

4.4 Explosion Proof Motor Repair Steps

4.4.1 Objective

In view of the heavy liability associated with burning of motors of this type, this product has been designed and manufactured to high technical standards, under rigid controls. In addition, in many areas it is required that explosion proof motors ONLY be repaired by licensed personnel or in licensed facilities authorized to do this type of work.

The following general procedures, safeguards, and guidelines must be followed in order to ensure repaired explosion proof motors operate as intended.

4.4.2 Repair Procedure and Precautions

Dismantle the damaged motor with appropriate tools without hammering and/or pitting machined surfaces such as enclosure joints, fastening holes, and all joints in general.

The position of the fan cover should be suitably marked prior to removal so as to facilitate reassembly later on.

Examine the motor's general condition and, if necessary, disassemble all parts and clean them with kerosene. Under no circumstances should scrapers, emery papers or tools be used that could affect the dimensions of any part during cleaning.

Protect all machined parts against oxidation by applying a coating of vaseline or oil immediately after cleaning.

STRIPPING OF WINDINGS

This step requires great care to avoid knocking and/or denting of enclosure joints and, when removing the sealing compound from the terminal box, damage or cracking of the frame.

IMPREGNATION

Protect all frame threads by inserting corresponding bolts, and the joint between terminal box and frame, by coating it with a non-adhesive varnish (ISO 287 - ISOLASIL).

Protective varnish on machined parts should be removed soon after treating with impregnating varnish. This operation should be carried out manually without using tools.

ASSEMBLY

Inspect all parts for defects, such as cracks, joint incrustations, damaged threads and other potential problems.

Assemble using a rubber headed mallet and a bronze bushing after ascertaining that all parts are perfectly fitted.

Bolts should be positioned with corresponding spring washers and evenly tightened.

TESTING

Rotate the shaft by hand while examining for any drag problems on covers or fastening rings.

Carry out running tests as for standard motors.

MOUNTING THE TERMINAL BOX

Prior to fitting the terminal box all cable outlets on the frame should be sealed with a sealing compound (1st layer) and an Epoxy resin (ISO 340) mixed with ground quartz (2nd layer) in the following proportions:

340A resin	50 parts
340B resin	50 parts
Ground quartz	100 parts

Drying time for this mixture is two hours during which the frame should not be handled and cable outlets should be upwards.

When dry, see that the outlets and areas around the cables are perfectly sealed.

Mount the terminal box and paint the motor.

4.4.3 Miscellaneous Recommendations

- Any damaged parts (cracks, pittings in machined surfaces, defective threads) must be replaced and under no circumstances should attempts be made to recover them.
- Upon reassembling explosion proof motors IPW55 the substitution of all seals is mandatory.
- Should any doubts arise, consult WEG.

5. Malfunctioning

Most malfunctions affecting the normal running of electric motors can be prevented by maintenance and the appropriate precautions. While ventilation, cleanliness and careful maintenance are the main factors ensuring long motor life, a further essential factor is the prompt attention to any malfunctioning as signalled by vibrations, shaft knock, declining insulation resistance, smoke or fire, sparking or unusual slip ring or brush wear, sudden changes of bearing temperatures.

When failures of an electric or mechanical nature arise, the first step to be taken is to stop the motor and subsequent examination of all mechanical and electrical parts of the installation.

In the event of fire, the installation should be isolated from the mains supply, which is normally done by turning off the respective switches.

In the event of fire within the motor itself, steps should be taken to restrain and suffocate it by covering the ventilation vents.

To extinguish a fire, dry chemical or CO₂ extinguishers should be used - never water.

5.1 Standard Three-Phase Motor Failures

Owing to the widespread usage of asynchronous three-phase motors in industry which are more often repaired in the plant workshops, there follows a summary of possible failures and their probable causes, detection and repairs.

Motors are generally designed to Class B or F insulation and for ambient temperatures up to 40°C.

Most winding defects arise when temperature limits, due to current overload, are surpassed throughout the winding or even in only portions thereof. These defects are identified by the darkening or carbonizing of wire insulation.

5.1.1 Short Circuits Between Turns

A short circuit between turns can be a consequent of two coinciding insulation defects, or the result of defects arising simultaneously on two adjacent wires. As wires are randomly tested, even the best quality wires can have weak spots. Weak spots can, on occasion, tolerate a voltage surge of 30% at the time of testing for shorting between turns, and later fail due to humidity, dust or vibration. Depending on the intensity of the short, a magnetic hum becomes audible.

In some cases, the three-phase current imbalance can be so insignificant that the motor protective device fails to react. A short circuit between turns, and phases to ground due to insulation failure is rare, and even so, it nearly always occurs during the early stages of operation.

5.1.2 Winding Failures

a) One burnt winding phase

This failure arises when a motor runs wired in delta and current fails in one main conductor.

Current rises from 2 to 2.5 times in the remaining winding with a

simultaneous marked fall in speed. If the motor stops, the current will increase from 3.5 to 4 times its rated value.

In most instances, this defect is due to the absence of a protective switch, or else the switch has been set too high.

b) Two burnt winding phases

This failure arises when current fails in one main conductor and the motor winding is star-connected. One of the winding phases remains currentless while the others absorb the full voltage and carry an excessive current.

The slip almost doubles.

c) Three burnt winding phases

Probable cause 1

Motor only protected by fuses; an overload on the motor will be the cause of the trouble.

Consequently, progressive carbonizing of the wires and insulation culminate in a short circuit between turns, or a short against the frame occurs.

A protective switch placed before the motor would easily solve this problem.

Probable cause 2

Motor incorrectly connected. For example: A motor with windings designed for 230/400V is connected through a star-delta switch to 400V connection.

The absorbed current will be so high that the winding will burn out in a few seconds if the fuses or a wrongly set protective switch fail to react promptly.

Probable cause 3

The star-delta switch is not commutated and the motor continues to run for a time connected to the star under overload conditions. As it only develops 1/3 of its torque, the motor cannot reach rated speed. The increased slip results in higher ohmic losses arising from the Joule effect. As the stator current, consistent with the load, may not exceed the rated value for the delta connection, the protective switch will not react.

Consequent to increased winding and rotor losses the motor will overheat and the winding burn out.

Probable cause 4

Failures from this cause arise from thermal overload, due to too many starts under intermittent operation or to an overly long starting cycle. The perfect functioning of motor operating under these conditions is only assured when the following values are heeded:

- a) number of starts per hour;
- b) starting with or without load;
- c) mechanical brake or current inversion;
- d) acceleration of rotating masses connected to motor shaft
- e) load torque vs. speed during acceleration and braking.

The continuous effort exerted by the rotor during intermittent starting brings about heavier losses which provoke overheating.

Under certain circumstances with the motor idle there is a possibility that the stator winding is subjected to damage as a result of the

heating of the motor. In such a case, a slip ring motor is recommended as a large portion of the heat (due to rotor losses) is dissipated in the rheostat.

5.1.3 Rotor Failures

If a motor running under load conditions produces a noise of varying intensity and decreasing frequency while the load is increased, the reason, in most cases, will be an unsymmetrical rotor winding.

In squirrel-cage motors the cause will nearly always be a break in one or more of the rotor bars; simultaneously, periodical stator current fluctuations may be recorded. As a rule, this defect appears only in molded or die cast aluminum cages.

Failures due to spot heating in one or another of the bars in the rotor stack are identified by the blue coloration at the affected points. Should there be failures in various contiguous bars, vibrations and shuddering can occur as if due to an unbalance, and are often interpreted as such. When the rotor stack acquires a blue or violet coloration, it is a sign of overloading.

This can be caused by overly high slip, by too many starts or overlong starting cycles. This failure can also arise from insufficient main voltage.

5.1.4 Bearing Failures

Bearing damage is a result of overloading brought about by an overly taut belt or axial impacts and stresses.

Underestimating the distance between the drive pulley and the driven pulley is a common occurrence.

The arc of contact of the belt on the drive pulley thus becomes inadmissibly small and thereby belt tension is insufficient for torque transmission.

In spite of this it is quite usual to increase belt tension in order to attain sufficient drive.

Admittably, this is feasible with the latest belt types reinforced by synthetic materials.

However, this practice fails to consider the load on the bearing and the result is bearing failure within a short time.

Additionally there is the possibility of the shaft being subjected to unacceptably high loads when the motor is fitted with a pulley that is too wide.

5.1.5 Shaft Fractures

Although bearings traditionally constitute the weaker part, and the shafts are designed with wide safety margins, it is not beyond the realm of possibility that a shaft may fracture by fatigue from bending stress brought about by excessive belt tension.

In most cases, fractures occur right behind the drive end bearing.

As a consequence of alternating bending stress induced by a rotating shaft, fractures travel inwards from the outside of the shaft until the point of rupture is reached when resistance of the remaining shaft cross-section no longer suffices.

Avoid additional drilling the shaft (fastening screw holes) as such operations tend to cause stress concentration.

5.1.6 Unbalanced V-Belt Drives

The substitution of only one of a number of other parallel belts on a drive is frequently the cause of shaft fractures, as well as being malpractice.

Any used, and consequently stretched belts retained on the drive, especially those closest to the motor, while new and unstretched belts are placed on the same drive turning farther from the bearing, can augment shaft stress.

5.1.7 Damage Arising from Poorly Fitted Transmission Parts or Improper Motor Alignment

Damage to bearing and fracture in shafts often ensue from inadequate fitting of pulleys, couplings or pinions. These parts "knock" when rotating. The defect is recognized by the scratches that appear on the shaft or the eventual scalelike flaking of the shaft end.

Keyways with edges pitted by loosely fitted keys can also bring about shaft failures.

Poorly aligned couplings cause knocks and radial and axial shaking to shaft and bearings.

Within a short while these malpractices cause the deterioration of the bearings and the enlargement of the bearing cover bracket located on the drive end side.

Shaft fracture can occur in more serious cases.



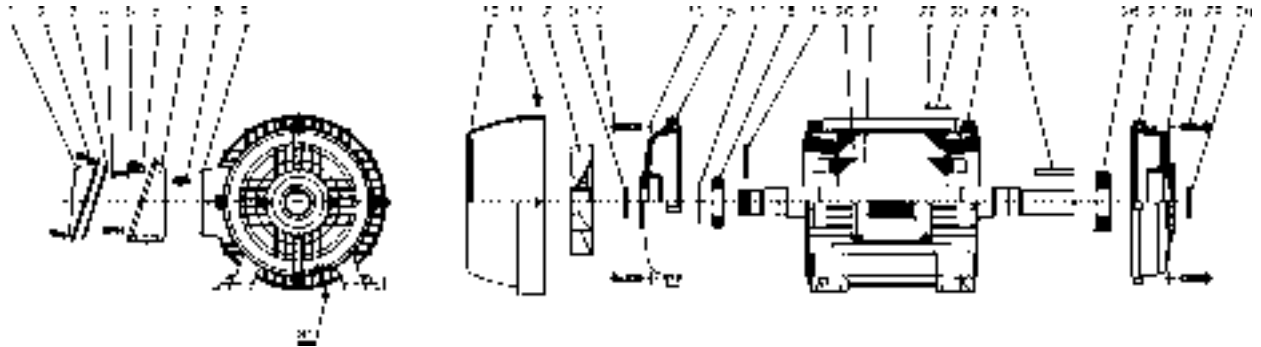
5.2 Troubleshooting chart

FAILURE	PROBABLE CAUSE	CORRECTIVE MEASURES
Motor fails to start	<ol style="list-style-type: none"> 1. No voltage supply 2. Low voltage supply 3. Wrong control connections 4. Loose connection at some terminal lug 5. Overload 	<ul style="list-style-type: none"> • Check feed connections to control system and from this to motor. • Check voltage supply and ascertain that voltage remains within 10% of the rated voltage shown on the motor nameplate. • Compare connections with the wiring diagram on the motor nameplate. • Tighten all connections. • Try to start motor under no-load conditions. If it starts, there may be an overload condition or a blocking of the starting mechanism. Reduce load to rated load level and increase torque.
High noise level	<ol style="list-style-type: none"> 1. Unbalance 2. Distorted shaft 3. Incorrect alignment 4. Uneven air gap 5. Dirt in the air gap 6. Extraneous matter stuck between fan and motor casing 7. Loose motor foundation 8. Worn bearings 	<ul style="list-style-type: none"> • Vibrations can be eliminated by balancing rotor. If load is coupled directly to motor shaft, the load can be unbalanced. • Shaft key bent; check rotor balance and eccentricity. • Check motor alignment with machine running. • Check shaft for warping or bearing wear. • Dismantle motor and remove dirt or dust with jet of dry air. • Dismantle motor and clean. Remove trash or debris from motor vicinity. • Tighten all foundation studs. If necessary, realign motor. • Check lubrication. Replace bearing if noise is excessive and continuous.
Overheating of bearings	<ol style="list-style-type: none"> 1. Excessive grease 2. Excessive axial or radial strain on belt 3. Deformed shaft 4. Rough bearing surface 5. Loose or poorly fitted motor end shields 6. Lack of grease 7. Hardened grease cause locking of balls 8. Foreign material in grease 	<ul style="list-style-type: none"> • Remove grease bleeder plug and run motor until excess grease is expelled. • Reduce belt tension. • Have shaft straightened and check rotor balance. • Replace bearings before they damage shaft. • Check end shields for close fit and tightness around circumference. • Add grease to bearing. • Replace bearings. • Flush out housings and relubricate.
Intense bearing vibration	<ol style="list-style-type: none"> 1. Unbalanced rotor 2. Dirty or worn bearing 3. Bearing rings too tight on shaft and/or bearing housing 4. Extraneous solid particles in bearing 	<ul style="list-style-type: none"> • Balance rotor statically and dynamically. • If bearing rings are in perfect condition, clean and relubricate the bearing, otherwise, replace bearing. • Before altering shaft or housing dimensions, it is advisable to ascertain that bearing dimensions correspond to manufacturer's specifications. • Take bearing apart and clean. Reassemble only if rotating and support surfaces are unharmed.
Overheating of motor	<ol style="list-style-type: none"> 1. Obstructed cooling system 2. Overload 3. Incorrect voltages and frequencies 4. Frequent inversions 5. Rotor dragging on stator 6. Unbalanced electrical load (burnt fuse, incorrect control) 	<ul style="list-style-type: none"> • Clean and dry motor; inspect air vents and windings periodically. • Check application, measuring voltage and current under normal running conditions. • Compare values on motor nameplate with those of mains supply. Also check voltage at motor terminals under full load. • Exchange motor for another that meets needs. • Check bearing wear and shaft curvature. • Check for unbalanced voltages or operation under single-phase condition.

6. Spare Parts and Component Terminology

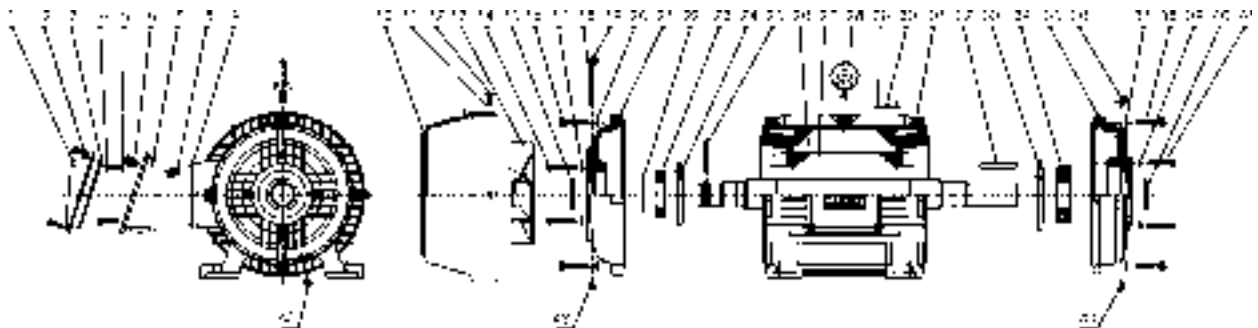


THREE-PHASE MOTORS IP55 NEMA - Frames 140T - W180T - 180T - 210T and W210T



Part Nr.	Description	Part Nr.	Description	Part Nr.	Description
1	Terminal box cover	13	V'Ring	25	Shaft key
2	Terminal box cover fixing bolt	14	Non-drive end endshield fixing bolt	26	Drive end bearing
3	Terminal box cover gasket	15	Non-drive end endshield washer	27	Drive endshield
4	Terminal box fixing bolt	16	Non-drive endshield	28	Drive endshield washer
5	Terminal box fixing washer	17	Spring washer	29	Drive end endshield fixing bolt
6	Terminal box grounding lug	18	Non-drive bearing	33	V'Ring
7	Terminal box	19	Fan fixing pin	31	Drain plug
8	Frame grounding lug	20	Wound stator		
9	Terminal box o'ring gasket	21	Rotor / shaft assembly		
10	Fan cover	22	Nameplate fixing rivet		
11	Fan cover fixing bolt	23	Nameplate		
12	Fan	24	Frame		

THREE-PHASE MOTORS IP55 NEMA - Frames 250T - W250T - 280T and 320T



Part Nr.	Description	Part Nr.	Description	Part Nr.	Description
1	Terminal box cover	16	Non-drive end endshield fixing bolt	30	Nameplate
2	Terminal box cover fixing bolt	17	Non-drive end bearing cap washer	31	Frame
3	Terminal box cover gasket	18	Non-drive end grease nipple	32	Shaft key
4	Terminal box fixing bolt	19	Non-drive end grease nipple cover	33	Drive end bearing cap
5	Terminal box fixing washer	20	Non-drive end endshield washer	34	Drive end bearing
6	Terminal box grounding lug	21	Non-drive endshield	35	Drive andshield
7	Terminal box	22	Spring washer	36	Drive end grease nipple cover
8	Frame grounding lug	23	Non-drive end bearing	37	Drive endshield washer
9	Terminal box o'ring gasket	24	Non-drive end bearing cap	38	Drive end endshield fixing bolt
10	Fan cover	25	Fan fixing pin	39	Drive end bearing cap washer
11	Fan cover washer	26	Wound stator	40	V'Ring
12	Fan cover fixing bolt	27	Rotor and shaft	41	Drive end bearing cap fixing bolt
13	Fan	28	Eyebolt	42	Drain plug
14	Non-drive end bearing cap bolt	29	Nameplate fixing rivet	43	Non-drive and grease relief
15	V'Ring			44	Drive end grease relief

9.0 NUTRIENT PUMP

9.1 PUMP SPECIFICATION SHEET

SIEMENS

ZABOCS[®]
PRODUCT SPECIFICATION SHEET

NUTRIENT FEED PUMP

CUSTOMER

Siemens Industry, Inc.
SAN DIEGO, CA

PROJECT

**ZABOCS BIOLOGICAL ODOR CONTROL SYSTEM
TYPICAL FOR 6X SYSTEMS**

PUMP PERFORMANCE:
4.7 LPH @ 560 kPa

**SIEMENS Wallace & Tiernan Products PREMIA 75 Solenoid Metering Pump, Model
P75ECL5DHPTC1A5 complete with:**

- Teflon-faced Diaphragm
- Teflon Seats/O-Rings
- Glass-filled Polypropylene (GFPPL) Head
- Glass-filled Polypropylene (GFPPL) Fittings
- 50Watts/0.3 Amps @ 230 Volts
- Capacity 4.7 Lph @ 560 kPa
- Australian style plug

9.2 PUMP DRAWING

PREMIA® 75

SOLENOID METERING PUMPS

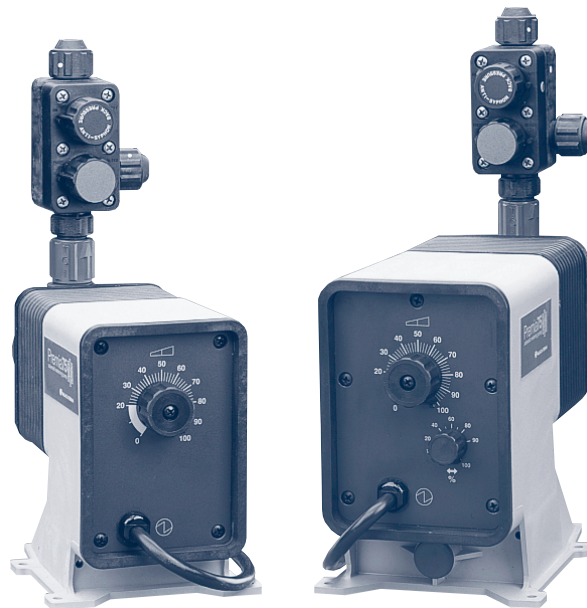
MONO AND ECONO SERIES

Key Features – Mono Series

- 4 sizes to cover a range of capacities up to 1.27 gph (4.73 l/h) and pressures up to 80 psi (5.6 bar).
- Manual control by on-line adjustable stroke length, fixed stroke frequency.
- Optional external pulse control.
- Auto degassing pump arrangements available up to 1.27 gph (4.73 l/h).
- 3-function valve supplied as standard.
- 5:1 turndown ratio.
- Metering performance reproducible to within +/-3%.
- ETL certified for indoor and outdoor use per UL standard 778, as well as CSA standard C22.2 and NSF Standard 50.

Key Features – Econo Series

- 8 sizes to cover a range of capacities up to 1.27 gph (4.73 l/h) and pressures up to 150 psi (10 bar).
- Manual control by on-line adjustable stroke length and stroke frequency.
- Optional external pulse control.
- Auto degassing pump arrangements available up to 1.27 gph (4.73 l/h).
- 3-function valve supplied as standard.
- 100:1 turndown ratio.
- Metering performance reproducible to within +/-3%.
- ETL certified for indoor and outdoor use per UL standard 778, as well as CSA standard C22.2 and NSF Standard 50.



OPERATING BENEFITS

Reliable Metering Performance

Guided checks valves, with state-of-the-art ball and seat designs, provide precise seating and excellent priming and suction lift characteristics. The timing circuit is virtually unaffected by temperature, EMI and other electrical disturbances.

Rated for Continuous Duty

Premia® 75 pumps continue to meet their capacity and pressure specifications even during extended use. The solenoid is encapsulated in a fin-cooled, thermo-conductive enclosure that effectively dissipates heat and provides stability of output.

High Viscosity Capability

A straight flow path, and ample clearance between the diaphragm and head, enables the Mono and Econo series to handle chemicals with viscosities up to 1000 CPS.

High Specification Liquid End

The premium composite diaphragms are manufactured to stringent specifications to ensure long life, even under the most demanding applications. The design incorporates teflon-facing and fabric reinforcements, bonded to a preformed elastomeric support which combined with an integral o-ring for complete sealing and a metal insert will ensure volumetric accuracy even at varying discharge pressures.

TECHNICAL DATA

PUMP TECHNICAL DATA

Capacity and Back Pressure – Mono Series (MO)

Back Pressure, maximum psig	Capacity, nominal US gph			
	0.25	0.50	0.90	1.27
80	L1	L2	L3	L5

Capacity and Back Pressure – Econo Series (EC)

Back Pressure, maximum psig	Capacity, nominal US gph			
	0.25	0.50	0.90	1.27
150	H1	H2		
100			M3	M5
80	L1	L2	L3	L5

		Mono	Econo
Materials of Construction	Pump Head	Glass-filled Polypropylene (GFPP), Polyvinylidene Fluoride (PVDF), Styrene-Acrylonitrile (SAN), PVC, 316 SS	
	Diaphragm	Teflon-faced, Fabric-reinforced, Hypalon-backed, metal insert	
	Check Valves: Seats/O-rings Balls Fittings	Teflon, Hypalon, Viton Ceramic, Teflon, 316 SS, Hastalloy C GFPP, PVDF, PVC, 316 SS	
	Injection Valve/Foot Valve	Same as fittings and check valves selected	
	Tubing: Suction and Discharge tubing available	Ethylene Vinyl Acetate (EVA) maximum working pressure 79 psi PVC maximum working pressure 79 psi Polyethylene (PE) maximum working pressure 143 psi Polypropylene maximum working pressure 300 psi	
Connections	Tubing	3/16" ID x 5/16" OD (5mm ID x 8mm OD) 1/4" ID x 3/8" OD (6mm ID x 9mm OD) 3/8" ID x 1/2" OD (9mm ID x 12mm OD) For other connections consult W&T.	
	Piping	1/4" FNPT	
	Reproducibility at Max. Capacity	±3%	
	Maximum Viscosity	1000 CPS Viscosities measured with a Brookfield Viscometer, No. 2 and No. 3 spindles, 1.5 RPM	
	Maximum Stroke Frequency	125 SPM	
	Stroke Length Turndown Ratio	5:1	10:1
	Stroke Frequency Turndown Ratio	N/A	10:1
	Maximum Suction Lift at 1 cP	5 feet once primed	
	Power Input	115 VAC, 50/60 Hz, 1 Ph 230 VAC, 50/60 Hz, 1 Ph	
	Average Input Power @ Max. SPM	50 Watts	
	Average Current Draw	@ 115 VAC – 0.6 Amps @ 230 VAC – 0.3 Amps	
	Peak Input Power	130 Watts	
	Maximum Temperature	104°F	

5 FUNCTION VALVE TECHNICAL DATA

Materials of Construction	Valve Body	GFPP, PVDF, PVC	
	Diaphragm	Teflon-faced Hypalon	
	O-rings	Teflon	
	Hardware	18/8 SS	
	Maximum Operating Pressure	250 psi	
	Maximum Flow	10 gph	
	Maximum Viscosity	1000 CPS, Measured with a Brookfield Viscometer, No. 2 and No. 3 spindles, 1.5 RPM	
	Pressure Relief Setting	175 psi – coded green 125 psi – coded blue	
Connections	Tubing	1/4" ID x 3/8" OD (6mm ID x 9mm OD) 3/8" ID x 1/2" OD (9mm ID x 12mm OD)	For other connections consult W&T.
	Piping	1/4" MNPT	
	Relief Port	1/4" ID x 3/8" OD (6mm ID x 9mm OD) 3/8" ID x 1/2" OD (9mm ID x 12mm OD) 1/4" MNPT (with NPT connection only)	

TOTAL SOLUTIONS

Included as standard accessories with all models are a function valve, injection valve, foot valve/sinker/strainer, tubing and tubing straighteners.

A Wide Range of Additional Accessories is Available

Choose from tank feed systems, mixers, flow meters, liquid level controllers, flow indicators, wall mounting brackets, and many more. Reference publication TI 460.150 UA for additional information.

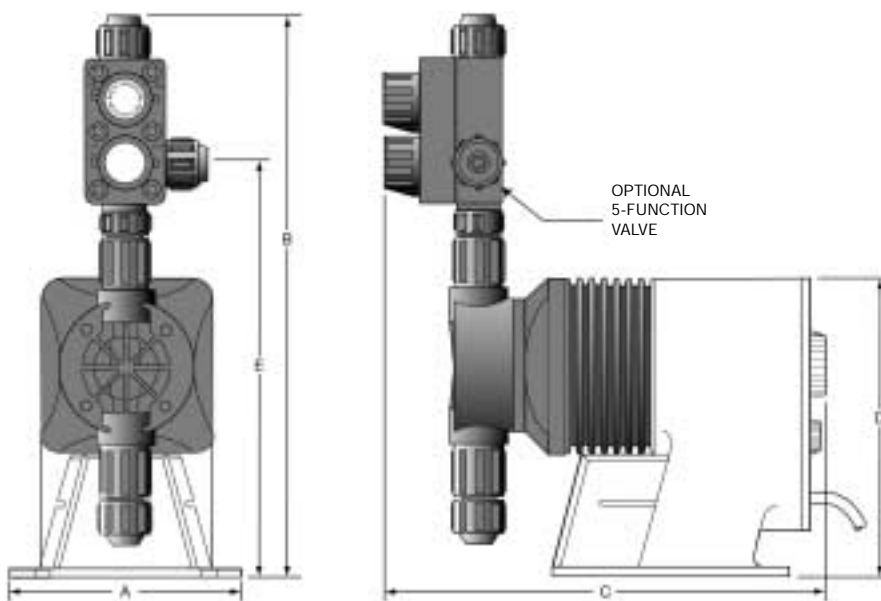
Quick and Economical Liquid End Maintenance

A unique PM Kit™ is available for every model. These convenient, economically priced packages contain new cartridge check valves, diaphragm, head and other important spare parts.

Dimensions and Shipping Weights

Econo Dimensions (inches)						
Model No.	A	B	C	D	E	Shipping Weight (lbs)
ECH1	5	12	10	6.5	8.7	10
ECH2	5	12.3	10	6.5	9	10
ECM3	5	12.3	10	6.5	9	10
ECM5	5	12.3	10	6.5	9	10
ECL1	5	12	10	6.5	8.7	10
ECL2	5	12.3	10	6.5	9	10
ECL3	5	12.3	10	6.5	9	10
ECL5	5	12.3	10	6.5	9	10

Mono Dimensions (inches)						
Model No.	A	B	C	D	E	Shipping Weight (lbs)
MOL1	5	12	6	6.5	8.7	10
MOL2	5	12.3	6	6.5	9	10
MOL3	5	12.3	6	6.5	9	10
MOL5	5	12.3	6	6.5	9	10



Agency Listings



PREMIA® 75

SOLENOID METERING PUMPS

MONO AND ECONO SERIES

EQUIPMENT SPECIFICATION

1.0 General

Chemical metering pumps shall be of the positive displacement, non-hydraulic, solenoid-driven, diaphragm type. Output shall be continuously rated at operating temperature and adjustable while pumps are in operation. Positive flow shall be ensured by the use of a minimum of four ball type check valves and a 3-function valve. The pump to be water-resistant for outdoor installation, and internally dampened for noise reduction. The pump to be a Wallace & Tiernan Products Premia® 75 (Mono), (Econo) Series.

2.0 Controls

2.1 Mono Series

The control panel shall be located opposite the liquid end. Output volume adjustments shall be made by a dial knob for stroke length.

External Pacing (optional)

The pump shall be capable of accepting non-voltage contact closures (e.g. contacting flow meter). As the contact closes, the pump shall stroke once; minimum contact closure time is 10 msec. Contact must open and close for each pump stroke, maximum closures – 125 per minute. The pump shall have a prime button located on the control panel. When the prime button is pushed, the pump will run at maximum stroking rate for ease of priming.

2.2 Econo Series

The control panel shall be located opposite the liquid handling end of the pump. Output vol-

ume adjustment shall be made by independent dial knobs for stroke length and stroke rate.

External Pacing (optional)

Pump controls shall be selectable between manual and external by means of a 2-position switch. In external mode, the pump shall accept non-voltage contact closures (e.g. contacting flow meter). As contact closes, the pump shall stroke once; minimum contact closure time is 10 msec. Contact must open and close for each pump stroke, maximum closures --125 per minute.

3.0 Electronic Drive

To prevent damage to the pump from overheating, the solenoid shall have automatic thermal overload protection. For overpressure conditions, the pump shall automatically stop pulsing when discharge pressure exceeds pump pressure rating by not more than 35%, when the pump is at maximum stroke rate. The electronic circuitry shall be EMI resistant and shall employ a metal oxide varistor for lightning protection. A fusible link on the pump's printed circuit board, solenoid and power to be a quick disconnect terminal at least 3/16" wide.

4.0 Enclosure

The pump drive shall be encased in a water-resistant housing constructed of chemically resistant glass-filled polyester. The electronic circuitry to be mounted at the rear of the pump for maximum protection against chemical intrusion.

Notes

- 5-function valve is not available on auto degassing arrangements.
- Auto degassing liquid end is only available with PVC head, ceramic balls, viton seals/o-rings and 3/16" ID, 5/16" OD (5mm ID, 8mm OD) suction tubing and 1/4" ID, 3/8" OD (6mm ID, 9mm OD) discharge tubing.
- Pump heads in SAN are not available on models rated above 100 psi (7 bar).

For technical information on the Premia® 75 Mini and Mini-DC Series request publication TI 460.150-2UA.

For technical information on the Premia® 75 Mega and Micro Series request publication TI 460.150-3UA.

For information on Premia® 75 solenoid metering pump accessories request publication TI 460.150-4UA.

For chemical resistance guidelines request publication TI 460.150-6UA.

For ordering information request publication TI 460.150-5UA.

USFilter
Taking care of the world's water.

Wallace & Tiernan Products
1901 West Garden Road
Vineland, NJ 08360
856.507.9000 tel
856.507.4125 fax

www.wallaceandtiernan.usfilter.com
Literature # TI 460.150-1 UA Revised 9/00
©2000 USFilter

VIVENDI
water company

Progressive changes in design may be made without prior announcement.

9.3 PUMP OPERATION AND MAINTENANCE MANUAL

PREMIA™ 75

ECONO

SOLENOID METERING PUMP

BOOK NO IM 460 150AA UA ISSUE A



ECONO

PREMIA™ 75

ECONO

SOLENOID METERING PUMP

BOOK NO. IM 460.150AA UA ISSUE A



WARNING: While installing, operating or servicing this equipment personnel can be exposed to a number of potentially hazardous situations which can result in severe personal injury and damage to the equipment. These situations are identified and procedures to avoid the potential hazards are highlighted and described by warnings appearing on the following pages. For this reason and to avoid possible severe personal injury or damage to the equipment, this equipment should be installed, operated and serviced only by trained, qualified personnel who are thoroughly familiar with the entire contents of this instruction book.

CONTENTS

TITLE	PARA./DWG. NO.
Very Important Safety Precaution	SP-1
Protective Equipment Page	1.010-6A
Regional Offices	1.010-1AT
Safety instructions	
Introduction	1
Principle of operation	1.1
Materials of construction	1.2
Manufacturers product warranty	1.3
Unpacking the pump	1.4
Precautions for operation	1.5
Installation, piping and wiring	2
Mounting	2.1
Piping	2.2
Wiring	2.3
Well pump system installation	2.4
5-Function valve	2.5
Start up and operation	3
Power	3.1
Start up and shut down	3.1.1
Priming	3.2
Air bleed operation	3.3
Capacity control	3.4
Stroke frequency adjustment	3.4.1
Stroke length adjustment	3.4.2
Controlling procedure	3.4.3
5-function valve operation	3.5
Pressure relief function	3.5.1
Back pressure function	3.5.2
Anti-syphon function	3.5.3
Pumphead air bleed function	3.5.4
Discharge drain function	3.5.5

Maintenance	4
Routine maintenance	4.1
Disassembly and assembly	4.2
Diaphragm removal	4.2.1
Diaphragm replacement	4.2.2
Valve replacement	4.2.3
5-Function valve	4.3
Fault finding	5
Loss of chemical residual	5.1
Too much chemical	5.2
Leakage at tubing connection	5.3
Failure to pump	5.4
Pump loses prime	5.5
Fitting leakage	5.6
Pump will not prime	5.7
Warning summary page	WARNING
Drive assembly	FIG. 1
Pump head assembly	FIG. 2
5-Function valve-parts	FIG. 3
5-Function valve	FIG. 4
Repair service	6
PM kits	7
PM schedule	7.1
Spare parts	8

VERY IMPORTANT SAFETY PRECAUTIONS

This and the following pages titled "VERY IMPORTANT SAFETY PRECAUTIONS" provide in brief, information of urgent importance to SAFETY and INSTALLATION OPERATION & MAINTENANCE of this equipment.

**WARNING**

TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, OBSERVE THE FOLLOWING:

WHEN HANDLING ANY HAZARDOUS MATERIAL, USE EXTREME CARE TO AVOID CONTACT WITH THE MATERIAL AND POSSIBLE SEVERE PERSONAL INJURY. WEAR EYE PROTECTION AND APPROPRIATE PROTECTIVE CLOTHING. IT IS THE RESPONSIBILITY OF THE EQUIPMENT USER TO OBTAIN AND FOLLOW THE SAFETY PRECAUTIONS OF THE MANUFACTURER OF THE HAZARDOUS MATERIAL.

DO NOT DISCONNECT THE DISCHARGE LINE FROM THE PUMP OR THE MAIN CONNECTION AND DO NOT DISASSEMBLE THE PUMPING PARTS WHILE THE SYSTEM IS UNDER PRESSURE. RELIEVE PRESSURE AND DRAIN THE DISCHARGE LINE FIRST.

DO NOT USE HOSE OR OTHER FLEXIBLE TUBING FOR THE DISCHARGE LINE WHEN PUMPING HAZARDOUS MATERIALS OR FOR DISCHARGE PRESSURE OR FLUID TEMPERATURE IN EXCESS OF 100 PSI OR 100°F. USE RIGID PIPE.

ALLOW SYSTEM TO DRAIN FULLY BEFORE ATTEMPTING TO DISASSEMBLE PIPING AND REMOVING VALVES AND/OR HEAD.

UNPLUG POWER CORD BEFORE REMOVING CONTROL PANEL TO PREVENT ELECTRICAL SHOCK.

DO NOT REPLACE HIGH TEMPERATURE CUT-OUT SWITCH WITH ONE OF A HIGHER VALUE

THIS EQUIPMENT SHOULD BE INSTALLED, OPERATED AND SERVICED ONLY BY TRAINED, QUALIFIED PERSONNEL WHO ARE THOROUGHLY FAMILIAR WITH THE ENTIRE CONTENTS OF THIS INSTRUCTION BOOK WHICH SHOULD BE THOROUGHLY REVIEWED AND UNDERSTOOD PRIOR TO INSTALLING AND OPERATING THE EQUIPMENT.

USE ONLY W&T LISTED PARTS EXCEPT COMMERCIALY AVAILABLE PARTS AS IDENTIFIED BY COMPLETE DESCRIPTION ON PARTS LIST. THE USE OF UNLISTED PARTS CAN RESULT IN EQUIPMENT MALFUNCTIONS HAVING HAZARDOUS CONSEQUENCES.

DO NOT DISCARD THIS INSTRUCTION BOOK UPON COMPLETION OF INSTALLATION. INFORMATION PROVIDED IS ESSENTIAL TO PROPER AND SAFE OPERATION AND MAINTENANCE.

NEVER REPAIR OR MOVE THE METERING PUMP WHILE OPERATING.

REFER TO THE MSDS FOR THE MATERIAL BEING HANDLED.

PUMP IS NOT TO BE USED TO HANDLE OR METER FLAMMABLE LIQUIDS OR MATERIALS.

DO NOT ATTEMPT TO PRIME USING A BLEED VALVE WITHOUT INSTALLING A RETURN LINE.

THIS PUMP IS SUPPLIED WITH A THREE PRONG GROUNDING TYPE POWER PLUG. TO REDUCE RISK OF ELECTRIC SHOCK, CONNECT ONLY TO A PROPERLY GROUNDED, GROUNDING TYPE RECEPTACLE.

Additional or replacement copies of this Instruction Book are available from:

WALLACE & TIERNAN, INC.
25 MAIN STREET
BELLEVILLE, NEW JERSEY 07109-3057

NOTE: When ordering material always specify model and serial number of apparatus.

NOTES ON PROTECTIVE EQUIPMENT & CLOTHING

The following Warning appears in several locations in this book. It is general in nature due to the variety of hazardous liquids this pump is capable of handling.

WARNING: WHEN DEALING WITH HAZARDOUS MATERIAL IT IS THE RESPONSIBILITY OF THE EQUIPMENT USER TO OBTAIN AND FOLLOW ALL SAFETY PRECAUTIONS RECOMMENDED BY THE MATERIAL MANUFACTURER/SUPPLIER.

It is good general practice to make use of the following types of protective equipment when handling any hazardous liquid. IT IS RECOMMENDED THAT SUCH PROTECTIVE EQUIPMENT BE USED BY ALL PERSONS SERVICING THIS PUMP, ASSOCIATED PIPING, TUBING, VALVES, AND ACCESSORIES, WHEN THE PUMP IS HANDLING ANY HAZARDOUS LIQUID.

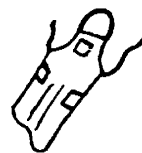
1. Goggles, flexible fitting, hooded ventilation (per ANSI Z87.1)



2. Face Shield (per ANSI Z87.1)



3. Chemical Apron



4. Chemical Gloves



NOTE: (1) ANSI Z87.1 "practice for occupational....eye and face protection" recommends goggles (#1 above) as the "preferred protection" when handling chemicals which present a hazard from splash, acid burns or fumes; for severe exposure, a face shield (#2 above) over the goggles is recommended.

(2) An eye flushing fountain and a deluge type shower may be recommended or required by insurance carriers or governmental safety agencies which should be consulted for specific requirements.

REGIONAL OFFICES

INSTALLATION, OPERATION, MAINTENANCE AND SERVICE INFORMATION

Direct any questions concerning this equipment which are not answered in the instruction book to the Reseller from whom the equipment was purchased. If the equipment was purchased directly from Wallace & Tiernan, Inc. contact the nearest office indicated below.

UNITED STATES

Suite 160
1301 Hightower Trail
Atlanta, GA 30350
TEL:- (770) 641-7570
FAX:- (770) 641-7696

P. O: Box 875
Shawnee Mission, KS 66201
TEL:- (913) 384-3933
FAX:- (913) 677-5753

Suite L
1809 North Mill St.
Naperville, IL 60563
TEL:- (708) 717-6900
FAX:- (708) 717-6906

Suite 200
10050 N. 25th Avenue
Phoenix, AZ 85021
TEL:- (602) 997-2115
FAX:- (602) 997-4733

CANADA

If the equipment was purchased directly from Wallace & Tiernan Canada, Inc. contact the nearest office indicated below.

ONTARIO

925 Warden Avenue
Scarborough, Ontario
M1L 4C5
J6A 6M4
(416) 751-7561

HALIFAX

P.O.BOX 2818, DEPS.,
Dartmouth, Nova Scotia
B2W 4R4
(902) 468-1964

QUEBEC

243 Blvd. Brien
Bureau 210
Repentigny, Quebec
(514) 582-4266

MEXICO

If the equipment was purchased directly from Wallace & Tiernan de Mexico, contact the nearest office indicated below.

MEXICO CITY

Via Jose Lopez Portillo No.321
Sta. Maria Cuauhtepc
Tultitlan, Edo. Mexico 54900
(5) 875-5060

CUERNAVACA

Av. Morelos No.882 Local A5
Plaza Esmeralda
Col. Centro
62270 Cuernavaca, Morelos
(73) 12-2606

GUADALAJARA

Av. Guadalupe No.4567
Col.Jardines de Guadalupe
Guadalajara, Jalisco
(3) 628-3712

COATZACOALCOS

Independencia No. 500 Depto 101
Esq. 18 de Marzo
96400 Coatzacoalcos, Veracruz
(921) 521-68

MONTERREY

Fray Bartolome de las Casa No.739
Co. Robie Norte
San Nicolas de los Garza
(8) 332-1150

READ ALL INSTRUCTIONS**GENERAL SAFETY CONSIDERATIONS**

- Always wear protective clothing including gloves and safety glasses when working on or near chemical metering pumps.
- Inspect tubing regularly for cracking or deterioration and replace as necessary. (when replenishing chemical solution). **Always wear protective clothing and safety glasses when inspecting tubing.**
- When pump is exposed to direct sunlight, use U.V. resistant tubing.
- Follow directions and warnings provided with the chemicals from the chemical manufacturer. Customer is responsible for determining chemical compatibility with chemical feed pump.
- Secure chemicals and metering pumps, making them inaccessible to children and pets.
- Make sure voltage on chemical metering pump matches the voltage at the installation.
- Do not cut plug off electrical cord or the ground lug - consult a licensed electrician for proper installation.
- Pump is **NOT** to be used to handle flammable liquids.

SAFETY OPERATING PROCEDURES

CAUTION: All pumps are tested with water before shipment. Remove head and dry thoroughly if you are pumping chemical that will react with water (i.e. sulfuric acid). Valve seats, ball checks, gaskets and diaphragm should also be dried.

- Finger tighten connections on pump head. **DO NOT USE A WRENCH.** Teflon tape is only necessary when pump is equipped with NPT connections.
- Before repair or moving pump, disconnect power cord or turn off power to pump. De-pressurize system and drain chemical. (**Always wear protective clothing and safety glasses when working on metering pump.**)
- Always consult licensed plumber and electrician before installation and make sure to conform to local codes.
- Consult with local health officials and qualified water conditioning specialist when treating potable water.
- Be sure to de-pressurize system prior to hook-up or disconnection of metering pump.
- If point of injection is lower than chemical tank and pump, install an anti-siphon valve.
- **DO NOT MODIFY** pump, this poses a potentially dangerous situation and voids warranty.
- For accurate volume output, pump must be **calibrated** under all operating conditions.

1 INTRODUCTION

These installation, operation and maintenance instructions cover your electronic metering pump. Refer to the pump nameplate to determine the actual model.

1.1 Principle of Operation

Diaphragm metering pumps are used to dispense chemicals or fluids. This is achieved by an electromagnetic drive mechanism (solenoid) which is connected to a diaphragm. When the solenoid is pulsed by the control circuit, it displaces the diaphragm which, through the use of check valves, moves the fluid out the discharge under pressure. When the solenoid is deenergized it returns the diaphragm and pulls more fluid into the pump head and the cycle repeats.

The pump stroke rate is controlled by the internal circuit and is changed by turning the rate knob. The mechanical stroke length of the pump is controlled by the stroke length knob.

1.2 Materials of Construction

The wetted materials (those parts that contact the solution being pumped) available for construction are glass filled polypropylene, PVC, San, Hypalon, Viton, Teflon, 316 Stainless Steel, PVDF, Ceramic, and Alloy C. These materials are very resistant to most chemicals. However, there are some chemicals, such as strong acids or organic solvents, which cause deterioration of some elastomer and plastic parts, such as diaphragm, valve seat, or head. Consult Chemical Resistance Guide or Supplier for information on chemical compatibility.

Various manufacturers of plastics, elastomers and pumping equipment publish guidelines that aid in the selection of wetted materials for pumping commercially available chemicals. Two factors must always be considered when using an elastomer or plastic part to pump chemicals. They are:

1. The temperature of service: Higher temperatures increase the effect of chemicals on wetted materials. The increase varies with the material and the chemical being used. A material quite stable at room temperature might be affected at higher temperatures.
2. Material choice: Materials with similar properties may differ greatly from one another in performance when exposed to certain chemicals.

1.3 Manufacturer's Product Warranty

The manufacturer warrants its equipment of its manufacture to be free of defects in material or workmanship. Liability under this policy extends for eighteen (18) months from the date of purchase or one (1) year from date of installation or whichever comes first. The manufacturer's liability is limited to repair or replacement of any device or part which is returned, prepaid, to the factory and which is proven defective upon examination. This warranty does not include installation or repair cost and in no event shall the manufacturer's liability exceed its selling price of such part.

The manufacturer disclaims all liability for damage to its products through improper installation, maintenance, use or attempts to operate such products beyond their functional capacity, intentionally or otherwise, or any unauthorized repair. Replaceable elastomeric parts are expendable and are not covered by any warranty either expressed or implied. The manufacturer is not responsible for consequential or other damages, injuries or expense incurred through use of its products.

The above warranty is in lieu of any other warranty, either expressed or implied. The manufacturer makes no warranty of fitness or merchantability. No agent of ours is authorized to make any warranty other than the above.

1.4 Unpacking the Pump

Check all equipment for completeness against the order and for any evidence of shipping damage. Shortages or damages should be reported immediately to the carrier and to the seller of the equipment.

The carton should contain: (See Figure A)

- Metering Pump
- Clear Flexible Suction Tubing
- Stiff White Discharge Tubing
- Foot Valve/Strainer Assy.
- Back Pressure Injection Valve Assy.
- One Instruction Book that you are now reading
- 5 Function Valve (most models)
- Tube Wand (most models)

Make sure that all items have been removed from the shipping carton before it is discarded.

1.5 Precautions for Operation

Each Electronic Metering Pump has been tested to meet prescribed specifications and safety standards. Proper care in handling, installation and operation will help in ensuring a trouble free installation .

Please read all these cautionary notes prior to installation and start-up of your metering pump.

1. Important: Pump must be installed and used with supplied back pressure/injection valve. Failure to do so could result in excessive pump output flow.
2. Handle the pump with care. Dropping or heavy impact may cause not only external damage to the pump, but also to electrical parts inside.
3. Install the pump in a place where the ambient temperature does not exceed 40°C (104°F) and relative humidity below 90%. The pump is water resistant and dust proof by construction and can be used outdoors, however **do not operate the pump submerged**. To avoid high internal pump temperatures, do not operate in direct sunlight.
4. Install the pump in a place convenient for its future maintenance and inspection, then fix it to prevent vibration.
5. Protective caps must be removed prior to installing tubing onto valve assemblies. Use tubing of specified size. Connect the tubing to the suction side securely to prevent the entrance of outside air. Make sure that there is no liquid leakage on the discharge side.
6. Be careful to check that the voltage of the installation matches the voltage indicated on the pump nameplate. Each pump is equipped with a three-prong plug. Always be sure the pump is grounded. To disconnect, do not pull wire but grip the plug with fingers and pull out. Do not use the receptacle in common with heavy electrical equipment which generates surge voltage. It can cause the failure of the electronic circuit inside the pump.
7. Tampering with electrical devices can be potentially hazardous. Always place chemicals and pump installation well out of the reach of children.



WARNING: Always disconnect electrical power. Never repair or move the metering pump while operating. For safety, always wear protective clothing (protective gloves and safety glasses) when working on or near chemical metering pumps. Refer to chemical supplier for safety data.

8. An air bleed valve is available for all models with tubing connection. Air purges should be performed when the pump chamber contains no fluid at the time of start-up. As a safety measure, connect the return tubing to the air bleed valve and bypass fluid back to storage tank or a suitable drain.
9. Chemicals used may be dangerous and should be used carefully and according to warnings on the label. Follow the directions given with each type of chemical. Do not assume chemicals are the same because they look alike. Always store chemicals in a safe location away from children. We cannot be responsible for the misuse of chemicals being fed by the pump. Always have the material safety data sheet (MSDS) available for any fluid being pumped.



WARNING: To prevent severe personal injury, refer to the MSDS for the material being handled.



CAUTION: All pumps are pretested with water before shipment. Remove head and dry thoroughly if you are pumping a material that will react with water, (i.e. sulfuric acid). Valve seats, ball checks, gaskets, and diaphragm should also be dried. Before placing pump into service, extreme care should be taken to follow this procedure.

10. Valve cartridges are stamped to indicate fluid flow direction. Always install so that markings read from top to bottom, with the arrow pointing in the direction of flow.
11. When metering hazardous material DO NOT use plastic tubing. Strictly use proper rigid pipe. Consult supplier for special adaptors or valve assemblies.



WARNING: Pump is NOT to be used to handle or meter flammable liquids or materials.

12. Standard white discharge tubing is not recommended for installations exposed to direct sunlight. Consult supplier for special black tubing.
13. Factory will not be held responsible for improper installation of pump, or plumbing. All cautions are to be read thoroughly prior to hook-up and plumbing. For all installations a professional plumber

should be consulted. Always adhere to local plumbing codes and requirements.

14. When using pump with pressurized systems, make sure the pressure of the system does not exceed the maximum pressure rating on the pump nameplate. Be sure to de-pressurize system prior to hook-up or disconnecting the metering pump.
15. Electronic power modules are equipped with automatic reset thermal overload devices and may reset unexpectedly.
16. The pump is designed to operate using a backpressure/injection valve. If the discharge point is below the liquid level of the source or if the discharge pressure is less than the suction pressure, siphoning may occur. To correct this condition, install an anti-siphon valve or other anti-siphon device. Check local regulations which may apply. Ref. Figure G1).

2 INSTALLATION, PIPING AND WIRING

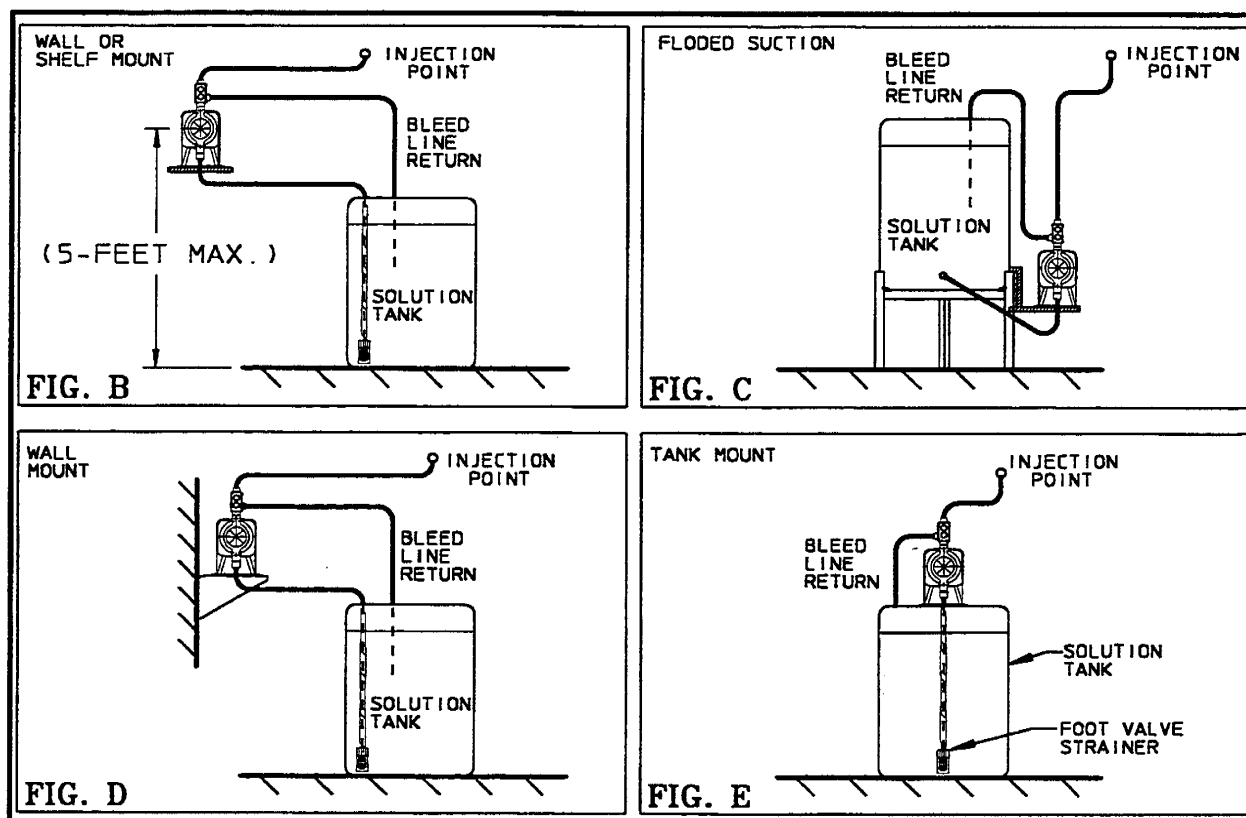
The metering pump should be located in an area that allows convenient connections to both the chemical storage tank and the point of injection. The pump is water resistant and dust proof by construction and can be used outdoors, however **do not operate submerged**. Avoid continuous temperatures in excess of 40°C (104°F). To do otherwise will result in damage to the pump.

2.1 Mounting

Typical mounting arrangements are shown in Figures B to E.

Important: Injection point must be higher than the top of the solution supply tank to prohibit gravity feeding, unless suitable backpressure is always present at the injection point. An anti-siphon may be installed to prevent gravity feed.

1. For wall or shelf mounting, refer to Figure B. Connect suction tubing to suction valve of chemical pump. Suction valve is the lower valve. Tubing should be long enough so that the footvalve/strainer assembly hangs about 2-3 inches above the bottom of chemical tank. To keep chemical from being contaminated, the tank should have a cover.
2. Flooded suction mounting (installing the pump at the base of the chemical storage tank, Figure C) is the most trouble free type of installation and is recommended for very low output requirements. Since the suction tubing is filled with chemical, priming is accomplished quickly and the chance of losing prime is reduced.



To mount pump, drill 4 holes of 1/4" diameter in the shelf as shown in the dimension drawing (Figure F). Attach pump securely using four #10 bolts and nuts.

3. The pump can be mounted to a wall as shown in Figure D. A wall mount bracket kit is available which includes all necessary hardware to mount the pump to the bracket and the bracket to the wall. Mounting the pump other than as shown in Figure D defeats the purpose of the housing drain. Mounting dimensions for the pump are provided in Figure F for reference.

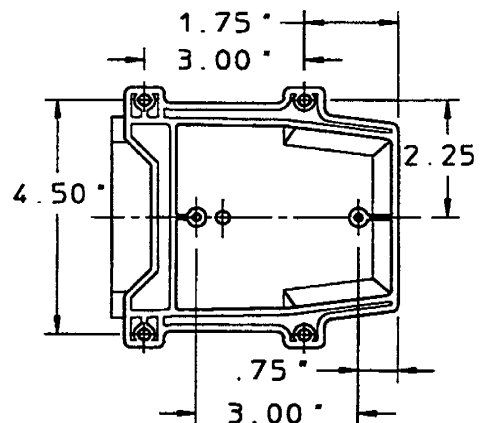


FIG.F

4. The pump can be mounted on top of a solution tank as shown in Figure E. Install chemical pump on the cover. Insert suction tubing through the center hole and cut tubing so footvalve/strainer hangs about 2-3 inches above the bottom of the tank. Mount the chemical pump rigidly by drilling four 1/4" holes and using four #10 screws and nuts.

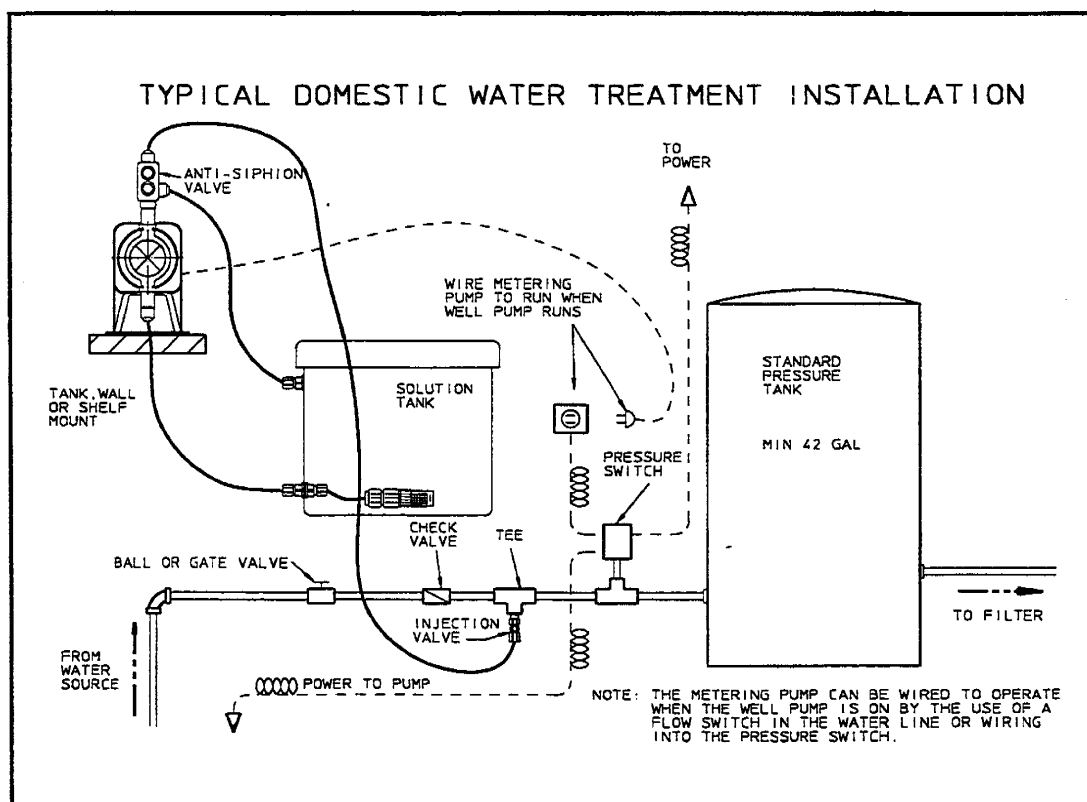


FIG. G

5. USE AN ANTI-SIPHON VALVE IN THE DISCHARGE LINE whenever the fluid pressure in the discharge line is below atmospheric pressure. This can occur if the injection point is on the suction side of a water pump or against a "negative" head such as when feeding down a well, SEE FIGURE G1.

2.2 Piping

1. Use provided tubing of specified size for connection. Connect tubing securely to prevent leakage of chemical and the entrance of air. Since plastic nuts are used for fittings, they should not be tightened excessively i.e. hand tighten only. NPT suction and discharge valves must **NOT** be overtightened. Hold fittings in place while adding piping and fittings. NPT suction and discharge valves should only be tightened 25 to 35 in. lbs.



WARNING: To avoid possible severe personal injury, do not use hose or other flexible tubing when pumping hazardous material or for discharge pressure or fluid temperature in excess 100 PSI or 100°F. Always use rigid pipe.

2. If the air bleed valve assembly is being used, a return line (tubing) should be securely connected and routed back to the storage tank.



WARNING: To avoid possible injury from chemicals do not attempt to prime using a bleed valve without installing a return line.

3. When pump is shelf mounted or top mounted on tank, suction tubing should be kept as short as possible. Pumps mounted on or above a tank should use the tube wand to ensure that the footvalve/strainer remains in a vertical position. The vertical position is critical to proper footvalve performance. To assemble, alternating large and small diameter sections are inserted 1" to 2" and twisted to lock in place. The tubes are telescoped to vary length to match the tank (maximum length is 36"). Feed suction tubing through tube wand until it extends beyond the end of the tube wand. **Do not kink suction tubing.** Attach footvalve/strainer to suction tubing. Install suction tubing with tube wand and footvalve/strainer into tank. Adjust length of suction tubing to hold footvalve/strainer approximately 2" from bottom of tank (see figure H). Connect suction tubing to suction side of pump.
4. To maintain metering performance, a back pressure/injection valve is provided. The injection valve must be installed in the discharge line. Best practice is to install the injection valve at the point of chemical injection.
5. If the discharge tubing is going to be exposed to direct sunlight, black tubing should be used instead of the standard white translucent tubing supplied with each pump. To obtain, contact supplier.

6. To prevent clogging or check valve malfunction always install a strainer assembly to the end of the suction tubing (Figure E). This footvalve/strainer assembly should always be installed 2 to 3 inches above the bottom of the chemical tank. This will help prevent clogging the strainer with any solids that may settle on the tank bottom. The chemical tank and footvalve/strainer should be cleaned regularly, to ensure continuous trouble free operation. If the chemical being pumped regularly precipitates out of solution or does not dissolve easily or completely (e.g. calcium hydroxide), a mixer should be used in the chemical tank. These are readily available in many motor configurations and mountings. To obtain, contact supplier.
7. A flooded suction (tank liquid level always at a higher elevation than the pump) is recommended when pumping sodium hypochlorite (NaOCl) and hydrazine solution (N_2H_2) etc. which are liable to produce air bubbles. Maintaining a low liquid temperature will also help eliminate this problem.
8. Pipe corrosion can result if dilution at the injection point does not occur rapidly. This problem is easily prevented by observing this simple rule: install injection fitting so that the end is in the center of the flow stream of the line being treated. Trim injector tip as required. See Figure I. Note: Extended injection assemblies are available for large water lines. Consult your supplier for more information.

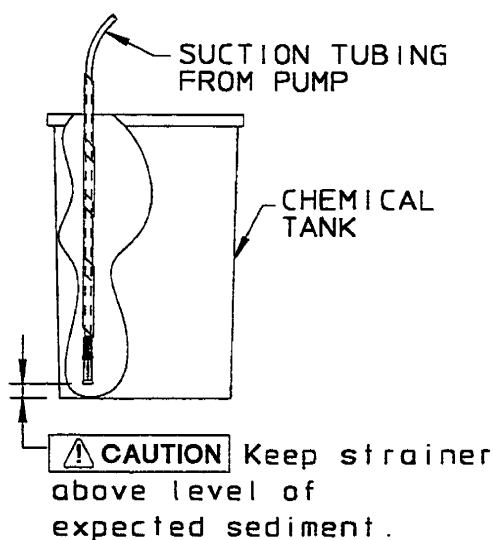


FIG. H

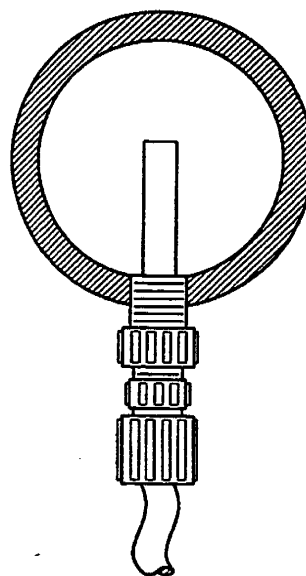


FIG. I

2.3 Wiring

1. The metering pump should be wired to an electrical source which conforms to those on the pump nameplate. (Applying higher voltage than the pump is rated for will damage the internal circuit.)



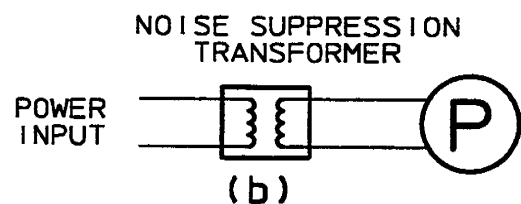
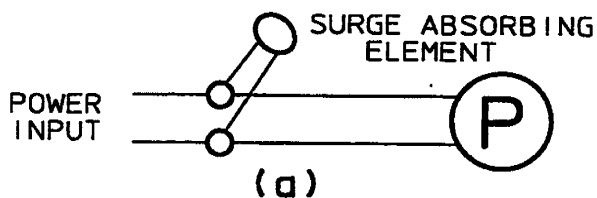
WARNING: Risk of electrical shock. This pump is supplied with a three prong grounding type power plug. To reduce risk of electric shock, connect only to a properly grounded, grounding type receptacle.

NOTE: Field wiring must conform to local electrical codes.

2. In the electronic circuit of the control unit, measures for surge voltage are made by means of surge absorbing elements and high voltage semiconductors. Nevertheless, excessive surge voltage may cause failure in some areas. Therefore, the receptacle should not be used in common with heavy electrical equipment which generates high voltage. If this is unavoidable, however, measures should be taken by (a) the installation of a surge absorbing element (varistor of min. surge resistance 2000A) to the power supply connection of the pump, or (b) the installation of a noise suppression transformer.



Caution: Pump must be properly grounded to provide proper surge protection. Pump should be installed to meet local electrical code requirements.



2.4 Well Pump System Installation

1. Ensure that the metering pump voltage matches the voltage of the well pump. Typical well pump electrical circuits are shown in Figure K. All electric wiring should be installed in accordance to local electrical codes by a licensed electrician.
2. Install the back pressure/

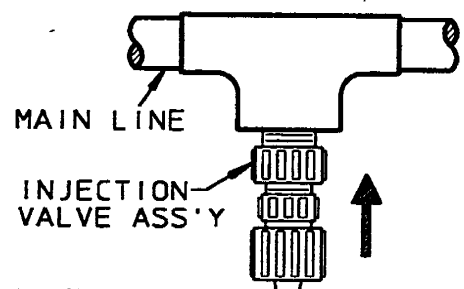


FIG.J

injection valve on the discharge side of the metering pump into a tee which is installed into the water line going to the pressure tank. A typical installation is shown in Figure J.

Pumps carrying the NSF seal are listed for swimming pools, spas, and hot tubs. And when proper materials are selected, are capable of handling but not limited to the following chemical solutions:

12½% sodium hypochlorite	12% aluminium sulphate
2% calcium hypochlorite	10% hydrochloric acid
20% dichloro-s-triazinone	10% sodium hydroxide
5% trichloro-s-triazinone	5% sodium carbonate

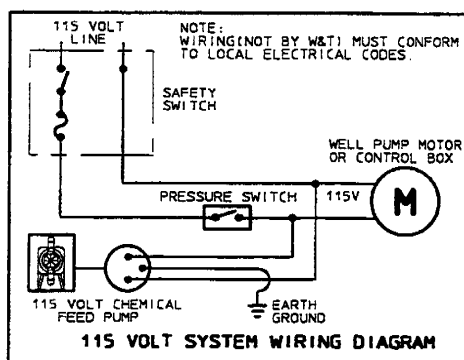
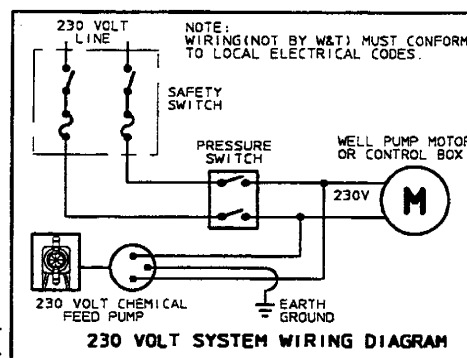


FIG. K



2.5 5-Function Valve

Tubing Version: Remove tubing nut from discharge valve cartridge. Install O-ring supplied into groove around tubing tip. Screw 5-function valve onto discharge valve. Connect discharge tubing to 5-function valve "OUTLET" and bypass tubing to "RETURN" connection.

NPT Version: Apply Teflon tape or sealant to threads of 5-function valve and screw "INLET" connection into discharge valve of pump. Connect piping to "OUTLET" and "RETURN" connections of 5-function valve.

3 START UP AND OPERATION

3.1 Power

All metering pumps are available in 115 volts at 50/60 Hertz, single phase. Optionally 230 volts at 50/60 Hertz, single phase can be provided. **Prior to start-up always check to ensure that the pump voltage/frequency/phase matches that of the power supply**



CAUTION: If pump is fitted with a PVC pumphead (5th position of model number is "V" -PVC is grey not black), uniformly hand tighten the four head screws before use (approx. 18-20 inch pounds). Periodically tighten after use.

3.1.1 Start up and Shut Down

1. To start the pump, plug the pump into an appropriate outlet.
2. To shut down or stop the pump, unplug the pump from the outlet.

3.2 Priming



WARNING: When working on or around a chemical metering pump installation, protective clothing and gloves and safety glasses should be worn at all times.

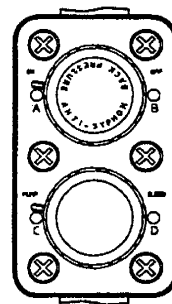


CAUTION: All pumps are tested with water. If the chemical to be pumped reacts when mixed with water (e.g. sulfuric acid) the pumphead should be removed and dried thoroughly along with the diaphragm and valves seats.

1. Plug the pump into an appropriate outlet.
2. Adjust the stroke rate knob to the 100% setting mark (for more information see "Capacity Control").
3. Adjust the stroke length knob to the 100% setting mark (for more information see "Capacity Control").
4. If the discharge line is connected directly to a pressurized system it should be temporarily disconnected during priming of the pump. This pump is equipped with a bleed valve to simplify this operation by allowing easy bypass of the discharge fluid. All air must be purged from the pumphead before the pump will pump against pressure.

3.3 Air Bleed Operation

- A) While pump is running, turn bottom knob to the letter "D" position, also labeled "BLEED".
- B) Run with valve open until a solid



discharge valve area (ball check bypass tubing (1/4 x 3/8 supplied with valve), no air bubbles.

- C) Close air bleed valve by turning bottom knob to position "C" labeled "PUMP".



WARNING: For safety, always use protective clothing and gloves, wear safety glasses and use a proper container to hold the chemical.

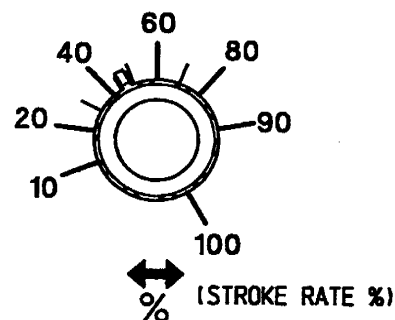
5. Chemical should reach the pumphead after a few minutes of operation. If not, remove the discharge fitting and moisten the discharge valve area (ball check and valve seats) with a few drops of chemical being fed to the metering pump.
6. If the pump continues to refuse to prime, refer to Fault Finding Section of these instructions.
7. Once the pump has been primed and is pumping the chemical through the head, turn off the power, reconnect the discharge tubing (if it had been removed) and immediately clean any spilled chemical that is on the pump housing or head.
8. Turn the power on once more and adjust the pump flow to the desired rate (see "Capacity Control").
9. Always check the calibration of the pump after start-up. It's best to calibrate the pump under your typical use conditions.

3.4 Capacity Control

Capacity can be controlled by means of the stroke length adjusting knob or stroke frequency adjusting knob. Graphs are for illustration purposes only. Use a calibration column for accurate calibration. Contact your pump supplier for proper calibration equipment.

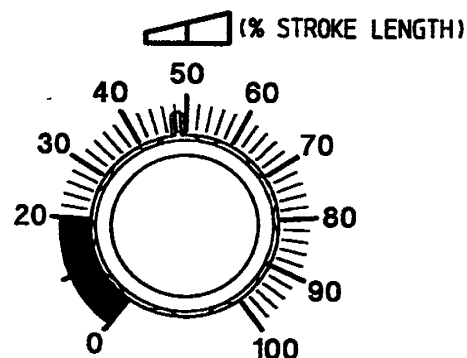
3.4.1 Stroke Frequency Adjustment:

- Stroke frequency can be controlled from 10 to 100% (12 to 125 spm) by means of the electronic circuit.
- Stroke frequency can be set by means of the stroke frequency adjusting knob even while the pump is in operation.



3.4.2 Stroke Length Adjustment:

- Stroke length can be controlled within 0 to 100% of the diaphragm displacement. (It should be controlled within 10 to 100% for practical use.)



- Stroke length can be set by means of the stroke length adjusting knob while the pump is in operation. **Do not turn the knob while the pump is stopped.**

3.4.3 Controlling Procedure:

Proper set points for stroke length and stroke frequency should be determined after consideration of the pump and characteristics of the fluid. The following procedure is recommended from the viewpoint of pump performance. **Note: The closer the stroke length is to 100 % the better the pump performance will be.**

- A) Set the stroke length to 100% then adjust the stroke frequency for coarse capacity control.
- B) Measure the capacity.
- C) When the measured capacity is less than the required value, increase the stroke frequency and measure the capacity again.
- D) Then, adjust the stroke length for fine capacity control.
- E) Finally, measure the capacity and make sure that the required value is obtained.

Example

Set Stroke Length = 100%
 Set Stroke Rate = 100%
 Output Capacity = 30 GPD*
 (Rated Pressure)

Desired Flow = 12 GPD
 Adjust Stroke Rate to 50%
 Output Capacity = $0.50 \times 30 = 15 \text{ GPD}^*$

Stroke Length Setting = $\frac{12}{15} \times 100 = 80\% \text{ approx.}$

Thus to obtain the desired flow, stroke length is set at 80% and stroke rate is set at 50% i.e. output capacity = $0.80 \times 0.50 \times 30 = 12 \text{ GPD}^*$

* Check these values by measurement. Output capacity is higher when feeding against less than rated pressure.

3.5 5-Function Valve Operation

3.5.1 Pressure Relief Function

Designed to relieve excessive pump discharge pressure (approximately 50% above PRV rating). PRV is functional anytime the bottom control knob is turned to the "C" position, also labelled "PUMP".

Color code for PRV rating

Blue	100psi
Green	150 psi
Red	250 psi

3.5.2 Back Pressure Function

The back pressure function allows the pump to meter to atmosphere by creating a discharge restriction of approximately 20 psi. Back pressure is provided anytime the knob is turned to "A" position also labelled "ON".

NOTE: The back pressure function is not intended to prevent flowthrough from elevated supply tanks. The pump rated pressure does not have to be derated when the back pressure knob is in the "ON" position.

3.5.3 Anti-Syphon Function

The anti-syphon function prevents syphoning through the pump when pumping to a receptacle lower than the pump. This feature is active when the top knob is turned to the letter "A" position, also labelled "ON".

3.5.4 Pumphead Air Bleed Function

This function is used when starting the pump to aid in priming. It allows for removal of air from the pumphead by bypassing air and fluid out the "RETURN" connection. This feature will function when the bottom knob is turned to the letter "D" position, also labelled "BLEED".

3.5.5 Discharge Drain Function

This function is used to depressurize the pump discharge line and/or drain it. This function is accomplished by turning the top knob to the "B" position, also labelled "OFF", and the bottom knob to the "D" position, also labelled "BLEED". This will bypass discharge line fluid to the 5-function valve "RETURN" line.

4 MAINTENANCE



WARNING: Before performing any maintenance or repairs on chemical metering pumps, be sure to disconnect all electrical connections and insure that all pressure valves are shut off and pressure in the pump and lines has been bled off.



WARNING: Always wear protective clothing, gloves and safety glasses when performing any maintenance or repairs on chemical metering pumps.

4.1 Routine Maintenance

1. Routinely check the physical operating condition of the pump. Look for the presence of any abnormal noise, excessive vibration, low flow and pressure output or high temperatures [when running constantly at maximum stroke rate, the pump housing temperature can be up to 160°F (70°C)].
2. For optimum performance, cartridge valves should be changed every 4-6 months. Depending on the application, more frequent changes may be required. Actual operating experience is the best guide in this situation. Repeated short-term deterioration of valve seats and balls usually indicates a need to review the suitability of wetted materials selected for the application. Contact the supplier for guidance.
3. Check for leaks around fittings or as a result of deteriorating tubing e.g. when standard white translucent discharge tubing is exposed to direct sunlight. Take appropriate action to correct leak by tightening fittings or replacing components.
4. Keep the pump free of dirt/debris as this provides insulation and can lead to excessive pump temperatures.
5. If the pump has been out of service for a month or longer, clean the pumphead/valve assemblies by pumping fresh water for approximately 30 minutes. If the pump does not operate normally after this “purging run”, replace cartridge valve assemblies.

4.2 Disassembly and Assembly

4.2.1 Diaphragm Removal

1. Flush pumphead and valve assemblies out by running pump on water or other suitable neutralizing solution. Wash outside of pump down if chemical has dripped on pump.

2. Set stroke length of pump to 0% and unplug pump.
3. Disconnect tubing or piping from the pump. Remove the four pumphead screws and then remove the pumphead assembly.
4. Remove the diaphragm by grasping it at the outer edges and turning it counterclockwise until it unscrews from the electronic power module (EPM). Don't lose the deflection plate or diaphragm shims which are behind the diaphragm. Note shim quantity can be from 0 to 2.
5. Inspect diaphragm if it is intended to be used again. Look for indications of the Teflon face being overstretched, (localized white areas) or the elastomer on the back of the diaphragm being worn. Excessive amounts of either condition require diaphragm replacement.

4.2.2 Diaphragm Replacement

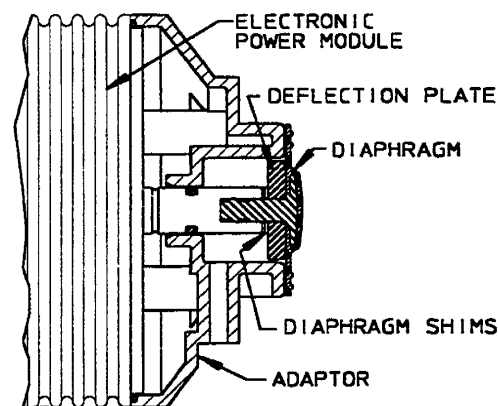
Refer to drawings in the back of the manual.

1. When replacing the diaphragm, it's always a good idea to replace the valve cartridges and other worn parts. A kit is available from your supplier with all parts necessary to completely rebuild your pump's wet end. All your supplier needs to know is the "PM kit No." on your pump's nameplate to supply this kit.

2. Set pump stroke length to 0% and unplug the pump.

3. If you kept the shims from the original diaphragm or know the original quantity you can avoid Step #4 for shimming the diaphragm and go to Step #5.

4. Slide the diaphragm deflection plate onto the back of the diaphragm stud, radius side towards the diaphragm. Next slide two shims onto the diaphragm threaded stud and screw the diaphragm into the EPM unit. Refer to sketch. Turn diaphragm clockwise until deflection plate and shims are tight against solenoid shaft, diaphragm stops turning. If there is a gap between the adaptor and diaphragm, repeat the procedure removing one shim each time until the diaphragm just touches the adaptor or is slightly recessed.



5. Apply grease to areas of the diaphragm that contact the deflection plate or radius on the adaptor.
6. Screw the diaphragm into the EPM unit's shaft with the deflection

- plate and appropriate number of shims in between.
7. Adjust stroke length to 50%. It is easier to do this if you temporarily turn the pump on. Place the pumphead onto the adaptor with flow arrows pointing up and install and tighten pumphead screws. Tighten screws until pumphead pulls up against adaptor.
 8. Adjust stroke length back to 100% for easier priming and place pump back into service.

4.2.3 Valve Replacement

1. Flush pump to clean any chemical from pumphead.
2. Unplug pump and disconnect any tubing or piping.
3. Unscrew valve cartridges and discard. Also remove O-Rings down inside pumphead.
4. Using new O-Rings, install new valve cartridges with stamped letters reading from top to bottom, and the arrow pointing in the direction of flow. Hand tighten only, do not use wrenches or pliers. This is especially important when the pumphead is SAN material.
5. Reconnect tubing or piping and reinstall the pump.

4.3 5-Function Valve

The only maintenance required is to replace the diaphragms whenever the pumphead diaphragm is replaced. Sometimes when pumping dirty fluids, solids may become trapped between the PRV diaphragm (bottom one) and the PRV seat. This may cause the PRV to weep slightly. This is easily remedied by removing the diaphragm and wiping it with a cloth and reinstalling it. If the damage is excessive, the diaphragm will have to be replaced.

5 FAULT FINDING

5.1 Loss of Chemical Residual

CAUSE	REMEDY
1. Pump setting too low	1. Adjust to higher setting (pump must be operating during the stroke length adjustment).
2. Scale at injection point	2. Clean injection parts with 8% muriatic acid or undiluted vinegar. (Also, see Maintenance Section).
3. Solution container allowed to run dry	3. Refill the tank with solution and prime. (See Start-Up and Operation Section).

5.2 Too Much Chemical

CAUSE	REMEDY
1. Pump setting too high	1. Lower pump setting (pump must be operating to adjust stroke length knob).
2. Chemical in solution tank too rich	2. Dilute chemical solution. NOTE: For chemical that reacts with water, it may be necessary to purchase a more dilute grade of chemical direct from chemical supplier.
3. Siphoning of chemical into	3. Test for suction or vacuum at the injection well or main line point. If suction exists, install an anti-siphon valve.

5.3 Leakage at Tubing Connection

CAUSE	REMEDY
1. Worn tube ends	1. Cut off end of tubing (about 1") and then replace as before.
2. Chemical attack	2. Consult your seller for alternate material.

5.4 Failure to Pump

CAUSE	REMEDY
1. Leak in suction side of pump	1. Examine suction tubing. If worn at the end, cut approximately an inch off and replace.
2. Valve seats not sealing	2. Clean valve seats if dirty or replace with alternate material if deterioration is noted.
3. Low setting on pump	3. When pumping against pressure, the dials should be set above 20% capacity for a reliable feed rate.
4. Low solution level	4. Solution must be above foot valve.
5. Diaphragm ruptured	5. Replace diaphragm as shown in the "Maintenance Section." Check for pressure above rated maximum at the injection point. NOTE: Chemical incompatibility with diaphragm material can cause diaphragm rupture and leakage around the pump head.
6. Pumphead cracked or broken	6. Replace pump head as shown in "Maintenance Section." Make sure fittings are hand tight only. Using pliers and wrench can crack pump head. Also, chemical incompatibility can cause cracking and subsequent leakage.
7. Pumphead contains air or chlorine gas	7. After turning off all pressure lines, disconnect discharge tubing and install bleed valve assembly.
8. Breakdown or disconnection of wiring	8. Connect wiring properly. Check fuse or circuit breaker.
9. Voltage drop	9. Take measures after investigation of cause.
10. Malfunction of electronic	10. Contact supplier.

5.5 Pump Loses Prime

CAUSE	REMEDY
1. Dirty check valve	1. Remove and replace or clean off any scale or sediment.
2. Ball checks not seating or not sealing properly.	2. Check seat and ball checks for chips, clean gently. If deformity or deterioration is noted, replace part with proper material. Resulting crystals can hold check valves open, therefore the valves must be disassembled and cleaned. Be sure to replace all parts as shown in the Parts Diagram (at the end of the manual).
3. Solution container allowed to run dry	3. Refill container with proper chemical.

5.6 Fitting Leakage

CAUSE	REMEDY
1. Loose fittings	1. All fittings can be hand tightened to prevent leakage. Clean off chemicals which have spilled on pump.
2. Broken or twisted gasket	2. Check gaskets and replace if broken or damaged.
3. Chemical attack	3. Consult your pump supplier for alternate material.

5.7 Pump Will Not Prime

CAUSE	REMEDY
1. Too much pressure at discharge	1. Turn off all pressure valves, loosen outlet tubing connection at discharge point. Remove discharge valve cartridge. Dampen ball check and valve seats with a few drops of solution. Set pump dials to maximum rate. When pump is primed, reconnect all tubing connections.

2. Check valves not sealing

2. Disassemble, loosen, clean and check for deterioration or swelling. Reassemble and wet the valve assembly, then prime. See Start-Up and Operating Section.

3. Output dials not set at maximum

3. Always prime pump with output dials set at maximum rated capacity.

4. Suction lift height too much

4. Decrease suction lift or pull vacuum on pump discharge until pump is primed.

5. Pump equipped with spring loaded high viscosity valves

5. Loosen discharge valve to aid in priming, take necessary safety precautions, or apply vacuum to pump discharge.

WARNING LABEL

The following warning labels have been attached to the equipment and are listed below.

AAA 2520

This equipment may handle HAZARDOUS materials, which can cause severe personal injury.

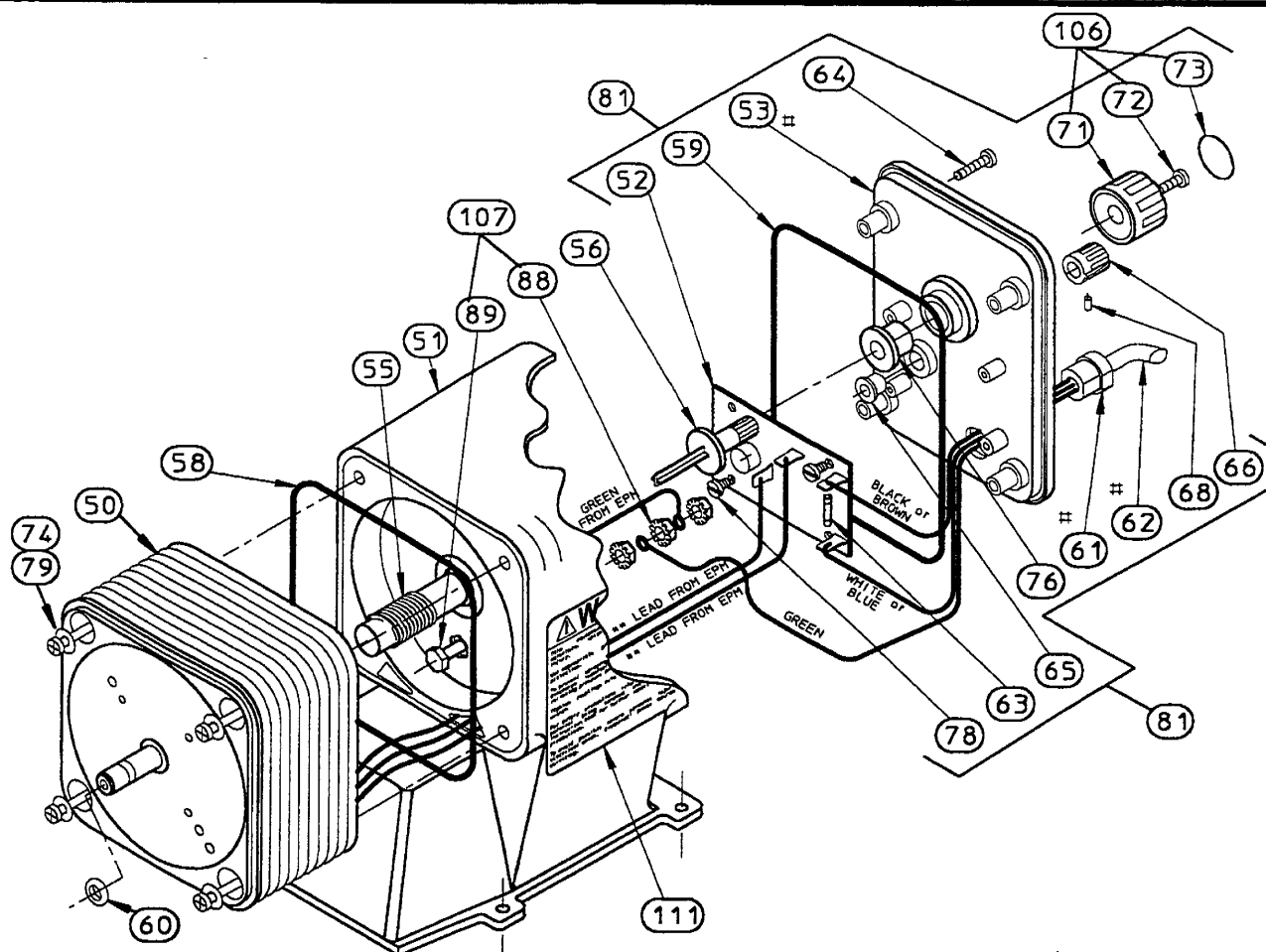
Use appropriate protective clothing and eye protection.

To prevent spraying of liquid DO NOT disconnect discharge tube/main connection without first relieving pressure and draining line.

Tighten couplings nuts by hand - DO NOT use wrench.

For safety precautions refer to the MSDS for the material being handled and the equipment instruction book for further important details and precautions.

To avoid possible severe personal injury from electrical shock, disconnect power source before servicing.



ITEM	PART NAME	QTY	ITEM	PART NAME	QTY
50	ELECTRONIC POWER MODULE (EPM)	1	66	KNOB, STROKE RATE/SWITCH	1
51	HOUSING	1	68	KNOB, SET SCREW	1
52	ELECTRONIC CONTROL BOARD	1	71	KNOB, STROKE LENGTH	1
53*	CONTROL PANEL	1	72	KNOB MOUNTING SCREW	1
55	FEMALE ADJUSTMENT SHAFT	1	73	KNOB DECAL, STROKE LENGTH	1
56	MALE ADJUSTMENT SHAFT	1	74	EPM MOUNTING SCREW	4
58	EPM/HOUSING O-RING	1	76	GROMMET, STROKE LENGTH	1
59	CONTROL PANEL O-RING	1	77*	PANEL LABEL (NOT SHOWN)	1
60	SECONDARY SEAL	1	78	ELECTRONIC CONTROL BOARD SCREW	2
61*	STRAIN RELIEF	1	79	EPM MOUNTING WASHER	4
62*	POWER CORD	1	81	CONTROL PANEL ASSEMBLY	REF
63	FUSE, 1-1.5-amp 2AG	1	88	GROUND LUG NUT	3
64	CONTROL PANEL SCREW	4-5	89	GROUND LUG BOLT	1
65	GROMMET, STROKE RATE/SWITCH	1	93	CONTROL PANEL SUB-ASSEMBLY	REF
* COMPONENTS OF ITEM #93.			106	KNOB KIT, STROKE LENGTH	REF
** 115 VOLT EPM UNITS HAVE GREY LEADS			107	GROUND LUG KIT	REF
** 230 VOLT EPM UNITS HAVE RED LEADS.			111	LABEL, DECAL 'WARNING' (US)	2

DWG. TITLE

ECONO DRIVE ASSEMBLY

OWN BY: HMK

CAD DWG.# 3-K-5

DATE: 11-3-95

AC00136.US1

FIG. 1

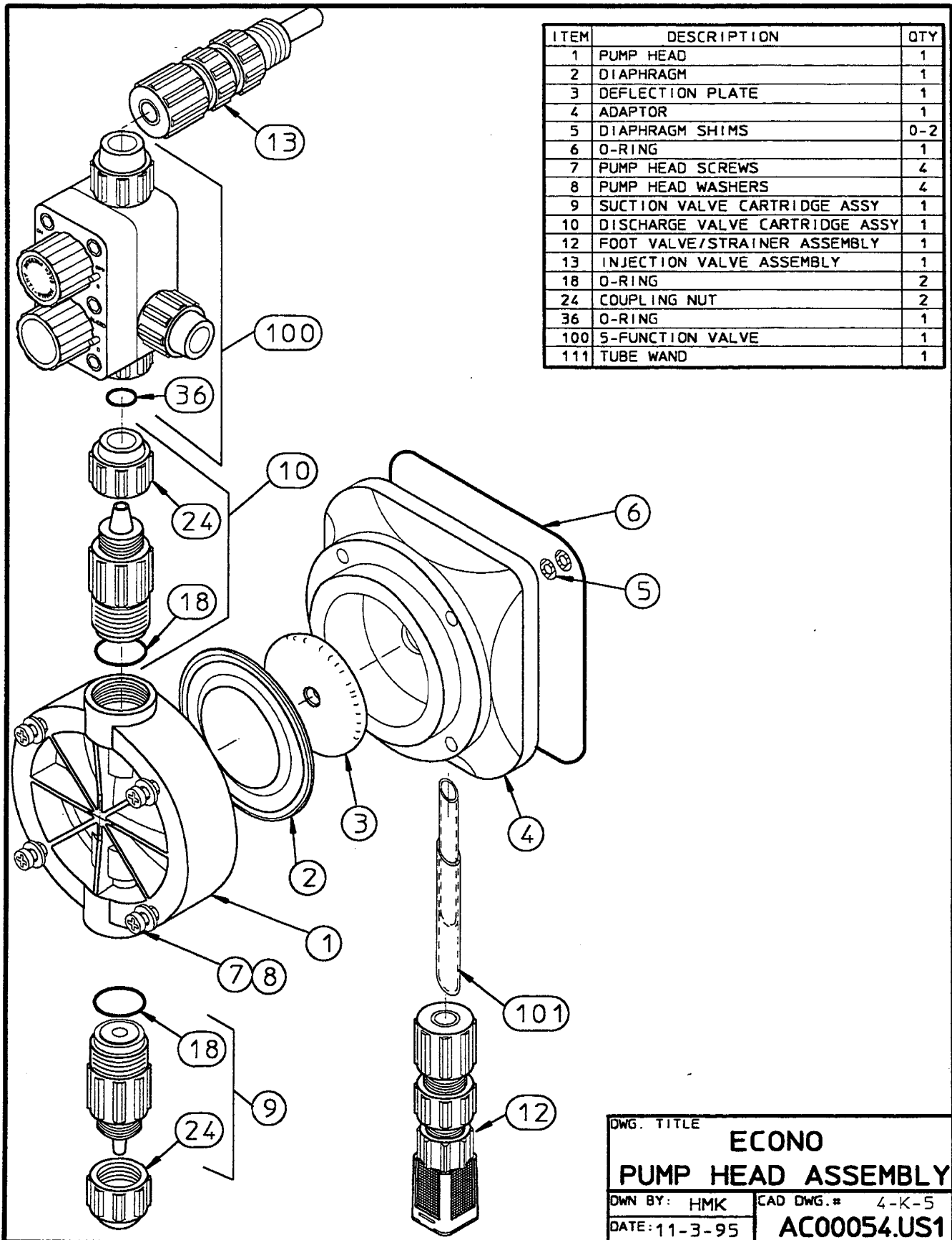
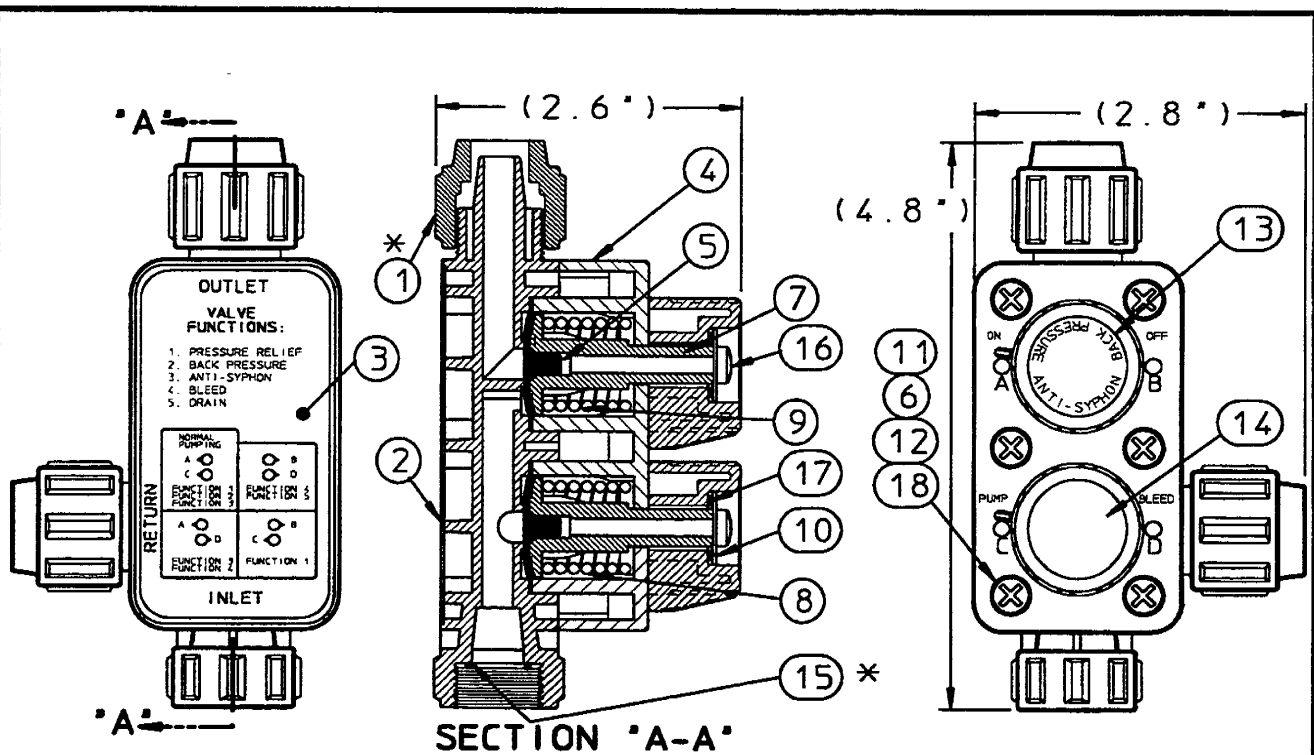


FIG. 2



ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	COUPLING NUT, .38" O.D.(FPP)	2	9	SPRING	1
	COUPLING NUT, .38" O.D.(PVD)		10	FLAT WASHER	2
	COUPLING NUT, .50" O.D.(FPP)		11	SCREW, FILLISTER #10-32x1.5"lg.	6
	COUPLING NUT, .50" O.D.(PVD)		12	NUT, HEX #10-32 x .13"thk.	6
2	BODY, VALVE, .25"-NPT(FPP)	1	13	LABEL, KNOB(BLACK)	1
	BODY, VALVE, .25"-NPT(PVD)		14	LABEL, KNOB 100psi(BLUE)	1
	BODY, VALVE, .38"O.D.TUBE(FPP)			LABEL, KNOB 150psi(GREEN)	
	BODY, VALVE, .38"O.D.TUBE(PVD)			LABEL, KNOB 250psi(RED)	
	BODY, VALVE, .50"O.D.TUBE(FPP)			LABEL, KNOB 50psi(BLACK)	
	BODY, VALVE, .50"O.D.TUBE(PVD)		*15	GASKET, O-RING, TFE	1
3	LABEL, 5-FUNCTION	1	16	SCREW, SELF-TAP .75"lg.	2
4	BODY BLOCK	1	17	SPRING, CURVED WASHER	2
5	DIAPHRAGM ASSEMBLY	2	18	WASHER, FLAT .091"thk.	6
6	FLAT WASHER	6	NOTE: FPP = GLASS FILLED POLYPROPYLENE. PVD = POLYVINYLIDENE FLUORIDE. TFE = TEFLON.		
7	KNOB, ADJUSTMENT	2			
8	SPRING, P.R.V., 50psi	1			
	SPRING, P.R.V., 100psi				
	SPRING, P.R.V., 150psi				
	SPRING, P.R.V., 250psi				

* - REQUIRED FOR VALVES WITH TUBING CONNECTIONS ONLY.

DWG. TITLE	
5-FUNCTION VALVE ASSEMBLY	
DWN BY: HMK	CAD DWG. # 4-K-5
DATE: 11-4-95	AC00054.US2

FIG. 3

5-Function Valve

Material of Construction

Valve Body	- Glass Filled Polypropylene (GFPPL)
Diaphragms	- Polyvinylidene Fluoride (PVDF)
O-Rings	- Teflon Faced Hypalon
O-Rings	- Teflon
Hardware	- 188 Stainless Steel (recessed)

Maximum Flow - 240 GPD

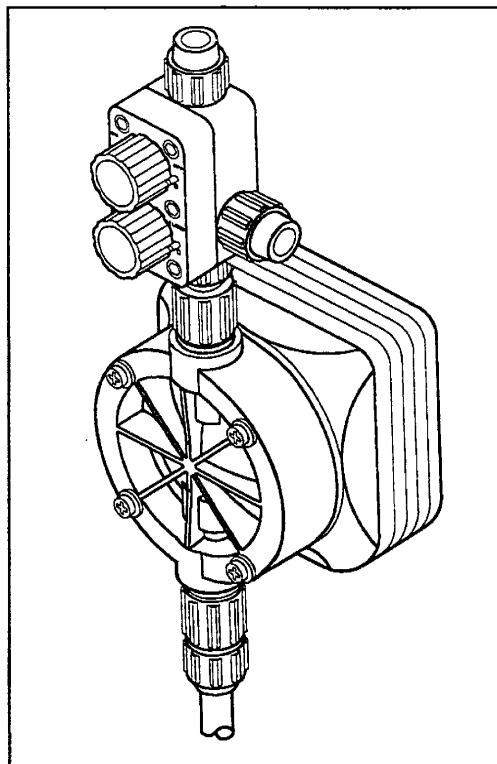
Maximum Viscosity - 1000 CPS

Pressure Relief Settings - 250 PSI (275)
(nominal cracking - 150 PSI (175)
pressure) - 100 PSI (125)

NOTE: Pressure relief may occur at 50%
above maximum pressure rating off pump.

Connections - 1/4" X 3/8" tubing
- 3/8" X 1/2" tubing
- 1/4" MNPT

Relief Port - 1/4" X 3/8" tubing
- 1/4" MNPT (with NPT connection Only)



1/4" MNTP CONNECTION			3/8" OD TUBING CONNECTION			1/2" OD TUBING		
MODEL NUMBER	PSI	VALVE BODY	MODEL NUMBER	PSI	VALVE BODY	MODEL NUMBER	PSI	VAVLE BODY
AAA 3029	250	GFPPL	AAA 3026	250	GFPPL	AAA 3032	250	GFPPL
AAA 3011	150	GFPPL	AAA 3008	150	GFPPL	AAA 3014	150	GFPPL
AAA 2993	100	GFPPL	AAA 2990	100	GFPPL	AAA 2996	1000	GFPPL
AAA 3038	250	PVDF	AAA 3035	250	PVD	AAA 3041	250	PVDF
AAA 3020	150	PVDF	AAA 3017	150	PVDF	AAA 3023	150	PVDF
AAA 3002	100	PVDF	AAA 2999	100	PVDF	AAA3005	100	PVDF

NOTE: PVDF is standard for PVC, san and pvdf

FIG. 4

6 REPAIR SERVICE

Normally following the instructions in the previous sections of the manual will rectify any pump problems. If, however, after following these instructions the pump does not perform properly, it can be returned for repair. Please follow the instructions below:

1. Pump cannot be serviced properly if the original pump nameplate or data contained on the nameplate is not intact.
2. Thoroughly flush pumphead and outside of pump with water or a suitable fluid to neutralize any residual chemical left in pump.
3. Include written explanation of the following:
 - A) Problem _____
 - B) Pumped Fluid _____
Name _____
Viscosity _____
Fluid Temperature _____
 - C) Pressure _____
@ Discharge _____
@ Suction _____
 - D) Environmental Temperature _____
 - E) Electrical Service _____
Volts _____
Hz _____
Phase _____
 - F) Nameplate Data _____
Series _____
Serial # _____
PM Kit # _____
4. Package the pump in the original box if available and send to the address specified by your pump supplier.

The manufacturer has built a reputation for superior reliability by supplying carefully-designed, high-quality equipment. Even the best equipment, however, requires a minimal amount of maintenance. PM kits are designed to guard against unnecessary downtime and assure you the highest level of efficient and uninterrupted service.

PM kits contain those recommended spare parts which will most likely require normal maintenance.

A typical PM kit includes Valve Cartridges with O-Rings, Head, Diaphragm, Secondary O-Ring Seal, Head Screws, Washers and an exploded view drawing.

PM kits will save you money. When you need a part, you've got it! You can cut downtime and production loss from days to minutes. You also save by buying parts in PM kit form compared with buying individual parts.

Each PM kit part is vacuum-sealed to keep it clean even when stored for long periods of time.



A PM kit is a troubleshooter's best friend. In the event of a breakdown, it will put you back in business fast! Preventive maintenance will insure continuous high performance of your pump.

Keep on pumping! Get all the money-saving and security benefits of PM kits immediately.

Selecting a PM kit

The PM kits part number is displayed on the pump model label as shown.

To order the proper PM kit model, begin with the letter "K" followed by the 2nd, 5th, 6th, 7th and the 8th position of the pump model number.

<h1>Premia™ 75</h1> <p>solenoid metering pump</p>		
Series	Serial Number	
Econo	XXXX11430	
0.25 GPH 0.95 LPH	80 PSI 5.6 Kg/cm	
115VAC	50/60 HZ	4 AMPS
		1 Phase
Model Number		
P75ECL1DAPTT1		
Made in the USA		
 WALLACE & TIERNAN® 25 MAIN ST. BELLEVILLE N.J. 07109		

EX. MODEL: P75-EC L1 D A P T T I
 2nd 5th 6th 7th 8th

PM KIT MODEL: K L1 P T T 1

7.1 PREVENTIVE MAINTENANCE SCHEDULE AND RECORD OF PERFORMANCE

This equipment should receive scheduled preventive maintenance on a one (1) year cycle.* It is recommended that the following table be used to plan, schedule and record this important work.

Date of Installation _____

PREVENTIVE MAINTENANCE LOG	
SCHEDULE DATE	DATE PERFORMED

* NOTE: This is the recommended cycle. Your local operating conditions may call more frequent preventive maintenance.

**AVOID UNSCHEDULED DOWNTIME
KEEP A PREVENTIVE MAINTENANCE KIT ON HAND
REORDER PROMPTLY WHEN USED**

SECTION 8 SPARE PARTS

It is recommended that a preventive maintenance kit for your specific model always be on hand. See either data name plate on your pump for the PM kit model number or the PM kits sheet in this book for information on ordering the proper PM kit model for your pump.

SECTION 8 SPARE PARTS

It is recommended that a preventive maintenance kit for your specific model always be on hand. See either data name plate on your pump for the PM kit model number or the PM kits sheet in this book for information on ordering the proper PM kit model for your pump.

10.0 INSTRUMENTATION

10.1 INSTRUMENTATION SPECIFICATION SHEET

**ZB-5000 INSTRUMENTATION
TYPICAL FOR 6X SYSTEMS**

Pressure Regulating Valve

**PR-1001, PR-2001, PR-3001,
PR-4001, PR-5001, PR-6001**

Manufacturer:	Honeywell Braukmann
Pressure Range:	103 to 620 kPa
Body Material:	Bronze
Internal Parts:	Stainless Steel & thermoplastics
Process Connection:	19mm FNPT
Model Number:	45805K63

Pressure Gauge

**PI-1001, PI-2001, PI-3001,
PI-4001, PI-5001, PI-6001,**

Manufacturer:	Ashcroft
Range:	0-700 kPa
Size:	64mm
Model:	25-1009-SW02B100
Material:	Stainless-Steel
Process Connection:	6mm MNPT

Media Water Rotameter

**FI-1201, FI-2201, FI-3201
FI-4201, FI-5201, FI-6201**

Manufacturer:	King Instruments
Range:	227 - 2271 L/H
Fitting Material:	PVC
O-ring Material:	EPR
Process Connection:	25mm FNPT
Model:	751021 6A-02

Media Water Solenoid Valve

**S-1001, S-2001, S-3001
S-4001, S-5001, S-6001**

Manufacturer:	ASCO
Enclosure:	NEMA 4X
Orifice Size:	19mm
Body Material:	Brass
Disc and Seat Material:	Buna N
Watts:	6.1
Power Supply:	220 VAC/50 Hz
Process Connection:	19mm FNPT, Normally Closed
Catalog No.:	8210G009

Differential Pressure Gauge

**PDI-1001, PDI-2001, PDI-3001
PDI-4001, PDI-5001, PDI-6001**

Manufacturer:	Dwyer
Range:	0-10 in. W.C.
Size:	4"
Construction:	Aluminum
Model Number:	Model 2010D, Magnahelic, Dual-Scale
Process Connection:	1/8" FNPT Pressure Ports

SIEMENS

ZABOCS[®]
PRODUCT SPECIFICATION SHEET

ZB-5000 INSTRUMENTATION

Hose Bibb

HB-1001, HB-2001, HB-3001

HB-4001, HB-5001, HB-6001

Manufacturer:

McMaster

Temperature Range

40° to 180° F

Body Material:

Brass

Process Connection:

1/2" FNPT

Model Number:

4792K61

Sound Enclosure Ventilation Fan

Manufacturer:

Hoffman

Flow Rate:

39 CFM

Power Supply

230 VAC/50 Hz

Catalog No.:

SF0526002

10.2 PRESSURE REGULATING VALVE OPERATION AND MAINTENANCE MANUAL

D05 Pressure Regulating Valves

Braukmann

PRODUCT DATA



FEATURES

- Noncorroding unitized cartridge contains all working parts and is easily replaceable.
- Includes built-in strainer and thermal bypass.
- Balanced seat construction provides superior pressure regulation.
- Inlet and outlet are internally threaded female NPT, and externally threaded for use with union assemblies.
- One model can be used in low, standard or high pressure applications; D05 has a 15 to 150 psi outlet pressure adjustment range with up to 400 psi inlet pressure.
- Available with or without gauge tap.
- U06P Stand-In Pipe available for temporary installation during construction or system flushing.
- Two-year warranty.

APPLICATION

The Honeywell Braukmann D05 Pressure Regulating Valve is a high quality pressure regulating valve that maintains a constant outlet pressure over a wide range of inlet supply pressures. It is ideally suited for new residential and light commercial construction, drip irrigation, and applications requiring highly sensitive and accurate regulation.

The wide inlet pressure range of the D05 gives flexibility without compromising reduced outlet pressure accuracy or capacity. The superior balanced single-seat design maintains a constant outlet pressure over a wide range of inlet pressures. The noncorroding unitized cartridge insert contains all the working parts and is easily replaceable.

The D05 is used for water or air regulation. It is not suitable for steam.

CONTENTS

Application	1
Features	1
Specifications	2
Ordering Information	2
Installation	3
Operation	7
Troubleshooting	7
D05 Parts and Accessories	8



SPECIFICATIONS

Model:

D05 Pressure Regulating Valves

Construction Materials:

Body: Bronze.

Internal Parts: Stainless steel and engineered thermoplastic.

Regulator Mechanism: Fabric-reinforced diaphragm.

Inlet Pressure:

400 psi maximum.

Reduced Pressure Range:

15 to 150 psi (1/2 in. to 1 in.).

15 to 130 psi (1-1/4 in.).

Outlet Pressure:

Factory set at 60 psi.

Differential:

14 psi minimum (inlet to outlet).

Reduced Ratio:

10:1 maximum.

Temperature (Maximum):

Air: 158°F (70°C).

Water: 180°F (82°C).

Pipe Sizes:

1/2 in., 3/4 in., 1 in., and 1-1/4 in. available.

Connections:

Can be configured as female thread-by-thread, single- or double-union, NPT threaded or sweat.

Strainer Screen Size:

0.032 in.

Gauge Tap:

1/4 in. NPT (available on all models).

Approvals:

ASSE (Std. 1003) Certified.

IAPMO, CSA, and City of L.A. Listed.

Dimensions:

See Fig. 1.

SIZE (INCHES)	H	h ^{△1}	L ^{△1}
1/2	4-9/16 (116)	2-1/16 (52)	3-3/16 (81)
3/4	4-9/16 (116)	2-1/16 (52)	3-1/2 (89)
1	6 (152)	2-5/8 (66)	3-15/16 (100)
1-1/4	6 (152)	2-5/8 (66)	4-11/16 (119)

SIZE (INCHES)	SWEAT TAILPIECE		THREADED TAILPIECE	
	L ^{△2}	L' ^{△3}	L ^{△2}	L' ^{△3}
1/2	3-7/8 (98)	4-5/8 (118)	4-1/16 (103)	4-15/16 (126)
3/4	4-5/16 (110)	5-3/16 (132)	4-5/16 (110)	5-3/16 (132)
1	5-1/4 (133)	6-1/2 (166)	5 (127)	6-1/16 (154)
1-1/4	6-3/16 (157)	7-11/16 (195)	6 (152)	7-5/16 (185)

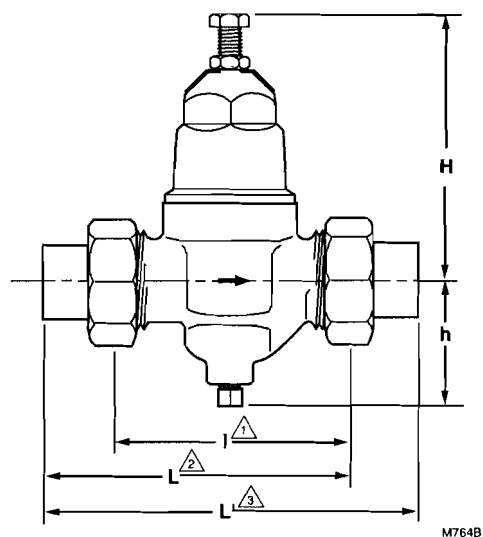
^{△1} NON-UNION MODEL.^{△2} SINGLE-UNION MODEL.^{△3} DOUBLE-UNION MODEL.^{△4} DIMENSIONS WITH GAUGE PLUG.

Fig. 1. D05 installation dimensions in in. (mm).

ORDERING INFORMATION

When purchasing replacement and modernization products from your manufacturing representative, specify the complete model number.

If you have additional questions, need further information, or would like to comment on our products or services, please contact:

Honeywell Sparco/Braukmann
Customer Service
65 Access Road
Warwick, Rhode Island 02886
www.honeywell.ca/braukmann/
www.sparco-inc.com

In Canada—Contact your nearest Honeywell Home and Building Control Sales Office.

Water Capacities (See Table 1)

The suitability of a given regulator size is dependent on the pressure requirements of each installation. To determine the pressure regulator valve size required for a specific installation, determine the following:

1. Pressure differential between inlet and outlet pressure in pounds per square inch (psi),
2. Capacity in gallons per minute (gpm), and
3. Allowable reduced pressure falloff in psi.

Given these variables, use Table 1 to determine the proper size pressure regulator valve for your application.

Example: An installation has 135 psi inlet pressure, 60 psi outlet pressure (75 psi pressure differential). If 12 gpm capacity is required with only 10 psi falloff allowable, a 1/2 in. D05 is required.

Table 1. Water Capacities.

Pressure Regulator Valve Size	Reduced Pressure Falloff (psi)	Pressure Differential Between Inlet and Outlet							
		25 psi		50 psi		75 psi		100 psi or more	
		Flow Capacity (US gpm)	Velocity (ft/sec) ^a	Flow Capacity (US gpm)	Velocity (ft/sec) ^a	Flow Capacity (US gpm)	Velocity (ft/sec) ^a	Flow Capacity (US gpm)	Velocity (ft/sec) ^a
1/2 inch	6	7.0	7.3	8.0	8.3	9.0	9.4	10.0	10.4
	10	10.0	10.4	11.0	11.5	12.0	12.5	13.0	13.5
	15	13.0	13.5	15.0	15.6	16.0	16.7	17.0	17.7
	20	15.5	16.0	18.0	19.5	19.0	21.0	20.0	22.0
3/4 inch	6	9.0	5.4	10.0	6.0	11.0	6.5	12.0	7.1
	10	15.0	8.9	16.0	9.5	17.0	10.0	18.0	10.7
	15	20.0	11.9	22.0	13.7	23.0	13.7	24.0	14.3
	20	23.0	13.9	26.0	17.6	27.0	16.7	28.0	17.3
1 inch	6	11.5	4.2	13.0	4.7	14.5	5.3	16.0	5.8
	10	20.0	7.2	21.5	7.8	23.0	8.3	24.5	8.9
	15	28.0	10.7	30.0	10.9	33.0	12.0	35.0	12.7
	20	32.0	14.0	37.0	13.5	40.0	15.5	41.0	15.0
1-1/4 inch	6	13.5	2.9	16.0	3.4	20.0	4.3	22.0	4.7
	10	22.0	4.7	29.0	6.2	34.0	7.3	38.0	8.1
	15	37.0	7.9	56.0	12.0	62.5	13.4	73.0	15.6
	20	55.0	11.8	78.0	16.7	87.0	18.6	101.0	21.6

^a Velocity in feet per second is based on schedule 40 pipe size. recommended pressure falloff for general use is approximately 104 kPa (15 psi). Recommended velocities for the flow of water: Residential and general use, 5 to 10 feet per second; industrial use, 7 to 15 feet per second; boiler feed, 7 to 15 feet per second.

In Canada—Contact your nearest Honeywell Home and Building Control Sales Office.

INSTALLATION

When Installing this Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in these instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out the product operation as provided in these instructions.

Procedure

1. Flush the system clear of sediment or debris.
2. Close the supply valve and downstream isolating valve

(if used).

3. Install the D05 with the arrow on the body pointing in the direction of water flow. (The D05 can be mounted in any position.)

The D05 can be installed directly onto the pipe by using the female NPT threads on each end. If space limitations restrict turning the D05, install single- or double-unions.

NOTE: Heat from soldering can damage internal parts of the D05. Always remove the tailpiece(s) from the D05 during soldering, or disassemble the D05 prior to heating the casting.

4. Open the supply valve.

Changing the Outlet Pressure (See Fig. 2)

The D05 is factory set to 60 psi. To change the outlet pressure, turn the adjusting bolt counterclockwise to reduce pressure or clockwise to increase pressure.

To adjust the outlet pressure to a desired setting:

- 1 Close the supply shutoff valve and open a downstream faucet to relieve static pressure in the line.
- 2 Install a pressure gauge to the gauge tap on D05G models, or temporarily with a downstream hose bib on other D05 models.
- 3 Loosen the locknut by turning counterclockwise two turns.
- 4 Turn the adjusting bolt counterclockwise several turns to make sure the setting is below the desired setting.
- 5 Close all downstream valves and/or faucets and slowly open the supply valve until fully open.
- 6 Turn the adjusting bolt clockwise to gradually increase the pressure until the gauge indicates the desired outlet pressure (under no flow condition).
- 7 Reopen a downstream valve. During flow, there will normally be a pressure falloff of 3 to 15 psi depending on the amount of water flow.
- 8 Tighten the locknut by turning clockwise until tight. Do not overtighten.

Replacing the Cartridge (See Fig. 3)

The working parts of the D05, including diaphragm, valve

spring, and disk are all contained in a replaceable cartridge. To replace the cartridge:

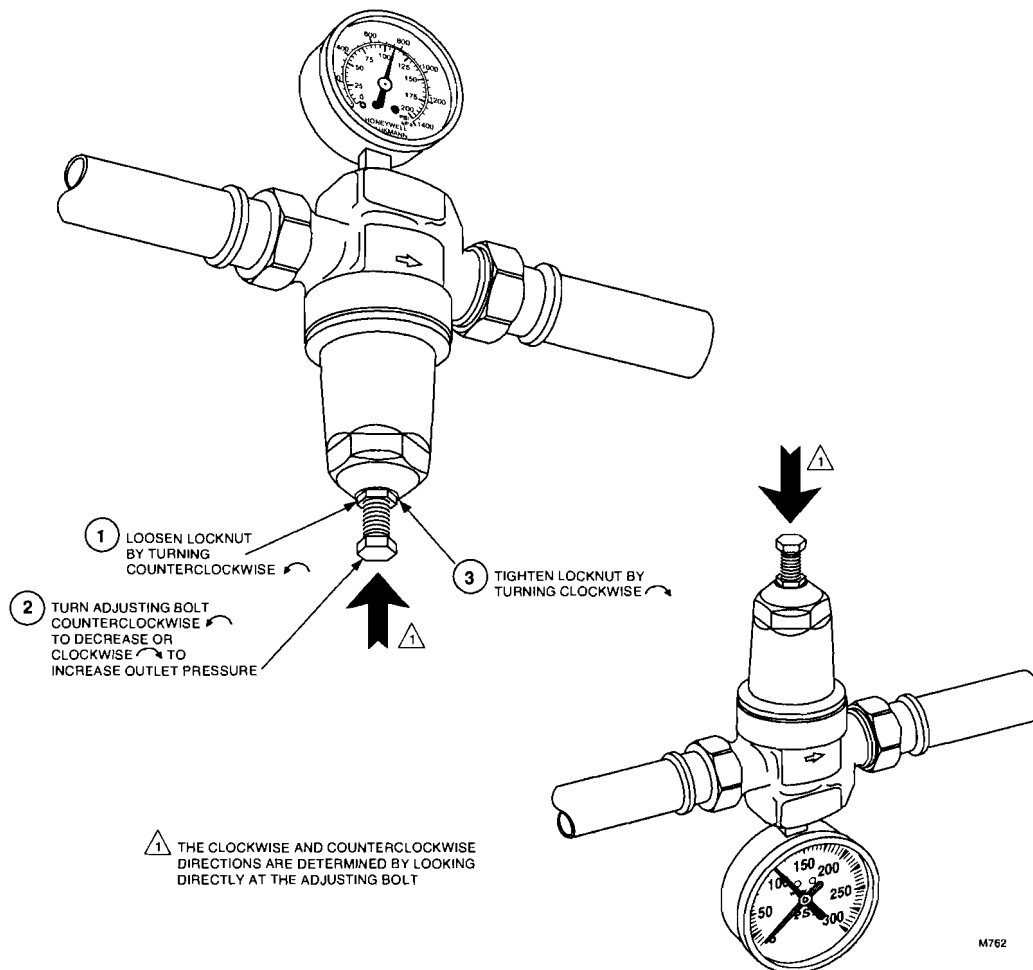
- 1 Shut off the supply valve and open a downstream faucet to relieve the system pressure.

CAUTION

To prevent injury and/or equipment damage, loosen locknut and turn adjusting screw counterclockwise to remove spring tension.

- 2 Loosen locknut and turn adjusting screw counterclockwise to remove spring tension.
- 3 Remove the bonnet and washer using an adjustable wrench, socket, or box-end wrench.
- 4 Remove the cartridge using two screwdrivers as levers.
- 5 Attach new O-rings and screen onto the new cartridge. Make sure O-rings are properly installed above and below the screen.
- 6 Insert the new cartridge. Do not scratch the sides.
- 7 Place the washer on top of the cartridge.

NOTE: The inner lip must be pointing up to avoid damaging the diaphragm.



M762

- 8 Replace the spring, spring cup, and bonnet.

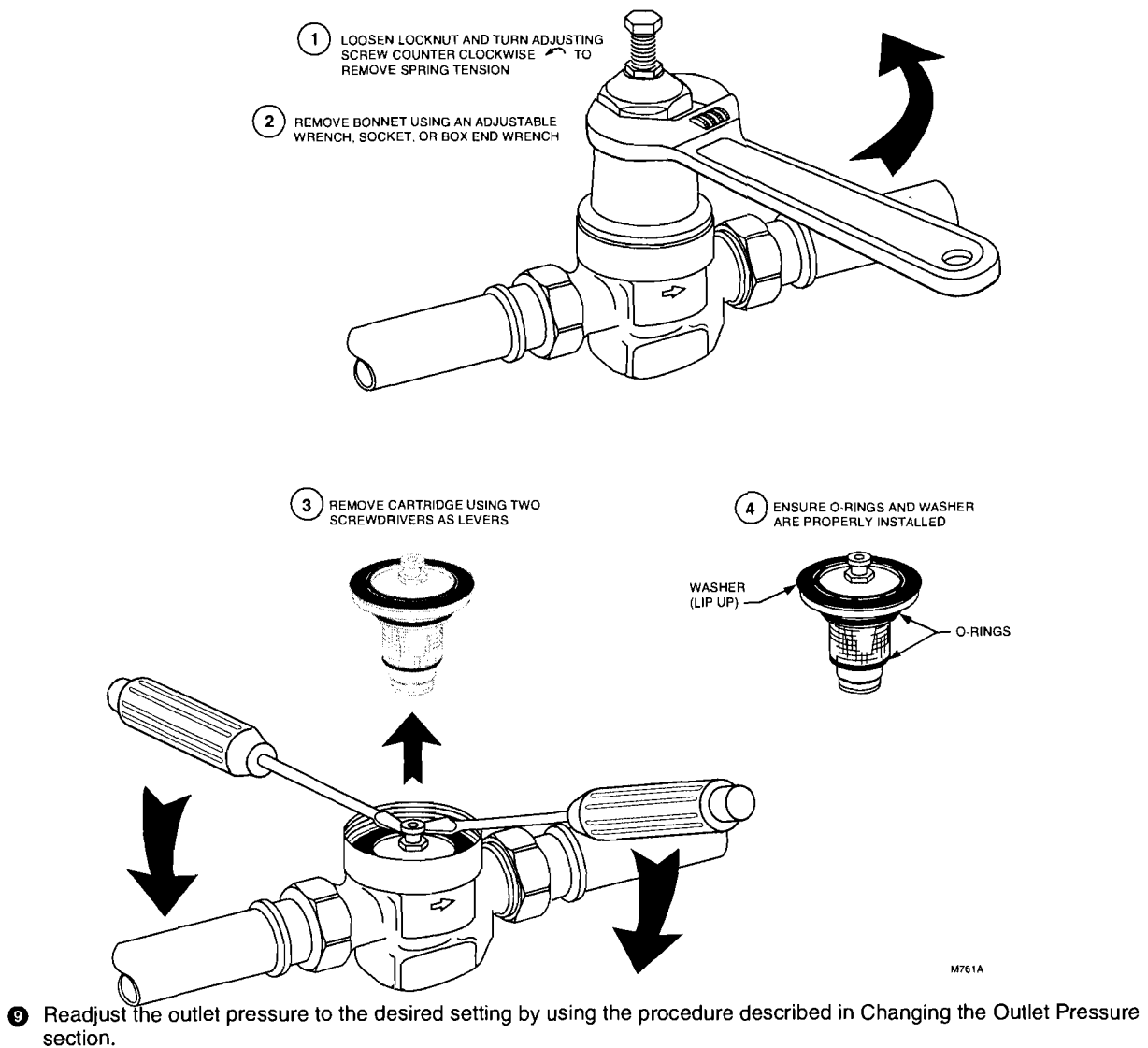


Fig. 2. Changing outlet pressure.

Fig. 3. Replacing the D05 cartridge.

Cleaning the Cartridge Screen

- Warning:** Clean the cartridge screen:
- Shut off the supply valve and open a downstream faucet to relieve the system pressure.

CAUTION

To prevent injury and/or equipment damage, loosen locknut and turn adjusting screw counterclockwise to remove spring tension.

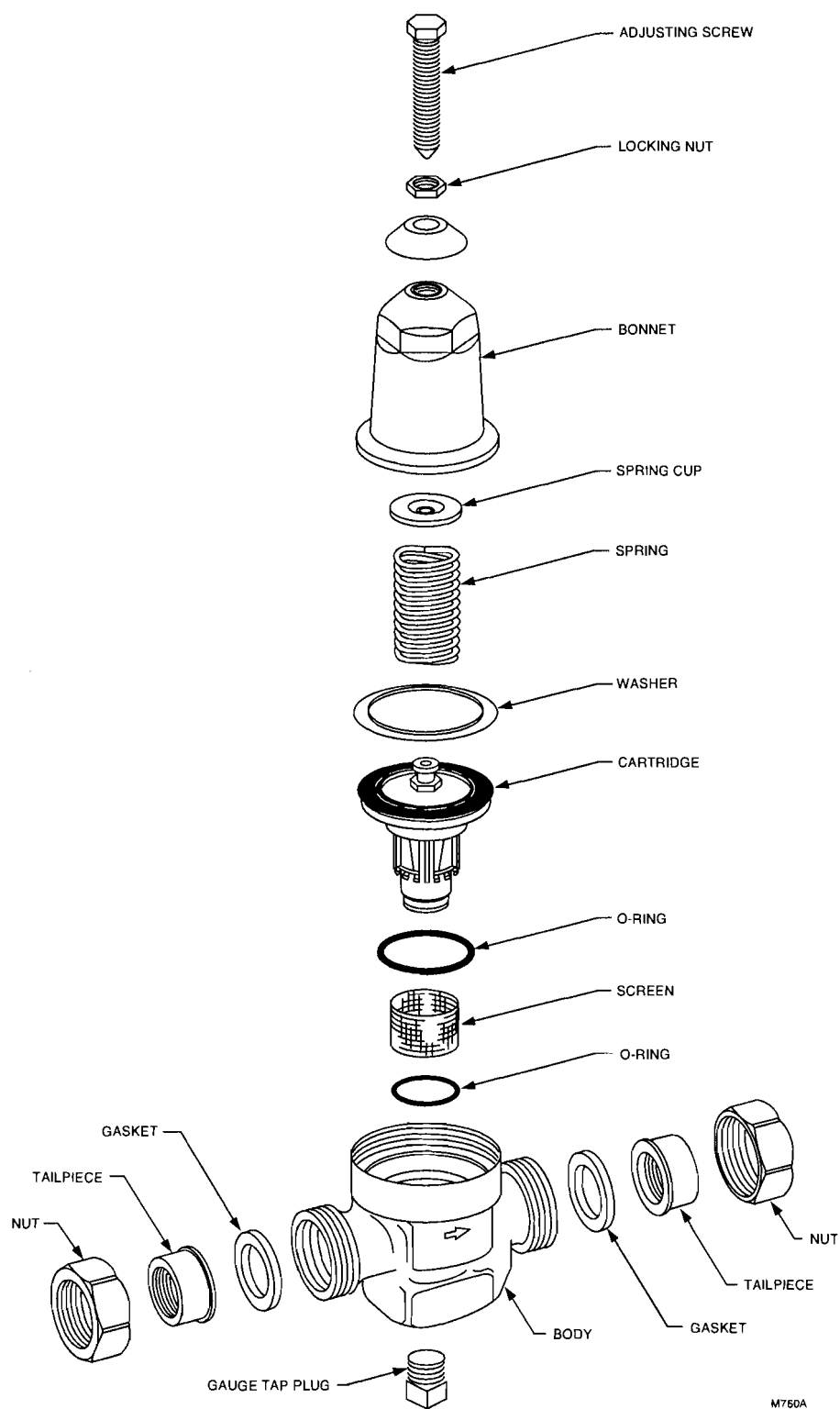
- Loosen locknut and turn adjusting screw counterclockwise to remove spring tension.
- Remove the bonnet and washer using an adjustable wrench, socket, or box-end wrench.

- Remove the cartridge using two screwdrivers as levers as shown in Fig. 3.
- Remove and clean the cartridge screen.

NOTE: D05G models can be cleaned to some extent by removing the gauge tap plug and using an air hose to blow air into the unit.

- Replace the cartridge screen and make sure the O-rings are installed properly.
- Carefully clean the cartridge seat area.
- Insert the cartridge. Do not scratch the sides.
- Place the washer on top of the cartridge.

NOTE: The inner lip must be pointing up to avoid damaging the diaphragm.



- 11 Readjust the outlet pressure to the desired setting by using the procedure described in Changing the Outlet Pressure section.

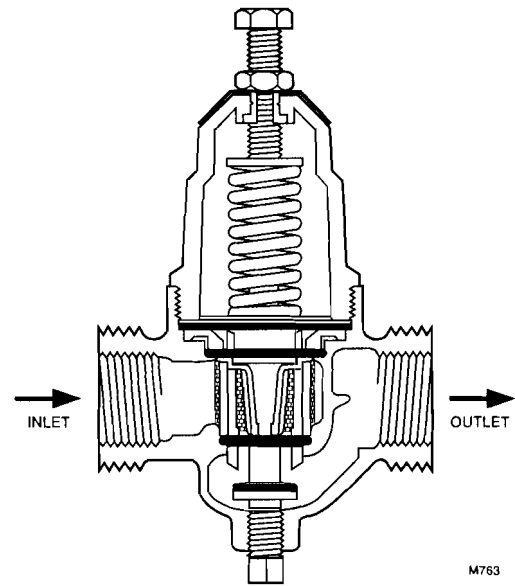
- 10 Replace the spring, spring cup and bonnet (see Fig. 4).

Fig. 4. D05 exploded view.

OPERATION

The Honeywell Braukmann D05 is a balanced, direct acting pressure regulating valve. The D05 provides constant downstream pressure regardless of varying inlet pressures and downstream flow demands.

The spring force holds the valve in the open position until downstream pressure, sensed by a port, is sufficient to press on the underside of the diaphragm and close the valve. As downstream pressure drops due to demand, the force on the diaphragm is reduced and the valve opens. Adjustment is made by manually turning the adjustment screw clockwise to increase the spring force and require a higher downstream pressure to close the valve. Similarly, reducing the spring force lowers the outlet set pressure.



Once the outlet pressure is set, the D05 automatically regulates to maintain the downstream pressure. See Fig. 5 for the internal construction of the D05.

Fig. 5. Internal construction of D05.

TROUBLESHOOTING

Table 2 provides a troubleshooting guide for the D05 Pressure Regulating valves.	
Problem	Solution
Whistling noise.	<ul style="list-style-type: none"> Slightly increase or decrease the outlet pressure until the noise disappears.
Will not hold pressure.	<ul style="list-style-type: none"> Clean the filter cartridge.
Chatters.	<ul style="list-style-type: none"> Replace the screen and O-rings. Replace the cartridge (see replacing the cartridge section).
Freezes up.	<ul style="list-style-type: none"> Replace bonnet or cartridge, if damaged. To avoid future freeze-up: <ul style="list-style-type: none"> — Temporarily (slightly) open a downstream faucet if the DS05 is going to be exposed to temperatures below 32°F (0°C). The slight water flow will eliminate freeze-up. — Move the DS05 to a location with an ambient temperature above 32°F (0°C) if it is currently exposed to prolonged temperatures below 32°F (0°C).
Pressure gauge measures a lower pressure under flow conditions than was originally set during static conditions.	<ul style="list-style-type: none"> DS05 is functioning properly. No action is necessary. The pressure decrease is characteristic of all directacting pressure regulating valves and is referred to as falloff.

Table 2. Troubleshooting the D05 Pressure Regulating Valves.**D05 Parts and Accessories****Order Number Description***Replacement Parts*

203223	Bonnet Assembly for 1/2 and 3/4 in. Valves.
203224	Bonnet Assembly for 1 and 1-1/4 in. Valves.
272840	Gasket for 1/2 in. D05/DS05 (quantity 24).
272841	Gasket or 3/4 in. D05/DS05 (quantity 24).
272842	Gasket for 1 in. D05/DS05 (quantity 24).
272843	Gasket for 1-1/4 in. D05/DS05 (quantity 24).
K05A1009	Replacement Cartridge, Screen and O-ring for 1/2 and 3/4 in. Valves.
K05A1017	Replacement Cartridge, Screen and O-ring for 1 and 1-1/4 in. Valves.
K05B1007	Replacement Screen and O-ring for 1/2 and 3/4 in. Valves.
K05B1015	Replacement Screen and O-ring for 1 and 1-1/4 in. Valves.

Union Kits

K06U1069	Union Kit—1/2 in., includes nut, female NPT threaded tailpiece and gasket.
----------	--

Order Number**Description**

K06U1077	Union Kit—3/4 in., includes nut, female NPT threaded tailpiece and gasket.
K06U1085	Union Kit—1 in., includes nut, female NPT threaded tailpiece and gasket.
K06U1135	Union Kit—1-1/4 in. for D05/D505, includes nut, female NPT threaded tailpiece and gasket.
K06U1093	Union Kit—1/2 in., includes nut, sweat tailpiece and gasket.
K06U1101	Union Kit—3/4 in., includes nut, sweat tailpiece and gasket.
K06U1119	Union Kit—1 in., includes nut, sweat tailpiece and gasket.
K06U1143	Union Kit—1-1/4 in. for D05/D505, includes nut, sweat tailpiece and gasket.

Accessories

202868	Filter Washer, 3/4 in., for use with U06P1045 Plastic Stand-in Pipe.
202869	Filter Washer, 1 in., for use with U06P1052 Plastic Stand-in Pipe.
U06P1045	Plastic Stand-in Pipe (spacer) for use with D05 Double Union Pressure Regulating Valves, 3/4 in.
U06P1052	Plastic Stand-in Pipe (spacer) for use with D05 Double Union Pressure Regulating Valves, 1 in.

Pressure Gauges

M39A1032	Pressure Gauge with Bottom Inlet; 0 to 160 psi.
MT194A1006	Water Pressure Test and Recording Gauge with Hose Bib Connection; 0 to 300 psi.

Honeywell Braukmann**Home and Building Control**

Honeywell Inc.
1985 Douglas Drive North
Golden Valley, MN 55422

Home and Building Control

Honeywell Limited-Honeywell Limitée
155 Gordon Baker Road
North York, Ontario
M2H 2C9

Helping You Control Your World

10.3 PRESSURE GAUGE OPERATION AND MAINTENANCE MANUAL



PRESSURE GAUGE INSTALLATION, OPERATION AND MAINTENANCE

Cold Service - The minimum recommended operating temperature for all gauges is -50°F. A hermetically sealed gauge case is recommended to minimize condensate freezing on the movement, thus hindering its action. Gauges filled with silicone oil will provide maximum resistance to the effects of operating in freezing conditions. While glycerin filled gauges can be safely stored at temperatures down to -50°F, their operation is impeded at temperatures below +20°F due to the marked increase in the viscosity of the glycerin.

Gauge reuse - ASME B40.1 recommends that gauges not be moved indiscriminately from one application to another. Whereas the cumulative number of pressure cycles on an in-service or previously used gauge is generally unknown, it is generally safer to install a new gauge whenever and wherever possible. This will also minimize the possibility of a reaction with previous media.

Tightening of gauge - Torque should never be applied to the gauge case. Instead, an open end or adjustable wrench should always be used on the wrench flats of the gauge socket to tighten the gauge into the fitting or pipe. NPT threads require the use of a suitable thread sealant, such as pipe dope or teflon tape, and must be tightened very securely to ensure a leak tight seal.

CAUTION: Torque applied to a diaphragm seal or its attached gauge, that tends to loosen one relative to the other, can cause loss of fill and subsequent inaccurate readings. Always apply torque **only** to the wrench flats on the lower seal housing when installing filled diaphragm seal assemblies or removing same from process lines.

Frequency of Inspection - This is quite subjective and depends upon the severity of the service and how critical the accuracy of the indicated pressure is. For example, a monthly inspection frequency may be in order for critical, severe service applications. Annual inspections, or even less frequent schedules, are often employed in non-critical applications.

In-service inspection - If the accuracy of the gauge cannot be checked in place, the user can at least look for (a) erratic or random pointer motion; (b) readings that are suspect -especially indications of pressure when the user believes the true pressure is 0 psig.

When to check accuracy - Obviously any suspicious behavior of the gauge pointer warrants a full accuracy check be performed, even if the gauge is not showing any symptoms of abnormal performance, the user may want to establish a frequency of bench type inspection.

When to recalibrate - This depends on the criticality of the application. If the accuracy of a 3-2-3% commercial type gauge is only 0.5% beyond specification, the user must decide whether it's worth the time and expense to bring the gauge back into specification. Conversely if the accuracy of a 0.25% test gauge is found to be 0.1% out of specification then obviously the gauge should be recalibrated.

Other considerations -These include (a) bent or unattached pointers clue to extreme pressure pulsation; (b) broken windows which should be replaced to keep dirt out of the internals; (c) leakage of gauge fill; (d) case damage - dents and/or cracks; (e) any signs of service media leakage through the gauge including its connection; (f) discoloration of gauge fill that impedes readability.

GAUGE REPLACEMENT

It is recommended that the user stock one complete Ashcroft instrument for every ten (or fraction thereof) of that instrument type in service. With regard to gauges having a service history, consideration should be given to discarding rather than repairing them. Gauges in this category include the following:

- a. Gauges that exhibit a span drift greater than 10%. It is possible the bourdon tube has suffered thinning of its walls by corrosion.
- b. Gauges that exhibit a zero shift greater than 25%. It is likely the bourdon tube has seen significant overpressure leaving residual stresses that may be detrimental to the application.
- c. Gauges which have accumulated over 1,000,000 pressure cycles with significant pointer excursion.
- d. Gauges showing any signs of corrosion and/or leakage of the pressure system.
- e. Gauges which have been exposed to high temperature or simply exhibit signs of having been exposed to high temperature - specifically 260°F or greater for soft soldered systems; 450°F or greater for brazed systems; and 750°F or greater for welded systems.
- f. Gauges showing significant friction error and/or wear of the movement and linkage (assuming the movement cannot be replaced).
- g. Gauges having damaged sockets, especially damaged threads.
- h. Liquid filled gauges showing loss of case fill.

NOTE - ASME B40.1 does not recommend moving gauges from one application to another. This policy is prudent in that it encourages the user to procure a new gauge, properly tailored by specification, to each application that arises.

10.4 MAKE-UP WATER ROTAMETER OPERATION AND MAINTENANCE MANUAL

INSTALLATION INSTRUCTION for 7300 Meter

To get the most from the flowmeter you are about to install take time to read the following information before beginning work.

- 1) Carefully inspect the meter for damage that may have occurred during shipping.
- 2) Make sure your pressure, temperature, fluid and other requirements are compatible with the meter.
- 3) Select a suitable location for installation to prevent excess stress on the meter which may result from:
 - a) Misaligned pipe.
 - b) The weight of related plumbing.
 - c) "Water Hammer" which is most likely to occur when flow is suddenly stopped as with quick closing solenoid and operated valves.
(If necessary a surge chamber should be installed. This will also be useful in high pressure start-up situations.)
 - d) Thermal expansion of liquid in a stagnated or valve isolated system.
 - e) Instantaneous pressurization which will stress the meter and could result in tube failure.

Note: In closed thermal transfer or cooling systems install the meter in the cool side of the line to minimize meter expansion and contraction and possible related fluid leaks.

- 4) Handle the meter carefully during installation.
 - a) Use an appropriate amount of Teflon tape on external pipe threads before making connections. Do not use paste or stick type thread sealing products.
- 5) Install the meter vertically with the inlet port at the bottom.
- 6) Meters should be cleaned with a mild soap solution. This will be an effective cleaner of rust stains. Caution must be used so that materials of construction are not damaged by cleaning solutions. Hard water deposits can be removed with a 5% acetic acid solution (vinegar).

CAUTION:

- 7) Meters are not oxygen cleaned. Use with incompatible fluids will cause O-rings to swell and break tubes. Meters used in gas service should have suitable valves plumbed in at the inlet and outlet of the meter. The valve at the outlet should be used to create back pressure as required to prevent float bounce. The inlet valve should be used for throttling purposes.
- 8) **Pressure and temperature maximums must never be exceeded.**

PRESSURE/TEMPERATURE		
Pressure and temperature ratings are inversely proportional, while ratings with metal fittings are simultaneous.		
7330, 7830 Series Union Ends Models		
Tube Size	Polysulfone Tube PVC Fittings PSIG/ °F	Polysulfone Tube PVDF Fittings PSIG/ °F
4, 5, 6	150/130	150/160

NOTE

Pressure and temperature limits are based on a study of the engineering data for particular materials used in construction and on the design of individual models. This information is supplemented by destructive testing results. Maximum pressures suggested are at 70° F. Maximum temperatures suggested are at 0 psig, so pressure and temperature maximums are inversely proportional. Pressure and temperature maximums for these meters are simultaneous. Meters exposed to difficult environments such as those created by certain chemicals, excessive vibration or other stress inducing factors could fail at or below the suggested maximums. **Never** operate meters above pressure and temperature maximums. Meter failure could result in damage to equipment and serious personal injury. Always use suitable safety gear including OSHA approved eye protection when working around meters in service. We are happy to pass along chemical compatibility information that has been published by the manufacturers of raw materials used in our products; however, this information should not be construed as a recommendation made by King Instrument Company, Inc. for a specific application. Specifications are subject to change without notice.

KING INSTRUMENT COMPANY
16792 Burke Lane, Huntington Beach, CA 92647
Phone (714) 841-3663 Fax (714) 847-2062

10.5 MAKE-UP WATER SOLENOID VALVE OPERATION AND MAINTENANCE MANUAL

Installation & Maintenance Instructions

2-WAY INTERNAL PILOTED—OPERATED SOLENOID VALVES
NORMALLY CLOSED OPERATION — GENERAL SERVICE
3/8", 1/2" OR 3/4" NPT

SERIES
8210
8211

Form No.V5848R2

NOTICE: See separate solenoid installation and maintenance instructions for information on: Wiring, Solenoid Temperature, Cause of Improper Operation, Coil or Solenoid Replacement.

DESCRIPTION

Series 8210 valves are 2-way normally closed internal pilot—operated solenoid valves designed for general service. Valves are made of rugged forged brass. Series 8210 valves are provided with a general purpose solenoid enclosure.

Series EF8210 and 8211 are the same as Series 8210 except they are provided with an explosionproof or explosionproof/watertight solenoid enclosure.

OPERATION

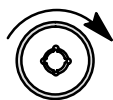
Normally Closed: Valve is closed when solenoid is de—energized; open when energized.

IMPORTANT: Minimum operating pressure differential required is 5 psi.

Manual Operator (optional feature)

Manual operator allows manual operation when desired or during an electrical power outage. To engage manual operator (open the valve), push in knurled cap and rotate stem clockwise 180°. Valve will now be in the same position as when the solenoid is energized. To disengage manual operator (close the valve), turn stem counterclockwise 180°.

Push in and rotate
180° clockwise to operate



CAUTION: For valve to operate electrically, manual operator stem must be fully rotated counterclockwise.

Relocation of Manual Operator

Manual operator may be relocated at 90° increments by rotating the valve bonnet as follows:

WARNING: To prevent the possibility of death, serious injury or property damage, turn off electrical power, depressurize valve, and vent fluid to a safe area before relocating manual operator.

1. See separate solenoid installation and maintenance instruction's and follow instructions to loosen solenoid to allow rotation of enclosure.
2. Be sure manual operator stem is fully rotated counterclockwise.
3. Remove bonnet screws from valve body.
4. Lift valve bonnet slightly and rotate to desired position. Do not rotate the diaphragm assembly with the valve bonnet.
5. Replace bonnet screws and torque in a crisscross manner to 95 ± 10 in—lbs [$10,7 \pm 1,1$ Nm].
6. Position and tighten solenoid in place, see separate instructions.

WARNING: To prevent the possibility of death, serious injury or property damage, check valve for proper operation before returning to service.

7. Test operate valve electrically and manually. Be sure valve can be test operated without effecting other equipment.
8. Restore line pressure and electrical power supply to valve.

INSTALLATION

Check nameplate for correct catalog number, pressure, voltage, frequency, and service. Never apply incompatible fluids or exceed pressure rating of the valve. Installation and valve maintenance to be performed by qualified personnel.

Future Service Considerations

Provision should be made for performing seat leakage, external leakage, and operational tests on the valve with a nonhazardous, noncombustible fluid after disassembly and reassembly.

Temperature Limitations

For maximum valve ambient and fluid temperatures, refer to chart below. Check catalog number and watt rating on nameplate.

Watt Rating AC or DC	Catalog Number Prefix	Solenoid Class	Max. Amb. Temp. °F	Max. Fluid Temp. °F
6	None or DF	F	122	180
AC	HT	H	140	180
6.1	None, KF, SF, or SC	F	125	180
AC	HT, KH, ST or SU	H	140	180
11.2	None or HT	F or H	77	150
DC	None, HT, KF, KH, SC, SF or ST	F or H	104	150

Positioning

This valve is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub—assembly area.

Mounting

For mounting bracket (optional feature) dimensions, refer to Figure 1.

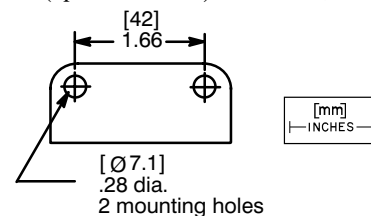


Figure 1. Mounting bracket dimensions

Piping

Connect piping to valve according to markings on valve body. Apply pipe compound sparingly to male pipe threads only. If applied to valve threads, the compound may enter the valve and cause operational difficulty. Avoid pipe strain by properly supporting and aligning piping. When tightening the pipe, do not use valve or solenoid as a lever. Locate wrenches applied to valve body or piping as close as possible to connection point.

⚠ CAUTION: To protect the solenoid valve, install a strainer or filter suitable for the service involved in the inlet side as close to the valve as possible. Clean periodically depending on service conditions. See ASCO Series 8600, 8601 and 8602 for strainers.

MAINTENANCE

⚠ WARNING: To prevent the possibility of death, serious injury or property damage, turn off electrical power, depressurize valve, and vent fluid to a safe area before servicing the valve.

NOTE: It is not necessary to remove the valve from the pipeline for repairs.

Cleaning

All solenoid valves should be cleaned periodically. The time between cleanings will vary depending on the medium and service conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. In the extreme case, faulty valve operation will occur and the valve may fail to open or close. Clean strainer or filter when cleaning the valve.

Preventive Maintenance

- Keep the medium flowing through the valve as free from dirt and foreign material as possible.
- While in service, the valve should be operated at least once a month to insure proper opening and closing.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Causes of Improper Operation

- **Incorrect Pressure:** Check valve pressure. Pressure to valve must be within range specified on nameplate.
- **Excessive Leakage:** Disassemble valve and clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Valve Disassembly

1. Disassemble valve in an orderly fashion using exploded views for identification and placement of parts. Refer to Figure 2 for AC construction; Figure 3 for DC construction.
 2. Remove solenoid enclosure. See separate instructions.
- *For AC construction (standard or with manual operator), proceed as follows:*
 3. For standard construction, remove bonnet screws, solenoid base sub-assembly, core spring, core assembly, diaphragm spring, diaphragm assembly and body gasket from valve body.
 4. For manual operator constructions, unscrew solenoid base sub-assembly first then follow step 3 for removal of parts.
 5. For normal maintenance (cleaning) it is not necessary to disassemble the manual operator unless an ASCO Rebuild Kit is being installed. To disassemble, remove stem pin, manual operator stem, stem spring and stem gaskets (2).
 - *For DC construction (standard or with manual operator), proceed as follows:*
 6. Unscrew solenoid base sub-assembly first then follow step 3 and 5 for removal of parts.

Note: Diaphragm spring is omitted for DC construction.

7. All Parts are now accessible for cleaning or replacement. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Valve Reassembly

1. Lubricate body gasket and solenoid base gasket with DOW CORNING® 200 Fluid lubricant or an equivalent high-grade silicone fluid.

2. Lubricate manual operator stem gaskets (2) with DOW CORNING® 111 Compound lubricant or an equivalent high-grade silicone grease.
3. Replace body gasket and diaphragm assembly. Locate bleed hole in diaphragm assembly approximately 45° from valve outlet.

- *For AC construction (standard or with manual operator), proceed as follows:*

4. Position diaphragm spring on diaphragm assembly. Be sure **large end** of diaphragm spring seats in cup of diaphragm assembly. For manual operator constructions, **small end** of diaphragm spring seats in cup of diaphragm assembly.
5. Install wide end of core spring in core assembly first, closed end protrudes from top of core assembly.
6. For standard construction, position core assembly with core spring and solenoid base sub-assembly (integral with bonnet) over diaphragm spring and diaphragm assembly.
7. Install bonnet screws and hand thread screws as far as possible, then torque bonnet screws in a crisscross manner to 95 ± 10 in-lbs [$10,7 \pm 1,1$ Nm].
8. For valve constructions with a manual operator, first install valve bonnet and bonnet screws as described in step 7.
9. Install solenoid base gasket, core assembly with core spring and solenoid base sub-assembly.
10. Torque solenoid base sub-assembly to 175 ± 25 in-lbs [$19,8 \pm 2,8$ Nm].
11. For valves with a manual operator proceed as follows:
 - A. Install two manual operator stem gaskets on stem. Refer to Step 2 for lubrication instructions.
 - B. Install stem spring and stem assembly with gaskets into valve bonnet.
 - C. Push stem assembly into valve bonnet; align stem pin hole and install stem pin.
 - D. Operate manual operator to be sure there is no misalignment or binding. Then rotate manual operator stem counterclockwise as far as possible.

- *For DC construction (standard or with manual operator), proceed as follows:*

12. For standard or manual operator constructions, replace valve bonnet and follow steps 7, 9 and 10. For manual operator constructions, install core spring in core assembly following step 5.
13. Install solenoid. See separate instructions.

⚠ WARNING: To prevent the possibility of death, serious injury or property damage, check valve for proper operation before returning to service. Also perform internal seat and external leakage tests with a nonhazardous, noncombustible fluid.

14. Restore line pressure and electrical power supply to valve.
15. After maintenance is completed, operate the valve a few times to be sure of proper operation. A metallic *click* signifies the solenoid is operating.

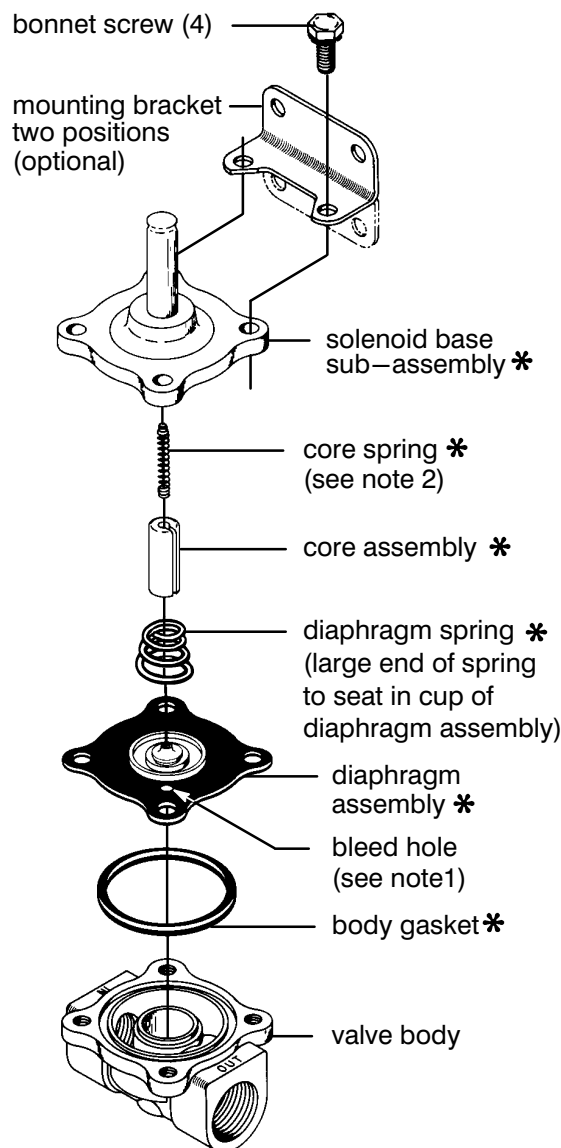
ORDERING INFORMATION FOR ASCO REBUILD KITS

Parts marked with an asterisk (*) in the exploded view are supplied in Rebuild Kits. When Ordering Rebuild Kits for ASCO valves, order the Rebuild Kit number stamped on the valve nameplate. If the number of the kit is not visible, order by indicating the number of kits required, and the Catalog Number and Serial Number of the valve(s) for which they are intended.

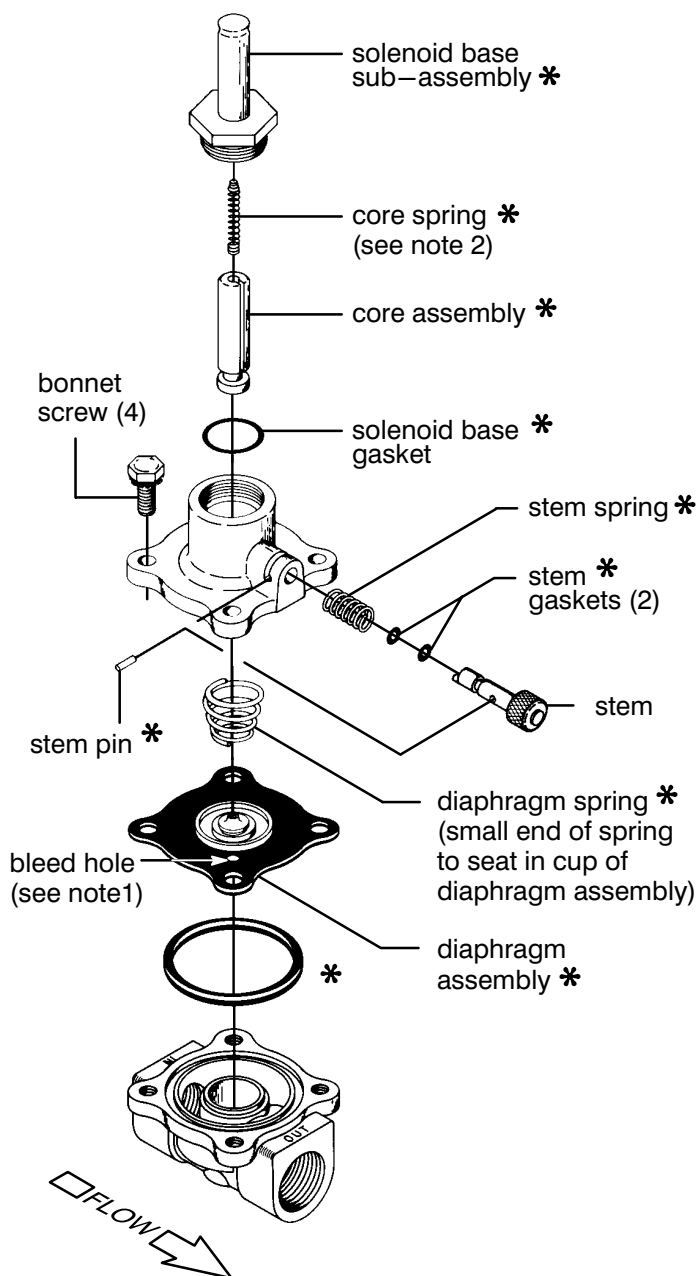
Torque Chart

Part Name	Torque Value Inch—Pounds	Torque Value Newton—Meters
Solenoid base sub—assembly	175 ± 25	19,8 ± 2,8
Bonnet screws	95 ± 10	10,7 ± 1,1

*** Indicates Parts Supplied
In ASCO Rebuild Kits**



AC Construction Standard



AC Construction with Manual Operator

Note:

1. Locate bleed hole in diaphragm assembly approximately 45° from valve outlet.
2. Wide end of core spring in core first, closed end protrudes from top of core.

Figure 2. Series 8210 — AC construction without solenoid.

10.6 NUTRIENT TANK LEVEL SWITCH

INSTALLATION AND OPERATING INSTRUCTIONS FOR ULTRASWITCH D30 DISPLACEMENT LEVEL SWITCH

INTRODUCTION

The D30 top entry level switch is a two position level regulator capable of controlling both the high and low level switching points of a pump or contactor set to pump liquid in or out of a pit or tank. The D30 level switch operates by Archimedes Principle. When an object is immersed in liquid its weight is reduced by an amount equal to the weight of the liquid it displaces. In the D30 switch a magnetically actuated microswitch detects the weight change that occurs when liquid submerges a set of solid polypropylene displacers suspended from the switch. Since it is weight change that actuates the switch, specific gravity, or weight per unit volume of the liquid medium is critical to the operation of the switch. The standard D30 level switch is set up to operate in water (with a specific gravity of 1.0 plus or minus 5%). Special displacers are available to suit liquids of other specific gravities.

The actuating arm of the D30 switch is encased in a blind cavity in the switch body. The microswitch in the electrical housing is actuated magnetically through the solid body of the switch. In pressure applications the entire arm and housing can be pressurised with no detrimental effect to the working of the switch. There are no electrical components in contact with the process liquid and no seals or other points of potential failure.

OPERATING ENVIRONMENT

The D30 level switch is an extremely versatile device. It can be used to control the level of liquid in wells, tanks, pits, sumps, bores, or in pressure or vacuum vessels, in fact virtually anywhere liquid is rising or falling in level. It can be used in potable water, distilled water, seawater or water that contains solids, pulp, froth, foam, grit or waste materials. The weatherproof electrical housing of the switch is normally mounted above the liquid to be sensed, and the solid displacers suspended by cord at the points where the rising or falling liquid levels are required to operate the switch. The suspension cord and the displacers are the only components of the switch that come in contact with the liquid, and these are made from inert polypropylene. Polypropylene is highly regarded for its chemical resistance. The specific chemical resistance for Polypropylene can be found in widely available chemical compatibility charts. Essentially the D30 level switch can be used in any liquid of S.G. that does not affect polypropylene, and at any temperature within the limits of tolerance of the displacers and cord.

INSTALLATION

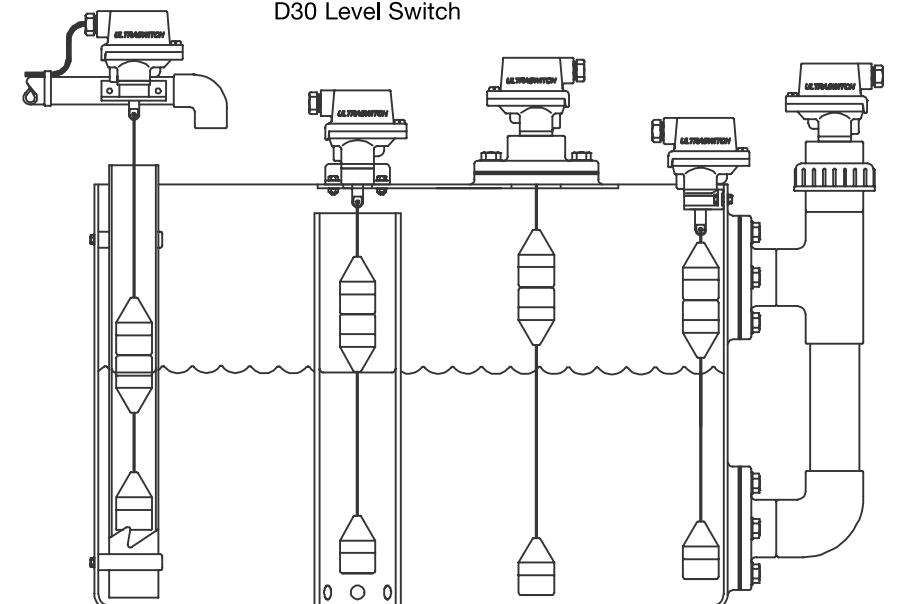
Fig. 1 shows some suggested methods of mounting the D30 switch. These include bracket mounts, pressure vessel mounting and the use of PVC or ABS pipe to fabricate stilling wells or shrouds to house the switch. Whatever method is used, it is critical to the correct operation of the switch that it be mounted absolutely vertically. The switch can be simply mounted in its bracket, or for pressure applications, solvent glued into standard PVC or ABS pipefittings. The displacers are designed to fit down the inside of 50NB PVC class 18 pipe. Such pipe can provide an excellent housing and carrier for the displacer assembly. When glueing the switch into pipefittings, take care not to use excess glue and not to allow glue to make contact with the actuating arm of the switch.

Cord length and the position of the displacers on the cord are fully user adjustable. Take care to ensure the bottom displacers do not touch the bottom of the tank, or the switch will not operate. The standard D30 switch is supplied with 3 metres of cord. Any required cord length can be used with the switch, and the bottom end of the cord should be knotted to prevent the displacers sliding off during adjustment or commissioning.

EXPOSED APPLICATIONS

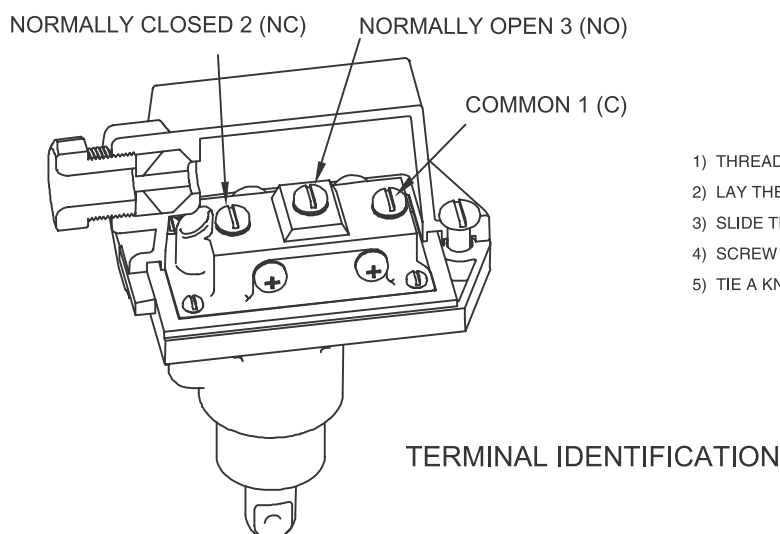
If this switch is to be mounted in an outside location, for example on top of an open water tank we recommend the switch be mounted in a shroud made from 50mm PVC. A simple pipe shroud, particularly if it is painted will protect the switch from reflected UV sunlight, and thus prevent degradation of the cord and top displacers. This simple precaution will greatly prolong the life of the switch.

Fig 1 Some suggested methods of mounting the D30 Level Switch



ELECTRICAL

The D30 switch houses a single pole double throw microswitch. Details of the layout of the switch and the terminal designation are shown in the sketch. On a rising liquid level Common to Normally open is closed and Common to Normally Closed is open. On a falling liquid level, the switch reverses state that is Common to Normally open is open and Common to Normally closed is closed. This allows the switch to be configured for either pump out or pump in applications.



Note

To pump out of a tank, use terminals 1 (C) and 2 (NC)

To pump into a tank, use terminals 1 (C) and 3 (NO)

MAINTENANCE & ADJUSTMENT

The D30 level switch is supplied pre-set but when required, the switching point in relation to specific gravity is adjustable via an Allen head screw accessed through a port at the end of the microswitch. Under normal circumstances the adjusting screw should not be altered. It is factory set and will only require adjusting if the switch is to be set up to operate in liquids at an SG other than 1.0. When maintenance is required, all components of the D30 level switch are available as spare parts; the body of the switch with the actuating arm included is one complete assembly and is non-serviceable. The actuating arm cannot be removed from the housing.

- 1) THREAD CORD THROUGH THE 3 COMPONENTS
- 2) LAY THE CORD IN THE TRENCH IN THE ANVIL
- 3) SLIDE THE ANVIL INTO THE TOP BODY HALF
- 4) SCREW THE TWO BODY HALVES TOGETHER
- 5) TIE A KNOT IN THE FREE END OF THE CORD

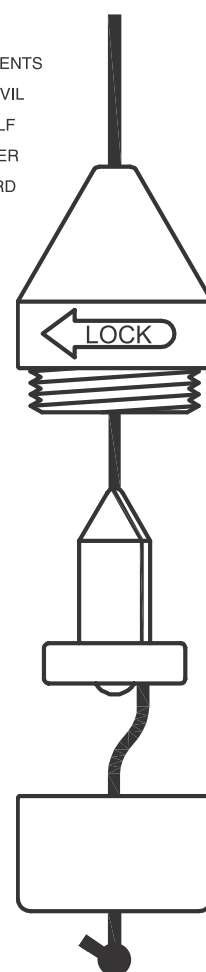


Fig 2 DISPLACER ASSEMBLY

ELECTRICAL DATA

The D30 level switch contains a high capacity single pole double throw microswitch with Tungsten contacts, specifically designed to control motor loads up to 2 Horse Power.

Rated Voltage	NON INDUCTIVE LOADS				INDUCTIVE LOADS			
	Resistive load		Lamp Load		Inductive Load		Motor Load	
	NC	NO	NC	NO	NC	NO	NC	NO
125 VAC	20 A		7.5 A		20 A		12.5 A	
250 VAC	20 A		7.5 A		20 A		8.3 A	
500 VAC	15 A		4 A		10 A		2 A	
8 VDC	20 A		3 A	1.5 A	20 A		12.5 A	
14 VDC	20 A		3 A	1.5 A	15 A		12.5 A	
30 VDC	6 A		3 A	1.5 A	5 A		5 A	
125 VDC	0.5 A		0.5 A		0.05 A		0.05 A	
250 VDC	0.25 A		0.25 A		0.03 A		0.03 A	

MADE IN AUSTRALIA BY

KELCO Engineering Pty Ltd

ABN 20 002 834 844

Head office and factory

9/9 Powells Road Brookvale 2100 NSW Australia

Phone: +61 2 9905 6425 Fax: +61 2 9905 6420

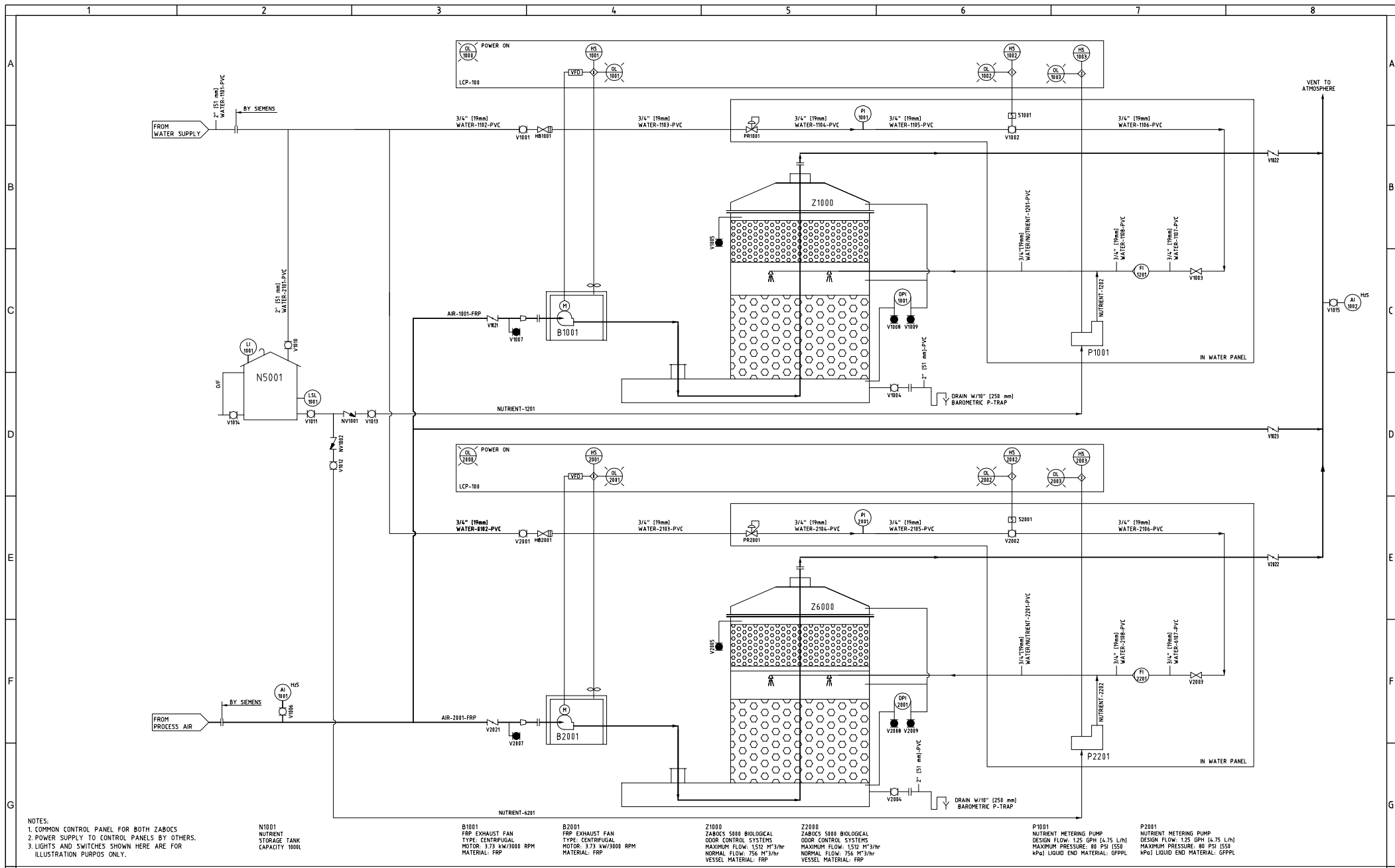
Email: sales@kelco.com.au Web: www.kelco.com.au

©2008 Kelco Engineering Pty Ltd

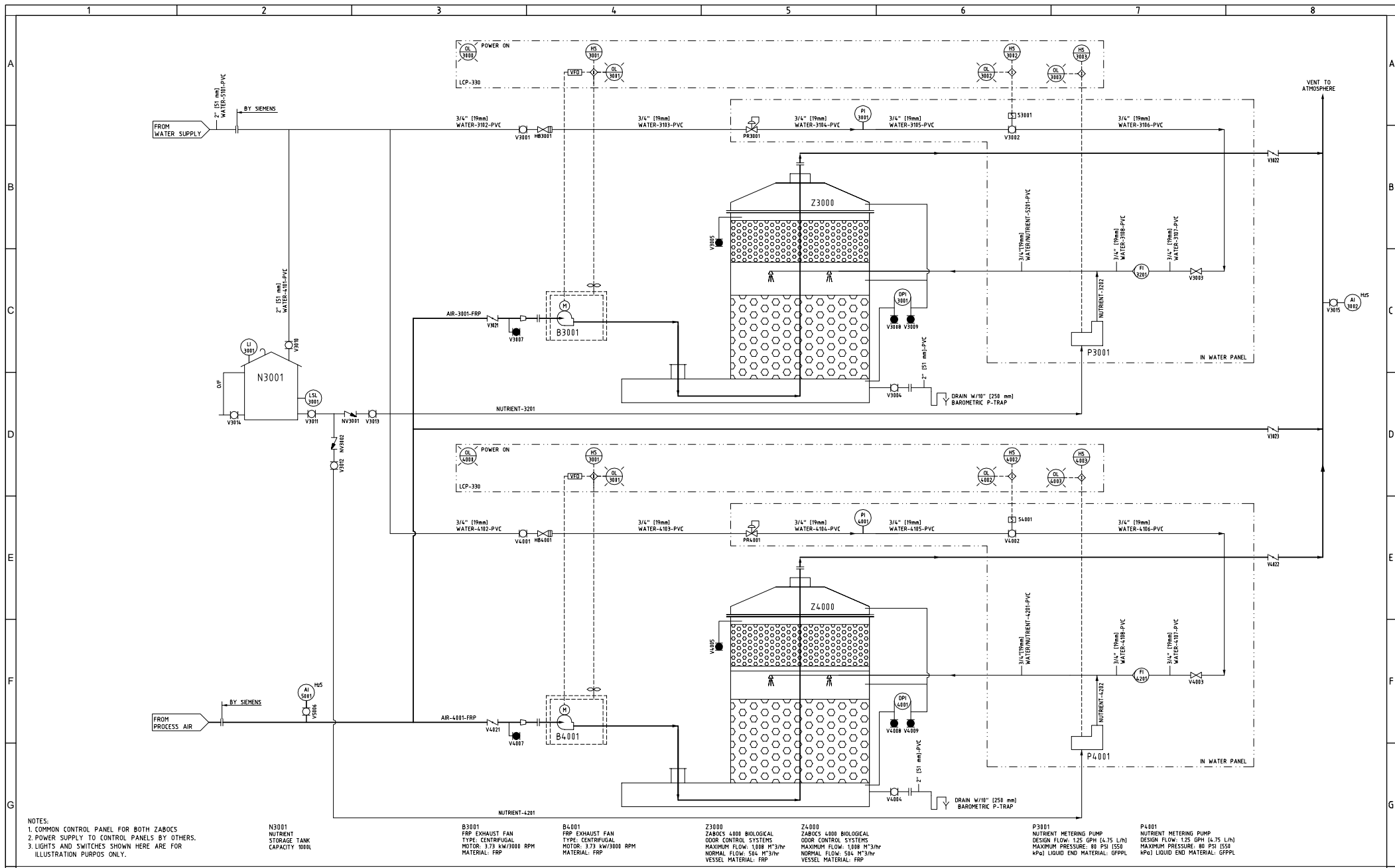
PLEASE NOTE: Kelco Engineering Pty Ltd reserves the right to change the specification of this product without notice. Kelco Engineering Pty Ltd accepts no liability for personal injury or economic loss as a consequence of the use of this product. All rights reserved copyright Kelco Engineering Pty Ltd © 2008.

11.0 SYSTEM DRAWINGS

11.1 PROCESS FLOW DIAGRAM

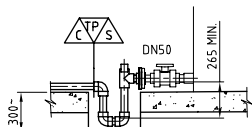


																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											</
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----

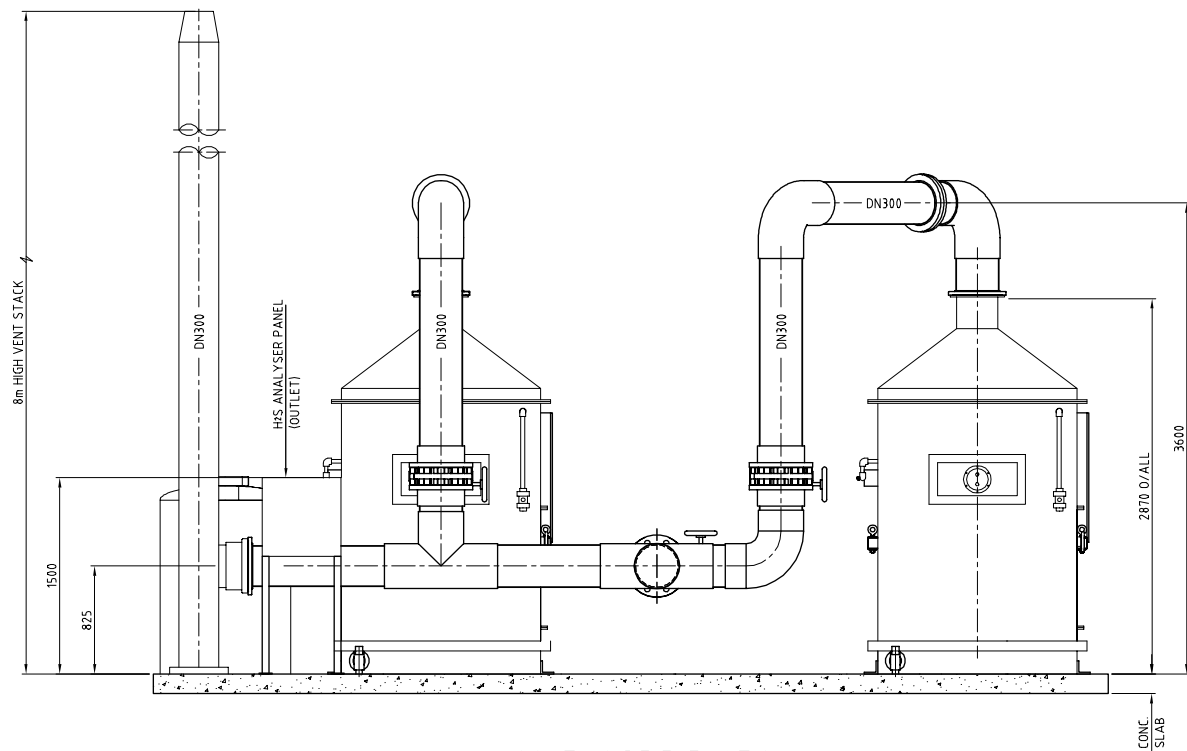


																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												</
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----

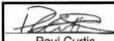
11.2 GENERAL ARRANGEMENT DRAWING



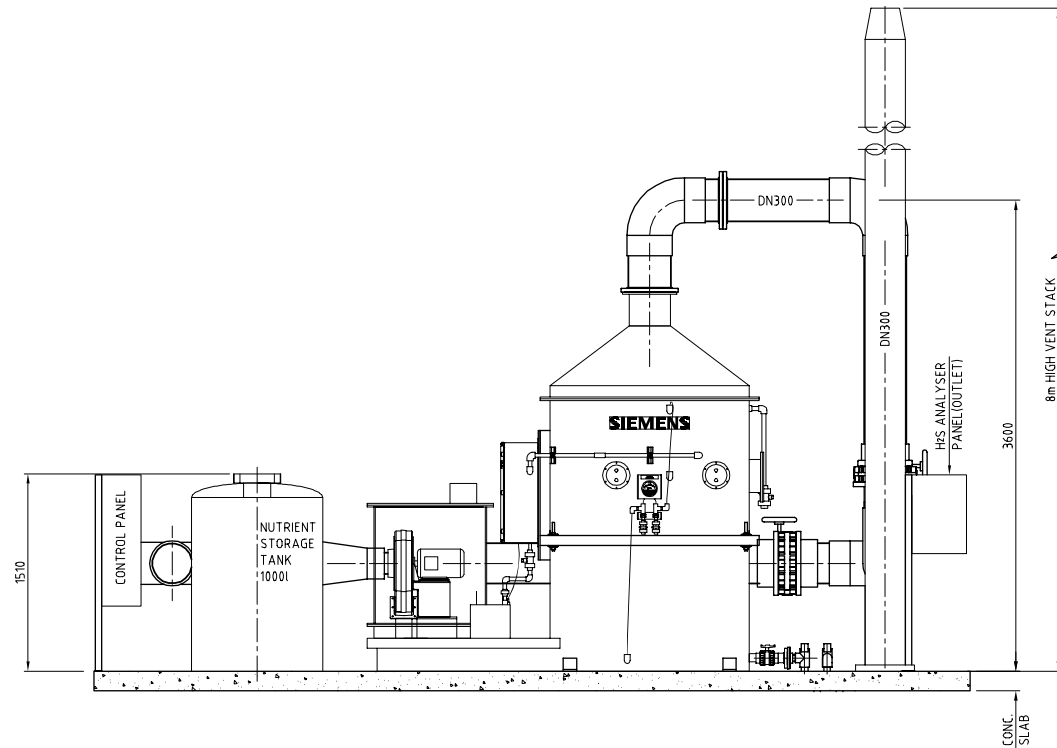
SYSTEM DRAIN TYP.



SOUTH SIDE ELEVATION


 Date: 12th January 2012
 Paul Curtis RPEQ No. 104193

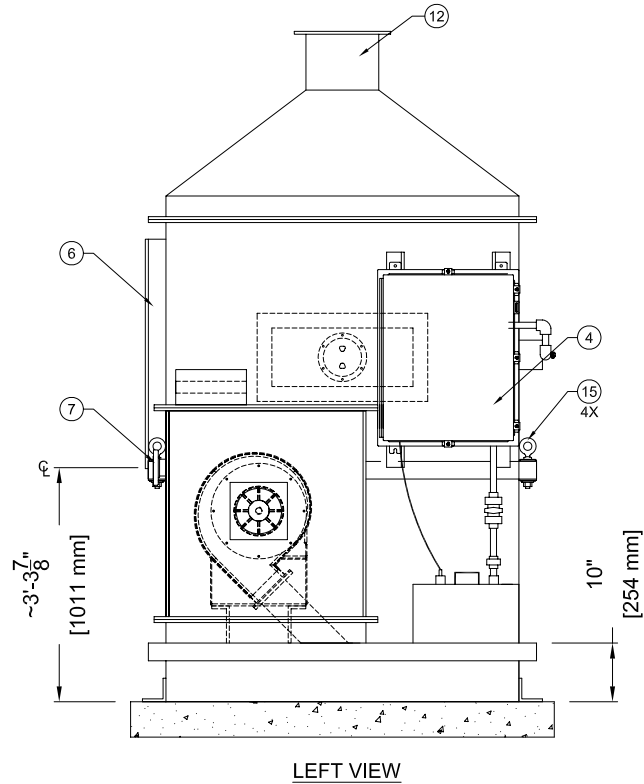
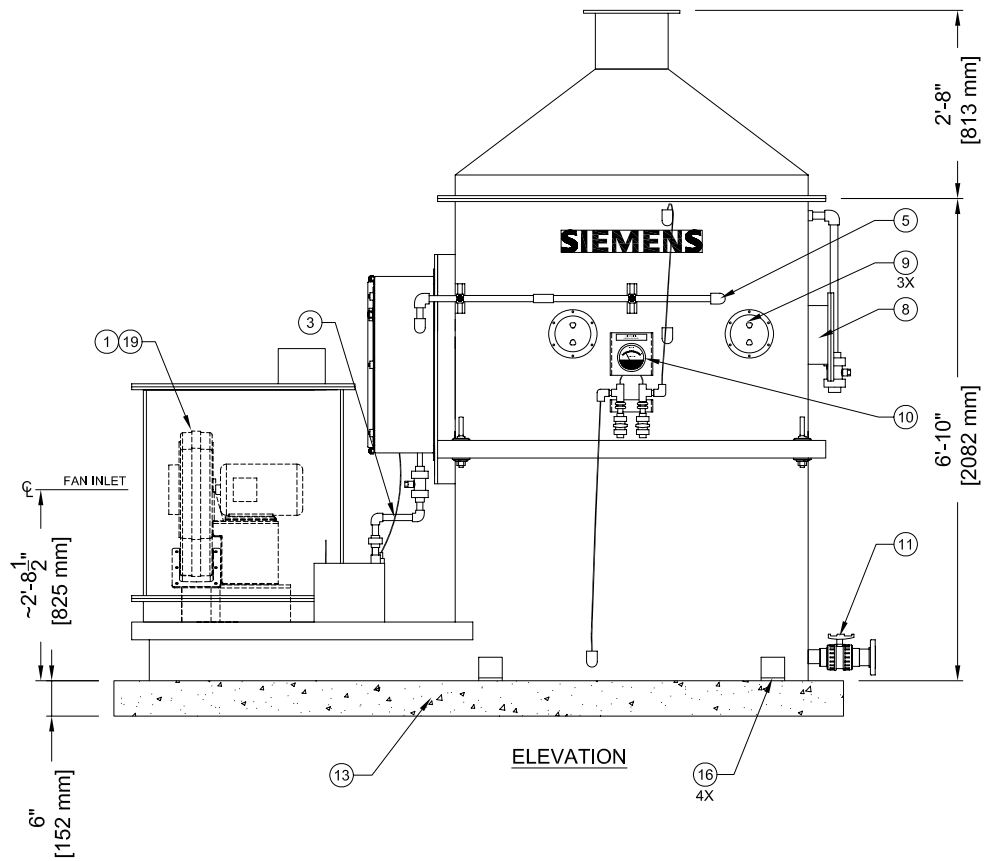
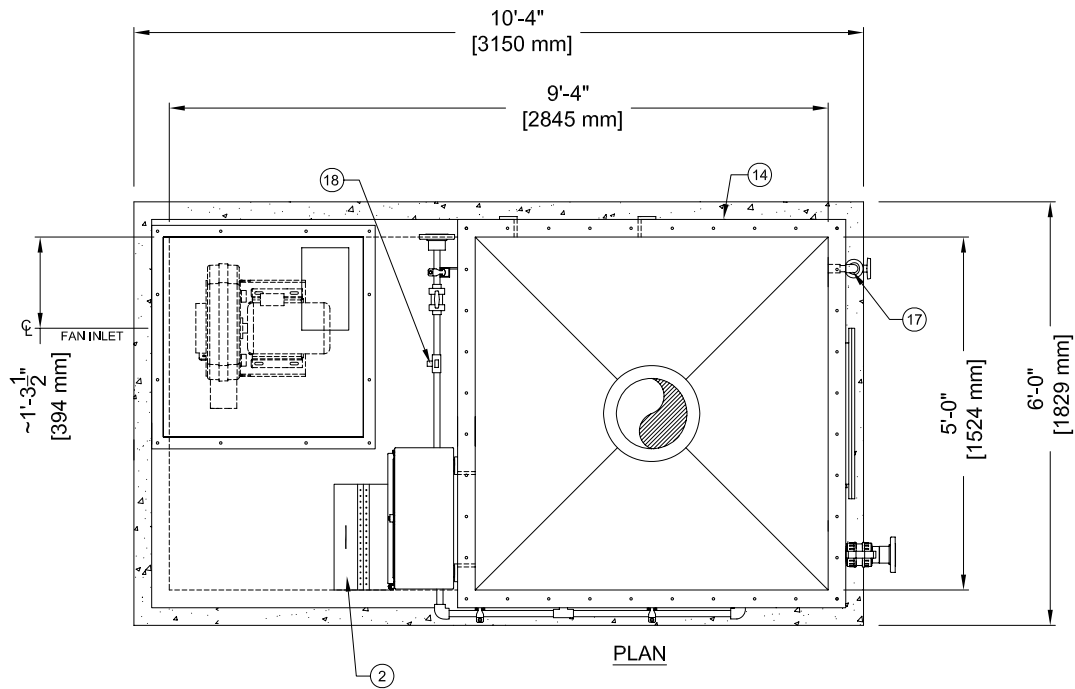
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--



WEST SIDE ELEVATION

Paul Curtis
Paul Curtis
Date: 12th August 2012
RPEQ No. 10413

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--



- NOMENCLATURE
1. FAN (8.75" [222 mm] OD SLIP-END INLET)
 2. NUTRIENT TANK
 3. NUTRIENT FEED LINE
 4. SST WATER CABINET
 5. WATER FEED LINE
 6. ELECTRICAL CONTROL PANEL MOUNTING BRACKET
 7. WATER INLET CONNECTION - 2" [50 mm] UNIVERSAL FLANGE
 8. MAIN ACCESS FLANGE
 9. ACCESS PORTS (TYP. OF 3)
 10. DIFFERENTIAL PRESSURE GAUGE
 11. SYSTEM DRAIN - 2" [50 mm] UNIVERSAL FLANGE
 12. STACK OUTLET FLANGE - 12" [305 mm] I.D
 13. SLOPED CONCRETE EQUIPMENT PAD
 14. ID TAG
 15. POSITIONING EYES (TYP. OF 4)
 16. ANCHOR LUGS (TYP. OF 4)
 17. OUTLET AIR SAMPLE PORT
 18. HOSE BIBB
 19. FRP FAN SOUND ENCLOSURE

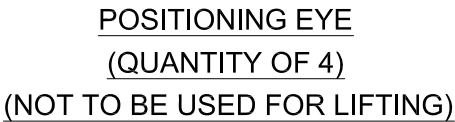
- NOTES:
1. APPROX. OPERATING WEIGHT: 8,500 LBS [3856 kg] (INCLUDES MEDIA)
 2. PLACE ON SLOPED CONCRETE, 5.5mm PER METER [1:192] FROM FAN TO DRAIN.
 3. SERVICE REQUIREMENTS:
ELECTRICAL: 400 VAC, 3PH, 25 AMPS, 50 HZ
POTABLE WATER: 3/4" [19 mm] LINE (30 PSI MIN.)
 4. BACKFLOW PREVENTER, IF REQUIRED, PROVIDED BY OTHERS.
 5. 10" [254 mm] BAROMETRIC P-TRAP ON DRAIN, PROVIDED BY OTHERS.
 6. ELECTRICAL CONTROL PANEL IS TO BE PROVIDED BY OTHERS.
 7. INLET AIR SAMPLE PORT IS TO BE PROVIDED LOOSE AND INSTALLED ON THE INLET DUCTWORK BY OTHERS.

TYPICAL OF
2X SYSTEMS

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--



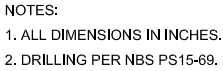
ANCHOR BOLTS TO BE 316 SS HVU ADHESIVE ANCHOR SYSTEM



A schematic diagram of a thick-walled cylinder. The cylinder is shown in cross-section, with a central bore of diameter ID and an outer diameter of OD. The bore centerline is indicated by a dashed line. The length of the cylinder is L, and the wall thickness is T. The bore centerline is also labeled as BC.

NOTES:

1. ALL DIMENSIONS IN INCHES.
2. DRILLING PER ANSI STANDARD B16.9.



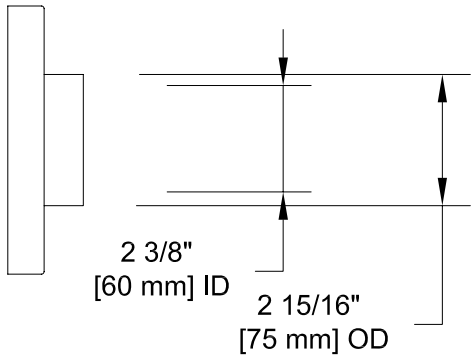
DRILLED DUCT FLANGES

ID	OD	BC	# HOLES	DIA	L	T	T
102 mm	213 mm	178 mm	4	11 mm	152 mm	10 mm	3 mm
152 mm	264 mm	229 mm	8	11 mm	152 mm	10 mm	3 mm
203 mm	314 mm	279 mm	8	11 mm	152 mm	10 mm	3 mm
254 mm	365 mm	330 mm	12	11 mm	152 mm	10 mm	3 mm
305 mm	416 mm	381 mm	12	11 mm	152 mm	10 mm	3 mm
356 mm	467 mm	432 mm	12	11 mm	152 mm	10 mm	3 mm
406 mm	518 mm	483 mm	16	11 mm	152 mm	13 mm	5 mm
457 mm	568 mm	533 mm	16	11 mm	152 mm	13 mm	5 mm
508 mm	619 mm	584 mm	20	11 mm	152 mm	13 mm	5 mm
610 mm	720 mm	686 mm	20	11 mm	152 mm	13 mm	5 mm
762 mm	873 mm	838 mm	28	11 mm	152 mm	13 mm	5 mm
914 mm	1026 mm	991 mm	32	11 mm	152 mm	13 mm	5 mm
1067 mm	1178 mm	1143 mm	36	11 mm	152 mm	16 mm	6 mm
1219 mm	1381 mm	1321 mm	44	14 mm	152 mm	16 mm	6 mm
1372 mm	1534 mm	1473 mm	48	14 mm	152 mm	16 mm	6 mm
1524 mm	1686 mm	1626 mm	52	14 mm	152 mm	16 mm	6 mm

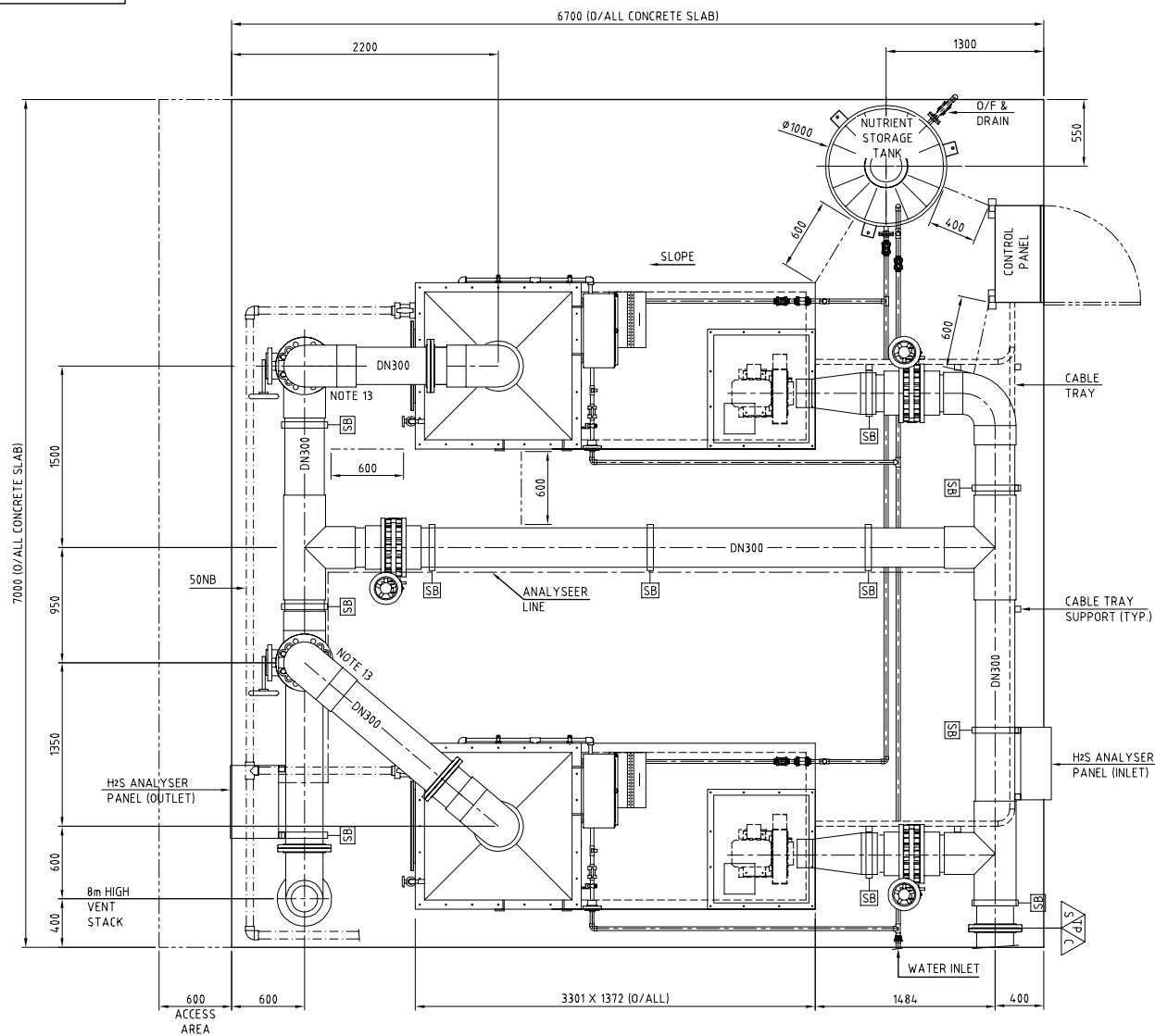
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

FAN INLET CONNECTION
(TYPICAL OF 1)
PER SYSTEM

WATER INLET AND DRAIN CONNECTION,
2" SCH 80 PVC DIAMETER UNIVERSAL FLANGE

[illegible]

FOR CONSTRUCTION



PLAN VIEW

REFERENCE DRAWING NO.	TITLE
QU-SP033-01-CIV-0110-0007/Rev1	SEWAGE PUMP STATION SP33 - GA
20338-PD-330	P&ID
20338-GA-331	SOUTH SIDE ELEVATION
20338-GA-332	EAST SIDE ELEVATION
20338-GA-333	WEST SIDE ELEVATION

NOTES:

1. EACH ZABOC VESSEL
APPROX OPERATING WEIGHT : 2722kg(INCLUDES MEDIA)
2. PLACE ZABOC VESSEL ON SLOPED CONCRETE 5.5mm PER METER (1:192)
FROM FAN TO DRAIN.
3. POTABLE WATER SERVICE REQUIREMENTS : 210kPa(MIN.)
4. BACK FLOW PREVENTOR, IF REQUIRED, PROVIDED BY OTHERS.
5. ALL VESSELS AND TANKS TO BE LEVELLED ON SITE AND FIXED USING
SS ANCHORS
6. ALL NUTRIENT PIPE WORK IS MADE OF GREY UPVC SCHEDULE 80
UNPAINTED.
7. ALL PIPE WORK TO BE INSTALLED WITH A SUITABLE GRADE TO ALLOW
FREE DRAINING.
8. PVC CEMENT AND CLEANER TO BE USED FOR ALL PVC PIPE WORK.
9. PIPES TO BE SUPPORTED USING GALVANIZED UNISTRUT, FLOOR
MOUNTED WITH SUITABLE GROUTING.
10. NYLON GASKETS TO BE USED ON UNISTRUT BASE TO PROVIDE
CORROSION PROTECTION.
11. SIGNAGE TO BE PROVIDED BY OTHERS
12. SUITABLE SUPPORT MEDIA TO BE PROVIDED BENEATH VESSELS.
13. SUPPORT DETAILS TO BE CONFIRM.

----- DRAIN TO WET WELL (BY OTHERS)

SB SUPPORT BRACKET

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

FOR CONSTRUCTION

TP
C S

BY OTHERS

DN50

SYSTEM DRAIN TYP.

8m HIGH VENT STACK

3600

DN300

H₂S ANALYSER PANEL(OUTLET)

DN300

H₂S ANALYSER PANEL(INLET)

757 INLET

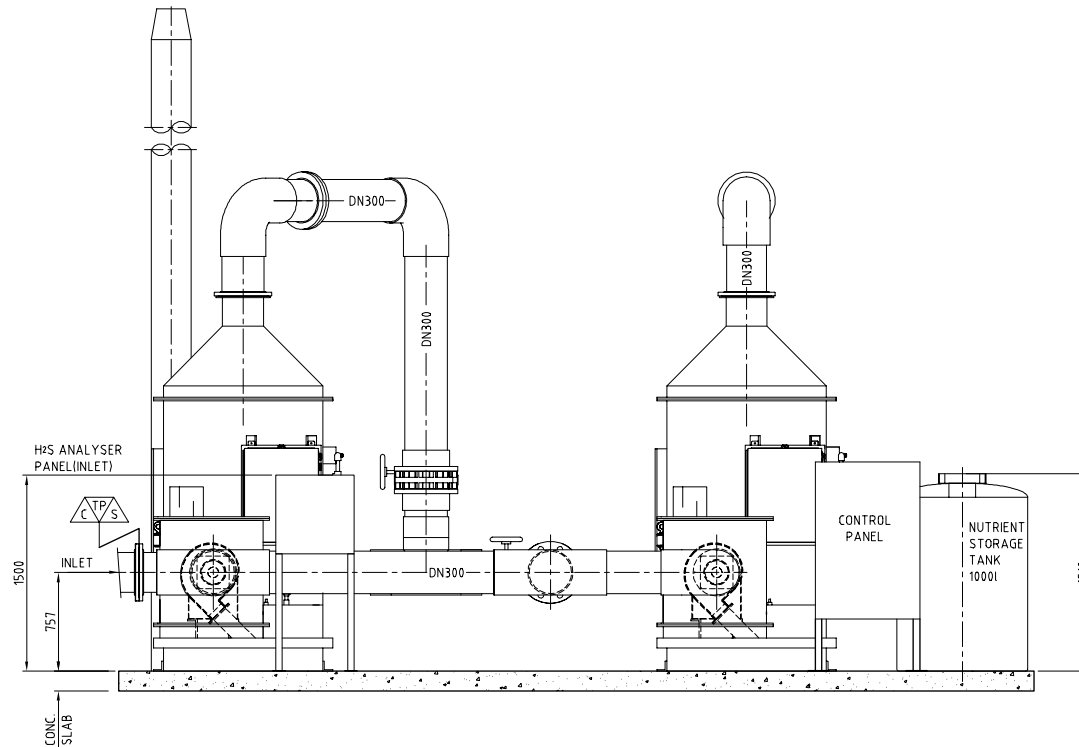
CONC. SLAB

SOUTH SIDE ELEVATION

SYSTEM DRAIN TYP.

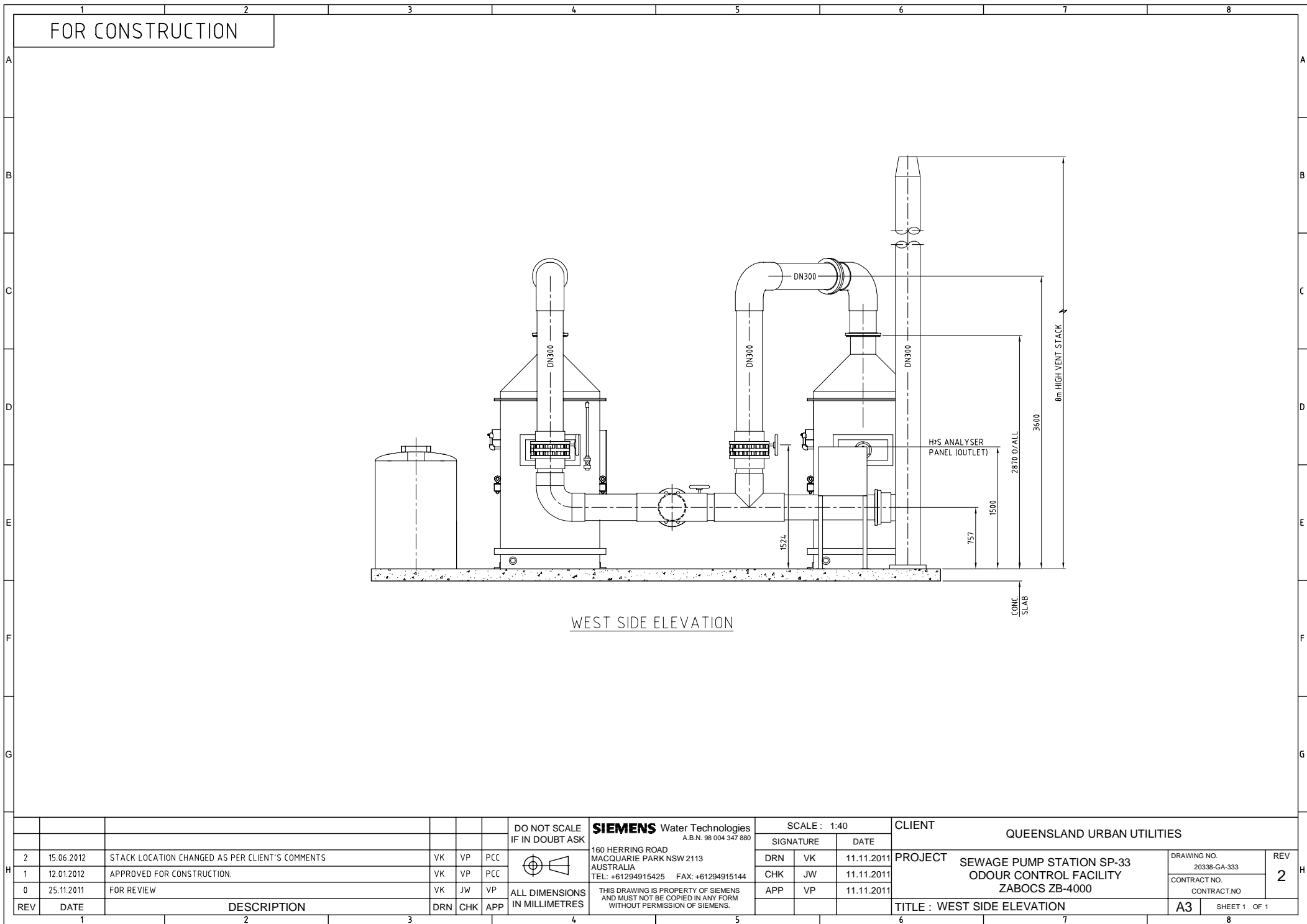
[illegible]

FOR CONSTRUCTION



EAST SIDE ELEVATION

																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				</
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----





NOMENCLATURE

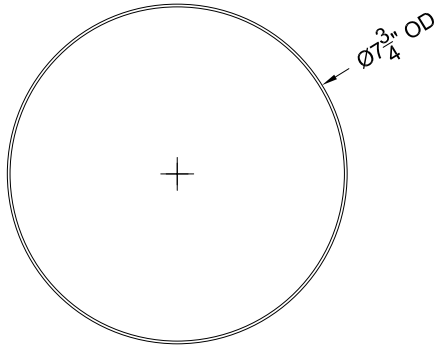
1. FAN (7.75" [197 mm] O.D. SLIP-END INLET)
2. NUTRIENT TANK
3. NUTRIENT FEED LINE
4. SST WATER CABINET
5. WATER FEED LINE
6. ELECTRICAL CONTROL PANEL MOUNTING BRACKET
7. WATER INLET CONNECTION - 2" [50 mm] UNIVERSAL FLANGE
8. MAIN ACCESS FLANGE
9. ACCESS PORTS (TYP. OF 3)
10. DIFFERENTIAL PRESSURE GAUGE
11. SYSTEM DRAIN - 2" [50 mm] UNIVERSAL FLANGE
12. STACK OUTLET FLANGE - 12" [305 mm] I.D.
13. SLOPED CONCRETE EQUIPMENT PAD
14. ID TAG
15. POSITIONING EYES (TYP. OF 4)
16. ANCHOR LUGS (TYP. OF 4)
17. OUTLET AIR SAMPLE PORT
18. HOSE BIBB
19. FRP FAN SOUND ENCLOSURE

NOTES:

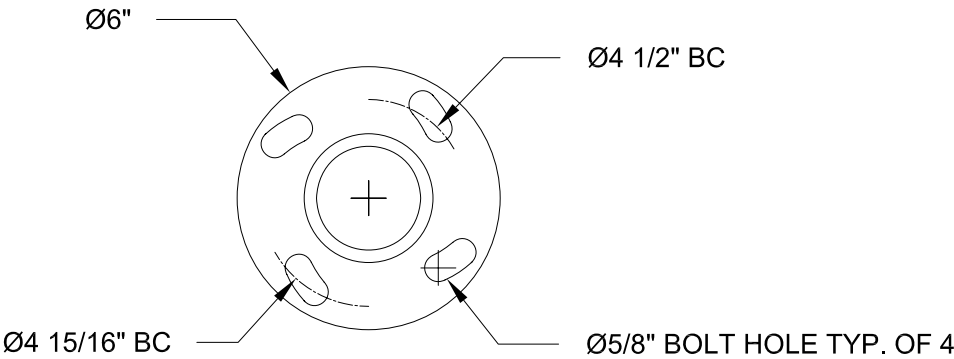
1. APPROX. OPERATING WEIGHT: 6,000 LBS [2722 kg] (INCLUDES MEDIA)
2. PLACE ON SLOPED CONCRETE, 5.5mm PER METER [1:192] FROM FAN TO DRAIN.
3. SERVICE REQUIREMENTS:
 - ELECTRICAL: 400 VAC, 3PH, 25 AMPS, 50 HZ
 - POTABLE WATER: $\frac{3}{4}$ " [19 mm] LINE (30 PSI MIN.)
4. BACKFLOW PREVENTER, IF REQUIRED, PROVIDED BY OTHERS.
5. 10" [254 mm] BAROMETRIC P-TRAP ON DRAIN, PROVIDED BY OTHERS.
6. ELECTRICAL CONTROL PANEL IS TO BE PROVIDED BY OTHERS.
7. INLET AIR SAMPLE PORT IS TO BE PROVIDED LOOSE AND INSTALLED ON THE INLET DUCTWORK BY OTHERS.

TYPICAL OF 2X SYSTEMS

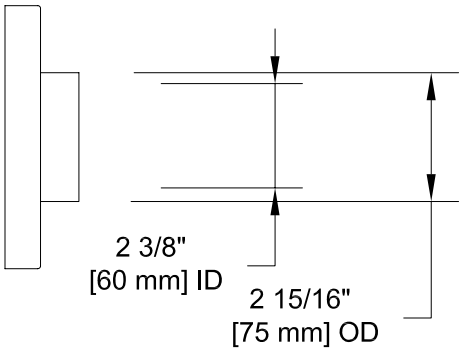
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--



FAN INLET CONNECTION
(TYPICAL OF 1)
PER SYSTEM

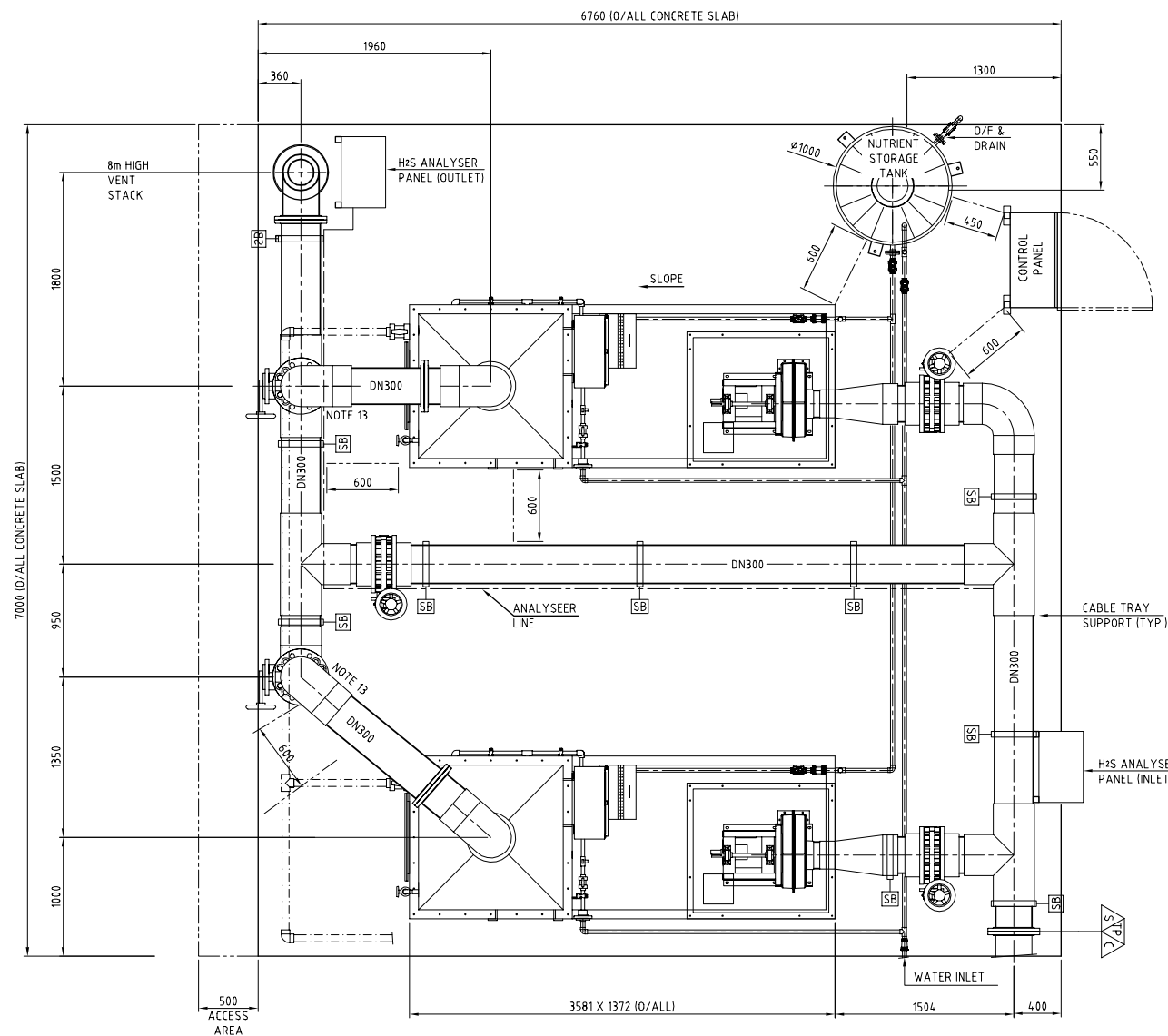


WATER INLET AND DRAIN CONNECTION,
2" SCH 80 PVC DIAMETER UNIVERSAL FLANGE



--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

FOR CONSTRUCTION



PLAN VIEW


REFERENCE DRAWING NO.	TITLE
QU-SP034-01-CIV-0110-0017/Rev1	SEWAGE PUMP STATION SP34 - GA
20338-PD-340	P&ID
20338-GA-341	SOUTH SIDE ELEVATION
20338-GA-342	EAST SIDE ELEVATION
20338-GA-343	WEST SIDE ELEVATION

NOTES:

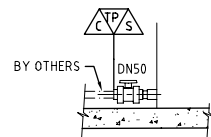
1. EACH ZABOC VESSEL
APPROX OPERATING WEIGHT : 2722kg(INCLUDES MEDIA)
2. PLACE ZABOC VESSEL ON SLOPED CONCRETE 5.5mm PER METER (1:192)
FROM FAN TO DRAIN.
3. POTABLE WATER SERVICE REQUIREMENTS : 210kPa(MIN.)
4. BACK FLOW PREVENTOR, IF REQUIRED, PROVIDED BY OTHERS.
5. ALL VESSELS AND TANKS TO BE LEVELLED ON SITE AND FIXED USING
SS ANCHORS
6. ALL NUTRIENT PIPE WORK IS MADE OF GREY UPVC SCHEDULE 80
UNPAINTED.
7. ALL PIPE WORK TO BE INSTALLED WITH A SUITABLE GRADE TO ALLOW
FREE DRAINING.
8. PVC CEMENT AND CLEANER TO BE USED FOR ALL PVC PIPE WORK.
9. PIPES TO BE SUPPORTED USING GALVANIZED UNISTRUT, FLOOR
MOUNTED WITH SUITABLE GROUTING.
10. NYLON GASKETS TO BE USED ON UNISTRUT BASE TO PROVIDE
CORROSION PROTECTION.
11. SIGNAGE TO BE PROVIDED BY OTHERS
12. SUITABLE SUPPORT MEDIA TO BE PROVIDED BENEATH VESSELS.
13. SUPPORT DETAILS TO BE CONFIRM.

--- DRAIN TO WET WELL (BY OTHERS)

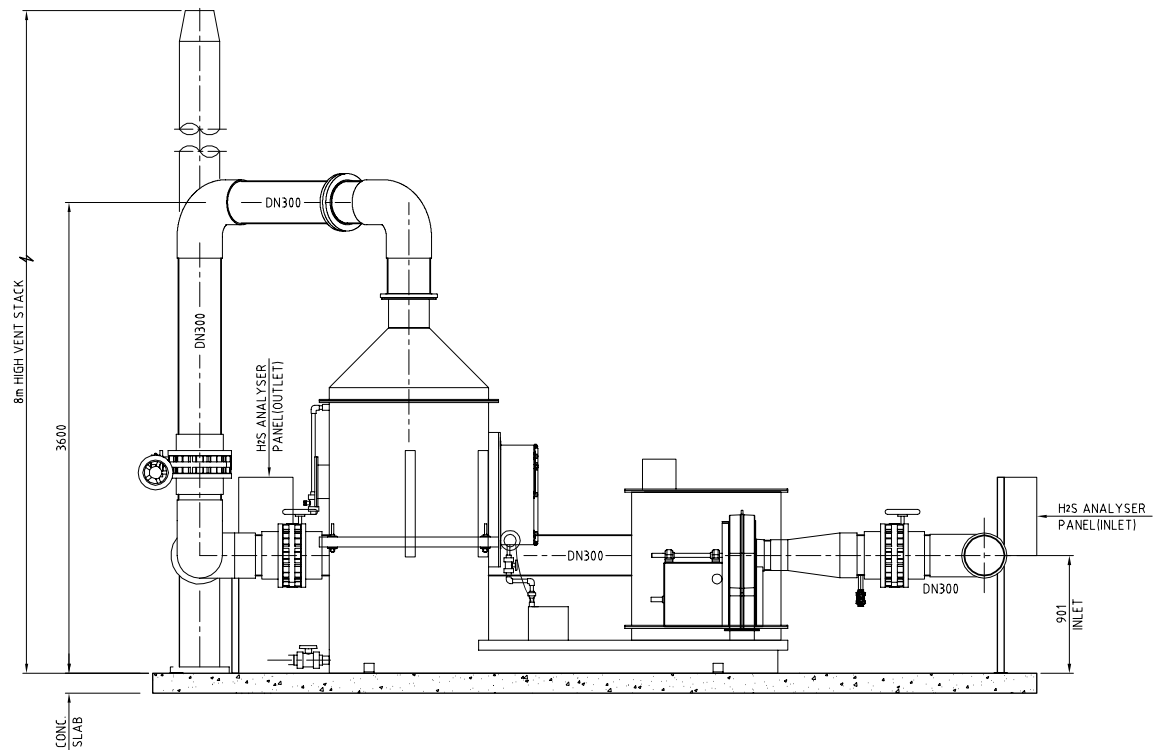
SB SUPPORT BRACKET

									DO NOT SCALE IF IN DOUBT ASK		SIEMENS Water Technologies A.B.N. 98 004 347 880		SCALE : 1:40		CLIENT								
											160 HERRING ROAD MACQUARIE PARK NSW 2113 AUSTRALIA TEL: +61294915425 FAX: +61294915144		SIGNATURE		DATE		QUEENSLAND URBAN UTILITIES						
H	2	15.06.2012	APPROVED FOR CONSTRUCTION.				VK	VP	PCC		THIS DRAWING IS PROPERTY OF SIEMENS AND MUST NOT BE COPIED IN ANY FORM WITHOUT PERMISSION OF SIEMENS.	DRN		VK		11.11.2011		PROJECT	SEWAGE PUMP STATION SP-34 ODOUR CONTROL FACILITY ZABOCS ZB-4000		DRAWING NO. 20338-GA-340		REV 2
	1	12.01.2012	APPROVED FOR CONSTRUCTION.				VK	VP	PCC			CHK		JW		11.11.2011					CONTRACT NO. CONTRACT.NO		
	0	25.11.2011	FOR REVIEW				VK	JW	VP			APP		VP		11.11.2011							
REV		DATE		DESCRIPTION				DRN	CHK	APP	ALL DIMENSIONS IN MILLIMETRES						TITLE : GENERAL ARRANGEMENT-PLAN				A3	SHEET 1 OF 1	
		1		2				3				4		5		6		7				8	

FOR CONSTRUCTION



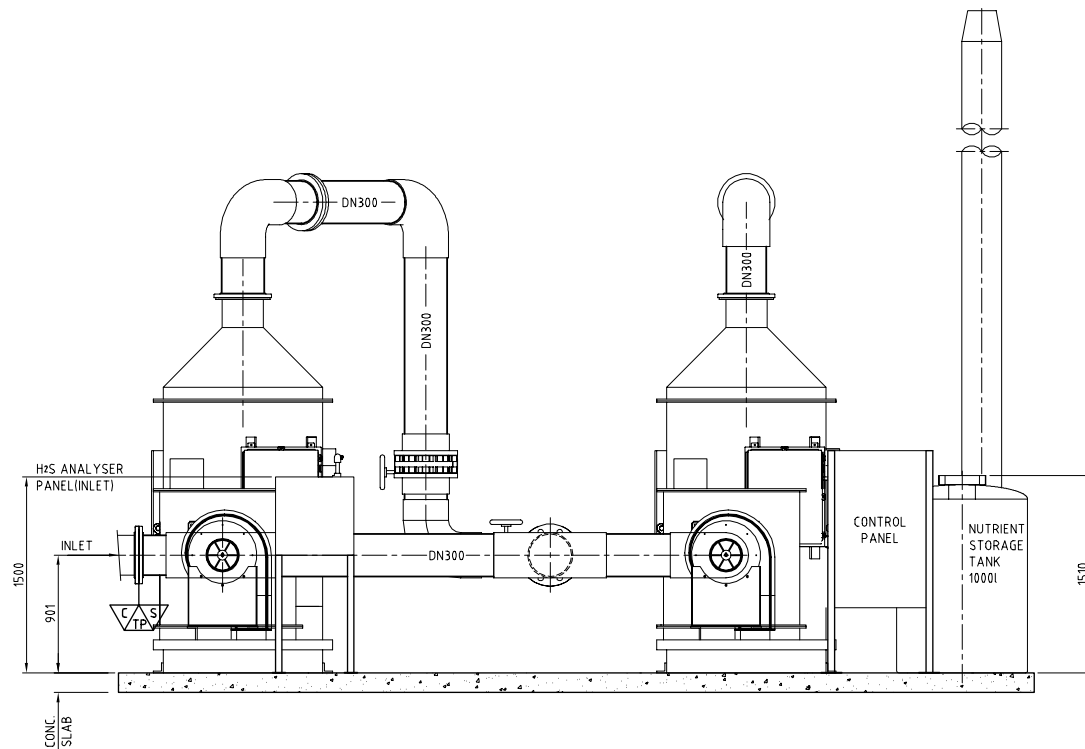
SYSTEM DRAIN TYP.




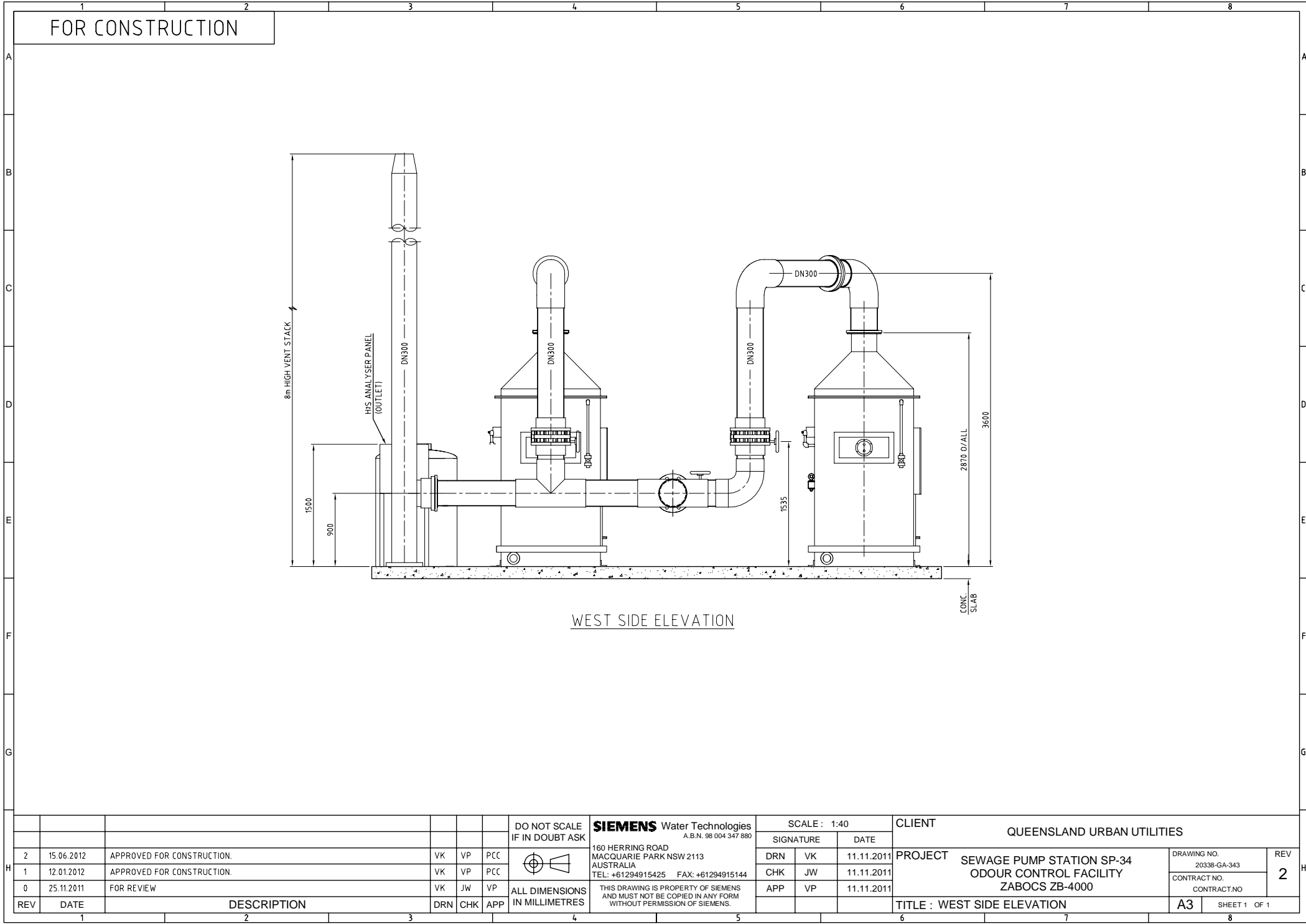
SOUTH SIDE ELEVATION

						DO NOT SCALE IF IN DOUBT ASK	SIEMENS Water Technologies <small>A.B.N. 98 004 347 880</small> 160 HERRING ROAD MACQUARIE PARK NSW 2113 AUSTRALIA TEL: +61294915425 FAX: +61294915144	SCALE : 1:40		CLIENT QUEENSLAND URBAN UTILITIES			
REV	DATE	DESCRIPTION	DRN	CHK	APP			SIGNATURE	DATE	PROJECT SEWAGE PUMP STATION SP-34 ODOUR CONTROL FACILITY ZABOCS ZB-4000		DRAWING NO. 20338-GA-341	REV
2	15.06.2012	APPROVED FOR CONSTRUCTION.	VK	VP	PCC		THIS DRAWING IS PROPERTY OF SIEMENS AND MUST NOT BE COPIED IN ANY FORM WITHOUT PERMISSION OF SIEMENS.	DRN	VK	11.11.2011	TITLE : SOUTH SIDE ELEVATION	CONTRACT NO.	2
1	12.01.2012	APPROVED FOR CONSTRUCTION.	VK	VP	PCC			CHK	JW	11.11.2011		CONTRACT.NO.	
0	25.11.2011	FOR REVIEW	VK	JW	VP			APP	VP	11.11.2011			
						ALL DIMENSIONS IN MILLIMETRES						A3	SHEET 1 OF 1

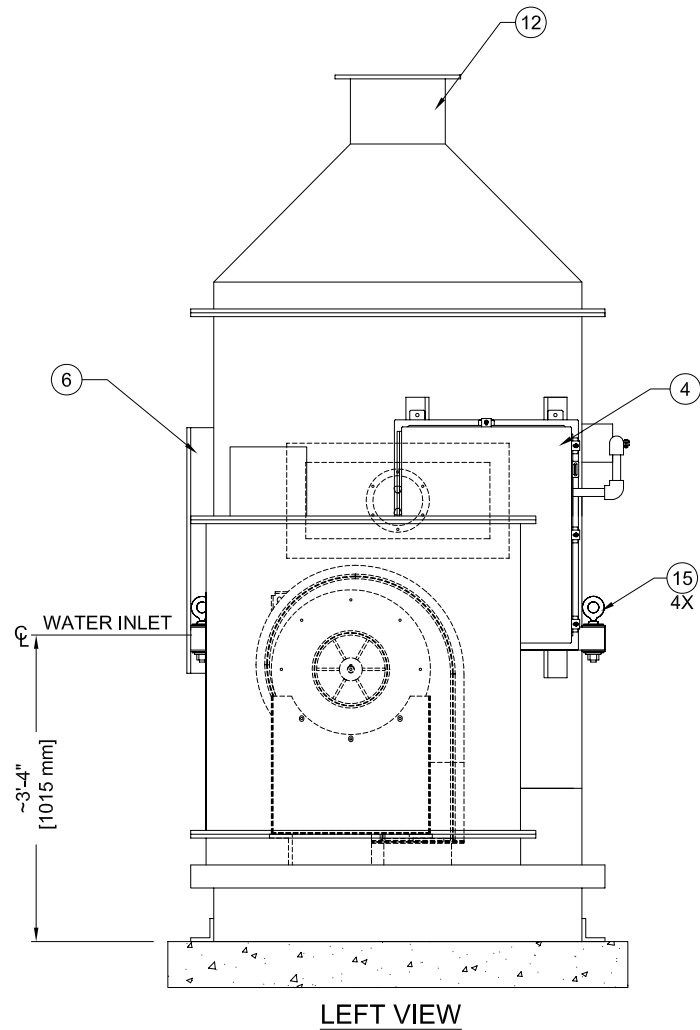
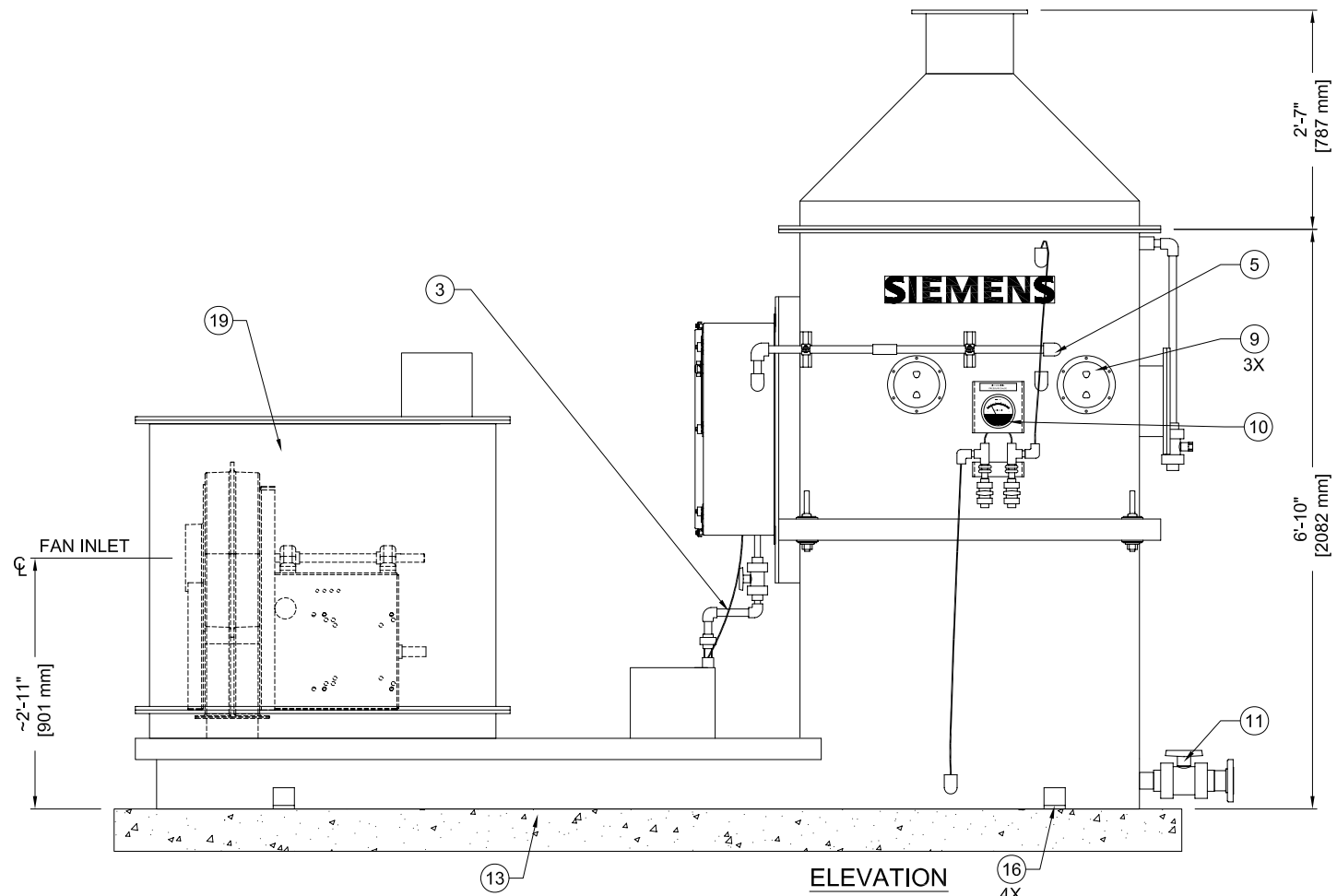
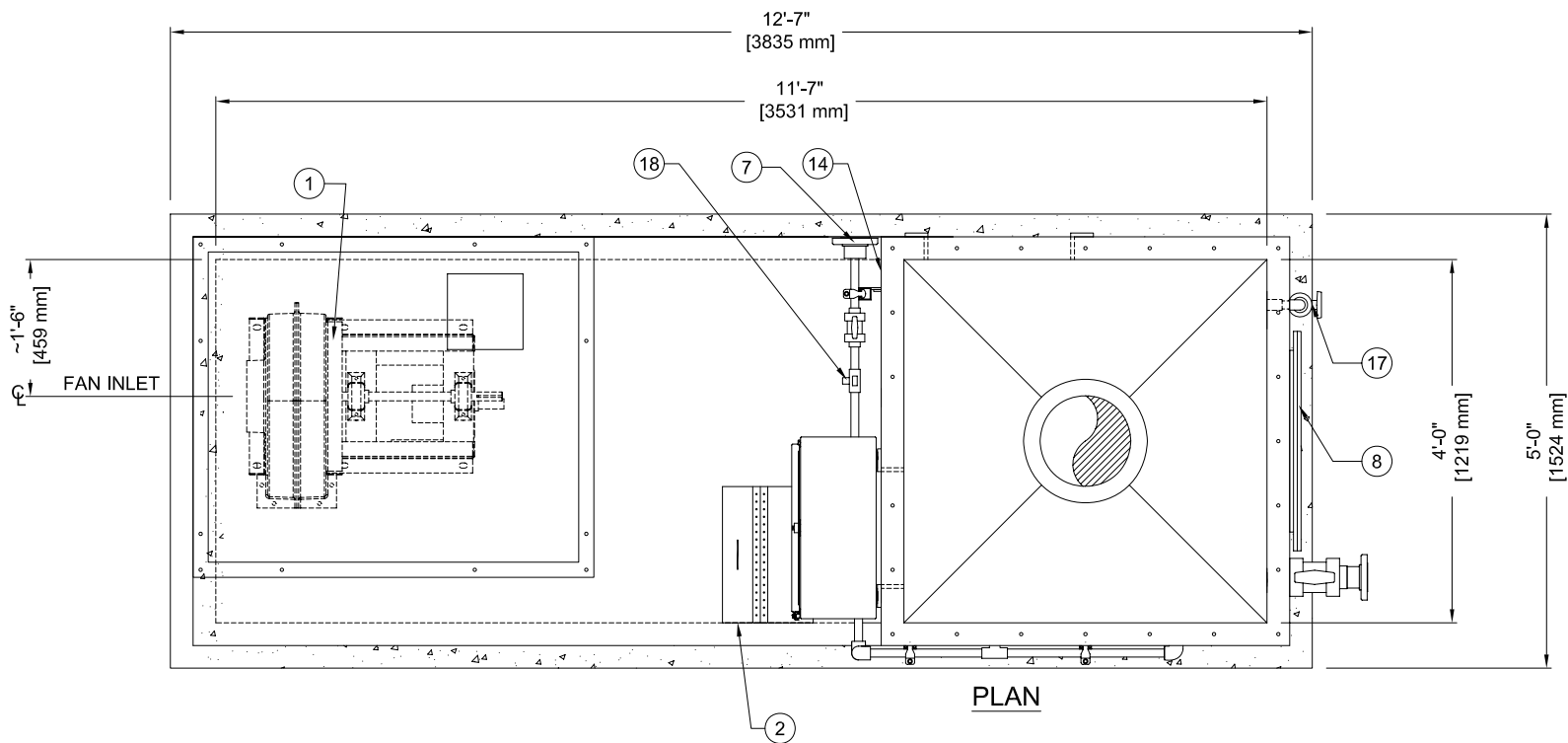
FOR CONSTRUCTION



										DO NOT SCALE IF IN DOUBT ASK		SIEMENS Water Technologies A.B.N. 98 004 347 880		SCALE : 1:40		CLIENT								
												160 HERRING ROAD MACQUARIE PARK NSW 2113 AUSTRALIA TEL: +61294915425 FAX: +61294915144		SIGNATURE		DATE		QUEENSLAND URBAN UTILITIES						
2	15.06.2012	APPROVED FOR CONSTRUCTION.				VK	VP	PCC			DRN		VK	11.11.2011	PROJECT SEWAGE PUMP STATION SP-34 ODOUR CONTROL FACILITY ZABOCS ZB-4000				DRAWING NO. 20338-GA-342		REV 2			
1	12.01.2012	APPROVED FOR CONSTRUCTION.				VK	VP	PCC			CHK		JW	11.11.2011					CONTRACT NO. CONTRACT.NO					
0	25.11.2011	FOR REVIEW				VK	JW	VP	ALL DIMENSIONS IN MILLIMETRES		APP		VP	11.11.2011	THIS DRAWING IS PROPERTY OF SIEMENS AND MUST NOT BE COPIED IN ANY FORM WITHOUT PERMISSION OF SIEMENS.				TITLE : EAST SIDE ELEVATION		A3		SHEET 1 OF 1	
REV	DATE	DESCRIPTION				DRN	CHK	APP																



						DO NOT SCALE IF IN DOUBT ASK	SIEMENS Water Technologies A.B.N. 98 004 347 880 160 HERRING ROAD MACQUARIE PARK NSW 2113 AUSTRALIA TEL: +61294915425 FAX: +61294915144	SCALE : 1:40		CLIENT QUEENSLAND URBAN UTILITIES					
							THIS DRAWING IS PROPERTY OF SIEMENS AND MUST NOT BE COPIED IN ANY FORM WITHOUT PERMISSION OF SIEMENS.	SIGNATURE		DATE	PROJECT SEWAGE PUMP STATION SP-34 ODOUR CONTROL FACILITY ZABOCS ZB-4000		DRAWING NO. 20338-GA-343	REV 2	
2	15.06.2012	APPROVED FOR CONSTRUCTION.	VK	VP	PCC			DRN	VK	11.11.2011					
1	12.01.2012	APPROVED FOR CONSTRUCTION.	VK	VP	PCC			CHK	JW	11.11.2011					
0	25.11.2011	FOR REVIEW	VK	JW	VP			APP	VP	11.11.2011					
REV	DATE	DESCRIPTION			DRN	CHK	APP	ALL DIMENSIONS IN MILLIMETRES		TITLE : WEST SIDE ELEVATION				A3	SHEET 1 OF 1
1		2		3		4		5		6		7		8	



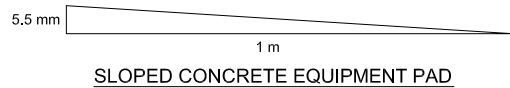
NOMENCLATURE

1. FAN (9.4375" [240 mm] O.D. SLIP-END INLET)
2. NUTRIENT TANK
3. NUTRIENT FEED LINE
4. SST WATER CABINET
5. WATER FEED LINE
6. ELECTRICAL CONTROL PANEL MOUNTING BRACKET
7. WATER INLET CONNECTION - 2" [50 mm] UNIVERSAL FLANGE
8. MAIN ACCESS FLANGE
9. ACCESS PORTS (TYP. OF 3)
10. DIFFERENTIAL PRESSURE GAUGE
11. SYSTEM DRAIN - 2" [50 mm] UNIVERSAL FLANGE
12. STACK OUTLET FLANGE - 12" [305 mm] I.D.
13. SLOPED CONCRETE EQUIPMENT PAD
14. ID TAG
15. POSITIONING EYES (TYP. OF 4)
16. ANCHOR LUGS (TYP. OF 4)
17. OUTLET AIR SAMPLE PORT
18. HOSE BIBB
19. FRP FAN SOUND ENCLOSURE

NOTES:

1. APPROX. OPERATING WEIGHT: 6,000 LBS [2,722 kg] (INCLUDES MEDIA)
2. PLACE ON SLOPED CONCRETE, 5.5mm PER METER [1:192] FROM FAN TO DRAIN.
3. SERVICE REQUIREMENTS:
 - ELECTRICAL: 400 VAC, 3PH, 25 AMPS, 50 HZ
 - POTABLE WATER: $\frac{3}{4}$ " [19 mm] LINE (30 PSI MIN.)
4. BACKFLOW PREVENTER, IF REQUIRED, PROVIDED BY OTHERS.
5. 14" [356 mm] BAROMETRIC P-TRAP ON DRAIN, PROVIDED BY OTHERS.
6. ELECTRICAL CONTROL PANEL IS TO BE PROVIDED BY OTHERS.
7. INLET AIR SAMPLE PORT IS TO BE PROVIDED LOOSE AND INSTALLED ON THE INLET DUCTWORK BY OTHERS.

TYPICAL OF 2X SYSTEMS




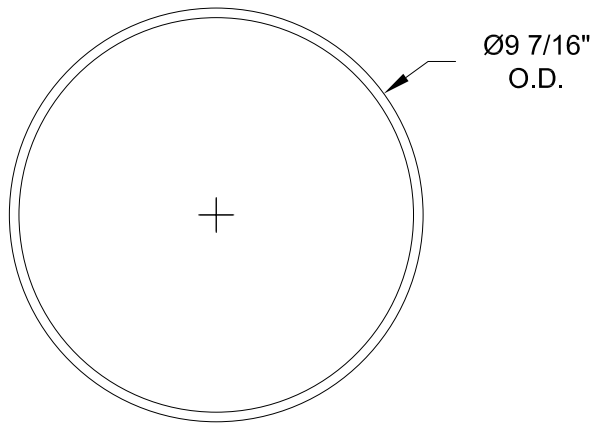
REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN

COMPANY CONFIDENTIAL

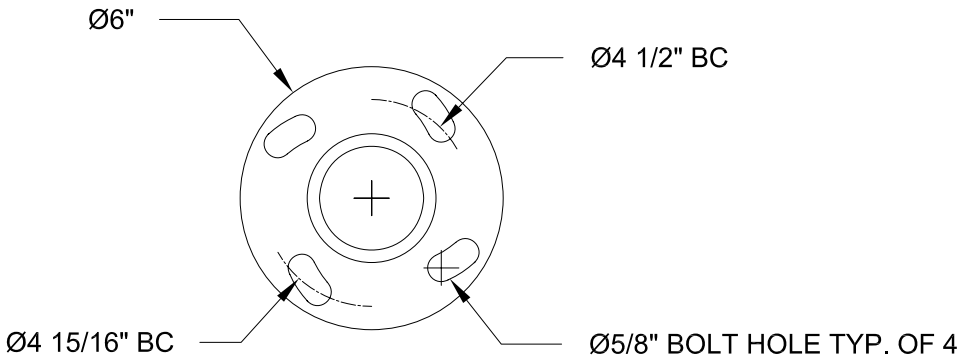
THIS DOCUMENT AND ALL INFORMATION CONTAINED HEREIN ARE THE PROPERTY OF SIEMENS AND/OR ITS AFFILIATES. THE DESIGN CONCEPTS AND INFORMATION ARE EXPRESSLY LOANED TO YOU AND ARE TO BE USED AND ARE SUBMITTED IN CONFIDENCE. THEY ARE NOT TRANSFERABLE AND MUST BE USED ONLY FOR THE PURPOSES FOR WHICH THE DOCUMENT IS EXPRESSLY LOANED. IT IS NOT TO BE COPIED, REPRODUCED, LOANED OR USED IN ANY OTHER MANNER WITHOUT THE EXPRESS WRITTEN CONSENT OF SIEMENS. IN NO EVENT SHALL THEY BE USED IN ANY MANNER THAT IS DETRIMENTAL TO THE INTERESTS OF SIEMENS. ALL RIGHTS ARE RESERVED. UPON THE DEMAND OF SIEMENS, THIS DOCUMENT, ALONG WITH ALL COPIES AND EXTRACTS, AND ALL RELATED NOTES AND ANALYSES, MUST BE RETURNED TO SIEMENS OR TO ANY OTHER AUTHORITY DESIGNATED BY SIEMENS. THE DELIVERY OF THIS DOCUMENT CONSTITUTES AGREEMENT TO THESE TERMS AND CONDITIONS.

DESIGNER NN	DATE 10/04/11
CHECKER DP	DATE 10/04/11
ENGINEER NN	DATE 10/04/11
MANAGER DP	DATE 10/04/11
FILE: 000202-G3	
SCALE: NTS	

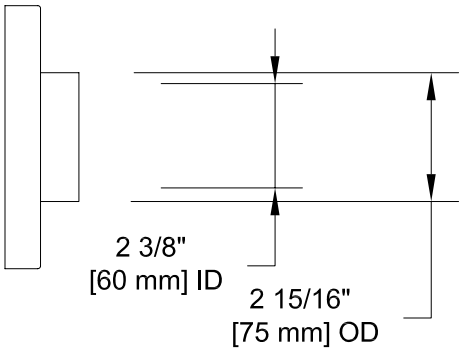
TITLE QUEENSLAND URBAN UTILITIES, SPS 34 ZB-4000 BIOLOGICAL ODOR CONTROL SYSTEM GENERAL ARRANGEMENT DRAWING				
CLIENT SIEMENS LTD AUSTRALIA				
<div style="display: flex; align-items: center;"> <div style="flex: 1;">  </div> <div style="flex: 1;"> Industry San Diego, CA 858-487-2200 </div> </div>				
PROJECT 000202	CODE —	DRAWING G3	SHEET 1 OF 3	REV —



FAN INLET CONNECTION
(TYPICAL OF 1)
PER SYSTEM



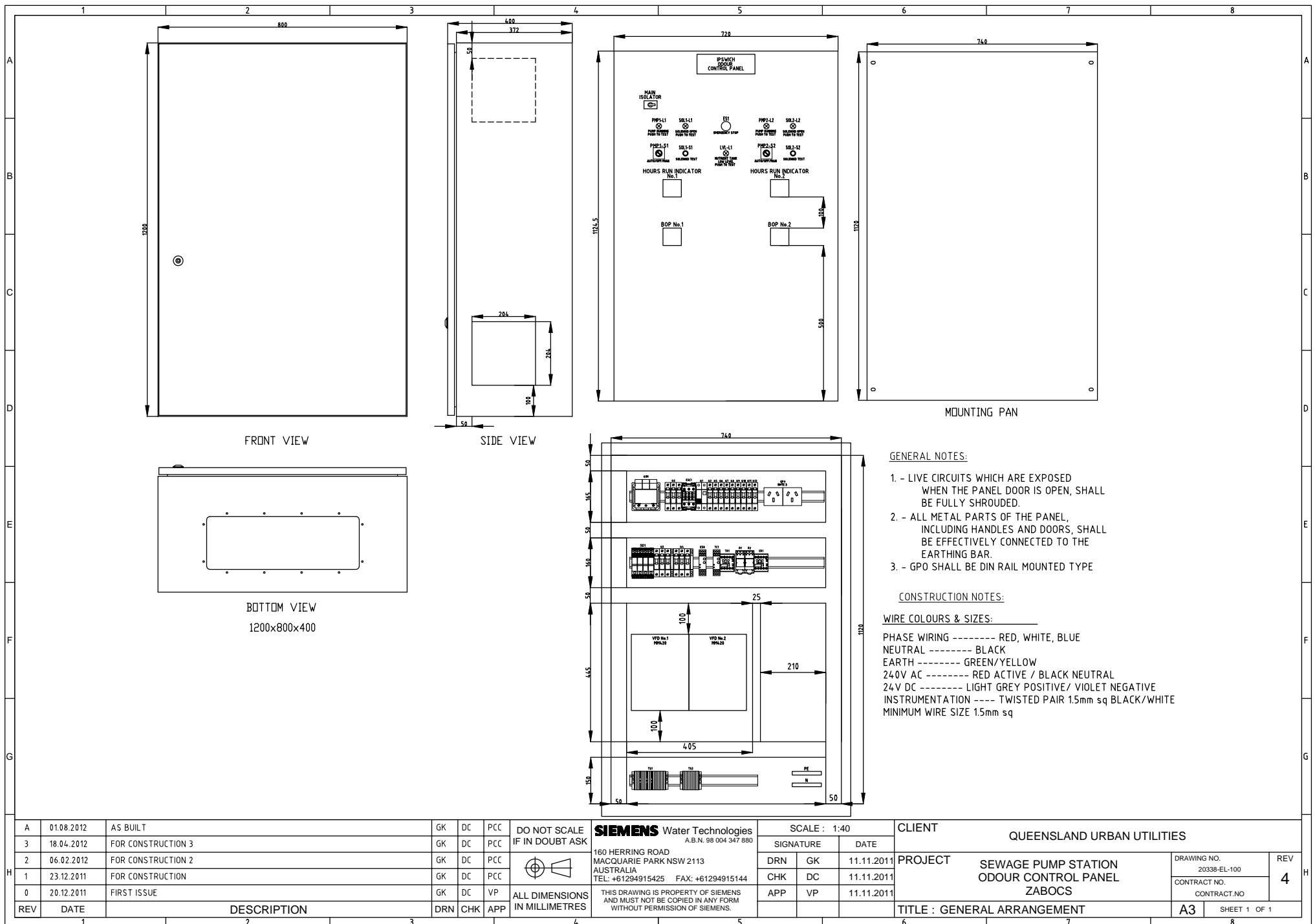
WATER INLET AND DRAIN CONNECTION,
2" SCH 80 PVC DIAMETER UNIVERSAL FLANGE



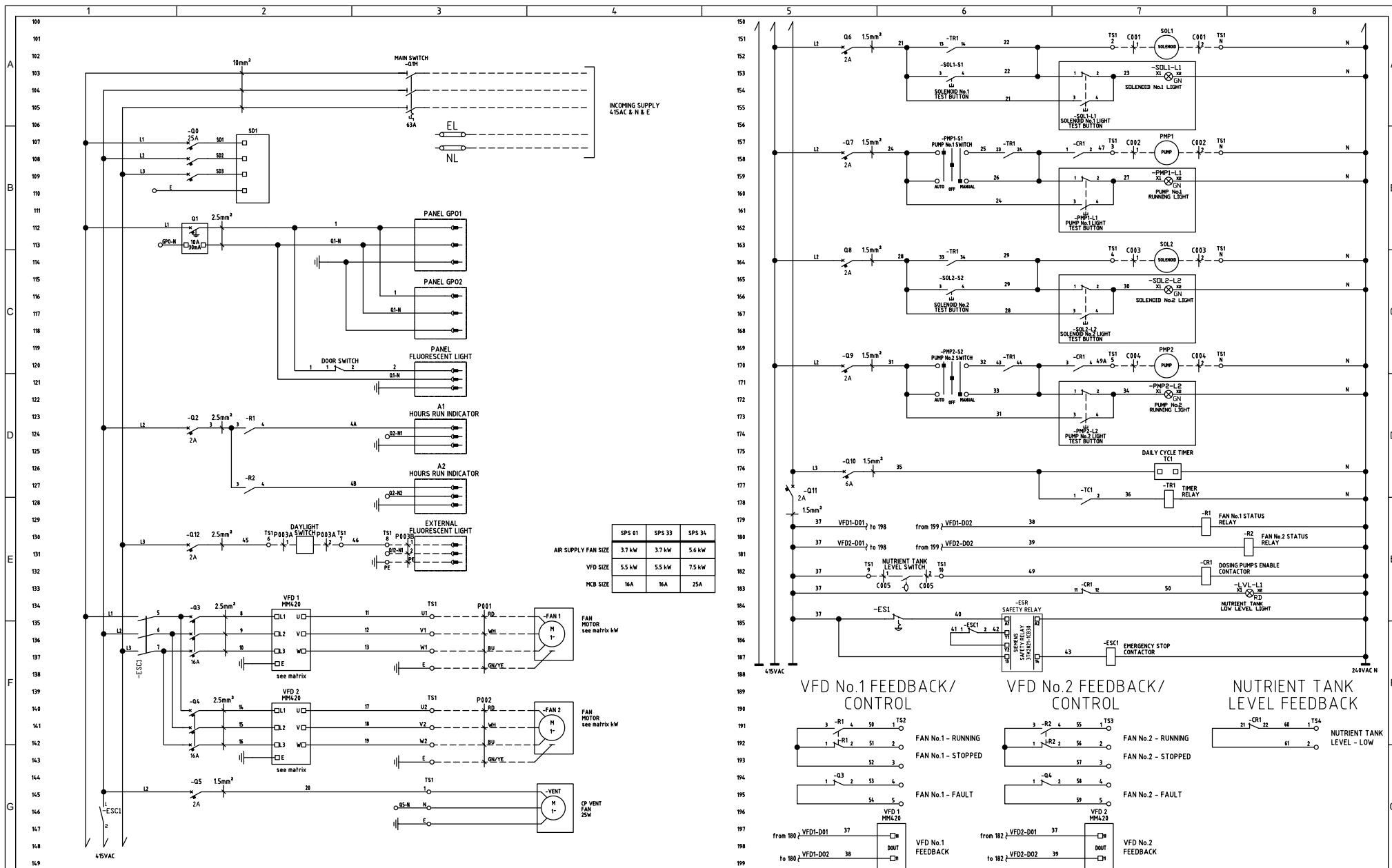
																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													</
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----

12.0 ELECTRICAL CONTROL PANEL

12.1 ELECTRICAL CONTROL PANEL FACE DRAWING



12.2 ELECTRICAL CONTROL PANEL LADDER LOGIC DIAGRAM



H	5	1.08.2012	AS BUILT	GK	DC	PCC	DO NOT SCALE IF IN DOUBT ASK	<div>SIEMENS Water Technologies A.B.N. 98 004 347 880</div> <div>160 HERRING ROAD MACQUARIE PARK NSW 2113 AUSTRALIA TEL: +61294915425 FAX: +61294915144</div> <div>THIS DRAWING IS PROPERTY OF SIEMENS AND MUST NOT BE COPIED IN ANY FORM WITHOUT PERMISSION OF SIEMENS.</div>	SCALE : 1:40		CLIENT				
	4	8.05.2012	CABLE NUMBERS ADDED FOR CONSTRUCTION	GK	DC	PCC			SIGNATURE		DATE	QUEENSLAND URBAN UTILITIES			
	3	18.04.2012	FOR CONSTRUCTION 3	GK	DC	PCC			DRN	GK	11.11.2011	PROJECT	SEWAGE PUMP STATION ODOUR CONTROL PANEL ZABOCS	DRAWING NO. 20338-EL-200	REV 5
	2	06.02.2012	FOR CONSTRUCTION 2	GK	DC	PCC			CHK	DC	11.11.2011			CONTRACT NO.	
	1	23.12.2011	FOR CONSTRUCTION	GK	DC	PCC			APP	VP	11.11.2011			CONTRACT NO.	
	REV	DATE	DESCRIPTION	DRN	CHK	APP	ALL DIMENSIONS IN MILLIMETRES					TITLE : WIRING DIAGRAM			A3
	1		2		3		4		5		6		7		8

12.3 TIMER MANUAL



Safety precautions

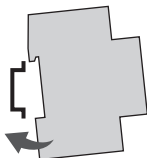
- The connection and installation of electrical devices may only be carried out by a qualified electrician.
- Interventions in and changes to the device result in the voiding of the warranty claim.
- Observe your national regulations and the respective safety provisions.
- Fixed and flexible conductors of up to 10 mm² may be attached to the external terminal clips.
- Flexible cables with a cross-section ≤ 1 mm² should not be attached.

General information

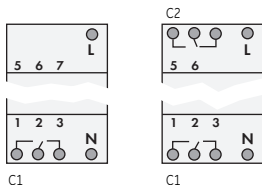
- Deactivation commands take priority over activation commands.
- If the power supply is correct, the dots shown between the hours and minutes (HH:MM) are displayed permanently. The dots flash if the power supply is interrupted.
- If there is no power supply, the position indicator display goes out after 2 minutes.
- The whole display flashes the battery needs to be changed for up to 2 weeks to warn that.

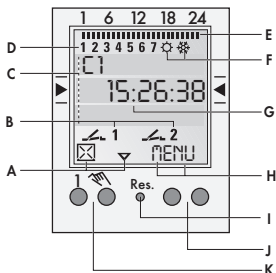


Installation on DIN rail



Terminal diagram





Display

A Function displays of the two left-hand buttons

B Channel status displays

— 1 = Channel 1 ON

— 1 = Channel 1 OFF

Channel 1 = C1, Channel 2 = C2

C 3 communication lines for time display, menu items, entry prompts etc.

D Day-of-week display

E Overview of daily switching program

F Display of summer/winter time

G Operating voltage (permanently lit dots)
Reserve power operation (dots flash)

H Function displays of the two right-hand buttons

Buttons

I Reset

The programs are retained in the case of a reset. The date and time must be set again. Press reset button with a blunt object (pen).

J Right-hand buttons

K Left-hand buttons with manual switch function in Automatic mode

General information

- The middle communication line shows the selectable menu item. If confirmed with **OK**, this item is activated.
- Flashing texts or symbols require an entry.
- If no entries are made within the next 2 minutes, the clock reverts to Auto mode.

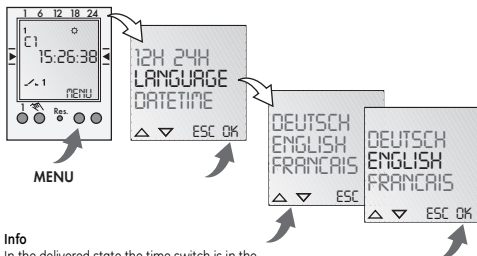
Function displays of the two left-hand buttons:

- △ scroll up in menu
- ▽ scroll down in menu
- ☒ Select/reject suggestion
- ✓ Select/accept suggestion
- + Press briefly = +1
Press and hold (approx. 2 sec) = +5
- Press briefly = -1
Press and hold (approx. 2 sec) = -5

Function displays of the two right-hand buttons:

- MENU** Exits the Automatic mode and enters the Programming mode
- ESC** Press briefly = one step back
Press and hold (approx. 2 sec) = return to Automatic mode
- OK** Make selection and apply
- EDT** Change request in Read mode
- NO** Do not execute command
- YES** Execute command
- DEL** Delete

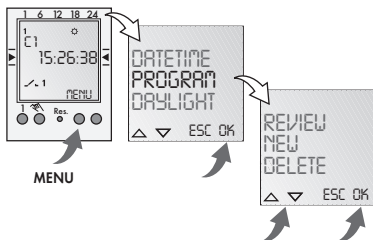
Initial start-up - selection of menu language

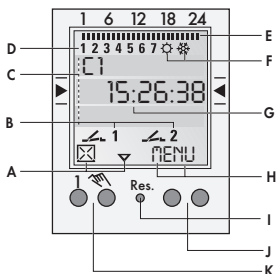


Info

In the delivered state the time switch is in the Auto mode with a preset time, date and the menu language English.

Prog.





Allgemein

- Die mittlere Kommunikationszeile zeigt den zur Auswahl stehenden Menüpunkt. Bei einer Bestätigung mit **OK** wird dieser aktiviert.
- Blinkende Texte oder Symbole erfordern eine Eingabe.
- Erfolgt innerhalb von 2 Minuten keine Eingabe kehrt die Uhr in den Auto-Mode zurück.

Funktionsanzeigen der beiden linken Tasten:

- △ im Menü nach oben blättern
- ▽ im Menü nach unten blättern
- ☒ Auswahl/Vorschlag verwerfen
- ✓ Auswahl/Vorschlag annehmen
- + Kurz Drücken = +1
Lang Drücken (ca. 2 sec) = +5
- Kurz Drücken = -1
Lang Drücken (ca. 2 sec) = -5

Display

- A Funktionsanzeigen der beiden linken Tasten
- B Kanalzustandsanzeigen
 ↘ 1 = Kanal 1 EIN
 ↗ 1 = Kanal 1 AUS
 Kanal 1 = C1, Kanal 2 = C2
- C 3 Kommunikationszeilen für Zeitanzeige, Menüpunkte, Eingabeaufforderungen etc.
- D Wochentaganzeige
- E Übersicht Tages-Schaltprogramm
- F Anzeige Sommer-/Winterzeit
- G Betriebsspannung (permanente Punkte) Gangreservebetrieb (Punkte blinken)
- H Funktionsanzeigen der beiden rechten Tasten

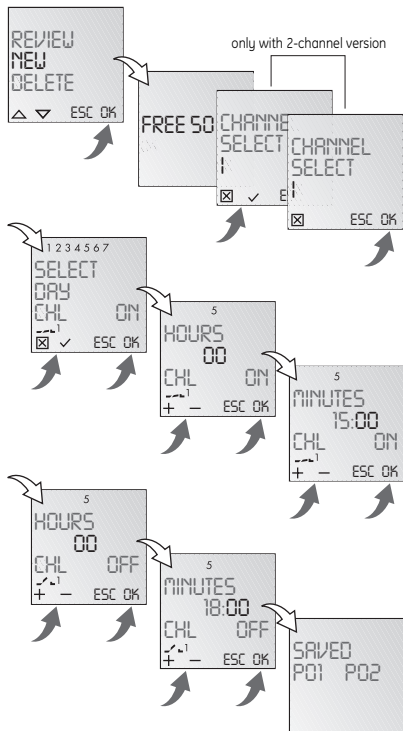
Tasten

- I Reset
Bei einem Reset bleiben die Programme erhalten. Es muss Datum und Uhrzeit neu eingestellt werden. Resettaste mit einem stumpfen Gegenstand (Kugelschreiber) betätigen.
- J Rechte Tasten
- K Linke Tasten mit Handschalterfunktion im Automatikbetrieb

Funktionsanzeigen der beiden rechten Tasten:

- MENU** Verlassen des Automatikbetriebes und Einstieg in den Programmiermodus
- ESC** Kurz Drücken = einen Schritt zurück
Lang Drücken (ca. 2 sec) = Zurück in den Automatikbetrieb
- OK** Auswahl treffen und übernehmen
- EDT** Änderungswunsch im Lesen-Mode
- N** Befehl nicht ausführen
- J** Befehl ausführen
- DEL** Löschen

New program



Info

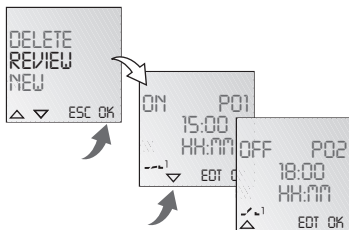
The time switch has 50 memory spaces.

Example

ON command for channel 1 at 3 pm. OFF command at 6 pm.

- Select NEW program and confirm with **OK**.
- The free memory spaces are briefly displayed.
- Select channel and confirm with **OK**.
- Select day block or individual day (block formation as desired) and confirm with **OK**.
- Enter hour for ON command (+/-) and confirm with **OK**.
- Enter minute for ON command (+/-) and confirm with **OK**.
- Enter hour for OFF command (+/-) and confirm with **OK**.
- Enter minute for OFF command (+/-) and confirm with **OK**.
- Program is saved.
- Program jumps to selection REVIEW, NEW, DELETE. Now additional programs can be created.

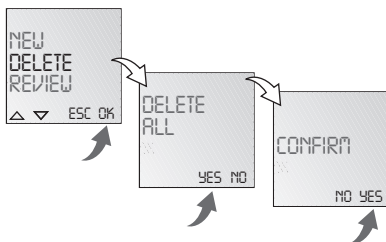
View, edit program



Info

- The program steps can be scrolled through with **▽** **▲**.
- The respective program can be edited by pressing **EDT**. The procedure is the same as when creating a new program.

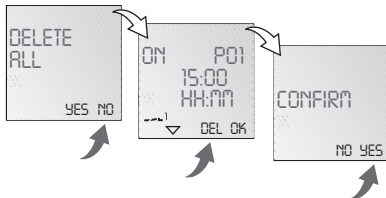
Delete all programs



Info

- It is possible to delete all programs with **YES**.
- By pressing **NO**, individual programs can be deleted.

Delete individual programs

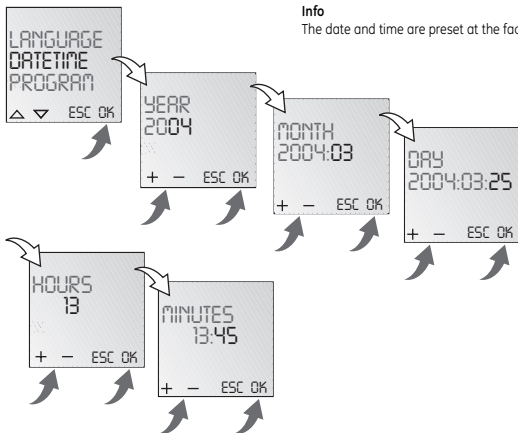


Info

When deleting individual programs, the corresponding program steps are deleted (e.g. P01 ON and P02 OFF).



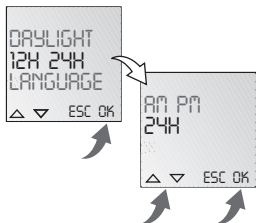
Set date and time



Info

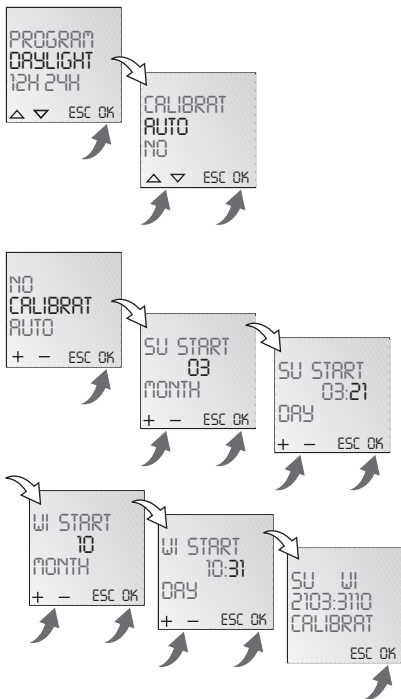
The date and time are preset at the factory.

Set AM/PM (12-hour-) or 24-hour display





Switchover for summer/winter time



Info

The following settings are possible:

AUTO

Factory presetting of the published calendar dates. This is automatically recalculated for each year.

NO

No switchover

CALIBRAT

Programming. The start date of the summer time and winter time must be entered for this purpose. The factory presetting is overwritten.

The programmed summer/ winter time is automatically recalculated for each year.

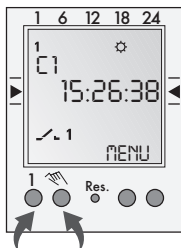
The changeover takes place on the same specified day of the week in the same week of each month.

Example

03/21 Start summer time
10/31 Start winter time



Operating mode



Info

Left-hand button = Channel 1

Right-hand button = Channel 2 (only with 2-channel version)

Press 1 x = FIX ON = continuous ON

Press 2 x = FIX OFF = continuous OFF

Press 3 x = return to Auto mode

FIX ON:

FIX OFF:

AUTO: (no display) programmed switching times



Technical Data

Dimensions H x W x D	45 x 35 x 60 mm	Ambient temperature	-13°F to 131°F (25°C to +55°C)
Weight g (approx.)	170	Protection class	II
Supply voltage	see imprint on device	Accuracy	typ. ±2.5 s/day at 68°F (20°C)
Power consumption	5 VA	Reserve power	3 years from factory at +20°C (20°C)
Switching capacity		Shortest switching time	1 min.
- ohmic load (VDE, IEC)	16 A/250 VAC	Memory spaces	50
- inductive load cos φ 0.6	8 A/250 VAC	Block formation of day of the week	fixed/free selection
- Incandescent lamp load	1,000 W	Switching status display	yes
Switching output	potential-free	Sealable	yes
Switch contacts	1 or 2 changeover contact(s)		

12.4 VARIABLE FREQUENCY DRIVE OPERATION AND MAINTENANCE MANUAL






MICROMASTER 420/430/440

Getting Started Guide 入门指南

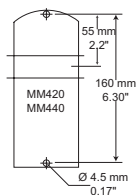


English	<p>Warnings, Cautions and Notes The following Warnings, Cautions and Notes are provided for your safety and as a means of preventing damage to the product or components in the machines connected.</p> <p>Specific Warnings, Cautions and Notes that apply to particular activities are listed at the beginning of the relevant sections. Please read the information carefully, since it is provided for your personal safety and will also help prolong the service life of your inverter and the equipment you connect to it.</p>
Deutsch	<p>Warnungen, Vorsichtshinweise und Hinweise Die nachstehenden Warnungen, Vorsichtshinweise und Hinweise sind für die Sicherheit des Benutzers vorgesehen sowie als Hilfsmittel, um Schaden an dem Erzeugnis oder an Teilen der angeschlossenen Maschine zu verhindern.</p> <p>Spezifische Warnungen, Vorsichtshinweise und Hinweise, die für bestimmte Tätigkeiten gelten, sind am Anfang der jeweiligen Abschnitte zusammengestellt. Bitte diese Informationen sorgfältig lesen, da sie für Ihre persönliche Sicherheit bestimmt sind und auch eine längere Lebensdauer des Umrichters und der daran angeschlossenen Geräte unterstützen.</p>
Français	<p>Avertissements et remarques Les avertissements et remarques figurant dans la suite sont donnés pour assurer la sécurité de l'utilisateur ainsi que pour prévenir des dommages sur le produit ou sur des éléments de la machine raccordée.</p> <p>Les avertissements et remarques spécifiques, applicables à certaines activités, sont regroupés au début du chapitre correspondant. Prière de lire attentivement ces informations car elles sont importantes pour votre sécurité personnelle ainsi que pour assurer une longue durée de vie du variateur ainsi que des appareils raccordés.</p>
Español	<p>Advertencias, precauciones y notas Las presentes advertencias, precauciones y notas están pensadas para su seguridad y como medio para prevenir daños en el producto o en componentes situados en las máquinas conectadas.</p> <p>Advertencias, precauciones y notas específicas aplicables en actividades particulares figuran al comienzo de los capítulos o apartados correspondientes. Rogamos leer cuidadosamente la información ya que se entrega para su seguridad personal y le ayudará a prolongar la vida útil de su convertidor y el equipo que conecte al mismo.</p>
Italiano	<p>Avvertenze tecniche di sicurezza La presente guida operativa contiene avvertenze tecniche relative alla sicurezza delle persone ed alla prevenzione dei danni materiali che vanno assolutamente osservate.</p> <p>Le avvertenze, contrassegnate da un triangolo, a seconda del grado di pericolo, sono chiamate Pericolo, Attenzione, Avvertenze e sono di solito riportate all'inizio dei vari capitoli. Si raccomanda di leggere con attenzione le informazioni fornite, in quanto sono state stilate per garantire l'incolumità personale e per contribuire a prolungare la durata di funzionamento sia dell'Inverter sia delle apparecchiature ad esso collegate.</p>

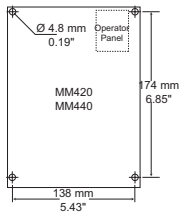
English	Deutsch	Français
<p> Warnings</p> <ul style="list-style-type: none"> ➤ This equipment contains dangerous voltages and controls potentially dangerous rotating mechanical parts. Non-compliance with Warnings or failure to follow the instructions contained in this manual can result in loss of life, severe personal injury or serious damage to property. ➤ Only suitably qualified personnel should work on this equipment, and only after becoming familiar with all safety notices, installation, operation and maintenance procedures contained in this manual. The successful and safe operation of this equipment is dependent upon its proper handling, installation, operation and maintenance. ➤ The DC link of all MICROMASTER modules remains at a hazardous voltage level for 5 minutes after all voltages have been disconnected. Therefore always wait for 5 minutes after disconnecting the inverter from the power supply before carrying out work on any MICROMASTER modules. ➤ This equipment is capable of providing internal motor overload protection in accordance with UL508C section 42. Refer to P0610 (level 3) and P0335. Motor overload protection can also be provided using an external PTC via a digital input. ➤ This equipment is suitable for use in a circuit capable of delivering not more than 10,000 (Frame Sizes A to C) or 42,000 (Frame Sizes D to GX) symmetrical amperes (rms), for a maximum voltage of: <ul style="list-style-type: none"> – MM420 = 230 V / 460 V – MM430 = 460 V – MM440 = 230 V / 460 V / 575 V when protected by an H, J or K type fuse, a circuit breaker or self-protected combination motor controller (for more details see Operating Instructions Appendix F). ➤ Class 1 60/75 °C copper wire only. <p>Note Before carrying out any installation and commissioning procedures, you must read all safety instructions and warnings, including all warning labels attached to the equipment. Make sure that the warning labels are kept in a legible condition and ensure missing or damaged labels are replaced.</p>	<p> Warnungen</p> <ul style="list-style-type: none"> ➤ Das vorliegende Gerät führt gefährliche Spannungen und steuert umfängliche mechanische Teile, die gegebenenfalls gefährlich sind. Die Missachtung der Warnungen oder das Nichtbefolgen der in dieser Anleitung enthaltenen Anweisungen kann Lebensgefahr, schwere Körperverletzung oder schwerwiegende Sachschäden bewirken. ➤ An diesen Geräten darf nur geeignetes, qualifizierte Personal arbeiten, und nur, nachdem es sich mit allen Sicherheitshinweisen, Installations-, Betriebs- und Wartungsanweisungen, die in dieser Anleitung vorhanden sind, vertraut gemacht hat. Der erfolgreiche und gefahrlose Betrieb des Gerätes hängt von seiner ordnungsgemäßen Handhabung, Installation, Bedienung und Wartung ab. ➤ Der Zwischenkreis aller MICROMASTER-Geräte behält nach dem Abtrennen sämtlicher Spannungen 5 Minuten lang eine gefährliche Spannung bei. Deshalb vor dem Durchführen von Arbeiten an einer der MICROMASTER-Baugruppen nach dem Abtrennen des Umrichters von der Stromversorgung 5 Minuten abwarten. ➤ Dieses Gerät kann inneren Motorüberlastungsschutz gemäß UL508C, Abschnitt 42, herstellen. Siehe P0610 (Stufe 3) und P0335. Motorüberlastungsschutz kann auch durch Verwendung eines externen PTC (Kaltleiters) über einen Digitaleingang hergestellt werden. ➤ Dieses Gerät kann in Netzen eingesetzt werden, die einen symmetrischen Strom von höchstens 10 kA (eff) (Bauformen A bis C) bzw. 42 kA (eff) (Bauformen D bis GX) bei einer maximalen Spannung von: <ul style="list-style-type: none"> – MM420 = 230 V / 460 V – MM430 = 460 V – MM440 = 230 V / 460 V / 575 V wenn es durch eine Sicherung vom Typ H, J oder K, einen Leitungsschutzschalter oder durch einen abgesicherten Motorabzweig geschützt ist (weitere Details siehe Betriebsanleitung Anhang F). ➤ Klasse 1 60/75 °C, nur Kupferdraht. <p>Hinweise Vor der Durchführung von Installations- und Inbetriebnahmearbeiten unbedingt alle Sicherheitshinweisungen und Warnungen bitte sorgfältig lesen, ebenso alle am Gerät angebrachten Warningschilder. Darauf achten, dass Warningschilder in leserbereitem Zustand gehalten werden und dafür sorgen, dass fehlende oder beschädigte Schilder gegebenenfalls ausgetauscht werden.</p>	<p> Attention</p> <ul style="list-style-type: none"> ➤ Le présent appareil est le siège de tensions dangereuses et pilote des pièces mécaniques rotatives qui peuvent présenter une source de danger. Le non-respect des avertissements ainsi que des consignes de sécurité figurant dans cette notice peuvent entraîner la mort, des blessures graves ou des dommages matériels importants. ➤ Seules des personnes qualifiées sont habilitées à intervenir sur cet appareil, et cela uniquement après qu'elles se soient familiarisées avec toutes les consignes de sécurité, les instructions d'installation, d'exploitation et de maintenance mentionnées dans cette notice. ➤ Le fonctionnement correct et sûr de cet appareil présuppose une manipulation, une installation, une utilisation et une maintenance conformes aux règles de l'art. Sur tous les MICROMASTER, il subsiste une tension élevée dans le circuit intermédiaire pendant les 5 minutes qui suivent la mise hors tension. Après coupure du variateur, il faudra par conséquent attendre le temps nécessaire avant d'intervenir sur les modules du MICROMASTER. ➤ Cet appareil est capable d'offrir une protection interne de la surcharge thermique du moteur conforme à UL 508C section 42. Se reporter à P0610 (Niveau 3) et P0335. La protection de surcharge thermique du moteur peut également être assurée par une sonde CTP montée sur le moteur. ➤ Cet appareil peut être utilisé dans des réseaux qui fournissent un courant symétrique de 10 kA (eff) (Formes de construction (tailles) A à C) ou 42 kA (Formes de construction (tailles) D à GX) maximum avec une tension maximale de : <ul style="list-style-type: none"> – MM420 = 230 V / 460 V – MM430 = 460 V – MM440 = 230 V / 460 V / 575 V lorsqu'il est protégé par un fusible de type H, J ou K, un disjoncteur de protection ou une dérivation de moteur protégée par fusible (pour plus de détails, voir Instructions de service annexe F). ➤ Seulement câble de cuivre Classe 1 60/75 °C <p>Remarques Avant de procéder à l'installation et à la mise en service, il faut lire attentivement les consignes de sécurité et les avertissements ainsi que toutes les marques d'avertissement apposées sur l'appareil. Veillez à maintenir la lisibilité des marques d'avertissement et à remplacer celles qui manquent ou qui ont été dégradées.</p>

Dimension Drawings
Maßbilder
Encombrements
Dibujos acotados
Disegni quotati

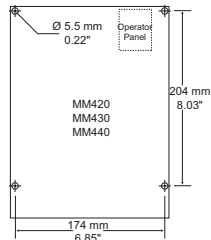
Frame Size A



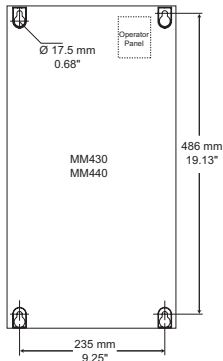
Frame Size B



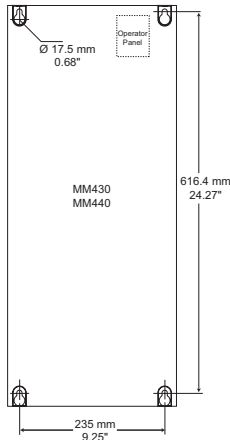
Frame Size C



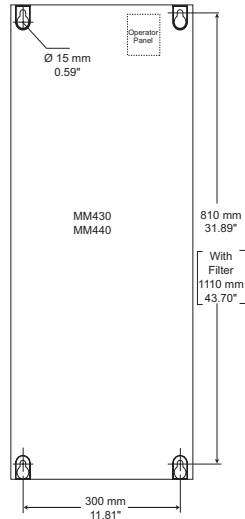
Frame Size D



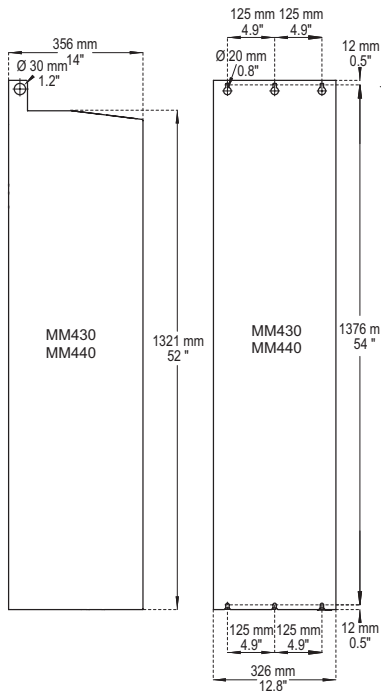
Frame Size E



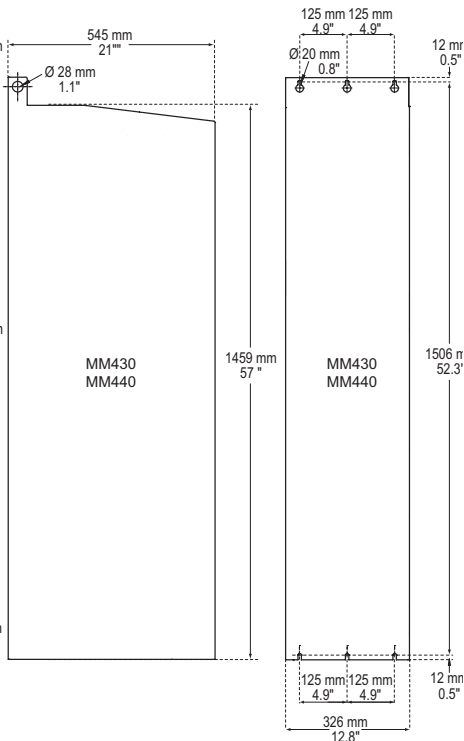
Frame Size F



Frame Size FX



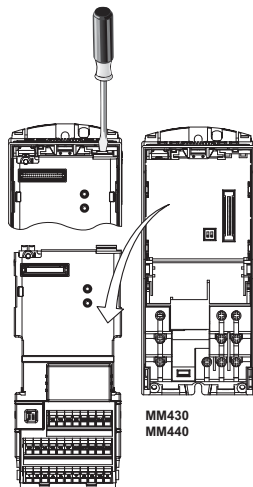
Frame Size GX



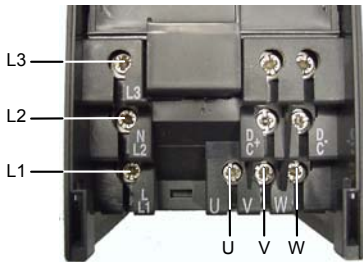
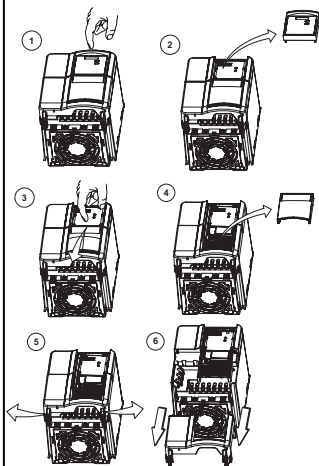
Connecting Power Terminals

Leistungsanschlüsse
Connexions de puissance
Conectores de carga
Connessioni

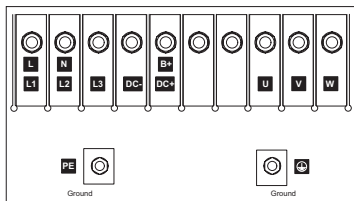
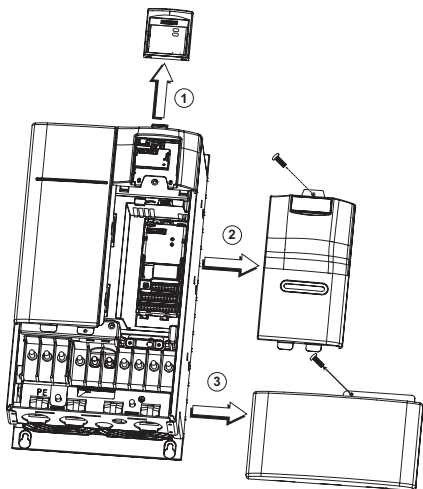
Frame Size A



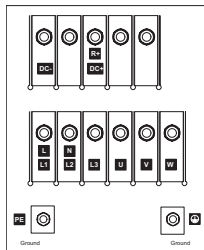
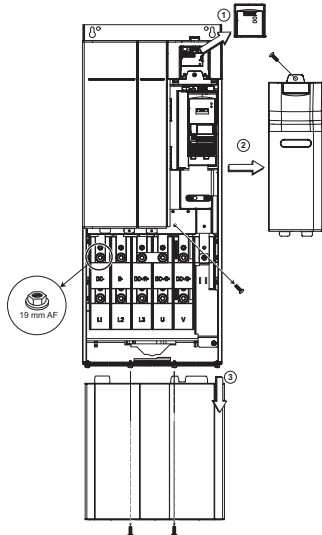
Frame Size B, C



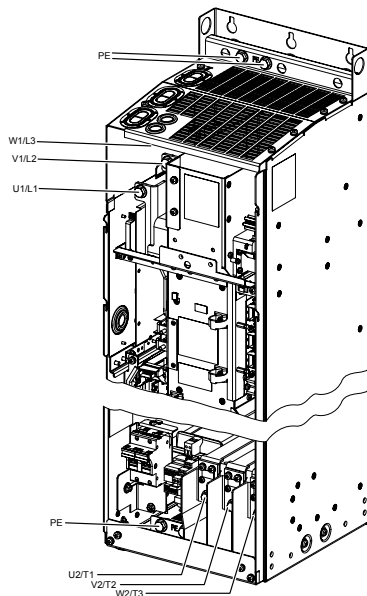
Frame Sizes D, E



Frame Size F

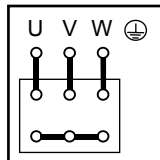
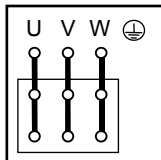


Frame Size FX, GX



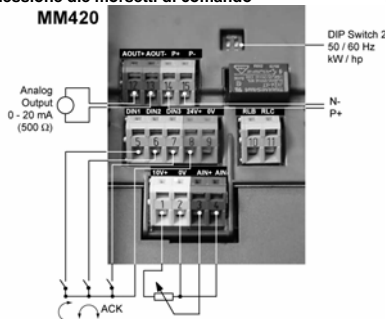
Motor
Motor
Moteur
Motor
Motore

PE
= Ground



Connecting Control Terminals
 Anschließen der Steuerklemmen
 Connexions de commande
 Conectores para líneas de control
 Connessioni die morsetti di comando

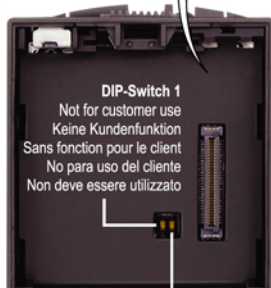
MM420



Motor Frequency
 Motorfrequenz
 Fréquence moteur
 Frecuencia del motor
 Frequenza motore

Remove SDP and I/O Board

MM430 MM440



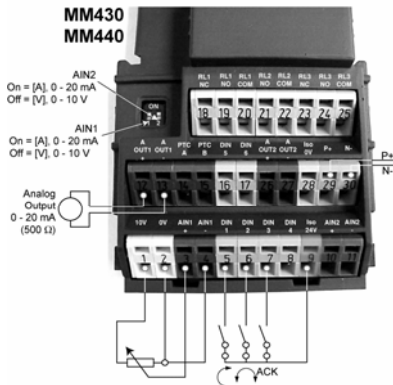
DIP-Switch 1

Not for customer use
 Keine Kundenfunktion
 Sans fonction pour le client
 No para uso del cliente
 Non deve essere utilizzato

DIP-Switch 2

OFF f = 50 Hz; ON f = 60 Hz
 Default Setting = OFF
 Werkseinstellung = OFF
 Réglage usine = OFF
 Ajuste de fabrica = OFF
 Default = OFF

MM430 MM440



MM420 Specifications

Frame Size	Dimensions		Tightening torque for power connections
A	W x H x D	mm	73 x 173 x 149
		inch	2.87 x 6.81 x 5.87
B	W x H x D	mm	149 x 202 x 172
		inch	5.87 x 7.95 x 6.77
C	W x H x D	mm	185 x 245 x 195
		inch	7.28 x 9.65 x 7.68

In order to have a UL compliant installation fuses from the SITOR range with the appropriate current rating must be used. *UL listed fuses such as Class NON from Bussmann are required for use in America

Input voltage range 1 AC 200 V – 240 V, $\pm 10\%$ (with built in Class A Filter)

Order No.	6SE6420-2AA1	2AB11-5AA1	2AB12-7AA1	2AB13-5AA1	2AB15-5AA1	2AB17-1BA1	2AB21-5BA1	2AB22-2BA1	2AB23-0CA1
Fuse	[A]	10	10	10	16	20	20	32	40
Recommended For UL specified	3NA	3B03	3B03	3B03	3B05	3B07	3B07	3B12	3B17
Input Cable, min.	[mm ²] [awg]	1.0 18	1.0 18	1.0 18	1.0 18	2.5 16	2.5 16	4.0 12	6.0 10
Input Cable, max.	[mm ²] [awg]	2.5 14	2.5 14	2.5 14	2.5 14	6.0 10	6.0 10	6.0 10	10.0 8
Output Cable, min.	[mm ²] [awg]	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.5 16
Output Cable, max.	[mm ²] [awg]	2.5 14	2.5 14	2.5 14	2.5 14	6.0 10	6.0 10	6.0 10	10.0 8

Input voltage range 1 AC 200 V – 240 V, $\pm 10\%$ (Unfiltered)

Order No.	6SE6420-2AA1	2UC11-5AA1	2UC12-7AA1	2UC13-5AA1	2UC15-5AA1	2UC17-1BA1	2UC21-5BA1	2UC22-2BA1	2UC23-0CA1
Recommended For UL specified	3NA	3B03	3B03	3B03	3B05	3B07	3B07	3B12	3B17
Input Cable, min.	[mm ²] [awg]	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	2.5 14
Input Cable, max.	[mm ²] [awg]	2.5 14	2.5 14	2.5 14	2.5 14	6.0 10	6.0 10	6.0 10	10.0 8
Output Cable, min.	[mm ²] [awg]	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.5 16
Output Cable, max.	[mm ²] [awg]	2.5 14	2.5 14	2.5 14	2.5 14	6.0 10	6.0 10	6.0 10	10.0 8

Input voltage range 3 AC 200 V – 240 V, $\pm 10\%$ (with built in Class A Filter)

Order No.	6SE6420-2AA1	2AC23-0CA1	2AC24-5CA1
Recommended For UL specified	3NA	3B10	3B12
Input Cable, min.	[mm ²] [awg]	2.5 14	2.5 14
Input Cable, max.	[mm ²] [awg]	10.0 8	10.0 8
Output Cable, min.	[mm ²] [awg]	1.5 16	2.5 14
Output Cable, max.	[mm ²] [awg]	10.0 8	10.0 8

Input voltage range 3 AC 200 V – 240 V, $\pm 10\%$ (Unfiltered)

Order No.	6SE6420-	2UC11-2AA1	2UC12-5AA1	2UC13-7AA1	2UC15-5AA1	2UC17-5AA1	2UC21-1BA1	2UC21-5BA1	2UC22-2BA1
Fuse	[A]	10	10	10	10	10	16	16	20
Recommended	3NA	3803	3803	3803	3803	3803	3805	3805	3807
For UL specified		*	*	*	*	*	*	*	*
Input Cable, min.	[mm ²] [awg]	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18
Input Cable, max.	[mm ²] [awg]	2.5 14	2.5 14	2.5 14	2.5 14	2.5 14	6.0 10	6.0 10	6.0 10
Output Cable, min.	[mm ²] [awg]	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18
Output Cable, max.	[mm ²] [awg]	2.5 14	2.5 14	2.5 14	2.5 14	2.5 14	6.0 10	6.0 10	6.0 10

Order No.	6SE6420-	2UC23-0CA1	2UC24-0CA1	2UC25-5CA1
Fuse	[A]	25	32	35
Recommended	3NA	3810	3812	3814
For UL specified		*	*	*
Input Cable, min.	[mm ²] [awg]	2.5 14	2.5 14	4.0 12
Input Cable, max.	[mm ²] [awg]	10.0 8	10.0 8	10.0 8
Output Cable, min.	[mm ²] [awg]	1.5 16	2.5 14	4.0 12
Output Cable, max.	[mm ²] [awg]	10.0 8	10.0 8	10.0 8

Input voltage range 3 AC 380 V – 480 V, $\pm 10\%$ (with built in Class A Filter)

Order No.	6SE6420-	2AD22-2BA1	2AD23-0BA1	2AD24-0BA1	2AD25-5CA1	2AD27-5CA1	2AD31-1CA1
Fuse	[A]	16	16	20	20	25	35
Recommended	3NA	3805	3805	3807	3807	3810	3814
For UL specified		*	*	*	*	*	*
Input Cable, min.	[mm ²] [awg]	1.0 18	1.0 18	1.5 16	2.5 14	4.0 12	6.0 10
Input Cable, max.	[mm ²] [awg]	6.0 10	6.0 10	6.0 10	10.0 8	10.0 8	10.0 8
Output Cable, min.	[mm ²] [awg]	1.0 18	1.0 18	1.0 18	1.5 16	2.5 14	4.0 12
Output Cable, max.	[mm ²] [awg]	6.0 10	6.0 10	6.0 10	10.0 8	10.0 8	10.0 8

Input voltage range 3 AC 200 V – 240 V, $\pm 10\%$ (Unfiltered)

Order No.	6SE6420-	2UC23-0CA1	2UC24-0CA1	2UC25-5CA1
Fuse	[A]	25	32	35
Recommended	3NA	3810	3812	3814
For UL specified		*	*	*
Input Cable, min.	[mm ²] [awg]	2.5 14	2.5 14	4.0 12
Input Cable, max.	[mm ²] [awg]	10.0 8	10.0 8	10.0 8
Output Cable, min.	[mm ²] [awg]	1.5 16	2.5 14	4.0 12
Output Cable, max.	[mm ²] [awg]	10.0 8	10.0 8	10.0 8

Input voltage range 3 AC 380 V – 480 V, $\pm 10\%$ (Unfiltered)

Order No.	6SE6420-	2UD13 -7AA1	2UD15 -5AA1	2UD17 -5AA1	2UD21 -1AA1	2UD21 -5AA1	2UD22 -2BA1	2UD23 -0BA1	2UD24 -0BA1
Fuse	[A]	10	10	10	10	10	16	16	20
Recommended	3NA	3803	3803	3803	3803	3803	3805	3805	3807
For UL specified		*	*	*	*	*	*	*	*
Input Cable, min.	[mm ²] [awg]	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.5 16
Input Cable, max.	[mm ²] [awg]	2.5 14	2.5 14	2.5 14	2.5 14	2.5 14	6.0 10	6.0 10	6.0 10
Output Cable, min.	[mm ²] [awg]	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18
Output Cable, max.	[mm ²] [awg]	2.5 14	2.5 14	2.5 14	2.5 14	2.5 14	6.0 10	6.0 10	6.0 10

Order No.	6SE6420-	2UD25 -5CA1	2UD27 -5CA1	2UD31 -1CA1
Fuse	[A]	20	25	35
Recommended	3NA	3807	3810	3814
For UL specified		*	*	*
Input Cable, min.	[mm ²] [awg]	2.5 14	4.0 12	6.0 10
Input Cable, max.	[mm ²] [awg]	10.0 8	10.0 8	10.0 8
Output Cable, min.	[mm ²] [awg]	1.5 16	2.5 14	4.0 12
Output Cable, max.	[mm ²] [awg]	10.0 8	10.0 8	10.0 8

MM430 Specifications

Frame Size		Dimensions		Tightening torques for power terminals	
C	B x H x T	mm	185 x 245 x 195	Nm	2,25
		inch	7.28 x 9.65 x 7.68	lb-ft	1,7
D	B x H x T	mm	275 x 520 x 245	Nm	10 (max.)
		inch	10.82 x 20.47 x 9.65	lb-ft	7.4 (max.)
E	B x H x T	mm	275 x 650 x 245	Nm	10 (max.)
		inch	10.82 x 25.59 x 9.65	lb-ft	7.4 (max.)
F	B x H x T	mm	350 x 850 mm x 320 (Height with filter 1150)	Nm	50
		inch	13.78 x 33.46 x 12.60 (Height with filter 45.28)	lb-ft	36.9
FX	B x H x T	mm	326 x 1400 x 356	Nm	25
		inch	12.80 x 55.12 x 12.83	lb-ft	18.4
GX	B x H x T	mm	326 x 1533 x 545	Nm	25
		inch	12.80 x 60.35 x 21.46	lb-ft	18.4

In order to have a UL compliant installation fuses from the SITOR range with the appropriate current rating must be used. *UL listed fuses such as Class NON from Bussmann are required for use in America

Input voltage range 3 AC 380 V ... 480 V, $\pm 10\%$ (with built in Class A Filter)

Order No.	6SE6430-	2AD27 -SCA0	2AD31 -1CA0	2AD31 -SCA0	2AD31 -8DA0	2AD32 -2DA0	2AD33 -0DA0
Recommended Fuse	[A]	20	32	35	50	63	80
	3NA	3807	3812	3814	3820	3822	3824
Fuses recommended for UL applications	[A]				50	63	80
	3NE	*	*	*	1817-0	1818-0	1820-0
Input Cable Min.	[mm ²]	2.5	4.0	6.0	10.0	10.0	16.0
	[AWG]	14	12	10	8	8	6
Input Cable Max.	[mm ²]	10.0	10.0	10.0	35.0	35.0	35.0
	[AWG]	8	8	8	2	2	2
Output Cable Min.	[mm ²]	2.5	4.0	6.0	10.0	10.0	16.0
	[AWG]	14	12	10	8	8	6
Output Cable Max.	[mm ²]	10.0	10.0	10.0	35.0	35.0	35.0
	[AWG]	8	8	8	2	2	2

Order No.	6SE6430-	2AD33 -7EA0	2AD34 -5EA0	2AD35 -5FA0	2AD37 -5FA0	2AD38 -8FA0
Recommended Fuse	[A]	100	125	160	160	200
	3NA	3830	3832	3836	3140	3144
Fuses recommended for UL applications	[A]	100	125	160	200	200
	3NE	1021-0	1022-0	1224-0	1225-0	1227-0
Input Cable Min.	[mm ²]	25.0	25.0	35.0	70.0	70.0
	[AWG]	3	3	2	2/0	2/0
Input Cable Max.	[mm ²]	35.0	35.0	150.0	150.0	150.0
	[AWG]	2	2	300	300	300
Output Cable Min.	[mm ²]	25.0	25.0	50.0	70.0	95.0
	[AWG]	3	3	1/0	2/0	4/0
Output Cable Max.	[mm ²]	35.0	35.0	150.0	150.0	150.0
	[AWG]	2	2	300	300	300

Input voltage range 3 AC 380 V ... 480 V, ± 10 % (Unfiltered)

Order No.	6SE6430-	2UD27-SCA0	2UD31-1CA0	2UD31-5CA0	2UD31-8DA0	2UD32-2DA0	2UD33-0DA0
Recommended Fuse	[A] 3NA	20 3807	32 3812	35 3814	50 3820	63 3902	80 3824
Fuses recommended for UL applications	[A] 3NE	-	-	-	50 1817-0	63 1818-0	80 1820-0
Input Cable Min.	[mm ²] [AWG]	2.5 14	4.0 12	6.0 10	10.0 8	10.0 8	16.0 6
Input Cable Max.	[mm ²] [AWG]	10.0 8	10.0 8	10.0 8	35.0 2	35.0 2	35.0 2
Output Cable Min.	[mm ²] [AWG]	2.5 14	4.0 12	6.0 10	10.0 8	10.0 8	16.0 6
Output Cable Max.	[mm ²] [AWG]	10.0 8	10.0 8	10.0 8	35.0 2	35.0 2	35.0 2

Order No.	6SE6430-	2UD33-7EA0	2UD34-5EA0	2UD35-5FA0	2UD37-5FA0	2UD38-8FA0
Recommended Fuse	[A] 3NA	100 3830	125 3832	160 3836	160 3140	200 3144
Fuses recommended for UL applications	[A] 3NE	100 1021-0	125 1022-0	160 1224-0	200 1225-0	200 1227-0
Input Cable Min.	[mm ²] [AWG]	25.0 3	25.0 3	35.0 2	70.0 2/0	70.0 2/0
Input Cable Max.	[mm ²] [AWG]	35.0 2	35.0 2	150.0 300	150.0 300	150.0 300
Output Cable Min.	[mm ²] [AWG]	25.0 3	25.0 3	35.0 2	70.0 2/0	95.0 4/0
Output Cable Max.	[mm ²] [AWG]	35.0 2	35.0 2	150.0 300	150.0 300	150.0 300

Input voltage range 3 AC 380 V ... 480 V, ± 10 % (Unfiltered)

Order No.	6SE6430-	2UD41-1FA0	2UD41-3FA0	2UD41-6GA0	2UD42-0GA0	2UD42-5GA0
Recommended Fuse	[A] 3NE1227-0	250 3NE1227-0	315 3NE1230-0	400 3NE1332-0	450 3NE1333-0	560 3NE1435-0
Input Cable Min.	[mm ²] [AWG] or [kcmil]	1 x 95 or 2 x 35 1 x 4/0 or 2 x 2	1 x 150 or 2 x 50 1 x 300 or 2 x 1/0	1 x 185 or 2 x 70 1 x 400 or 2 x 2/0	1 x 240 or 2 x 70 1 x 500 or 2 x 2/0	2 x 95 2 x 4/0
Input Cable Max.	[mm ²] [AWG] or [kcmil]	1 x 185 or 2 x 120 1 x 350 or 2 x 4/0	1 x 185 or 2 x 120 1 x 350 or 2 x 4/0	2 x 240 2 x 400	2 x 240 2 x 400	2 x 240 2 x 400
Output Cable Min.	[mm ²] [AWG] or [kcmil]	1 x 95 or 2 x 35 1 x 4/0 or 2 x 2	1 x 150 or 2 x 50 1 x 300 or 2 x 1/0	1 x 185 or 2 x 70 1 x 400 or 2 x 2/0	1 x 240 or 2 x 70 1 x 500 or 2 x 2/0	2 x 95 2 x 4/0
Output Cable Max.	[mm ²] [AWG] or [kcmil]	1 x 185 or 2 x 120 1 x 350 or 2 x 4/0	1 x 185 or 2 x 120 1 x 350 or 2 x 4/0	2 x 240 2 x 400	2 x 240 2 x 400	2 x 240 2 x 400
Pipe cable shoe to DIN 46235	[mm]	10	10	10	10	10

MM440 Specifications

Frame Size	Dimensions		Tightening torque for power connections
A	WxHxD	mm 73 × 173 × 149	Nm 1.1
		inch 2.87 × 6.81 × 5.87	
B	WxHxD	mm 149 × 202 × 172	Nm 1.5
		inch 5.87 × 7.95 × 6.77	
C	WxHxD	mm 185 × 245 × 195	Nm 2.25
		inch 7.28 × 9.65 × 7.68	
D	WxHxD	mm 275 × 520 × 245	Nm 10 (max.)
		inch 10.82 × 20.47 × 9.65	
E	WxHxD	mm 275 × 650 × 245	Nm 10 (max.)
		inch 10.82 × 25.59 × 9.65	
F	WxHxD	mm 350 × 850 Height with filter 1150	Nm 50
		inch 13.78 × 33.46 × 12.60 Height with filter 45.28	
FX	WxHxD	mm 326 × 1400 × 356	Nm 25
		inch 12.80 × 55.12 × 12.83	
GX	WxHxD	mm 326 × 1533 × 545	Nm 25
		inch 12.80 × 60.35 × 21.46	

In order that the system is in compliance with UL, UL-certified fuses must be used with the appropriate rated current. *UL listed fuses such as Class NON from Bussmann are required for use in America

Input voltage range 1 AC 200 V – 240 V, ± 10 % (with built in Class A Filter)

Order No.	6SE6440-	2AB11 -2AA1	2AB12 -5AA1	2AB13 -7AA1	2AB15 -5AA1	2AB17 -5AA1	2AB21 -1BA1	2AB21 -5BA1	2AB22 -2BA1	2AB23 -0CA1
Fuse	[A]	10	10	10	16	16	20	20	32	40
Recommended	3NA	3803	3803	3803	3805	3805	3807	3807	3812	3817
for UL specified		*	*	*	*	*	*	*	*	*
Input Cable Min.	[mm ²]	1.0	1.0	1.0	1.5	1.5	2.5	2.5	4.0	6.0
	[awg]	18	18	18	16	16	14	14	12	10
Input Cable Max.	[mm ²]	2.5	2.5	2.5	2.5	2.5	6.0	6.0	6.0	10.0
	[awg]	14	14	14	14	14	10	10	10	8
Output Cable Min.	[mm ²]	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5
	[awg]	18	18	18	18	18	18	18	18	16
Output Cable Max.	[mm ²]	2.5	2.5	2.5	2.5	2.5	6.0	6.0	6.0	10.0
	[awg]	14	14	14	14	14	10	10	10	8

Input voltage range 1 AC 200 V – 240 V, ± 10 % (Unfiltered)

Order No.	6SE6440-	2UC11 -2AA1	2UC12 -5AA1	2UC13 -7AA1	2UC15 -5AA1	2UC17 -5AA1	2UC21 -1BA1	2UC21 -5BA1	2UC22 -2BA1	2UC23 -0CA1
Fuse	[A]	10	10	10	16	16	20	20	32	40
Recommended	3NA	3803	3803	3803	3805	3805	3807	3807	3812	3817
for UL specified		*	*	*	*	*	*	*	*	*
Input Cable Min.	[mm ²]	1.0	1.0	1.0	1.5	1.5	2.5	2.5	4.0	6.0
	[awg]	18	18	18	16	16	14	14	12	10
Input Cable Max.	[mm ²]	2.5	2.5	2.5	2.5	2.5	6.0	6.0	6.0	10.0
	[awg]	14	14	14	14	14	10	10	10	8
Output Cable Min.	[mm ²]	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5
	[awg]	18	18	18	18	18	18	18	18	16
Output Cable Max.	[mm ²]	2.5	2.5	2.5	2.5	2.5	6.0	6.0	6.0	10.0
	[awg]	14	14	14	14	14	10	10	10	8

Input voltage range 3 AC 200 V ~ 240 V, $\pm 10\%$ (with built in Class A Filter)

Order No.	6SE6440-	2AC23 -0CA1	2AC24 -0CA1	2AC25 -5CA1
Fuse	[A]	25	32	35
Recommended for UL specified	3NA	3810	3812	3814
		*	*	*
Input Cable Min.	[mm ²] [awg]	2.5 14	4.0 12	4.0 12
Input Cable Max.	[mm ²] [awg]	10.0 8	10.0 8	10.0 8
Output Cable Min.	[mm ²] [awg]	1.5 16	4.0 12	4.0 12
Output Cable Max.	[mm ²] [awg]	10.0 8	10.0 8	10.0 8

Input voltage range 3 AC 200 V ~ 240 V, $\pm 10\%$ (Unfiltered)

Order No.	6SE6440-	2UC11 -2AA1	2UC12 -5AA1	2UC13 -7AA1	2UC15 -5AA1	2UC17 -5AA1	2UC21 -1BA1	2UC21 -5BA1	2UC22 -2BA1	2UC23 -0CA1
Fuse	[A]	10	10	10	16	16	20	20	25	25
Recommended for UL specified	3NA	3803	3803	3803	3805	3805	3807	3807	3810	3810
		*	*	*	*	*	*	*	*	*
Input Cable Min.	[mm ²] [awg]	1.0 18	1.0 18	1.0 18	1.5 16	1.5 16	2.5 14	2.5 14	2.5 14	4.0 12
Input Cable Max.	[mm ²] [awg]	2.5 14	2.5 14	2.5 14	2.5 14	2.5 14	6.0 10	6.0 10	6.0 10	10.0 8
Output Cable Min.	[mm ²] [awg]	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	1.5 16
Output Cable Max.	[mm ²] [awg]	2.5 14	2.5 14	2.5 14	2.5 14	2.5 14	6.0 10	6.0 10	6.0 10	10.0 8

Order No.	6SE6440-	2UC24 -0CA1	2UC25 -5CA1	2UC27 -5DA1	2UC31 -1DA1	2UC31 -5DA1	2UC31 -8EA1	2UC32 -2EA1	2UC33 -0FA1	2UC33 -7FA1	2UC34 -5FA1
Fuse	[A]	32	35	50	80	80	100	125	200	200	250
Recommended for UL specified	3NA	3812	3814	3820	3824	3824	3830	3832	3140	3142	3144
	3NE	*	*	1817-0	1820-0	1820-0	1021-0	1022-0	1225-0	1225-0	1227-0
Input Cable Min.	[mm ²] [awg]	4.0 12	4.0 12	10.0 8	16.0 6	16.0 6	25.0 3	25.0 3	70.0 2/0	70.0 2/0	95.0 3/0
Input Cable Max.	[mm ²] [awg]	10.0 8	10.0 8	35.0 2	35.0 2	35.0 2	35.0 2	35.0 2	150.0 300	150.0 300	150.0 300
Output Cable Min.	[mm ²] [awg]	4.0 12	4.0 12	10.0 8	16.0 6	16.0 6	25.0 3	25.0 3	50.0 1/0	70.0 2/0	95.0 3/0
Output Cable Max.	[mm ²] [awg]	10.0 8	10.0 8	35.0 2	35.0 2	35.0 2	35.0 2	35.0 2	150.0 300	150.0 300	150.0 300

Input voltage range 3 AC 380 V ~ 480 V, $\pm 10\%$ (with built in Class A Filter)

Order No.	6SE6440-	2AD22 -2BA1	2AD23 -0BA1	2AD24 -0BA1	2AD25 -5CA1	2AD27 -5CA1	2AD31 -1CA1	2AD31 -5DA1
Fuse	[A]	16	16	20	20	32	35	50
Recommended for UL specified	3NA	3805	3805	3807	3807	3812	3814	3820
	3NE	*	*	*	*	*	*	1817-0
Input Cable Min.	[mm ²] [awg]	1.5 16	1.5 16	2.5 14	2.5 14	4.0 12	4.0 10	10.0 8
Input Cable Max.	[mm ²] [awg]	6.0 10	6.0 10	6.0 10	10.0 10	10.0 8	10.0 2	35.0 2
Output Cable Min.	[mm ²] [awg]	1.0 18	1.0 18	1.0 18	2.5 14	4.0 12	6.0 10	10.0 8
Output Cable Max.	[mm ²] [awg]	6.0 10	6.0 10	6.0 10	10.0 8	10.0 8	10.0 2	35.0 2

Order No.	6SE6440-	2AD31 -8DA1	2AD32 -2DA1	2AD33 -0EA1	2AD33 -7EA1	2AD34 -5FA1	2AD35 -5FA1	2AD37 -5FA1
Fuse	[A]	63	80	100	125	160	200	250
Recommended	3NA	3822	3824	3830	3832	3836	3140	3144
for UL specified	3NE	1818-0	1820-0	1021-0	1022-0	1224-0	1225-0	1227-0
Input Cable Min.	[mm ²]	10.0	16.0	25.0	35.0	50.0	70.0	95.0
	[awg]	8	6	3	3	2	2/0	3/0
Input Cable Max.	[mm ²]	35.0	35.0	35.0	35.0	150.0	150.0	150.0
	[awg]	2	2	2	2	300	300	300
Output Cable Min.	[mm ²]	10.0	16.0	25.0	35.0	50.0	70.0	95.0
	[awg]	8	6	3	3	1/0	2/0	3/0
Output Cable Max.	[mm ²]	35.0	35.0	35.0	35.0	150.0	150.0	150.0
	[awg]	2	2	2	2	300	300	300

Input voltage range 3 AC 380 V - 480 V, $\pm 10\%$ (Unfiltered)

Order No.	6SE6440-	2UD13 -7AA1	2UD15 -5AA1	2UD17 -8AA1	2UD21 -1AA1	2UD21 -5AA1	2UD22 -2BA1	2UD23 -0BA1	2UD24 -0BA1	2UD25 -5CA1	2UD27 -5CA1
Fuse	[A]	10	10	10	10	10	16	16	20	20	32
Recommended	3NA	3803	3803	3803	3803	3803	3805	3805	3807	3807	3812
for UL specified		+	+	+	+	+	+	+	+	+	+
Input Cable Min.	[mm ²]	1.0	1.0	1.0	1.0	1.0	1.5	1.5	2.5	2.5	4.0
	[awg]	18	18	18	18	18	16	16	14	14	12
Input Cable Max.	[mm ²]	2.5	2.5	2.5	2.5	2.5	6.0	6.0	6.0	10.0	10.0
	[awg]	14	14	14	14	14	10	10	10	8	8
Output Cable Min.	[mm ²]	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.5	4.0
	[awg]	18	18	18	18	18	18	18	18	14	12
Output Cable Max.	[mm ²]	2.5	2.5	2.5	2.5	2.5	6.0	6.0	6.0	10.0	10.0
	[awg]	14	14	14	14	14	10	10	10	8	8

Order No.	6SE6440-	2UD31 -1CA1	2UD31 -5DA1	2UD31 -8DA1	2UD32 -2DA1	2UD33 -0EA1	2UD33 -7EA1	2UD34 -5FA1	2UD35 -5FA1	2UD37 -5FA1
Fuse	[A]	35	50	63	80	100	125	160	200	250
Recommended	3NA	3814	3820	3822	3824	3830	3832	3836	3140	3144
for UL specified	3NE	+	1817-0	1818-0	1820-0	1021-0	1022-0	1224-0	1225-0	1227-0
Input Cable Min.	[mm ²]	6.0	10.0	10.0	16.0	25.0	25.0	35.0	70.0	95.0
	[awg]	10	8	8	6	3	3	2	2/0	3/0
Input Cable Max.	[mm ²]	10.0	35.0	35.0	35.0	35.0	35.0	150.0	150.0	150.0
	[awg]	8	2	2	2	2	2	300	300	300
Output Cable Min.	[mm ²]	6.0	10.0	10.0	16.0	25.0	25.0	35.0	70.0	95.0
	[awg]	10	8	8	6	3	3	2	2/0	3/0
Output Cable Max.	[mm ²]	10.0	35.0	35.0	35.0	35.0	35.0	150.0	150.0	150.0
	[awg]	8	2	2	2	2	2	300	300	300

Input voltage range 3 AC 380 V - 480 V, $\pm 10\%$ (Unfiltered)

Order No.	6SE6440-	2UD38-8FA1	2UD41-1FA1	2UD41-3GA1	2UD41-6GA1	2UD42-0GA1
Recommended Fuse	[A]	250	315	400	450	560
	3NE	1227-0	1230-0	1332-0	1333-0	1435-0
Pipe cable shoe to DIN 46235	[mm]	10	10	10	10	10
Input Cable Min.	[mm ²]	1 x 95 or 2 x 35	1 x 150 or 2 x 50	1 x 185 or 2 x 70	1 x 240 or 2 x 70	2 x 95
	[awg] or [kcmil]	1 x 4/0 or 2 x 2	1 x 300 or 2 x 1/0	1 x 400 or 2 x 2/0	1 x 500 or 2 x 2/0	2 x 4/0
Input Cable Max.	[mm ²]	1 x 185 or 2 x 120	1 x 185 or 2 x 120	2 x 240	2 x 240	2 x 240
	[awg] or [kcmil]	1 x 350 or 2 x 4/0	1 x 350 or 2 x 4/0	2 x 400	2 x 400	2 x 400
Output Cable Min.	[mm ²]	1 x 95 or 2 x 35	1 x 150 or 2 x 50	1 x 185 or 2 x 70	1 x 240 or 2 x 70	2 x 95
	[awg] or [kcmil]	1 x 4/0 or 2 x 2	1 x 300 or 2 x 1/0	1 x 400 or 2 x 2/0	1 x 500 or 2 x 2/0	2 x 4/0
Output Cable Max.	[mm ²]	1 x 185 or 2 x 120	1 x 185 or 2 x 120	2 x 240	2 x 240	2 x 240
	[awg] or [kcmil]	1 x 350 or 2 x 4/0	1 x 350 or 2 x 4/0	2 x 400	2 x 400	2 x 400

Input voltage range 3 AC 500 V – 600 V ± 10 % (Unfiltered)

Order No.	6SE6440-	2UE17 -SCA1	2UE21 -SCA1	2UE22 -2CA1	2UE24 -0CA1	2UE25 -SCA1	2UE27 -SCA1	2UE31 -1CA1	2UE31 -SDA1
Fuse	[A]	10	10	10	16	16	25	32	35
Recommended	3NA	3803-6	3803-6	3803-6	3805-6	3805-6	3810-6	3812-6	3814-6
for UL specified	3NE	*	*	*	*	*	*	*	1803-0
Input Cable Min.	[mm ²] [awg]	1.0 18	1.0 18	1.0 18	1.5 16	1.5 16	2.5 14	4.0 12	6.0 10
Input Cable Max.	[mm ²] [awg]	10.0 8	10.0 8	10.0 8	10.0 8	10.0 8	10.0 8	10.0 8	35.0 2
Output Cable Min.	[mm ²] [awg]	1.0 18	1.0 18	1.0 18	1.0 18	1.0 18	2.5 14	4.0 12	4.0 12
Output Cable Max.	[mm ²] [awg]	10.0 8	10.0 8	10.0 8	10.0 8	10.0 8	10.0 8	10.0 8	35.0 2

Order No.	6SE6440-	2UE31 -8DA1	2UE32 -2DA1	2UE33 -0EA1	2UE33 -7EA1	2UE34 -5FA1	2UE35 -5FA1	2UE37 -5FA1
Fuse	[A]	50	63	80	80	125	160	160
Recommended	3NA	3820-6	3822-6	3824-6	3824-6	3132-6	3136-6	3136-6
for UL specified	3NE	1817-0	1818-0	1820-0	1820-0	1022-0	1224-0	1224-0
Input Cable Min.	[mm ²] [awg]	10.0 6	10.0 6	16.0 6	25.0 3	25.0 3	50.0 1/0	50.0 1/0
Input Cable Max.	[mm ²] [awg]	35.0 2	35.0 2	35.0 2	35.0 2	150.0 300	150.0 300	150.0 300
Output Cable	[mm ²]	6.0	10.0	16.0	16.0	25.0	35.0	50.0
Min.	[awg]	10	8	6	6	3	2	1/0
Output Cable	[mm ²]	35.0	35.0	35.0	35.0	150.0	150.0	150.0
Max.	[awg]	2	2	2	2	300	300	300

English	<p>Commissioning</p> <p>The MICROMASTER comes with a Status Display Panel (SDP) and default parameters settings to cover the following:</p> <ul style="list-style-type: none"> ➤ Motor rating data; voltage, current and frequency are all compatible with the inverter data ➤ Linear V/f motor speed, controlled by an analog potentiometer ➤ Maximum speed 3000 rpm with 50 Hz (3600 rpm with 60 Hz); controllable using a potentiometer via the inverter's analogue inputs ➤ Ramp-up time / Ramp-down time = 10 s
Deutsch	<p>Inbetriebnahme</p> <p>Der MICROMASTER wird mit einem Zustands-Anzeigefeld (Status Display Panel, SDP) und mit Parametereinstellungen geliefert, die folgende Anforderungen abdecken:</p> <ul style="list-style-type: none"> ➤ Die Motordaten, Spannung, Strom und Frequenz sind sämtlich mit den Daten des Umrichters kompatibel ➤ Lineare U/f-Kennlinie für Motordrehzahl, durch ein analoges Potentiometer gesteuert ➤ Höchstdrehzahl 3000/min bei 50 Hz (3600/min bei 60 Hz); steuerbar über ein an die Analogeingänge des Umrichters angeschlossenes Potentiometer ➤ Rampenhochlaufzeit / Rampenrücklaufzeit = 10 s
Français	<p>Mise en service</p> <p>Le MICROMASTER est fourni avec un panneau d'affichage SDP et avec un préréglage des paramètres couvrant les exigences suivantes :</p> <ul style="list-style-type: none"> ➤ Les caractéristiques nominales du moteur, la tension, le courant et la fréquence sont compatibles avec les caractéristiques du variateur ➤ Caractéristique linéaire de vitesse U/f avec commande par potentiomètre ➤ Vitesse maximale 3000 tr/min à 50 Hz (3600 tr/min à 60 Hz) ; réglable par un potentiomètre raccordé à une entrée analogique du variateur ➤ Temps de montée et temps de descente de 10 s
Español	<p>Puesta en servicio</p> <p>El MICROMASTER se entrega equipado con un panel SDP (Status Display Panel) y parámetros ajustados por defecto que cubren los requisitos siguientes:</p> <ul style="list-style-type: none"> ➤ Los datos nominales del motor – tensión, corriente y frecuencia – son todos compatibles con los datos del convertidor ➤ Característica V/f lineal de variación de velocidad en el motor, controlada por un potenciómetro analógico ➤ Velocidad máxima 3000/min con 50 Hz (3600/min con 60 Hz), controlable con un potenciómetro a través de las entradas analógicas del convertidor ➤ Tiempo de aceleración / tiempo de deceleración = 10 s
Italiano	<p>Messa in servizio</p> <p>L MICROMASTER è fornito con un display (Status Display Panel) per la visualizzazione e l'impostazione di parametri di default con il quale si può verificare:</p> <ul style="list-style-type: none"> ➤ Compatibilità dei dati di targa del motore, della tensione, della corrente e della frequenza ai dati dell'inverter ➤ Velocità lineare V/f del motore controllata da un potenziometro analogico ➤ Velocità massima di 3000/min a 50 Hz (3600/min a 60 Hz); controllabile tramite potenziometro attraverso gli ingressi analogici dell'inverter ➤ Tempo di accelerazione / Tempo di decelerazione = 10 s

Additional documentation support

SD Manual Collection

The SD Manual Collection is a complete collection of all Standard Drives documentation across the entire range of Standard Drives products, including Inverters, Motors and Geared-Motors. It is available to order as a DVD which runs in its own java-driven HTML interface. The order number for the SD Manual Collection is: **6SL3298-0CA00-0MG0**

On-line documentation

All Standard Drives documentation is available on-line at the following site:

<http://support.automation.siemens.com/ww/view/en/4000024>

All documents are available for download, including Operating Instructions and Parameter Lists.

Device description files (GSD)

The device description files (GSD) are used to integrated an Inverter into a higher level control device, for example, SIMATIC S7. The required GSD files can be downloaded from the internet at the following site:

<http://support.automation.siemens.com/ww/view/en/23450835>

Commissioning file for DeviceNet (EDS file)

EDS file for the DeviceNet module for the MICROMASTER 420, 430 and 440. This is required to operate the MICROMASTER 4 via DeviceNet and to allow the configuration tools to recognise the inverter. The required EDS files can be downloaded from the internet at the following site: **<http://support.automation.siemens.com/ww/view/en/11783545>**

Zusätzlicher Dokumentations Support

SD Betriebsanleitungen Kollektion

Die SD Betriebsanleitungen Kollektion ist eine umfassende, komplette Kollektion von allen Standard Drives Dokumenten. Diese Kollektion geht quer durch den gesamten Bereich der Standard Drive Produkte, einschließlich Frequenzumrichter, Motoren und Getriebemotoren. Es ist möglich die Dokumentation auch als DVD zu bestellen, die im Java Format mit HTML Schnittstelle verwendet werden kann. Die Bestellnummer für die SD Betriebsanleitungen Kollektion ist: **6SL3298-0CA00-0MG0**

On-line Dokumentation

Die gesamte Standard Drive Dokumentationen sind On-line auf der folgender Webseite verfügbar:

<http://support.automation.siemens.com/ww/view/en/4000024>

Alle Dokumente können heruntergeladen werden, begriffen sind Bedienungsanleitungen und Parameterlisten.

Generic Station Description Dateien (GSD)

Die Generic Station Description Dateien (GSD) werden benutzt, um einen Frequenzumrichter an eine übergeordnete Steuerung einzubinden, zum Beispiel SIMATIC Step7. Die erforderlichen GSD Dateien können von der folgenden Webseite heruntergeladen werden. **<http://support.automation.siemens.com/ww/view/en/23450835>**














Projektierungsdatei für DeviceNet (EDS Datei)

EDS Datei für die DeviceNet-Baugruppe für die MICROMASTER-Geräte 420, 430 und 440. Diese wird benötigt, um den MICROMASTER 4 als Teilnehmer am DeviceNet zu betreiben und das Gerät dem Projektierungstools bekannt zu machen. Die erforderlichen EDS Dateien können von der folgenden Webseite heruntergeladen werden. **<http://support.automation.siemens.com/ww/view/en/11783545>**

	English	Deutsch
P0010 1 = Quick Commissioning	Start Quick Commissioning P0010 must always be set back to '0' before operating the motor. However if P3900 = 1 is set after commissioning this is done automatically	Start Schnellinbetriebnahme P0010 muss vor der Betrieb des Motors auf '0' zurückgesetzt werden. Wird nach der Inbetriebnahme P3900 = 1 eingestellt, dann erfolgt dies automatisch.
P0100 0 = kW / 50 Hz 1 = hp / 60 Hz 2 = kW / 60 Hz	Operation for Europe / N. America For setting 0 and 1 use DIP Switch 2. For setting 2 use P0100	Betrieb für Europa / Nordamerika Die Einstellungen 0 und 1 sind über DIP-Schalter 2 herzustellen. Einstellung 2 über P0100
P0304 10 V - 2000 V	Rated Motor Voltage Nominal motor voltage (V) from rating plate	Motornennspannung Motornennspannung (V) vom Typenschild des Motors
P0305 0 ... 2 * I _{nom}	Rated Motor Current Nominal motor current (A) from rating plate	Motornennstrom I _{nom} = Motornennstrom (A) vom Typenschild
P0307 0 kW - 2000 kW	Rated Motor Power Nominal motor power (kW) from rating plate. If P0100 = 1, values will be in hp	Motornennleistung Motornennleistung (kW) vom Typenschild. Bei P0100 = 1, sind die Werte in hp
P0310 12 Hz - 650 Hz	Rated Motor Frequency Nominal motor frequency (Hz) from rating plate	Motornennfrequenz Motornennfrequenz (Hz) vom Typenschild





	English	Deutsch
P0311 0 - 40000 1/min	Rated Motor Speed Nominal motor speed (rpm) from rating plate	Motornennndrehzahl Motornennndrehzahl (1/min) vom Typenschild
P0700	Selection of Command Source (on / off / reverse) 1 = BOP 2 = Terminal / Digital Inputs (default)	Wahl von Befehlsquellen (EIN / AUS / Richtungsumkehr) 1 = BOP 2 = Klemmen (Werkseinstellung)
P1000	Selection of Frequency Setpoint 1 = BOP 2 = Analogue Setpoint (default)	Wahl des Frequenzsollwerts 1 = BOP 2 = Analogsollwert (Werkseinstellung)
P1080	Min. Motor Frequency Sets minimum motor frequency (0 - 650 Hz) at which the motor will run irrespective of the frequency setpoint. The value set here is valid for both clockwise and anti- clockwise rotation	Minimal Motorfrequenz Stellt die minimale Motorfrequenz (0 - 650 Hz) ein, mit der der Motor unabhängig vom Frequenzsollwert läuft. Der hier eingestellte Wert gilt für beide Drehrichtungen
P1082	Max. Motor Frequency Sets maximum motor frequency (0 - 650 Hz) at which the motor will run at irrespective of the frequency setpoint. The value set here is valid for both clockwise and anti-clockwise rotation	Maximal Motorfrequenz Stellt die höchste Motorfrequenz (0 - 650 Hz) ein, mit der der Motor unabhängig vom Frequenzsollwert läuft. Der hier eingestellte Wert gilt für beide Drehrichtungen








	English	Deutsch
P1120 0 - 650 s	Ramp-Up Time Time taken for the motor to accelerate from standstill up to maximum motor frequency.	Rampenhochlaufzeit Zeit für das Beschleunigen vom Stillstand bis zur maximalen Motorfrequenz.
P1121 0 - 650 s	Ramp-Down Time Time taken for motor to decelerate from maximum motor frequency down to standstill	Rampenrücklaufzeit Zeit zum Verzögern von höchster Motorfrequenz bis zum Stillstand
P3900	End Quick Commissioning 0 = End Quick Commissioning without motor calculation or factory reset. 1 = End Quick Commissioning with motor calculation and factory reset (Recommended). 2 = End Quick Commissioning with motor calculation and with I/O reset. 3= End Quick Commissioning with motor calculation but without I/O reset.	Ende Schnellenbetriebnahme 0 = Beendet die Schnellenbetriebnahme auf Basis der aktuellen Einstellungen (ohne Motorberechnung). 1 = Beendet die Schnellenbetriebnahme auf Basis der Werkseinstellung (mit Motorberechnung) (empfohlen). 2 = Beendet die Schnellenbetriebnahme auf der Basis der aktuellen Einstellungen (mit Motorberechnung und E/A-Rücksetzung). 3= Beendet die Schnellenbetriebnahme auf der Basis der aktuellen Einstellungen (mit Motorberechnung, ohne E/A-Rücksetzung).

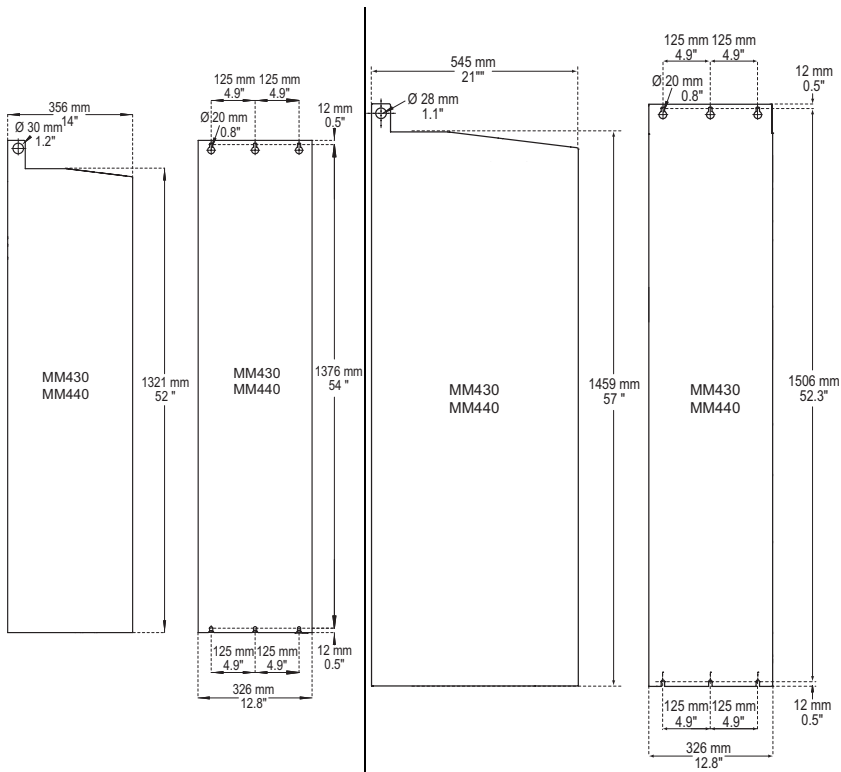
	Mains not present Keine Netzspannung Pas de tension réseau Red no presente Alimentazione di rete non presente
 	Ready to run Betriebsbereit Variateur prêt au service Preparado para funcionar Pronto ad entrare in funzione
 	Inverter fault - other than the ones listed below Andere Umrichterstörung als unten aufgezählt Autre défaut du variateur que ci-dessous Fallo en convertidor, uno de los listados abajo Errore inverter - diverso da quelli sotto elencati
 	Inverter running Umrichter in Betrieb Variateur en fonctionnement Convertidor en marcha Inverter in funzione
 	Fault overcurrent Störung Überstrom Défaut surintensité Fallo sobrecorriente Errore sovracorrente
 	Fault overvoltage Störung Überspannung Défaut surtension Fallo sobretensión Errore sovratensione
 	Fault motor overtemperature Störung Motorübertemperatur Défaut surchauffe moteur Fallo sobrettemperatura motor Errore surriscaldamento motore



LEDs for indicating the drive state
Anzeige des Umrichterzustands
LED d'état du variateur
LEDs indicadores estado de accionamiento
Led di visualizzazione dello stato del convertitore

 On Ein Marche On On	 Off Aus Arrêt Off Off
 ca. 0,3 s Flashing Flackernd Papillotement Parpadeo Sfarfallante	 ca. 1 s Twinkling Blinkend Clignotement Intermittencia Intermittente

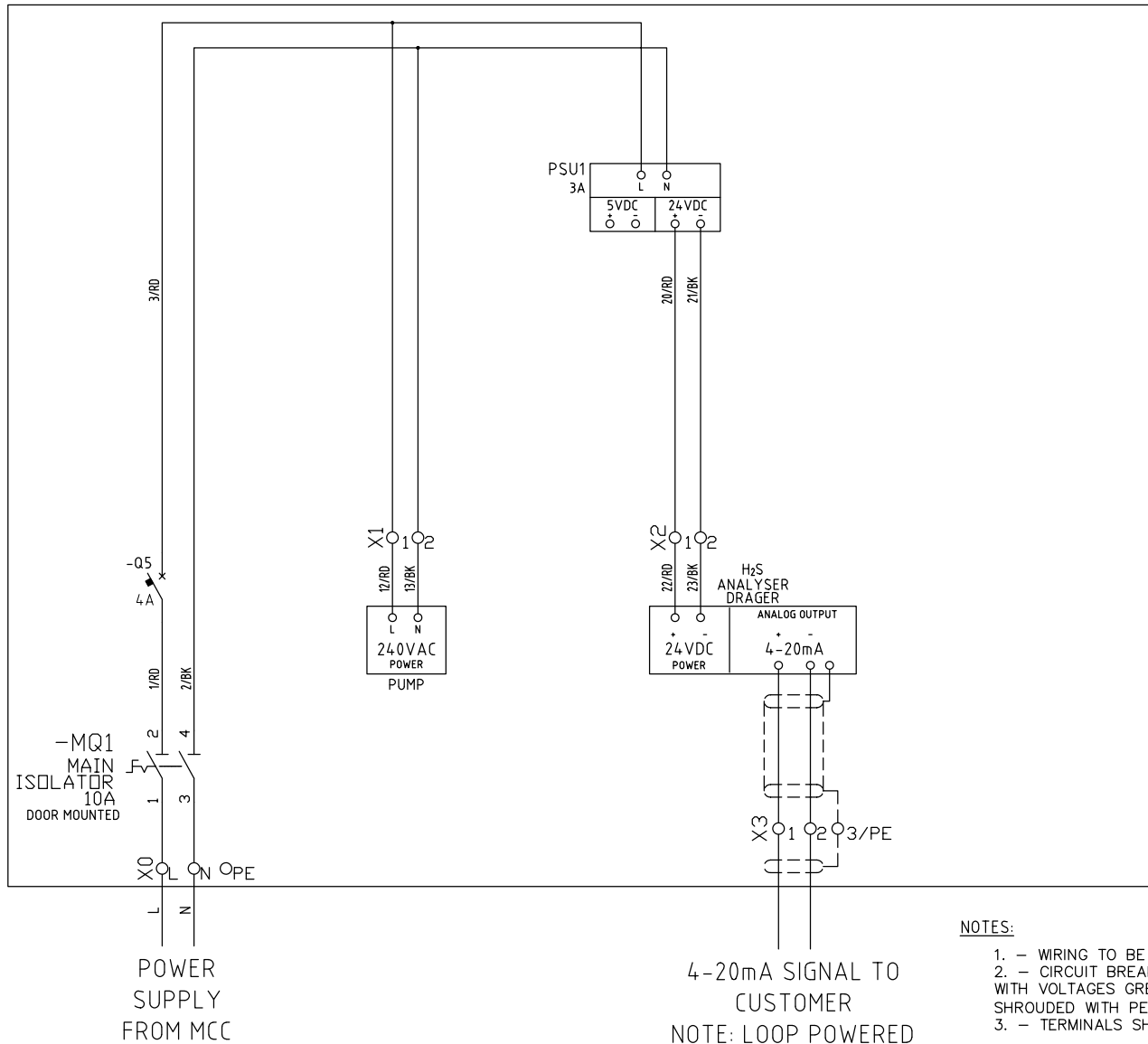
	<p>Fault inverter temperature Störung Umrichterübertemperatur Défaut surchauffe variateur Fallo sobretemperatura convertidor Errore surriscaldamento inverter</p>
	<p>Warning current limit - both LEDs twinkling same time Warnung Stromgrenzwert - Beide LEDs blinken gleichzeitig Seuil d'alarme de courant - les deux LED clignotent en phase Alarma límite corriente - Ambos LEDs intermiten al mismo tiempo Segnalazione limite corrente - Lampeggio intermittente contemporaneo di entrambi i LED</p>
	<p>Other warnings - both LEDs twinkling alternatively Sonstige Warnungen - Beide LEDs blinken abwechselnd Autres alarmes - les deux LED clignotent en alternance Otras alarmas - Ambos LEDs intermiten alternativamente Altre segnalazioni - Lampeggio intermittente alternato di entrambi i LED</p>
	<p>Undervoltage trip / undervoltage warning Unterspannungsabschaltung/-warnung Coupure/alarme de sous tension Disparo/alarma por minima tension Scatto per sottotensione / segnalazione sottotensione</p>
	<p>Drive is not in ready state - Display state > 0 Umrichter nicht bereit - Anzeige > 0 Variateur non prêt - affichage > 0 Accionamento no listo - Estado display > 0 Azionamento non in stato pronto - Stato display > 0</p>
	<p>ROM failure - Both LEDs flashing same time ROM Störung - Beide LEDs flackern gleichzeitig Défaut ROM - les deux LED papillotent en phase Fallo en ROM - Ambos LEDs parpadean al mismo tiempo Errore ROM - Sfarfallio contemporaneo di entrambi i LED</p>
	<p>RAM failure - Both LEDs flashing alternatively RAM Störung - Beide LEDs flackern abwechselnd Défaut RAM - les deux LED papillotent en alternance Fallo en RAM - Ambos LEDs parpadean alternativamente Errore RAM - Sfarfallio alternato di entrambi i LED</p>



13.0 H2S ANALYSER PANEL

13.1 H2S ANALYSER PANEL – HIGH RANGE M&E DRAWING

ANALYSER CABINET

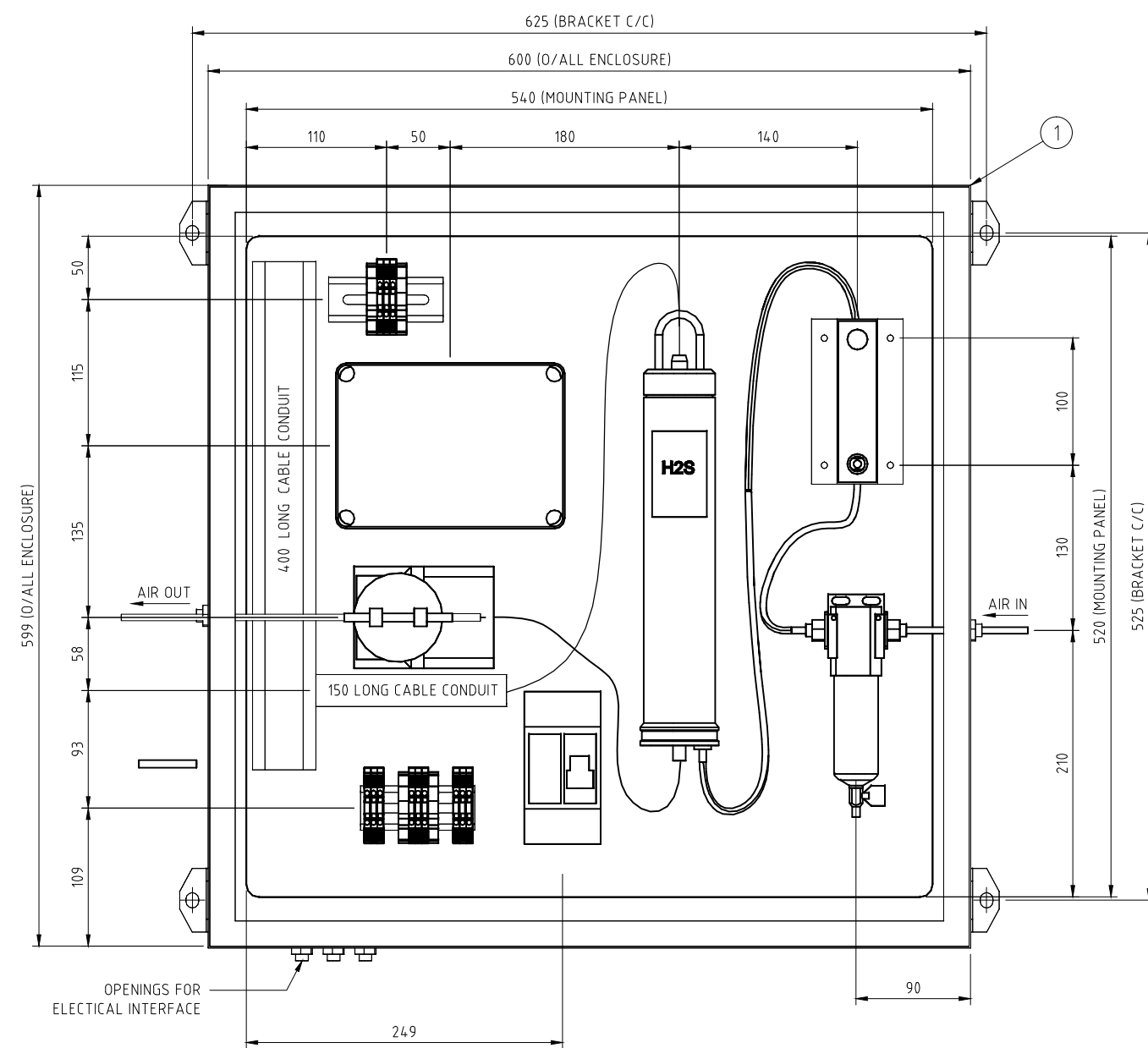


NOTES:

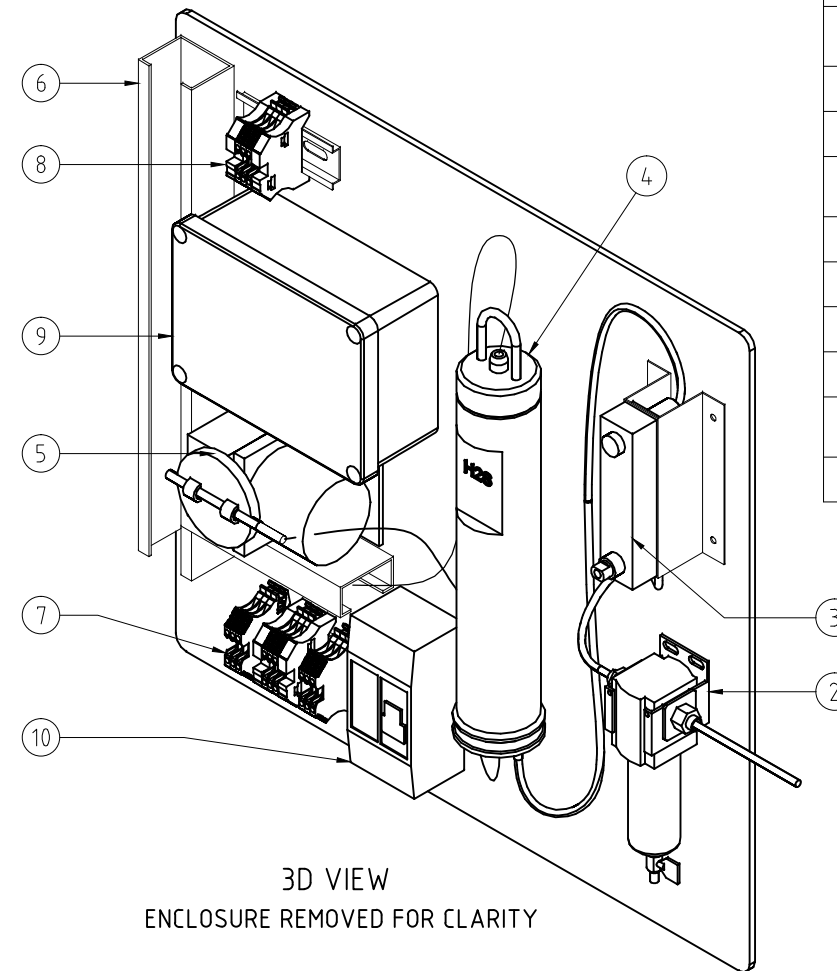
1. - WIRING TO BE IN ACCORDANCE WITH AS3000
2. - CIRCUIT BREAKER, POWER SUPPLY AND WIRE TERMINALS WITH VOLTAGES GREATER THAN 50 VOLTS ARE TO BE SHROUDED WITH PERSPEX COVER AND LABELLED "DANGER LIVE"
3. - TERMINALS SHALL BE WEIDMULLER TYPE WDU, WPE

REV			DATE			DESCRIPTION			DRN			CHK			APP			THIS DRAWING IS PROPERTY OF SIEMENS AND MUST NOT BE COPIED IN ANY FORM WITHOUT PERMISSION OF SIEMENS.			SCALE : 1:40			CLIENT			PROJECT			DRAWING NO.			REV		
3			01.08.2012			AS BUILT			GK			DC			PCC			160 HERRING ROAD MACQUARIE PARK NSW 2113 AUSTRALIA TEL: +61294915425 FAX: +61294915144			SIGNATURE			DATE			QUEENSLAND URBAN UTILITIES			DRAWING NO.			REV		
2			02.03.2012			FOR CONSTRUCTION 2			GK			DC			PCC						DRN			11.11.2011			PROJECT			20338-EL-300			3		
1			23.12.2011			FOR CONSTRUCTION			GK			DC			PCC						CHK			11.11.2011			SEWAGE PUMP STATION SP-01			CONTRACT NO.					
0			20.12.2011			FIRST ISSUE			GK			DC			VP						APP			11.11.2011			DRAGER ANALYSER CABINET			CONTRACT NO.					
REV			DATE			DESCRIPTION			DRN			CHK			APP												TITLE : WIRING DIAGRAM			A3			SHEET 1 OF 1		

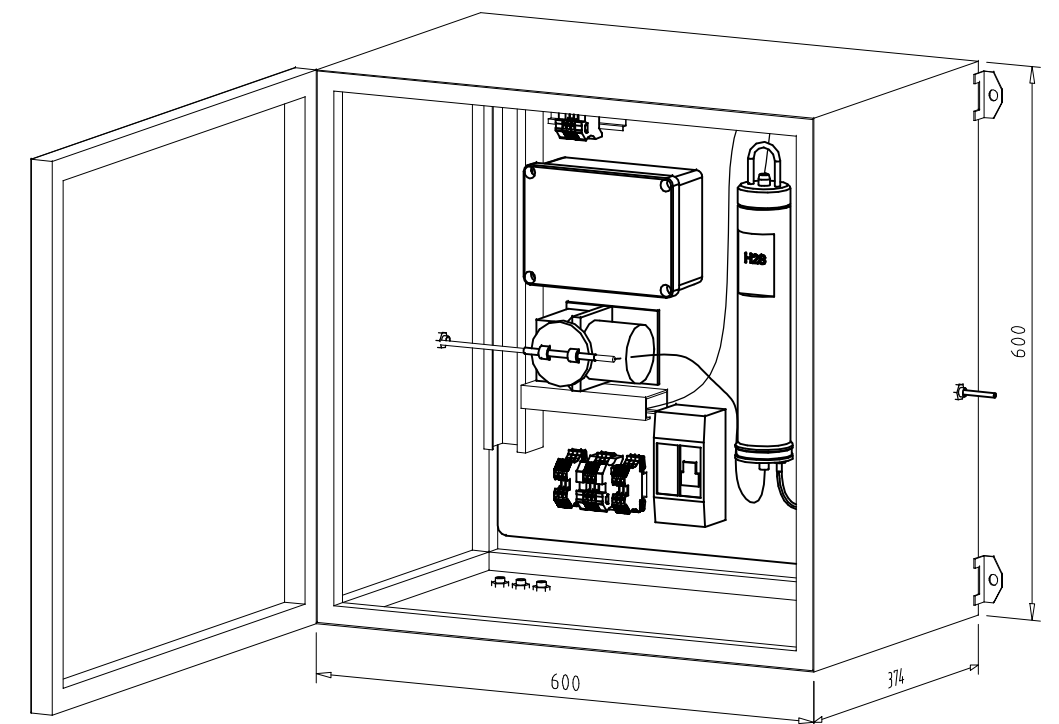
13.2 H2S ANALYSER PANEL – LOW RANGE M&E DRAWING



FRONT ELEVATION
DOOR REMOVED FOR CLARITY





3D VIEW
ENCLOSURE REMOVED FOR CLARITY

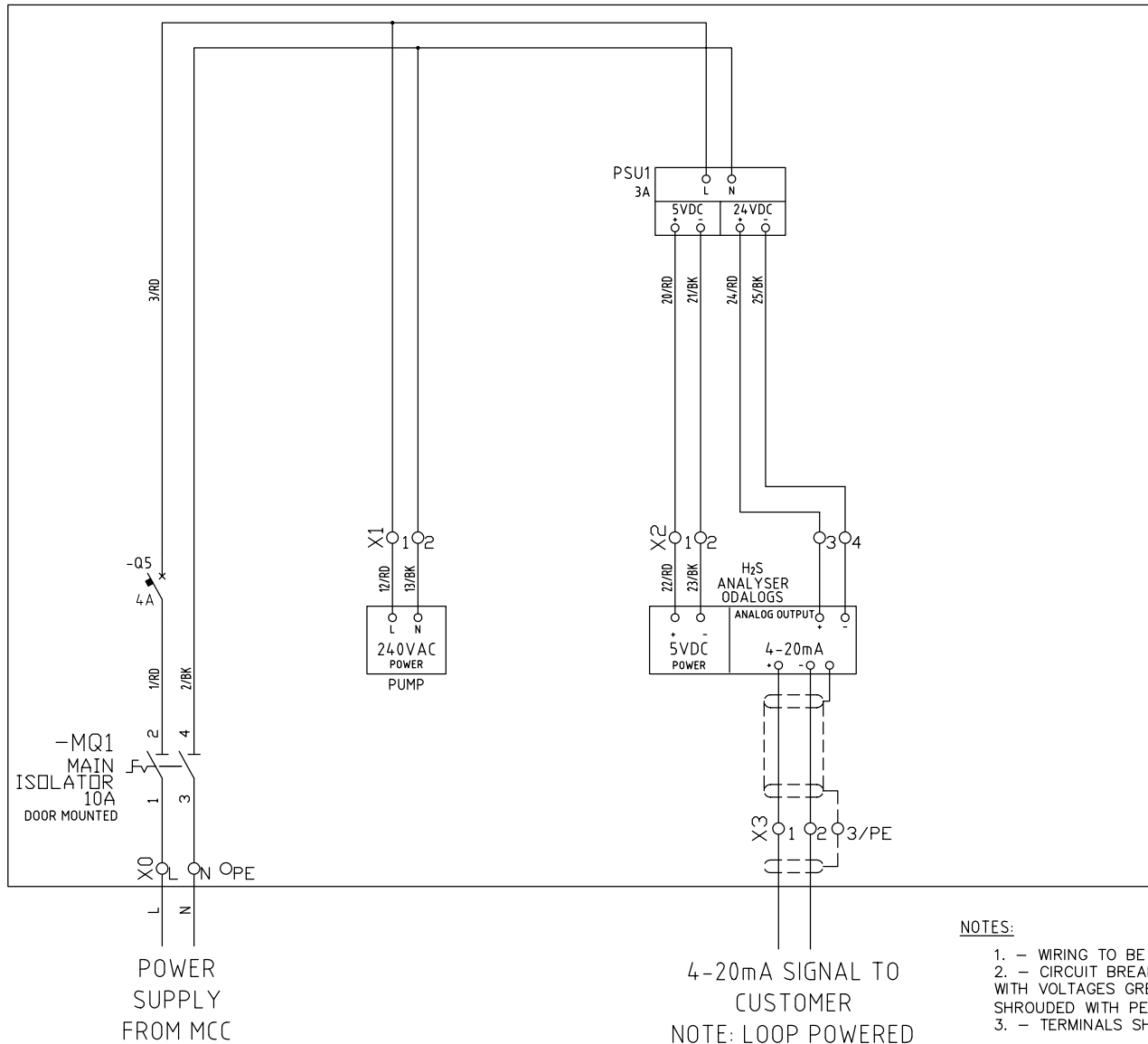


3D VIEW WITH ENCLOSURE

ITEM NO.	TITLE	QUANTITY
1	B&R IP21214/S ENCLOSURE, 316SS COMP. WITH 4 MOUNTING BRACKETS	1
2	AIR FILTER, AMJ3000	1
3	AIR ROTAMETER, KYTOLA LH-4B R-R	1
4	H2S ODALOG ANALYSER LOW RANGE, 0-2ppm	1
5	IWAKI AIR PUMP, APN085 LV-04	1
6	CABLE CONDUIT	-
7	TERMINAL STRIP	1
8	ISOLATION SWITCH (EXTERNAL ON DOOR)	1
9	35W DUAL OUTPUT SWITCHING POWER SUPPLY	1
10	CIRCUIT BREAKER	1

						DO NOT SCALE IF IN DOUBT ASK	 SIEMENS Water Technologies A.B.N. 98 004 347 880 160 HERRING ROAD MACQUARIE PARK NSW 2113 AUSTRALIA TEL: +61294915425 FAX: +61294915144	SCALE : 1:40		CLIENT							
								SIGNATURE		DATE		PROJECT SEWAGE PUMP STATION SP-01 ODOUR CONTROL FACILITY			DRAWING NO. 20338-GA-510		REV 2
2	17.06.2013	AS BUILT		VK	VP			DRN	VK	6.01.2012							
1	07.03.2012	AIR PUMP CHANGED		VK	JP			CHK	VP	6.01.2012							
0	17.01.2012	FOR REVIEW		VK	JP	VP	APP	VP	6.01.2012		TITLE : H2S ANALYSER PANEL - LOW RANGE			A3	SHEET 1 OF 1		
REV	DATE	DESCRIPTION			DRN	CHK	APP	ALL DIMENSIONS IN MILLIMETRES		THIS DRAWING IS PROPERTY OF SIEMENS AND MUST NOT BE COPIED IN ANY FORM WITHOUT PERMISSION OF SIEMENS.							

ANALYSER CABINET

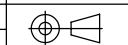


NOTES:

1. - WIRING TO BE IN ACCORDANCE WITH AS3000
2. - CIRCUIT BREAKER, POWER SUPPLY AND WIRE TERMINALS WITH VOLTAGES GREATER THAN 50 VOLTS ARE TO BE SHROUDED WITH PERSPEX COVER AND LABELLED "DANGER LIVE"
3. - TERMINALS SHALL BE WEIDMULLER TYPE WDU, WPE

									DO NOT SCALE IF IN DOUBT ASK			SIEMENS Water Technologies A.B.N. 98 004 347 880			SCALE : 1:40			CLIENT																
3			01.08.2012			AS BUILT			GK			DC			PCC			SIGNATURE			DATE			PROJECT SEWAGE PUMP STATION SP-01 ODALOG ANALYSER CABINET ZABOCS ZB-5000						DRAWING NO. 20338-EL-301		REV 3		
2			02.03.2012			FOR CONSTRUCTION 2			GK			DC			PCC			DRN			GK									11.11.2011				
1			23.12.2011			FOR CONSTRUCTION			GK			DC			PCC			CHK			DC									11.11.2011				
0			20.12.2011			FIRST ISSUE			GK			DC			VP			APP			VP									11.11.2011				
REV			DATE			DESCRIPTION			DRN			CHK			APP			ALL DIMENSIONS IN MILLIMETRES			THIS DRAWING IS PROPERTY OF SIEMENS AND MUST NOT BE COPIED IN ANY FORM WITHOUT PERMISSION OF SIEMENS.			TITLE : WIRING DIAGRAM						A3		SHEET 1 OF 1		
1			2			3			4			5			6			7			8													

DO NOT SCALE
IF IN DOUBT ASK



SIEMENS Water Technologies
A.B.N. 98 004 347 880
160 HERRING ROAD
MACQUARIE PARK NSW 2113
AUSTRALIA
TEL: +61294915425 FAX: +61294915144

ALL DIMENSIONS
IN MILLIMETRES

THIS DRAWING IS PROPERTY OF SIEMENS
AND MUST NOT BE COPIED IN ANY FORM
WITHOUT PERMISSION OF SIEMENS.

SCALE : 1:40

SIGNATURE

DRN

CHK

APP

VP

DATE

11.11.2011

11.11.2011

11.11.2011

11.11.2011

CLIENT

QUEENSLAND URBAN UTILITIES

PROJECT

SEWAGE PUMP STATION SP-01
ODALOG ANALYSER CABINET
ZABOCS ZB-5000

DRAWING NO.

20338-EL-301

CONTRACT NO.

CONTRACT.NO

REV

3

REV

REV

13.3 **SMC AIR FILTER**

Drain Separator for Vacuum
Series AMJ



Remove water droplets from air by simply installing in vacuum equipment connection lines. Effective for removing water droplets from the air sucked into vacuum pumps and ejectors, etc.

Drain Separator for Vacuum

Series *AMJ*

Over 90% of droplets can be removed through the use of a special water droplet removing element.

The provision of a drain cock makes it possible to discharge the drain manually after breaking the vacuum.

Even when the element is saturated with water, there is almost no drop in pressure (increase in resistance).

The element can be replaced with a single touch.



How to Order

AMJ 30 00- 03

AMJ3000-02B

Body size

30	3/8
40	1/2
50	3/4

Bracket

Nil	Without bracket
B	With bracket

Thread type

Nil	Rc(PT)
F	G(PF)
N	NPT

Port size

02	1/4
03	3/8
04	1/2
06	3/4
10	1

Models

Model	AMJ3000	AMJ4000	AMJ5000
Recommended flow rate ℓ/min (ANR)	200	300	500
Port size (nominal size B)	1/4, 3/8	3/8, 1/2	3/4, 1
Weight (kg)	0.3	0.6	1.1

Specifications

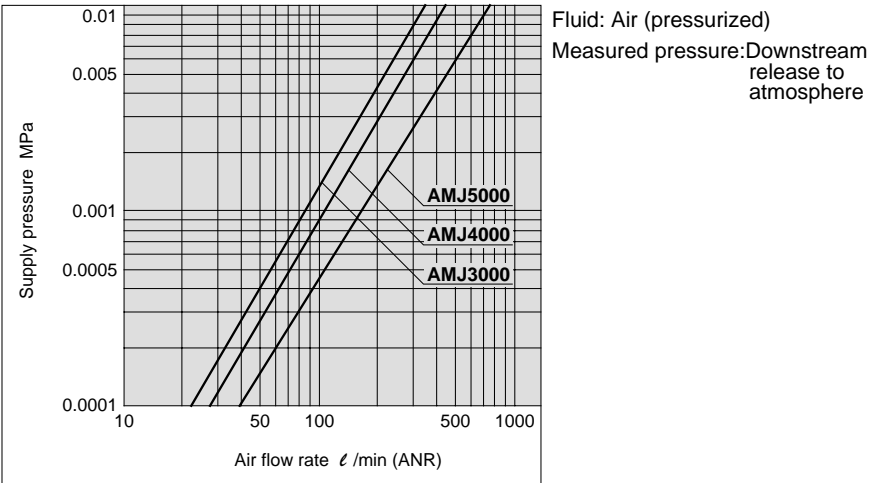
Fluid	Air
Maximum operating pressure	1.0MPa {10.2kgf/cm ² }
Minimum operating pressure	-750mmHg
Proof pressure	1.5MPa {15.3kgf/cm ² }
Ambient & fluid temperature	5 to 60°C
Water drop removal ratio	90%
Element life	2 years or when pressure drops by 0.02MPa {0.2kgf/cm ² }

Accessories (Optional)

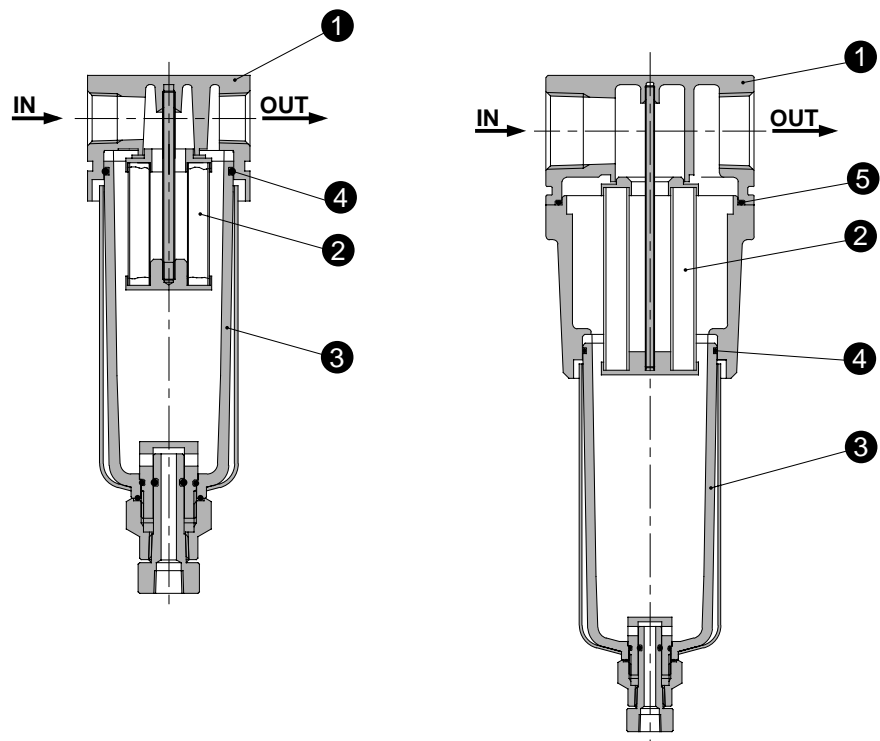
Applicable model	AMJ3000	AMJ4000	AMJ5000
Bracket assembly (with 2 mounting screws)	B340A	B440A	B640A

Drain Separator for Vacuum *Series AMJ*

Flow Rate Characteristics



Construction



Parts list

No.	Description	Material	Note
①	Body	Die-cast aluminum	Platinum silver coating

Replacement parts

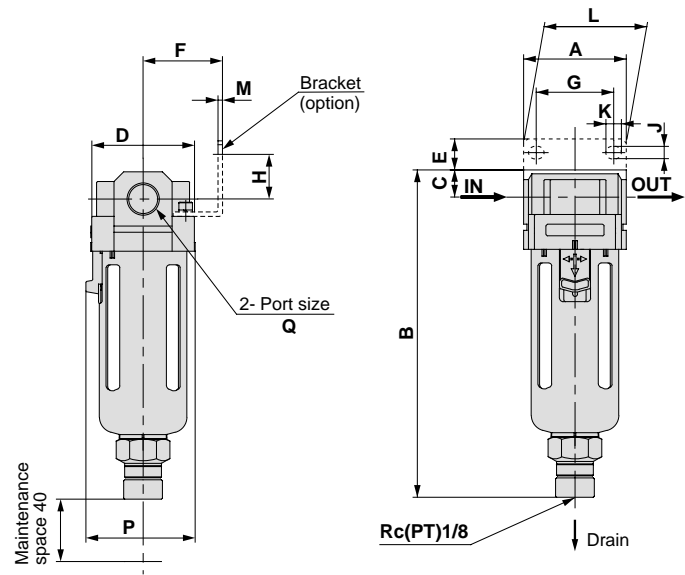
No.	Description	Material	Part No.		
			AMJ3000	AMJ4000	AMJ5000
②	Element assembly		AMJ-EL3000	AMJ-EL4000	AMJ-EL5000
③	Case assembly ^(Note)	Polycarbonate	AMJ-CA3000-A	AMJ-CA4000-A	AMJ-CA5000-A
④	O-ring	NBR	111512	111636	111636
⑤	O-ring	NBR	—	—	111710

(Note) The case assembly includes a case guard (material: SPCE).

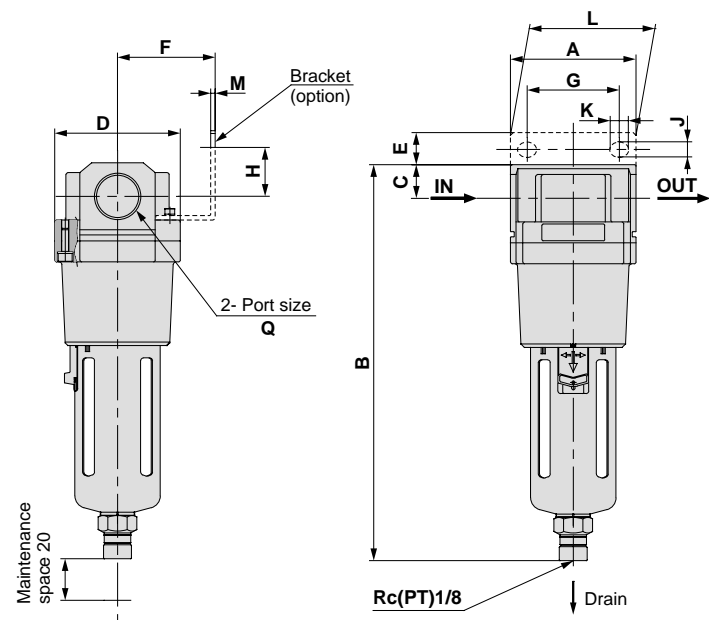
Series AMJ

Dimensions

AMJ3000, 4000



AMJ5000



Model	Port size Q	A	B	C	D	Bracket mounting dimensions								P
						E	F	G	H	J	K	L	M	
AMJ3000	Rc(PT)1/4, 3/8	53	169	14	53	16	41	40	23	6.5	8	53	2.3	56
AMJ4000	Rc(PT)3/8, 1/2	70	205	18	70	17	50	54	26	8.5	10.5	70	2.3	73
AMJ5000	Rc(PT)3/4, 1	90	284	24	90	23	70	66	35	11	13	90	3.2	—


(mm)





Series AMJ

Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by a label of "**Caution**", "**Warning**" or "**Danger**". To ensure safety, be sure to observe ISO 4414 Note 1), JIS B 8370 Note 2) and other safety practices.

 **Caution** : Operator error could result in injury or equipment damage.

 **Warning** : Operator error could result in serious injury or loss of life.

 **Danger** : In extreme conditions, there is a possible result of serious injury or loss of life.

Note 1) ISO 4414 : Pneumatic fluid power – Recommendations for the application of equipment to transmission and control systems.

Note 2) JIS B 8370 : Pneumatic system axiom.

Warning

1 The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.

Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.

2 Only trained personnel should operate pneumatically operated machinery and equipment.

Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.

3 Do not service machinery/equipment or attempt to remove components until safety is confirmed.

1. Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
2. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
3. Before machinery/equipment is re-started, take measures to prevent shooting-out of cylinder piston rod, etc. (Bleed air into the system gradually to create back-pressure.)

4 Contact SMC if the product is to be used in any of the following conditions:

1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.



Series AMJ

Air Cleaning Equipment Precautions 1

Be sure to read before handling.

Precautions on Design

Employ a safe design so that the following type of unexpected conditions will not occur.

⚠ Warning

1. A safe design should be employed which addresses the possibility of accidents following a drop in vacuum pressure due to clogging or trouble with the air supply, etc.

If vacuum pressure drops and the adsorption force of the vacuum pad is lost, work pieces which are being carried will fall, causing a danger of human injury and damage to machinery. Safety measures should be employed, such as the installation of drop prevention guides, etc.

2. When operating with repetitive positive/negative pressure with a rapid repetition, the positive pressure side should be kept at 0.1MPa or less.

Depending on conditions such as the pressure and the rate of repetition, the bowl may become hot.

Selection

⚠ Warning

1. Confirm the specifications.

The products contained in this catalog are designed only for use in compressed air systems (including vacuum).

Do not operate outside the specified range of pressure and temperature, etc., as this will cause damage or malfunction. (Refer to specifications.)

Contact SMC before using any fluid other than compressed air (including vacuum).

2. When selecting equipment, first adequately confirm the purpose for which it will be used, the required specifications and the operating conditions (pressure, flow rate, temperature, environment), etc. Then select from the latest catalog so that the specification range will not be exceeded. Contact SMC in advance with questions about any unclear points.

3. This product cannot be used on board vehicles or vessels.

This product cannot be used on board vehicles, vessels or other transportation devices, because vibration will cause damage. If this type of use is unavoidable, contact SMC in advance.

⚠ Caution

1. Do not allow flow greater than the rated flow rate.

If the flow exceeds the rated flow rate even momentarily, this can cause condensation and oil to be sprayed into the downstream side or result in damage.

Mounting

⚠ Warning

1. Instruction manual.

The product should be mounted and operated after reading the manual carefully and having a good understanding of its contents. The manual should also be kept where it can be referred to whenever necessary.

2. Ensure sufficient maintenance space.

Be sure to allow the space required for maintenance and inspections.

3. Be certain to keep threads tightened with the proper torque.

1. When screwing in piping, hold the side with the female thread and tighten with the recommended proper torque.

If the tightening torque is insufficient, this will cause looseness and faulty sealing. If the tightening torque is too high, this will cause damage to the threads, etc. Furthermore, if the female thread side is not held when tightening, a large force will be applied directly to the piping bracket and other parts, which may cause damage.

Recommended proper torque N·m (Kgf·cm)

Connection thread	M5	1/8	1/4	3/8	1/2	3/4	1
Torque	1.5 to 2 (15 to 20)	7 to 9 (70 to 90)	12 to 14 (120 to 140)	22 to 24 (220 to 240)	28 to 30 (280 to 300)	28 to 30 (280 to 300)	36 to 38 (360 to 380)

2. Twisting moment or bending moment other than the dead weight of the equipment should not be applied.

To avoid damage, external piping should be supported separately from the product.

3. Non-flexible piping is easily subject to the propagation of excessive moment load and vibration, etc. from steel and other similar pipes. Therefore, some type of flexible tubing should be used in between the equipment and the external piping to prevent this effect.

⚠ Caution

1. Confirm the mounting position.

Since the mounting position is different for each piece of equipment, this point should be confirmed either in this catalog or in the instruction manual. If mounted in a tilted position, this can cause malfunction of drain discharging and damage to the equipment.

2. Ensure sufficient maintenance space.

When installing and mounting, be sure to allow the space required for maintenance and inspections. Confirm the necessary maintenance space in the instruction manual for each piece of equipment.



Series AMJ

Air Cleaning Equipment Precautions 2

Be sure to read before handling.

Piping

Caution

1. Preparation before piping.

Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove cutting chips, cutting oil and other debris from inside the pipe.

2. Wrapping of pipe tape.

When screwing together pipes and fittings, etc., be certain that cutting chips from the pipe threads and sealing material do not get inside the piping.

Further, when pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the pipe.

3. Implement measures to prevent condensate from collecting inside piping.

For example, drains should be installed in the lower sections of piping that rises, or piping should be designed with a slight taper provided along the direction of flow so that drainage will not accumulate.

4. Confirm IN and OUT ports.

When piping is being installed, take care to prevent incorrect connection of the water and air sides, or the IN and OUT ports.

Air Supply

Warning

1. Types of fluid.

This product is designed for use with compressed air (including vacuum). Contact SMC in case a different fluid is to be used.

Contact SMC regarding the types of fluids which can be used in products designed for use with general purpose fluids.

2. Do not use compressed air which contains chemicals, organic solvents or corrosive gases.

Do not use compressed air containing chemicals, organic solvents, salt or corrosive gases, as this can cause damage and malfunction, etc.

3. Operating pressure range.

The operating pressure range is determined by the equipment being used. Operation beyond this range can cause malfunction or failure.

Operating Environment

Warning

1. Do not use in the following environments, as this can cause failure.

1. Locations with an atmosphere of corrosive gases, organic solvents or chemical solutions, and locations where there may be contact with the same.
2. Locations where there is contact with sea spray, water or steam.
3. Locations which receive direct sunlight. (Sunlight should be blocked to prevent deterioration of resin from ultra violet rays and over heating, etc.)
4. Locations near heat sources with poor ventilation. (Heat sources should be blocked off, because radiated heat may cause damage due to softening of materials.)

Operating Environment

Warning

5. Locations with impacts or vibration. (Confirm specifications.)
6. Locations with high moisture and dust. (Contact SMC in advance.)

2. Adhere to the fluid and ambient temperature ranges.

The fluid and ambient temperatures are determined by the equipment being used. Operation beyond this range can cause damage, failure or malfunction, etc.

Maintenance

Warning

1. Maintenance should be performed in accordance with the procedures in the instruction manual.

If handled improperly, this can cause damage or malfunction in equipment and devices, etc.

2. Maintenance operations.

Since compressed air can be dangerous if handled improperly, element replacement and other maintenance, etc. should be performed by personnel having sufficient knowledge and experience pertaining to pneumatic equipment, while also adhering to the product specifications.

3. Drain flushing.

Drains should be flushed periodically. (Refer to specifications.)

4. Pre-maintenance checks.

When the product is to be demounted, first the electric power supply should be shut off and supply pressure should also be stopped. Then compressed air in the piping should be exhausted, and an atmospheric release condition should be confirmed before proceeding.

5. Post maintenance checks.

After mounting, repair or renovation, compressed air and electric power, etc. can be reconnected, and then suitable function and leak inspections should be performed. If an audible leak is detected or equipment does not operate properly, operation should be stopped and correct mounting should be confirmed.

6. When performing inspections, the compressed air pressure should be set to zero.

When the compressed air side is to be disassembled for inspections or filter element replacement, etc., first confirm that the pressure is at zero before proceeding.

7. Disassembly and modification is prohibited.

The main unit should not be disassembled or modified, etc.

Caution

1. Do not step on or place heavy objects on the unit.

The equipment may be deformed or damaged, and if balance is lost, a fall may cause injury.

2. Discharge drainage regularly.

If drainage accumulates in equipment, in piping or other areas, this can cause malfunction of the equipment or unexpected trouble due to splash over into the downstream side, etc. Therefore, the amount of drainage should be checked every day.



Series AMJ Specific Product Precautions 1

Be sure to read before handling.

Refer to pages 4 through 6 for safety precautions and air cleaning equipment precautions.

Mounting

Caution

1. Air piping should be thoroughly flushed before mounting.
2. When piping and fittings, etc. are being screwed together, take care that cutting chips from the pipe threads, sealing material and other debris do not get inside the piping.
Further, when pipe tape is used, leave 1.5 to 2 thread ridges exposed at the end of the pipe.
3. The unit should be mounted vertically.

Atmosphere

Warning

1. Since the case material is polycarbonate, avoid using chemicals such as thinner, carbon tetrachloride, chloroform, aniline, cyclohexane, trichloroethylene, sulfuric acid, lactic acid or water-miscible cutting fluid (alkaline), etc. Operation of the product in an atmosphere containing any of these chemicals should also be avoided.

A neutral detergent may be used for cleaning the case.

2. Avoid use in direct sunlight.

Maintenance

Caution

1. The element should be replaced after 2 years of use, or before the pressure drops to 0.02MPa {0.2kgf/cm²}.

The spacer and O-ring should also be replaced at the same time that the element is replaced.

Sometimes when the case is removed for a purpose other than replacing the element, the spacer may stick to the case and come off. In this case however, it may be returned to its installed position and used again.

2. Drainage should be discharged by the time it reaches the upper limit.

Furthermore, when drainage is to be discharged or the element replaced, first confirm that all equipment, etc. is stopped, and return the case interior to atmospheric pressure before proceeding.

SMC UK Regional Centres

BELFAST

Tel:01232 778414 Fax:01232 778422
SMC Pneumatics (UK) Ltd
Northern Ireland Regional Centre
Suite 3, Shaftesbury House, Edgewater Road
Belfast
BT3 9JQ

BIRMINGHAM

Tel:01675 467177 Fax:01675 465073
SMC Pneumatics (UK) Ltd
Birmingham Regional Centre
24 The Courtyard, Gorsey Lane, Coleshill
Warwickshire
B46 1JA

BRISTOL

Tel:01179 522155 Fax:01179 522186
SMC Pneumatics (UK) Ltd
Bristol Regional Centre
5 East Gate Office Centre
East Gate Road, Eastville, Bristol
BS5 6XX

CRAWLEY

Tel:01293 614094 Fax:01293 614135
SMC Pneumatics (UK) Ltd
Crawley Regional Centre
9 Pelham Court, Pelham Place, Broadfield
Crawley
RH11 9AZ

CUMBERNAULD

Tel:01236 781133 Fax:01236 780611
SMC Pneumatics (UK) Ltd
Scottish Regional Centre
1 Carradale Crescent,
Broadwood Business Park, Cumbernauld
Glasgow
G69 9LE

DROITWICH - Opening Summer 98

SMC Pneumatics (UK) Ltd
Droitwich Regional Centre
Hampton Park, Hampton Lovett
Droitwich
Worcestershire

IPSWICH

Tel:01473 240040 Fax:01473 747707
SMC Pneumatics (UK) Ltd
Ipswich Regional Centre
Unit 6 & 7, Alpha Business Park
Whitehouse Road, Ipswich, Suffolk
IP1 5LT

MANCHESTER

Tel:0161 876 7371 Fax:0161 876 7372
SMC Pneumatics (UK) Ltd
Manchester Regional Centre
3 Modwen Road, Waters Edge Business Park
Ordsall Lane, Salford, Manchester
M5 3EZ

MILTON KEYNES

Tel: 01908 265247 Fax: 01908 262705
SMC Pneumatics (UK) Ltd
Vincent Avenue, Crownhill, Milton Keynes
MK8 0AN

NEWCASTLE

Tel:0191 487 2040 Fax:0191 487 2041
SMC Pneumatics (UK) Ltd
Newcastle Regional Centre
Unit B6 Marquis Court, Marquis Way
Team Valley Trading Estate, Gateshead
Tyne & Wear
NE11 0RU

POOLE

Tel:01202 732233 Fax:01202 737743
SMC Pneumatics (UK) Ltd
Poole Regional Centre
Unit 4 Acorn Business Centre, Ling Road
Poole, Dorset
BH12 4NZ

SHEFFIELD

Tel: 01909 565504 Fax: 01909 569717
SMC Pneumatics (UK) Ltd
Sheffield Regional Centre
Unit 6, North Anston Business Park
Houghton Road, North Anston, Sheffield
S31 7JJ

SMC UK Distributors

Birmingham

JAMES LISTER
Tel: 0121 5803800
Fax: 0121 5535951

Blackburn

BLACKBURN PNEUMATIC SYSTEM LTD
Tel: 01254 682232
Fax: 01254 682224

Bristol

APPLIED AUTOMATION
Tel: 0117 9827769
Fax: 0117 9235522

Bury St Edmunds

PNEUMATIC LINES
Tel: 01284 706239
Fax: 01284 761218

Cardiff

WALES FLUID POWER
Tel: 01222 494551
Fax: 01222 481955

East Grinstead

AUTARKY AUTOMATION
Tel: 01342 311388
Fax: 01342 323733

Newton Aycliffe

ONCAD AUTOMATION
Tel: 01325 311599
Fax: 01325 307562

Plymouth

APPLIED AUTOMATION
Tel: 01752 343300
Fax: 01752 341161

Redditch

MULTI-PNEUMATICS
Tel: 01527 522660
Fax: 01527 502474

13.4 KYTOLA FLOW METER

FLOW METER

Model L

Model L is a sturdy variable area flow meter for industrial liquid and gas flow monitoring.



Model LH



Model L with constant
flow regulator model 2850

FEATURES

- Plastic flow tube with stainless steel connections
- Flow adjustment valve
- Several flow ranges
- Clear, easy to read scale

TYPICAL APPLICATIONS

- Gas purging
- Water purging
- Liquid and gas flow monitoring

OPTIONS

- Scale for alternative gases and liquids
- Constant flow regulator
- Hand knob in flow adjustment valve
- Viton® or EPDM seals



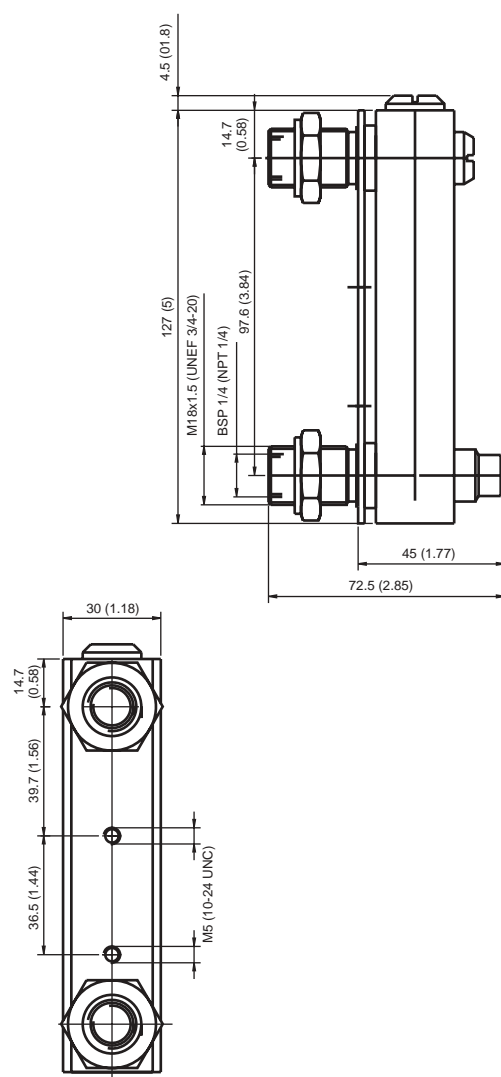
Technical data L

Model	LH -	LR -	LT -
Max. pressure	20 bar (30 bar/30 °C)	20 bar (30 bar/35 °C)	20 bar (30 bar/30 °C)
Max. temperature	75 °C	80 °C	70 °C
Flowtube	Acrylic (PMMA)	Grilamid (PA-12)	Trogamid-T (PA6-3-T)
Valve	AISI 316		
Connectors	AISI 316		
Seals	Nitrile (*Viton®, EPDM)		
Connections	NPT 1/4" (*BSP 1/4")		
Accuracy	±10% F.S. (H ₂ O, +20 °C)		
Weight	300 g		

*) Special construction on request

L	-	-	-	
				Special feature
			H	Hand knob in valve
			R	Connections BSP 1/4"
			V	Viton® -seals
				Scale
			A	H ₂ O (l/min) at +20°C
			R	Air (Nl/min) at +20°C / 101,3 kPa
			D	Relative scale 1-10
				Flow range
				H₂O Air
			4K*	2 - 18 ml/min 0,1 - 0,9 Nl/min
			4A*	2,5 - 30 ml/min 0,1 - 1,2 Nl/min
			4B*	5 - 55 ml/min 0,2 - 1,8 Nl/min
			4C*	15 - 85 ml/min 0,5 - 2,5 Nl/min
			5K	0,01 - 0,13 l/min 0,5 - 6 Nl/min
			5A	0,01 - 0,2 l/min 0,5 - 7 Nl/min
			5B	0,025 - 0,35 l/min 1 - 10 Nl/min
			5C	0,05 - 0,5 l/min 2 - 14 Nl/min
			8T	0,1 - 0,75 l/min 3 - 20 Nl/min
			8M	0,1 - 1 l/min 5 - 30 Nl/min
			8P	0,2 - 1,6 l/min 5 - 50 Nl/min
			8S	0,2 - 2,6 l/min 10 - 85 Nl/min
			8R	0,5 - 3 l/min 10 - 110 Nl/min
				Flow tube material
			H	Acrylic
			R	Grilamid TR 55
			T	Trogamid-T

* Accuracy is not guaranteed



mm (in)

MANUFACTURER

Kytola
INSTRUMENTS

KYTOLA OY • Olli Kytolan tie 1
P.O. Box 5 • FI-40951 MUURAME • FINLAND
Phone +358 14 339 0600 • Fax +358 14 631 419
E-mail sales@kytola.com • www.kytola.com

LOCAL
REPRESENTATIVE

13.5 IWAKI AIR PUMP

Air pumps

**Built-in air pumps
assure a long operating time**



Air pumps

Single and twin head types are available for the APN series.
Selectable thread or hose joint further widen an application range.
The BA series are capable of sending corrosive-/heated-gas.



Most appropriate for built-in applications

Diaphragm air pumps



The APN series, diaphragm air pumps, are compact and have motor-driven diaphragms. A highly-efficient motor and a special diaphragm, an enlarged bearing and an enhanced connecting rod have greatly improved vacuum performance, a starting characteristic and durability. The APN can fit to various applications, including gas sampling and medical equipment.

Clean air transfer

The motor-driven diaphragm pumps are oil-/carbon-free and are highly air-tight. Most suitable in medical or sampling equipment where air cleanness is required.

Highly-efficient design

A use of moulded parts enhances the pump performance and efficiency. The high-power motor also improves the starting characteristic.

Long life design

Fiber reinforced diaphragms, enlarged bearings and enhanced con rods have further improved reliability and durability in order for the pump to run over an extended time period in a continuous operation.

Easy maintenance

The pump head consists of only a few parts and can easily be dismantled and assembled.

Wide variations

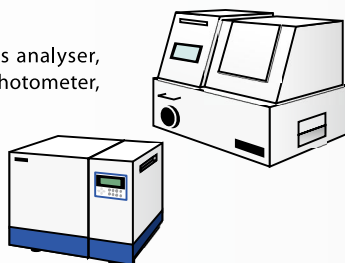
Either single- or twin-head type is selectable. Also, EPDM, FKM, NBR or PTFE diaphragm and hose/thread connections are available. A number of combinations (more than 60) varies the APN according to an intended use.

NOTE: A diaphragm material and a suction bore shape differs with models.

Applications

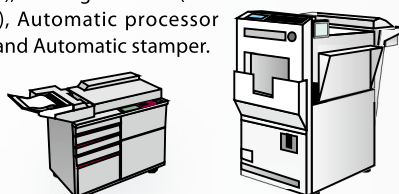
Analysers

Deaerator, Air analyser, Flue-gas analyser, Biochemical analyser, Spectral photometer, Leak tester and Dust counter.



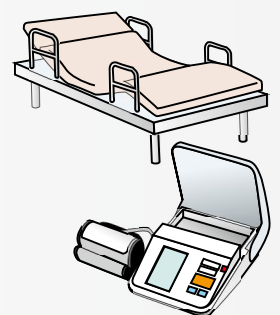
Printing and Automatic processing

Copy machine (paper transfer), Printing machine (film adsorption/ paper transfer), Automatic processor (blower), Printer, Air bearing and Automatic stamper.



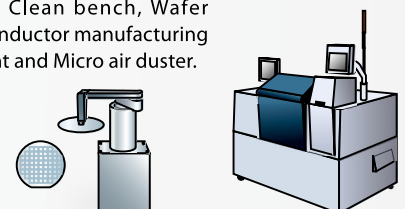
Medical equipment

Aspirator, Nebulizer, Low-frequency therapy equipment, Blood-pressure gauge, Endoscope, X-ray film adsorption/ transfer, Gas sterilizer, Tapper, Artificial respirator, Bedsore preventive mat, Interferential current therapy equipment, Oxygen generator and Normal saline solution spray.



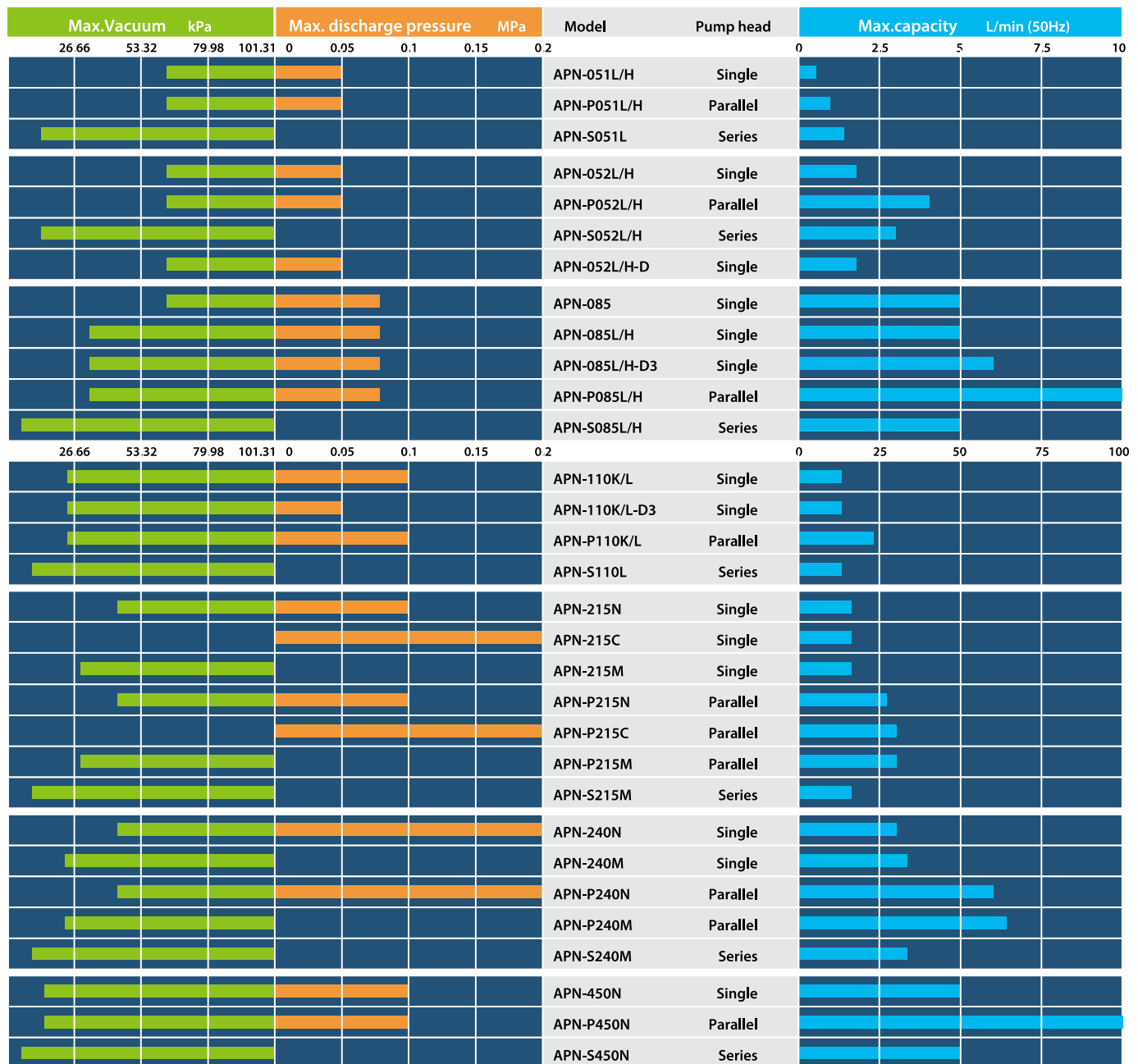
Electronics

PCB adsorption/transfer, Clean bench, Wafer adsorption/transfer, Semiconductor manufacturing equipment, Laser equipment and Micro air duster.



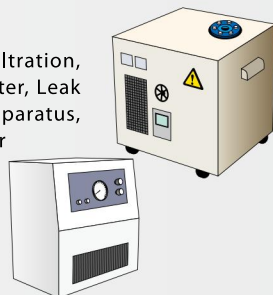
Either single or twin pump head type is selectable.

Thread and hose connections allow the pump to fit into various applications.



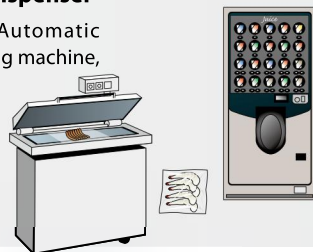
Physics and chemistry

Vacuum furnace, Aspirator, Vacuum filtration, Liquid chromatography, Particle counter, Leak tester, Spray, Turbidimeter, Culture apparatus, Aseptic bath, Micro air duster and Agitator



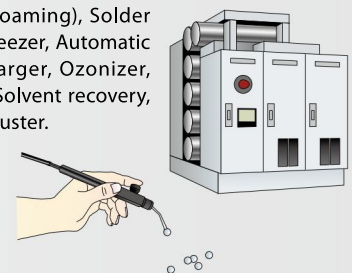
Food industry and Automatic dispenser

Food pack (vacuum packaging), Automatic dispenser, Thawing machine, Labelling machine, Bubbling machine and Deaerator



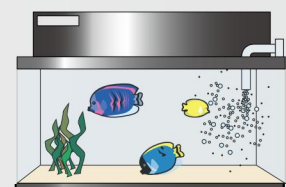
Industrial machine

Forming machine (vacuum defoaming), Solder adsorption, Washer, Vacuum tweezer, Automatic packaging, Automobile oil charger, Ozonizer, Vacuum chuck, Glass engraver, Solvent recovery, Lifter, Air tool, Air brush and air duster.



Aquarium fish and Live fish

Blower, Ozonizer, Air lift and Underwater camera



Pump variations

Single head type



Twin parallel heads type



Twin series heads type



Pump identification

APN - S 450 N A T X - 1 - 01

Special code
01-99

Model

051 • 052 • **085**
110 • 215 • 240
450

Type

1. 051,052 series (Port direction)
L : Horizontal
H : Vertical
2. 085 series (Port direction)
No symbol : "Corrosion resistant type"
L : Horizontal
H : Vertical
3. 110 series
K : Discharge and suction are parallel
L : Discharge and suction are horizontal
4. 215 series
M : Vacuum pump
N : Compressor & vacuum pump
C : Compressor
5. 240 series
M : Vacuum pump
N : Compressor & vacuum pump
6. 450 series
N : Compressor & vacuum pump

Number of pump heads

No code : Single
P : Twin (parallel)
S : Twin (series)

Power voltage

3 : AC115V 60Hz
4 : AC220/240V 50Hz
D1 : DC12V(Brush type)
D2 : DC24V(Brush type)
D3 : DC24V(Brushless type)
E4 : AC220/240V 50Hz With European type
(APN-085,110,215,240,450 series)

Joint type (size)

No code : Hose(Outer dia.ø8 : Both vertical and horizontal types.)
5 : Hose (Outer dia. ø5 Vertical type only.)
X : Thread (Rc1/8 Both vertical and horizontal types.)
X1 : Thread (G1/4 Both vertical and horizontal types.)

Diaphragm material • Valve material

V : FKM • FKM
E : EPDM • EPDM
N : NBR • NBR
T : PTFE+EPDM • SUS631-CSP
Note : On 051,052 series, V means PTFE+EPDM for diaphragm and FKM for valve.

Pump head material

No symbol : PPG
S : SUS304
A : ADC12

Pump application guide

Available Available Not Available

Model	Compressor	Vacuum	Pumphead			Connection					
			Single	Parallel	Series	Hose Parallel	Hose Straight	Hose Vertical	Thread Parallel	Thread Straight	Thread Vertical
APN-051L											
APN-051H											
APN-051H5											
APN-052L											
APN-052H											
APN-052H5											
APN-085											
APN-085L											
APN-085H											
APN-085 (Brushless type)											
APN-085L (Brushless type)											
APN-085H (Brushless type)											
APN-110K											
APN-110L											
APN-110K (Brushless type)											
APN-110L (Brushless type)											
APN-215N											
APN-215C											
APN-215M											
APN-240NA											
APN-240MA											
APN-450NA											
APN-450NS											

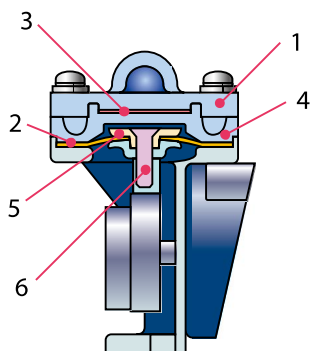
Specifications AC115V(60Hz)/AC220-240V(50Hz)

Model	Max.capacity L/min			Max.discharge pressure MPa	Max.vacuum kPa	Connection size		Motor						Mass kg	
	AC 115V	AC 220-240V	DC			Hose	Screw	Input W			Current A				
								AC 115V	AC 220-240V	DC	AC 115V	AC 220-240V	DC		
APN-051L/H/H5	0.7	0.6	—	0.05	61.32	ø8, ø5	Rc1/8	15	14	—	0.15	0.14	—	0.5	
APN-P051L/H/H5	1.4	1.2		—	—	13.33	ø8	—	20	18	—	0.2	0.18	—	0.85
APN-S051L	1.8	1.5		—	—	13.33	ø8, ø5	Rc1/8	15	15	—	0.15	0.15	—	0.5
APN-052L/H/H5	2.1	1.8	—	0.05	61.32	ø8, ø5	Rc1/8	36	30	—	0.36	0.3	—	0.85	
APN-P052L/H/H5	4.2	3.6		—	—	13.33	ø8	—	—	—	0.8(DC24V)	—	—	0.25(DC24V)	0.5
APN-S052L	3.6	3.0		—	—	13.33	ø8, ø5	—	—	—	4.8(DC12V)	—	—	1.25(DC12V)	0.5
APN-051L-D3	—	—	1.0	0.05	61.32	ø8	—	—	—	4.9(DC24V)	—	—	0.63(DC24V)	0.5	
APN-052L/H-D1	—	—	1.8	0.05	61.32	ø8, ø5	—	25	29	—	0.15	0.11	—	1.9	
APN-052L/H-D2	—	—	—	0.08	34.66	ø8	Rc1/4 G1/4	—	—	15	—	—	1.2	1.3	
APN-085	6.0	5.0	—					38	38	—	0.3	0.15	—	2.6	
APN-085L/H	—	—	6.0					—	—	—	—	—	—	—	
APN-085L/H-D3	12	10	—	—	7.99	ø8	Rc1/4 G1/4	—	48	—	—	0.23	—	2.5	
APN-P085L/H	6.0	5.0		—	—			—	15	—	—	1.4	1.5		
APN-S085L	—	—		14	—			68	—	—	0.33	—	3.8		
APN-110K	14	12	—	0.1	23.99	ø8	Rc1/4 G1/4	—	—	15	—	—	—	3.5	
APN-110L	—	—	14	0.05				—	95	95	—	0.93	0.5	—	5.2
APN-110K/L-D3	—	—	—	0.1				—	60	60	—	2.1	1.2	—	7.0
APN-P110L	28	24	—	—	7.99	ø9	G1/8	64	64	—	0.56	0.3	—	10.0	
APN-S110L	14	12		—	0.1			39.99	95	95	—	0.93	0.5	—	5.2
APN-215N	18	15		—	0.2			—	60	60	—	2.1	1.2	—	7.0
APN-215C	32	28	—	—	26.66	ø14	G1/4	90	90	—	3.2	1.9	—	10.0	
APN-P215N	36	30		—	0.1			39.99	95	95	—	3.2	1.9	—	10.0
APN-P215C	18	15		—	0.2			41.32	90	90	—	3.2	1.9	—	10.0
APN-P215M	34	30	—	—	21.33	—	Rc1/4	345	312(220V) 308(240V)	—	3.1	1.5 • 1.4	—	A12.0 S14.2	
APN-S215M	36	32		—	0.1			13.33	—	—	—	—	—	—	A12.8 S17.1
APN-240NAN	60	50		—	—			3.33	—	—	—	—	—	—	A13.0 S17.4
APN-240MAN	68	60	—	—	21.33	ø12	Rc1/4	345	312(220V) 308(240V)	—	3.1	1.5 • 1.4	—	A12.0 S14.2	
APN-P240NAN	72	64		—	0.1			13.33	—	—	—	—	—	—	A12.8 S17.1
APN-P240MAN	36	32		—	—			6.67	—	—	—	—	—	—	A13.0 S17.4
APN-S240MANX	60	50	—	0.1	13.33	ø12	Rc1/4	345	312(220V) 308(240V)	—	3.1	1.5 • 1.4	—	A12.0 S14.2	
APN-450NA/S	110	100		—	—			3.33	—	—	—	—	—	—	A12.8 S17.1
APN-P450NA/S	60	50		—	—			3.33	—	—	—	—	—	—	A13.0 S17.4
APN-S450NA/S	60	50	—	—	3.33	ø12	Rc1/4	345	312(220V) 308(240V)	—	3.1	1.5 • 1.4	—	A12.0 S14.2	
APN-450NA/S	110	100	—	—	3.33			—	—	—	—	—	—	A12.8 S17.1	
APN-P450NA/S	60	50	—	—	3.33			—	—	—	—	—	—	A13.0 S17.4	

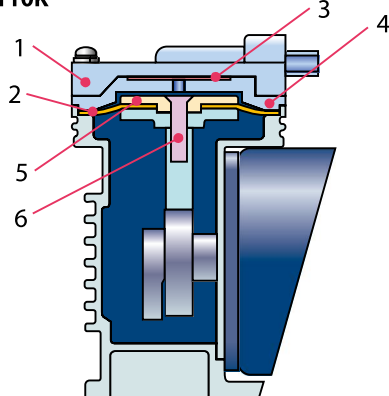
•Air flow temperature : 0-40°C •Ambient temperature : 5-40°C

Construction

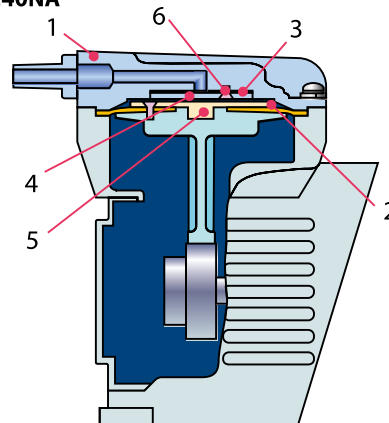
051L/052L



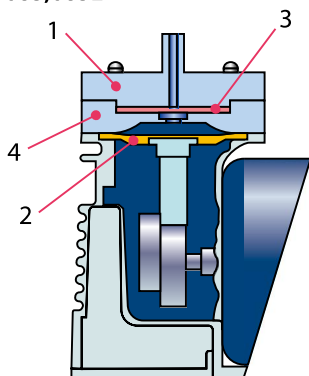
110K



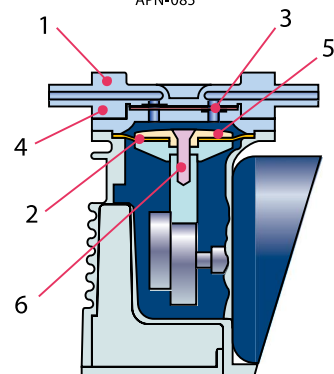
240NA



085,085L

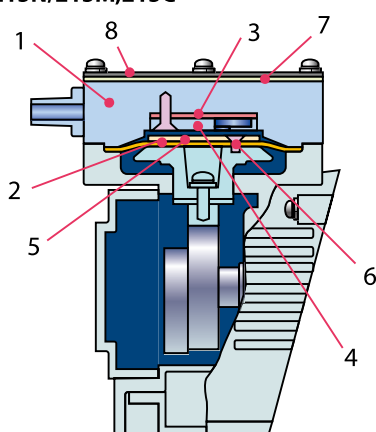


APN-085

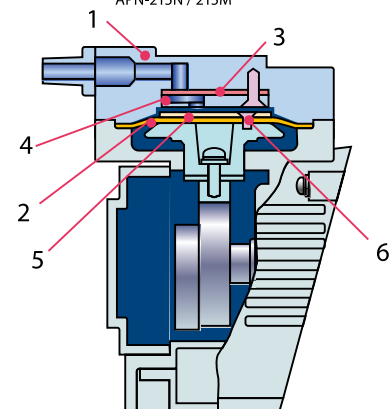


APN-085L

215N/215M,215C

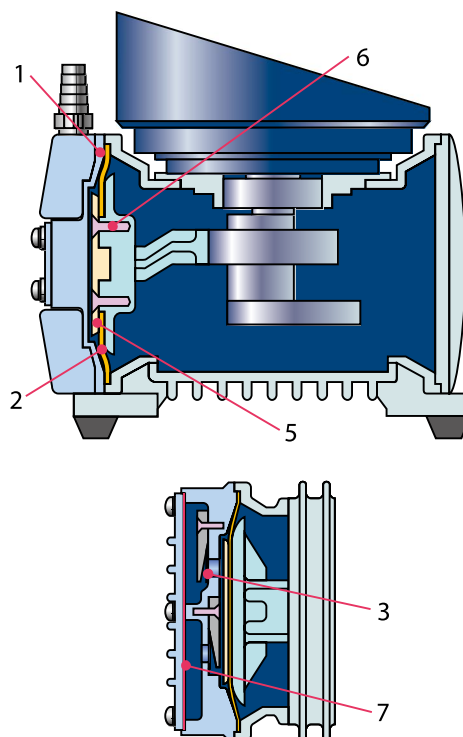


APN-215N / 215M



APN-215C

450NA



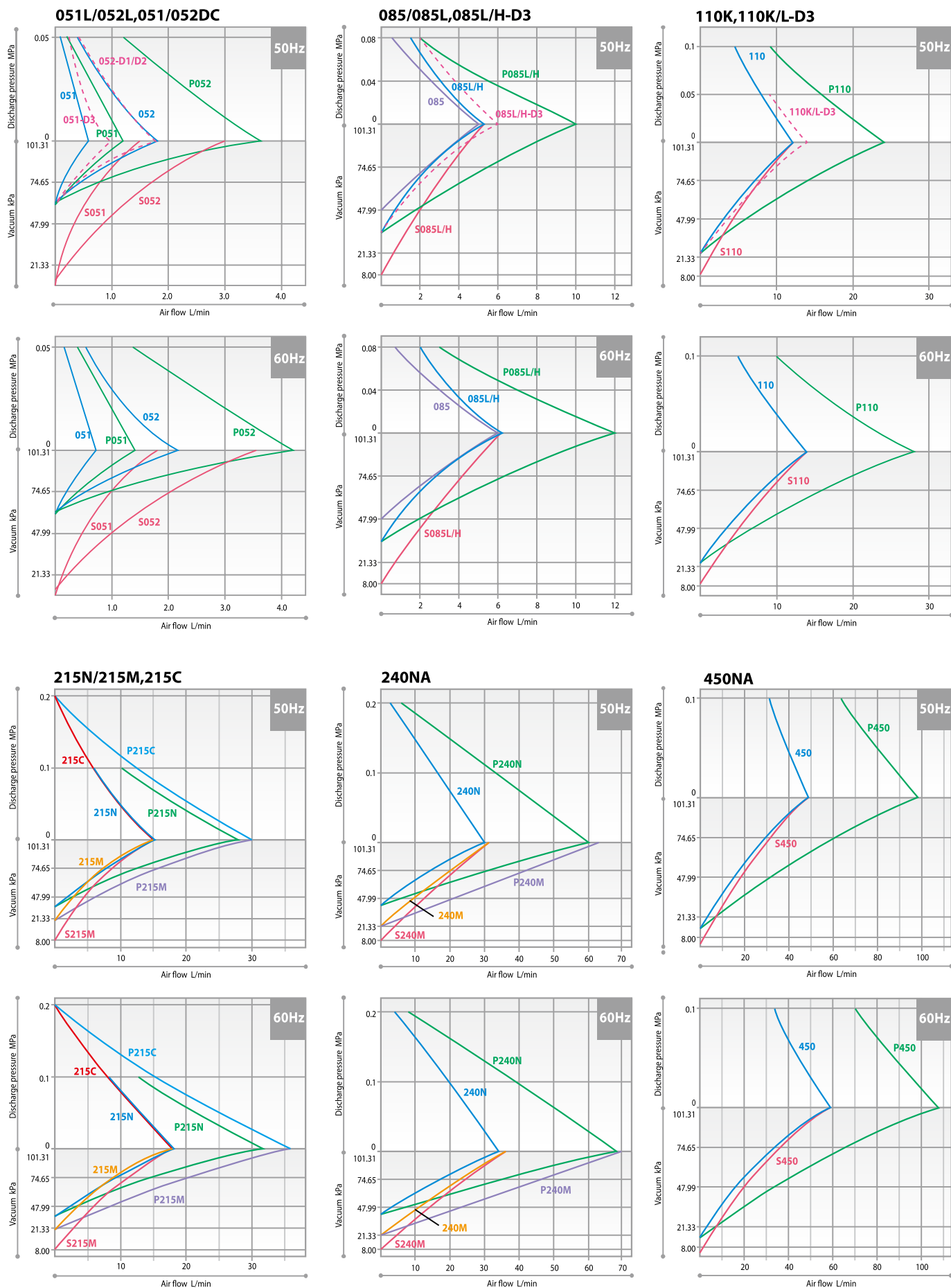
List of Available Materials

Symbol of Material	Name		
GFRPP	Glass-fiber-reinforced polypropylene	EPDM	Ethylene propylene rubber
GFRPPS	Glass-fiber-reinforced polyphenylene sulfide resin	NBR	Nitrile butadiene rubber
GFRPA	Glass-fiber-reinforced polyamide resin	ADC12	Aluminum diecast
PTFE	Tetra-fluoroethylene resin	SUS304	Stainless steel 304
FKM	Fluorocarbon rubber	SUS631-CSP	Stainless steel (strip steel for spring)

Materials

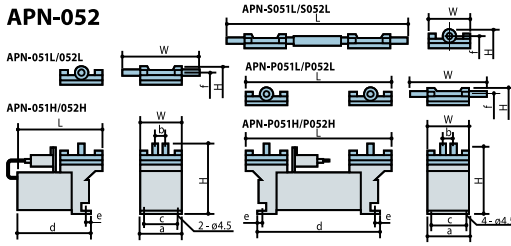
Model	051L,052L		085,085L			110K			215N		215C		215M		240	450	
Material code	V	E	V	E	N	V	E	N	V	E	V	E	V	E		AT	ST
1 Pump head	GFRPP		GFRPP			GFRPP			GFRPA		ADC12		GFRPP		ADC12	ADC12	SUS304
2 Diaphragm	PTFE+EPDM	EPDM	FKM	EPDM	NBR	FKM	EPDM	NBR	FKM	EPDM	FKM	EPDM	FKM	EPDM	NBR	PTFE+EPDM	
3 Valve	FKM	EPDM	FKM	EPDM	NBR	FKM	EPDM	NBR	FKM	EPDM	FKM	EPDM	FKM	EPDM	FKM	SUS631-CSP	
4 Valve seat	GFRPP		GFRPP			GFRPP			GFRPPS						ADC12	—	
5 Retainer plate	GFRPPS		GFRPPS			GFRPPS			GFRPPS						ADC12	ADC12	SUS304
6 Screw	SUS304		SUS304			SUS304			SUS304		SUS304		SUS304		SUS304	SUS304	
7 Seal gasket	—		—			—			FKM EPDM		—		FKM EPDM		—	EPDM	FKM
8 Pump head cover	—		—			—			SUS304		—		GFRPP		—	—	

Performance curves



Dimensions in mm

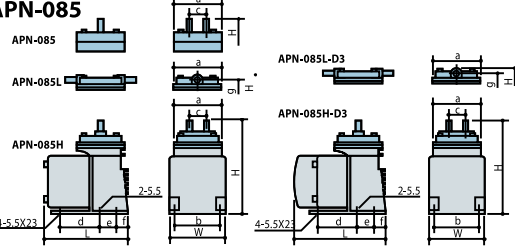
APN-052



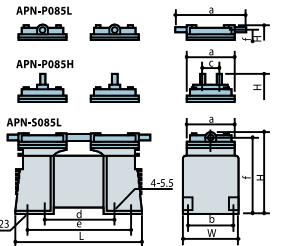
Model	W	H	L	a	b	c	d	e	f
APN-051L/052L	86	(75)	(94)	46	—	32	(80)*	6.5	67
APN-051H/052H	46	(78)	(94)	—	13	—	—	—	—

* Motor D1/D2: (77)mm, Motor D3: (76)mm

APN-085

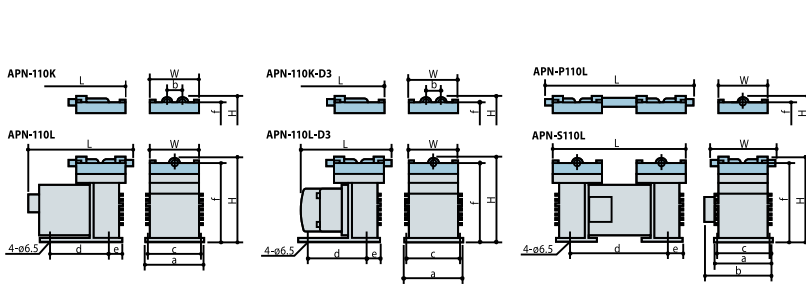


Model	W	H	L	a	b	c	d	e	f
APN-085	(136)	—	—	24	—	—	—	—	—
APN-085L	82.4	(121)	(124)	—	—	—	21.5	—	111
APN-085H	(140)	—	—	72	66	24	57	18.5	—
APN-085L-D3	(121)	—	—	—	—	—	—	—	111
APN-085H-D3	(140)	—	—	24	—	—	23	—	—



Model	W	H	L	a	b	c	d	e	f
APN-085L	(121)	—	—	106	—	—	—	—	111
APN-085H	82.4	(140)	(188)	—	—	—	—	—	—
APN-085L-D3	(121)	—	—	72	66	24	108	151	—

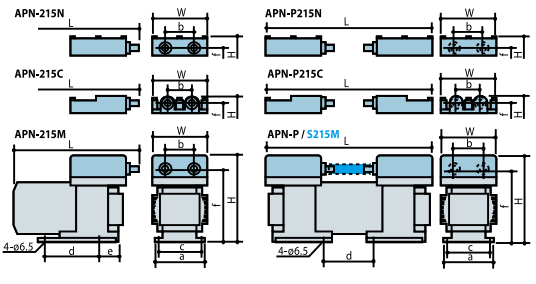
APN-110



Model	W	H	L	a	b	c	d	e	f
APN-110K	—	—	(152)	—	24	—	—	—	—
APN-110L	78	(134)	(164)	86	—	74	91	24	124
APN-110K-D3	—	—	(129)	—	24	—	—	—	—
APN-110L-D3	—	—	(141)	—	—	—	—	—	—

Model	W	H	L	a	b	c	d	e	f
APN-110L	78	(134)	(236)	86	(104)	74	(154)	24	(124)
APN-110L	102	(212)	—	—	—	—	—	—	—

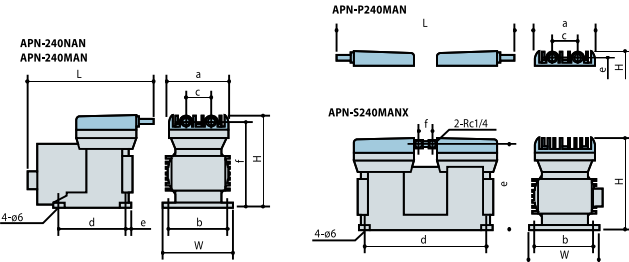
APN-215



Model	W	H	L	a	b	c	d	e	f
APN-215N	(147)	—	—	50	—	—	—	—	—
APN-215C	Ø96	(140)	(195)	90	39	74	91	36	(125)
APN-215M	(151)	—	—	50	—	—	—	—	—

Model	W	H	L	a	b	c	d	e	f
APN-215N	(147)	—	—	50	—	—	—	—	—
APN-215C	Ø96	(140)	(282)	110	39	78	(90)	—	(130)
APN-215M	(151)	—	—	50	—	—	—	—	—

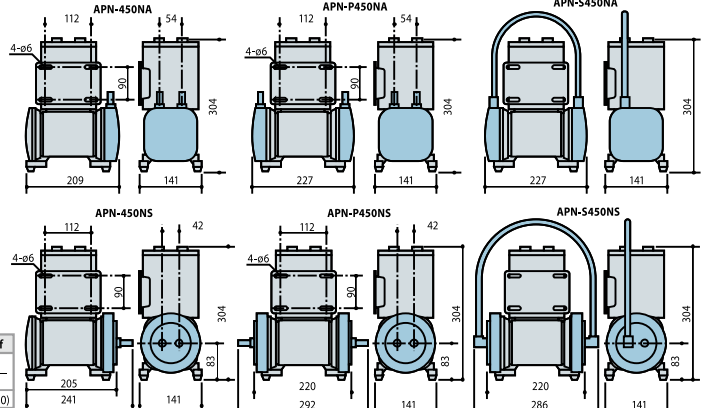
APN-240



Model	W	H	L	a	b	c	d	e	f
APN-240NAN	140	(186)	(219)	122	125	48	135	(26)	(173)
APN-240MAN	—	—	—	—	—	—	—	—	—

Model	W	H	L	a	b	c	d	e	f
APN-240NAN	140	(186)	(297)	122	125	48	(245)	(173)	—
APN-240MAN	—	—	—	—	—	—	—	—	—
APN-240MANX	—	—	—	—	—	—	—	—	(30)

APN-450



Optional accessory

Filter and Muffler

To be used as muffler when installed at discharge side and also as filter when installed at suction side. (Check valve incorporated filter is available as option)



AF - 2 V - 1 C

	1	2	3
1. Materials	V : FKM	E : EPDM	N : CR/NBR(Gasket, O ring, Check valve)
2. Connection	1 : G1/8(For type 215)	2 : G1/4(For type 085 and 110)	
3. Option	C : With Check valve		

www.iwakipumps.jp

IWAKI CO.,LTD. 6-6 Kanda-Sudacho 2-chome Chiyoda-ku Tokyo 101-8558 Japan TEL : (81)3 3254 2935 FAX : 3 3252 8892

EUROPE / U.S.A.

European office : IWAKI Europe GmbH
Holland : IWAKI Europe (NL Branch)
Austria : IWAKI (Austria) GmbH
Belgium : IWAKI Belgium N.V.
Denmark : IWAKI Nordic A/S
Finland : IWAKI Suomi Oy
France : IWAKI France S.A.
Germany : IWAKI Europe GmbH
Italy : IWAKI Italia S.R.L.
Norway : IWAKI Norge AS
Spain : IWAKI Iberica Pumps, S.A.
Sweden : IWAKI Sverige AB
Switzerland : IWAKI (Schweiz) AG
U.K. : IWAKI Pumps (UK) Ltd.
U.S.A. : IWAKI America Inc.
Argentina : IWAKI America Inc. (Argentina Branch)

TEL: (49)2154 9254 0 FAX: 2154 9254 48
TEL: (31)547 293 160 FAX: 547 292 332
TEL: (41)26 674 93 00 FAX: 26 674 93 02
TEL: (32)13 67 02 00 FAX: 13 67 20 30
TEL: (45)48 24 2345 FAX: 48 24 2346
TEL: (358)9 2745810 FAX: 9 2742715
TEL: (33)1 69 63 33 70 FAX: 1 64 49 92 73
TEL: (49)2154 9254 50 FAX: 2154 9254 55
TEL: (39)0444 371115 FAX: 0444 335350
TEL: (47)66 81 16 60 FAX: 66 81 16 61
TEL: (34)943 630030 FAX: 943 628799
TEL: (46)8 511 72900 FAX: 8 511 72922
TEL: (41)26 674 93 00 FAX: 26 674 93 02
TEL: (44)1743 231363 FAX: 1743 366507
TEL: (1)508 429 1440 FAX: 508 429 1386
TEL: (54)11 4745 4116

ASIA / OCEANIA

Australia : IWAKI Pumps Australia Pty Ltd.
China :
Hong Kong : IWAKI Pumps Co., Ltd.
Shanghai : IWAKI Pumps (Shanghai) Co., Ltd.
Guangzhou : GFTZ IWAKI Engineering & Trading Co., Ltd.
Beijing : GFTZ IWAKI Engineering & Trading Co., Ltd. (Beijing office)
Korea : IWAKI Korea Co., Ltd.
Malaysia : IWAKI Sdn. Bhd.
Singapore : IWAKI Singapore Pte Ltd.
Indonesia : IWAKI Singapore (Indonesia Branch)
Taiwan : IWAKI Pumps Taiwan Co., Ltd.
Thailand : IWAKI (Thailand) Co., Ltd.
Vietnam : IWAKI Pumps Vietnam Co., Ltd.

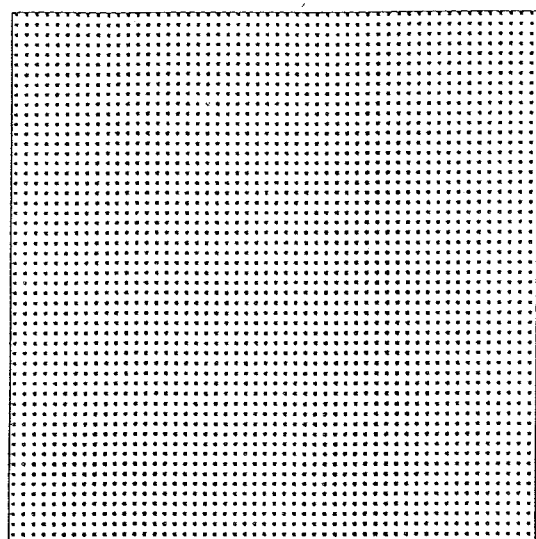
TEL: (61)2 9899 2411 FAX: 2 9899 2421
TEL: (852)2607 1168 FAX: 2607 1000
TEL: (86)21 6272 7502 FAX: 21 6272 6929
TEL: (86)20 8435 0603 FAX: 20 8435 9181
TEL: (86)10 6442 7713 FAX: 10 6442 7712
TEL: (82)2 2630 4800 FAX: 2 2630 4801
TEL: (60)3 7803 8807 FAX: 3 7803 4800
TEL: (65)616 2028 FAX: 6316 3221
TEL: (62)21 6906606 FAX: 21 6906612
TEL: (886)2 8227 6900 FAX: 2 8227 6818
TEL: (66)2 322 2471 FAX: 2 322 2477
TEL: (84)613 933456 FAX: 613 933399

()Country codes

Caution for safety use: Before use of pump, read instruction manual carefully to use the product correctly.
Actual pumps may differ from the photos. Specifications and dimensions are subject to change without prior notice. For further details please contact us.

Legal attention related to export.
Our products and/or parts of products fall in the category of goods contained in control list of international regime for export control.
Please be reminded that export license could be required when products are exported due to export control regulations of countries.





IWAKI PUMPS

IWAKI AIR PUMP

APN-085 TYPE

INSTRUCTION MANUAL

- Unpacking and Inspection (1)
- Description of Product (2)
- Identification Codes (3)
- Specifications (4)
- Handling Instructions (5)
- Installation, Piping, and Wiring (6)
- Operation (7)
- Maintenance and Inspection (8)
- Causes of Trouble and Troubleshooting (9)
- Disassembly and Assembly (10)
- Names of Parts (11)
- Dimensions and Performance (12)

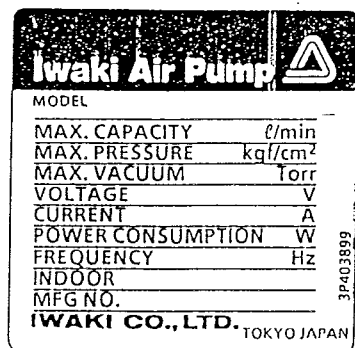
Thank you for having selected the Iwaki Air Pump APN type.
This instruction manual deals with the correct handling, maintenance, inspection, and troubleshooting procedures for the air pump. To make maximum use of the pump and to ensure safe and long operation, please read this manual carefully prior to operating the pump. In addition, please keep this instruction manual and the related official drawings together for quick and convenient reference.

Contents

■ Item	■ Page
① Unpacking and Inspection	1
② Description of Product	2
③ Identification Codes	3
④ Specifications	4
⑤ Handling Instructions	5
⑥ Installation, Piping, and Wiring	8
⑦ Operation	10
⑧ Maintenance and Inspection	11
⑨ Causes of Trouble and Troubleshooting	13
⑩ Disassembly and Assembly	14
⑪ Names of Parts	16
⑫ Dimensions and Performance	20

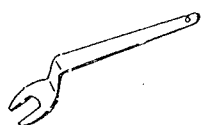
1

Unpacking and Inspection



After unpacking, check the following points to confirm that the delivered product and its accompanying parts and elements are exactly what you ordered. If you find anything wrong, refer to the dealer you placed your order with.

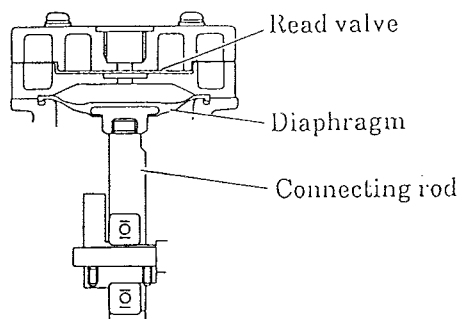
- ① Do the model, discharge amount, discharge pressure, degree of vacuum, motor output, voltage level, etc., indicated on the nameplate conform to your order?
- ② Have the pump unit and other elements been damaged or bolts and nuts been loosened during the delivery?
- ③ In the case of the APN-085 corrosion resistant type pump, see that the special wrench is included.



Special wrench

2

Description of Product



The Iwaki air pump APN type is a compact pump that takes in and discharges air by means of the reciprocating movement of a diaphragm. This diaphragm type pump does not allow the mixture of oil or carbon into the system. In addition, it is airtight. The series is best suited to systems for supplying clean air, such as for medical use and sampling applications.

3 Identification Codes

■ Pump type identification

APN — S 085 L N X — 1 — 02
① ② ③ ④ ⑤ ⑥ ⑦

① Serial-use code

No symbol : Single-use type
S : Twin-in-series type
S : Twin-in-pararell type

② Series code number

③ Pump type code

No symbol : Corrosion resistant type (Diaphragm mold type)
L : High-vacuum type (Horizontal tubing)
H : High-vacuum type (Vertical tubing)

④ Gas-contacting end part material

N: NBR
E: EPDM
V: FKM

⑤ Connection method

No symbol : Tube
X : Screwing (Rc 1/4)
X1 : Screwing (G 1/4)

⑥ Rated voltage

1: AC100V 3: AC115V
2: AC200V 4: AC220V/240V

⑦ Specification type

4 Specifications

■ Specifications

AC115V (60Hz) / AC220 · 240V (50Hz)

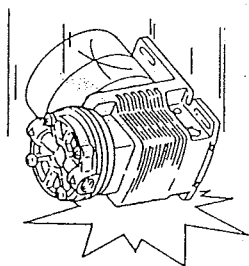
Model	Air Capacity ℓ/min	Max. Dis-charge Pressure MPa {kgf/cm ² }	Degree of Vacuum kPa {Torr}	Motor			Connection Port Diameter		Weight kg	Start-Up Temperature °C
				Input W	Out-put W	Curr-ent A	Hose	Screw		
APN-085V	5/6	0.08 {0.8}	61.3 {460}	25/29	10	0.15/ 0.11	φ8	Rc1/4 or G1/4	1.9	10
APN-085E										
APN-085LV-HV										
APN-085LE-HE										
APN-085LN-HN										
APN-P085LV-HV	10/12		34.66 {260}	38	15	0.3/ 0.15	φ8	Rc1/4	2.6	5
APN-P085LE-HE										
APN-P085LN-HN										
APN-S085LV	5/6	-----	8.0 {60}							5
APN-S085LE										
APN-S085LN										

Note

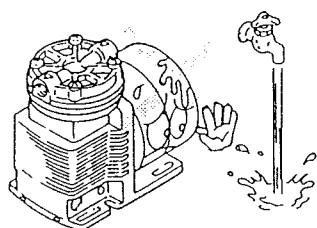
- 1: Do not operate these pumps at or above a discharge pressure of 0.08 MPa {0.8 kgf/cm²}.
- 2: The applicable gas temperature range is 0~40°C.
- 3: The pump ambient temperature range is 0~40°C. For start-up, run the pump at or above the start-up temperature shown above.

■ Gas-contacting end part material

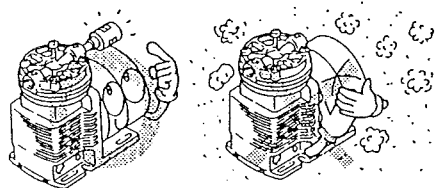
Type/Material Part Name	LN HN	V	LV HV	E	LE HE
Pump head	GFRPP				
Diaphragm	NBR	FKM		EPDM	
Valve					
Valve seat	GFRPP				
Retainer plate	PPS containing GF	-----	PPS containing GF	-----	PPS containing GF
Machine screw	SUS304 or equivalent	-----	SUS304 or equivalent	-----	SUS304 or equivalent



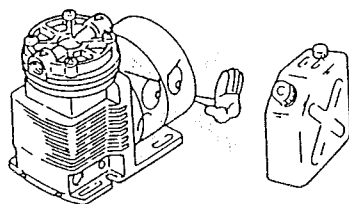
- ① Strong impacts caused by dropping the pump on the floor, striking it, etc., may result in faulty performance. Handle the pump with care.



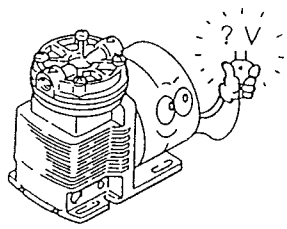
- ② Do not run the pump at a place with high humidity or splashing water. The water content in the air must be as low as possible. Otherwise, the moisture in the air, if condensed, may lower the performance or shorten the service life of the valve and diaphragm.



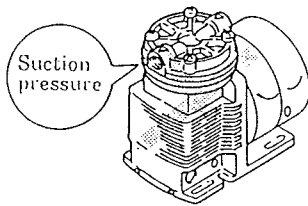
- ③ Avoid running the pump in a dusty place. Be sure to arrange a filter on the suction side so that no foreign matter enters the pump unit. Foreign matter in the pump unit may lower the performance of the pump and shorten the service life of the valve and diaphragm.



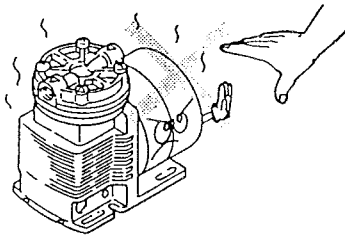
- ④ Avoid running the pump in an atmosphere that is corrosive or flammable. The pump operation site must be well ventilated. The ambient temperature and the temperature of the circulating air must be within a range of 0~40°C. The life of the motor and pump may be severely shortened if the above temperature range is exceeded.



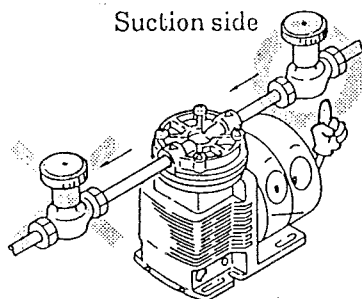
- ⑤ The operating voltage must be as specified on the nameplate. Otherwise, the pump may go out of order.



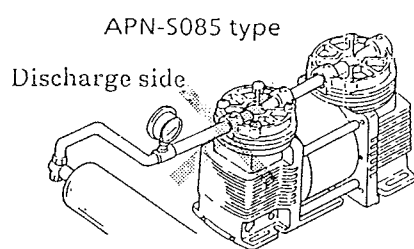
- ⑥ The pump cannot start if the pump chamber is applied with discharge pressure or suction pressure upon start-up. Start up the pump by eliminating the pressure applied to the pump chamber. When restarting pump operation after a long period of inactivity, the initial performance characteristic may not be stable. In such a case, do a warm-up run (unloaded operation) for about 10 minutes.



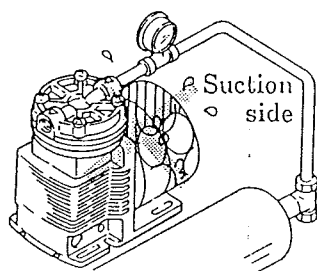
- ⑦ The surface temperature of the motor or the pump may be extremely high during system operation, but does not necessarily indicate any abnormality. Do not touch them directly or place any items near the pump which are easily deformed by heat.



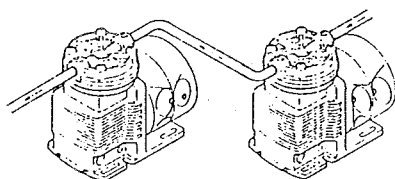
- ⑧ When adjusting the air flow rate by means of a valve, etc., be sure to carry out such control on the suction side only.



- ⑨ The APN-S type is designed for vacuum-load applications only. Never apply pressure to the discharge side.

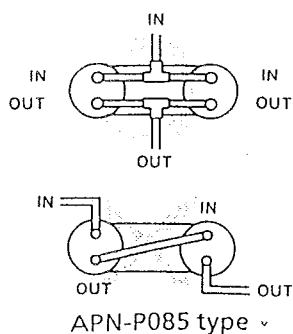


- ⑩ Apply atmospheric or vacuum pressure for the suction side pressure. If gas at a pressure above atmospheric pressure is supplied from the suction side, the life of the valve, diaphragm, bearing, etc., may be severely shortened.



- ⑪ Do not assign multiple pumps in a series along the piping. Otherwise, the pumps may fail to start or the motor may burn out.

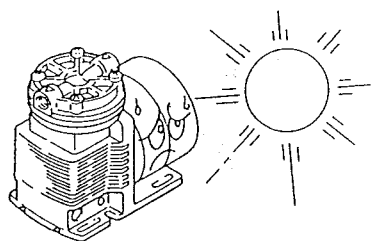
- ⑫ Do not carry or lift the pump by holding the power cable.



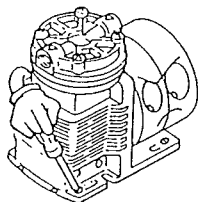
- ⑬ The APN-P type is for parallel configuration only. Do not run the pump in a series piping configuration.

6 Installation, Piping, and Wiring

■ Installation



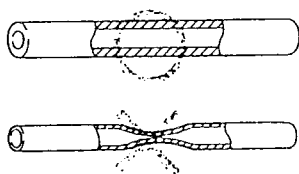
- ① Install the pump at a site where the ambient temperature does not exceed 40°C and the relative humidity does not exceed 90%. Do not install the pump outdoors.



- ② If the pump is installed with other device(s) in a system, select an installation position allowing ease and efficiency of removal or inspection work. A vibration-isolating rubber mat may be placed between the pump and the device so that the pump is isolated above the device without being affected by vibrations from it. For fixing the pump onto a device, use the tapped holes (M5, X8) at the bottom of the pump unit.

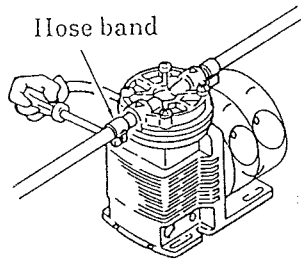
- ③ When the pump is to be placed on the floor, etc., without being fixed, set the rubber feet on a flat, level, vibration-free floor or surface.

■ Piping



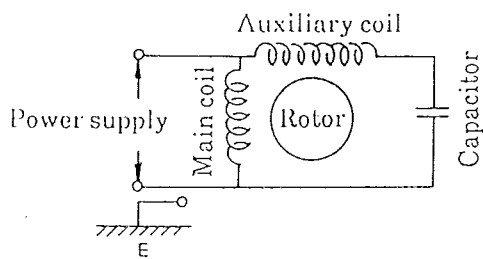
- ① Select a thick-walled hose for hose connection. A soft and thin-walled hose may be deformed and result in lowered suction power and air flow rate.

- ② The piping hose should be as short as possible and the number of bends must be kept to a minimum.

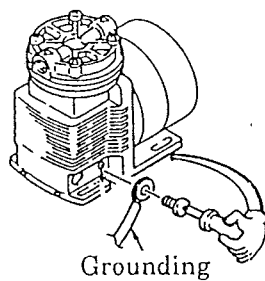


- ③ The hose must be connected firmly so as not to allow air leakage. The use of a hose band is recommended for the purpose.

■ Wiring



- ① Use approved wiring elements and parts only, and make sure the terminal connection is correct and firm.



- ② Use the grounding screw (M4) when connecting the grounding wire with the section marked E (or \perp) on the motor.

7 Operation

■ Operation

After the installation, piping, and wiring processes, operate the pump following the steps below.

No.	Step	Description
1	Checking of piping, wiring, and voltage	<ul style="list-style-type: none"> • Check for correct piping & electric wiring in accordance with "Piping" & "Wiring" sections in this manual. • Check that power voltage is as specified on nameplate.
2	Checking of valve	<ul style="list-style-type: none"> • Open valves fully on both suction & discharge sides.
3	Start-up	<ul style="list-style-type: none"> • Check items 1 & 2 above, then turn on pump Power switch & see that pump runs normally. • When ambient temperature is 10°C or below, pump start-up may not be smooth. Observe activation profile with Power switch at On, but without applying load for a while (1 to 2 minutes).
4	Operation	<ul style="list-style-type: none"> • After above start-up step, when rpm enters normal level, start operation of pump. • When regulating air supply rate, make sure to adjust rate by operating valve, etc., only on suction side.
5	Points to note during operation	<ul style="list-style-type: none"> • Check that pressure gauge, anemometer to confirm air supply rate, suction pressure, & discharge pressure conform to specified values. • When adjusting air supply rate, control valve on suction side only. • Confirm that suction side pressure is below atmospheric or vacuum pressure. • In case of power failure during operation, be sure to turn off Power switch. If Power switch is left on, motor may not start or may burn out when electricity is restored, depending on load condition.

8 Maintenance and Inspection

■ Daily check

Pay attention to the following points during pump operation, and stop pump operation immediately in the event of an abnormality. Then, take necessary measures with reference to the "Causes of Trouble and Troubleshooting" section.

No.	Checkpoint	Check and Measures	Checking Method
1	Does pump feed air normally?	<ul style="list-style-type: none"> • Is air circulating? • Are discharge & suction pressures at normal levels? • Are voltage & current at normal levels? 	<ul style="list-style-type: none"> • Check anemometer or pressure gauge, or check visually. • Compare values with those on nameplate.
2	Is there abnormal noise or vibration?	<ul style="list-style-type: none"> • Pump with problem may generate unusual noise or/& vibration. • Noise may grow louder due to resonance vibration of base holding pump. If noise is lowered by isolating pump from mounting surface, vibration-isolating rubber should be inserted between pump & base. 	<ul style="list-style-type: none"> • Visual & audio check • Visual & audio check
3	Is air leaking or being sucked in from any connection or piping section?	<ul style="list-style-type: none"> • Fasten each section as necessary. 	<ul style="list-style-type: none"> • Check anemometer or pressure gauge, or check visually.
4	Is surface temperature of pump or motor excessively high?	<ul style="list-style-type: none"> • Surface temperatures of pump & motor should be within range of ambient temperature + approx. 50°C. Even if surface is very hot to touch, there is no problem so long as temperature is within above range. 	<ul style="list-style-type: none"> • By touching surface or checking thermometer

■ Expendable parts

Suitable spare parts must always be kept at hand, particularly to support continuous operation over a long period.

Model	Load Range	Replacement Period (Hr)	
		Reed Valve	Diaphragm
APN-085 APN-P085 APN-S085	All Ranges	8500	8500

- ▶ The replacement periods above are estimated on the basis of continuous operation with air at 0~40°C.
- ▶ The durability of expendable parts depends on the pressure, temperature, and properties of the air handled. The values above should be taken as a guideline for replacement.

Problem	Cause	Pump does not start.	Pump stops during operation.	Air flow & discharge pressure decrease.	Abnormal noise	Thermal protector is activated.	Troubleshooting
	No power is supplied.	○					Inspect wiring.
	Motor failure (disconnection, capacitor failure, etc.)	○	○				Replace motor.
	Faulty or disconnected piping	○		○			Inspect piping & repair as necessary.
	Loosened screw(s) on pump head			○	○		Fasten screw(s).
	Loosened screw(s) on diaphragm			○	○		Fasten screw(s).
	Damaged diaphragm			○	○		Replace diaphragm.
	Foreign matter in filter			○			Disassemble, & eliminate foreign matter.
	Valve wear			○			Replace valve.
	Loosened screw(s) on bracket or diaphragm			○	○		Fasten screw(s).
	Eccentric shaft wear	○			○	○	Replace connecting rod unit. *
	Connecting rod unit bearing wear	○	○		○	○	Replace connecting rod unit. *
	Motor bearing wear	○	○		○	○	Replace motor.
	Lowered voltage	○	○				Increase voltage as rated.
	Suction side pressure is lower than atmospheric pressure.	○	○			○	Make discharge side pressure below atmospheric pressure.
	Discharge side pressure is higher than specified.		○			○	Discharge side pressure should be set at atmospheric level in case of serial type.
	Clogged filter (option)			○			Replace filter.
	Pump is started without eliminating residual pressure.	○				○	Eliminate pressure, then start up pump.

* For the replacement of asterisked elements, contact your dealer.

10 Disassembly and Assembly

[APN-085 type]

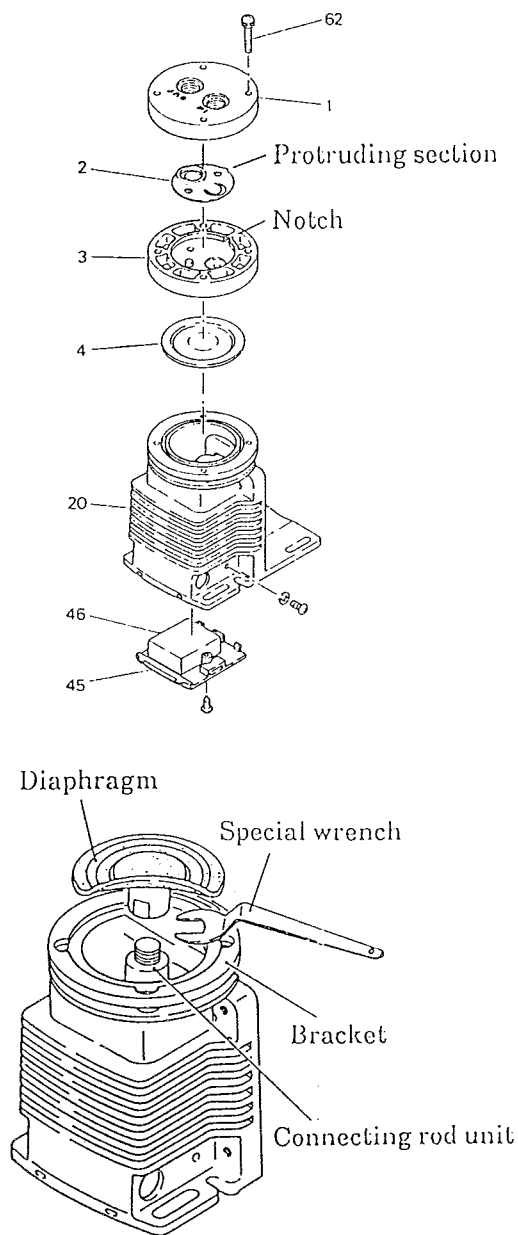


Fig.1

The pump should be disassembled and assembled referring to 'Names of Parts and Structure of Pump'.

■ Replacement of diaphragm

- ① Remove the four machine screws and take off the pump head, lead valve, and valve seat.
- ② The diaphragm (4) is screwed into the connecting rod unit (19). Insert the attached special wrench under the diaphragm (4), as shown in Figure 1, and rotate it counterclockwise so that the diaphragm can be removed.
- ③ Place a new diaphragm (4) and use the special wrench to fix it firmly into the connecting rod unit.

■ Replacement of lead valve

- ① As in the replacement of the diaphragm, remove the machine screws so that the pump head, lead valve, and pump unit can be taken off.

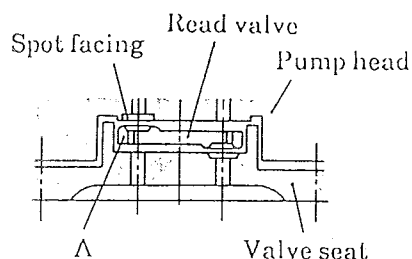


Fig.2

② Replace the lead valve with a new one and assemble the pump unit. In assembling the pump, first position the protruding section on the periphery of the lead valve into the notch prepared in the valve seat.

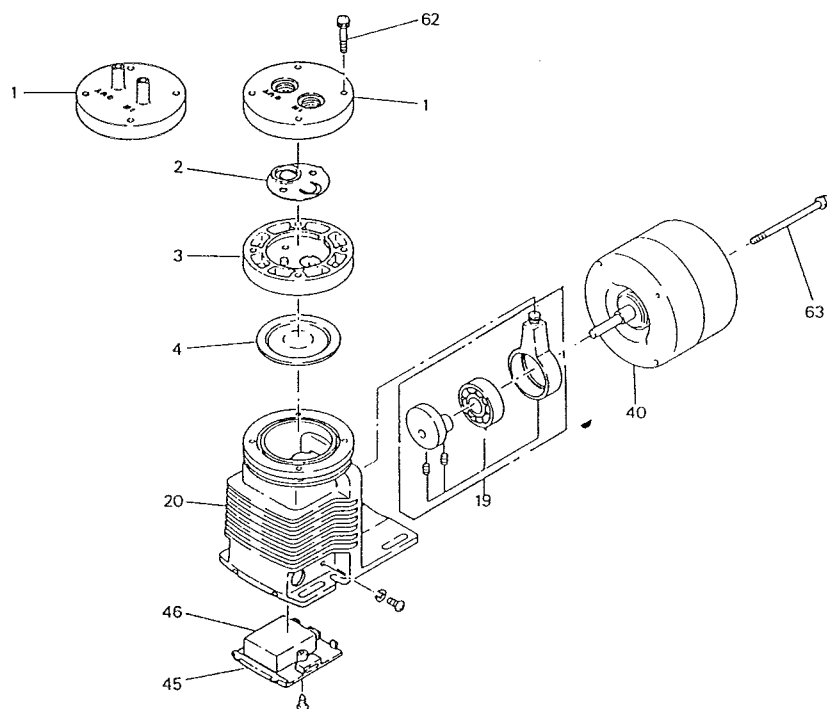
③ Match the pump head and the lead valve so that the protruding section of the lead valve enters the notch in the pump head, as shown in Figure 2.

④ After assembling the pump body, blow in air from the pump head suction side (IN) and confirm that air circulates normally. If the air circulation is normal, fix the pump head to the bracket by fastening the four machine screws.

- During the replacement of the lead valve or diaphragm, do not touch or rotate the machine screws for fixing the bracket or motor.
- Contact your dealer when replacing the connecting rod, eccentric shaft, or motor.

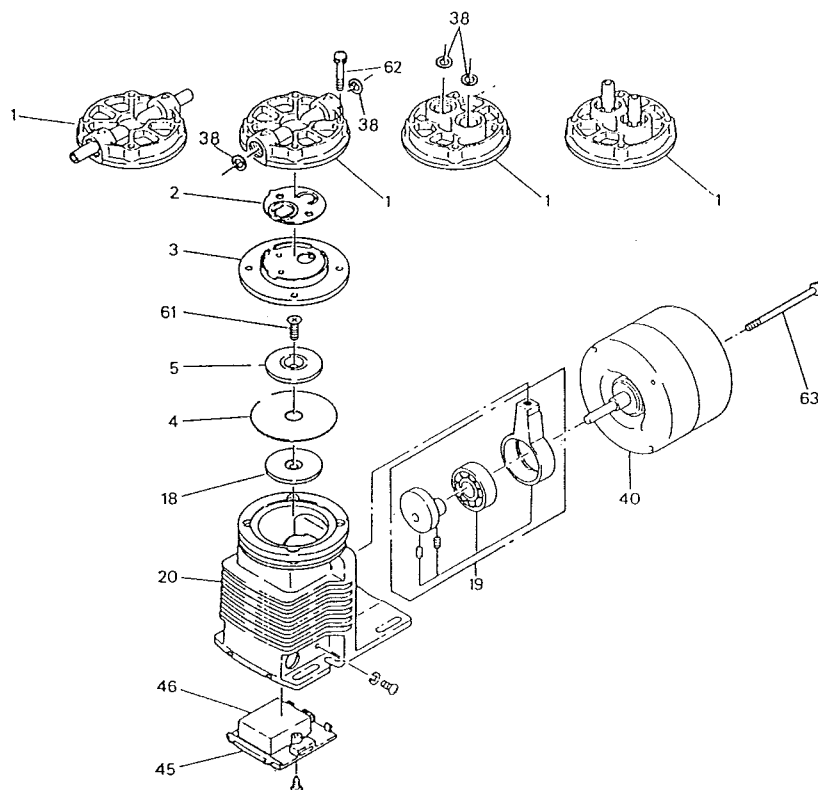
11 Names of Parts

● AP-085 type



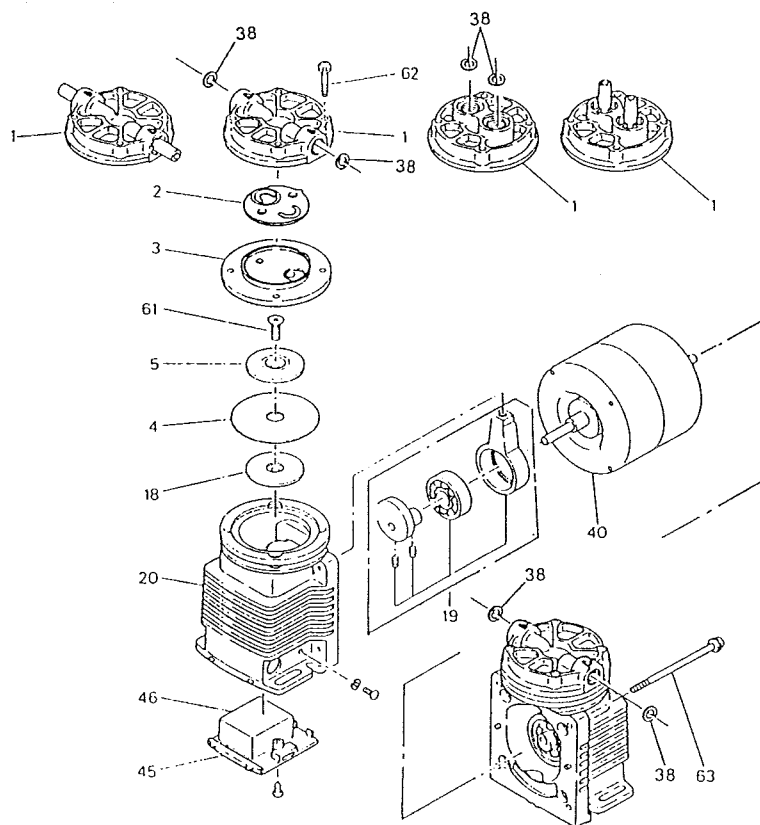
No.	Part Name	Quantity	No.	Part Name	Quantity
1	Pump head	1	40	Motor	1
2	Lead valve	1	45	Capacitor cover	1
3	Valve seat	1	46	Capacitor	1
4	Diaphragm	1	62	Machine screw	4
19	Connecting rod unit	1 set	63	Machine screw	4
20	Bracket	1			

● AP-085L and H types



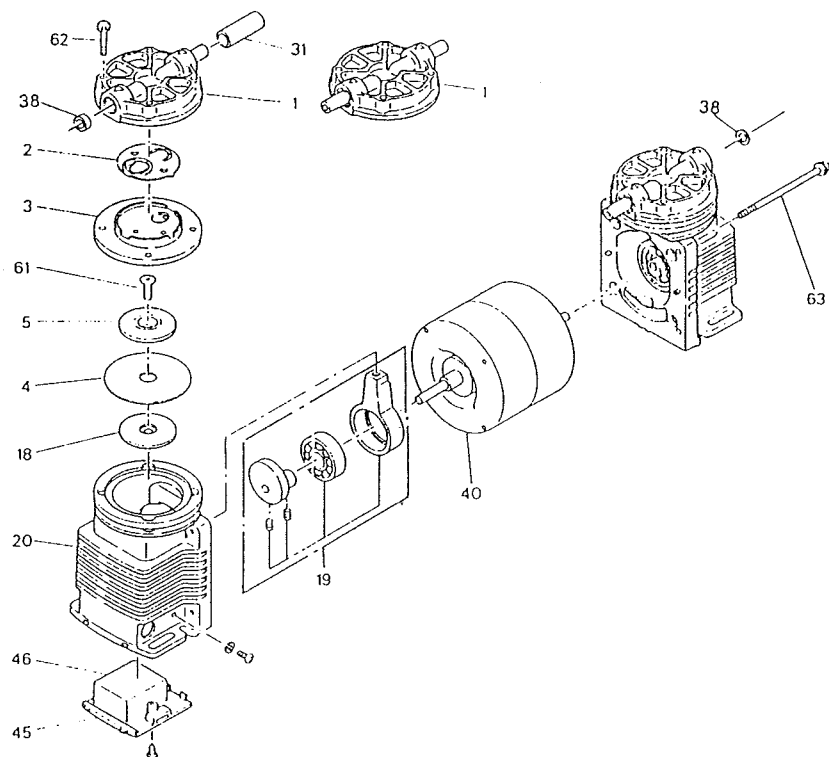
No.	Part Name	Quantity	No.	Part Name	Quantity
1	Pump head	1	20	Bracket	1
2	Lead valve	1	40	Motor	1
3	Valve seat	1	45	Capacitor cover	1
4	Diaphragm	1	46	Capacitor	1
5	Retainer plate	1	61	Countersunk head screw	1
18	Lower retainer plate	1	62	Machine screw	4
19	Connecting rod unit	1 set	63	Machine screw	4

● APN-P085 type



No.	Part Name	Quantity	No.	Part Name	Quantity
1	Pump head	2	20	Bracket	2
2	Lead valve	2	40	Motor	1
3	Valve seat	2	45	Capacitor cover	1
4	Diaphragm	2	46	Capacitor	1
5	Retainer plate	2	61	Countersunk head screw	2
18	Lower retainer plate	2	62	Machine screw	8
19	Connecting rod unit	2 set	63	Machine screw	4

APN-S085 type

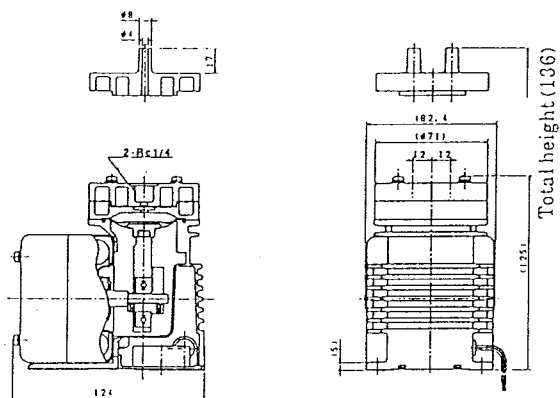


No.	Part Name	Quantity	No.	Part Name	Quantity
1	Pump head	2	31	Piping hose	1
2	Lead valve	2	40	Motor	1
3	Valve seat	2	45	Capacitor cover	1
4	Diaphragm	2	46	Capacitor	1
5	Retainer plate	2	61	Countersunk head screw	2
18	Lower retainer plate	2	62	Machine screw	8
19	Connecting rod unit	2 set	63	Machine screw	8
20	Bracket	2			

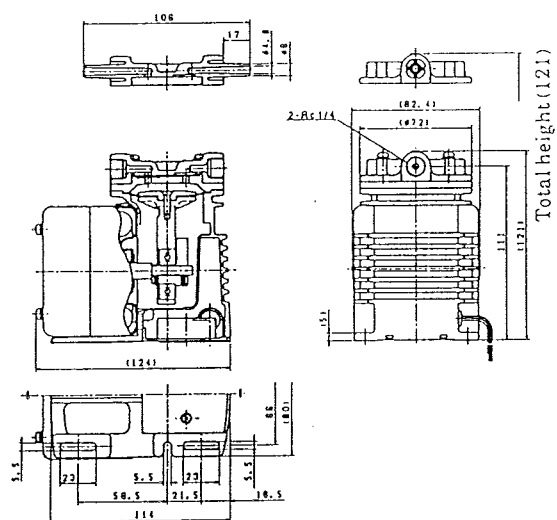
12 Dimensions and Performance

Outer dimensions

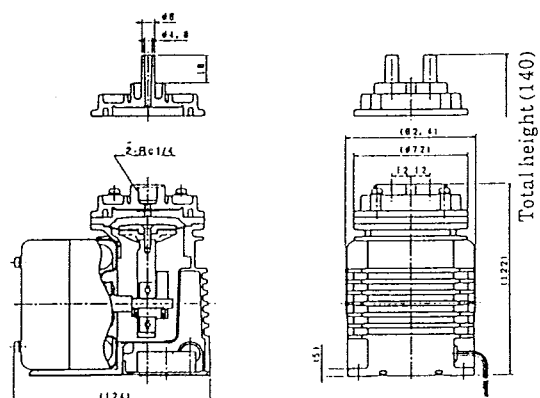
APN-085 type



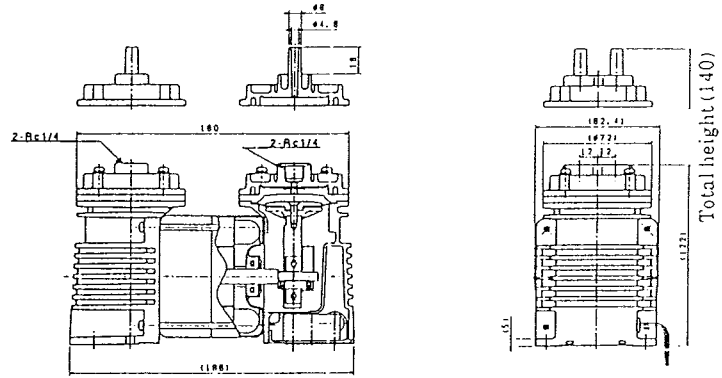
APN-085L type



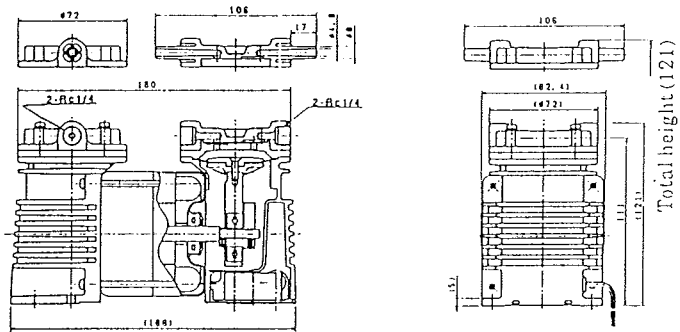
APN-085H type



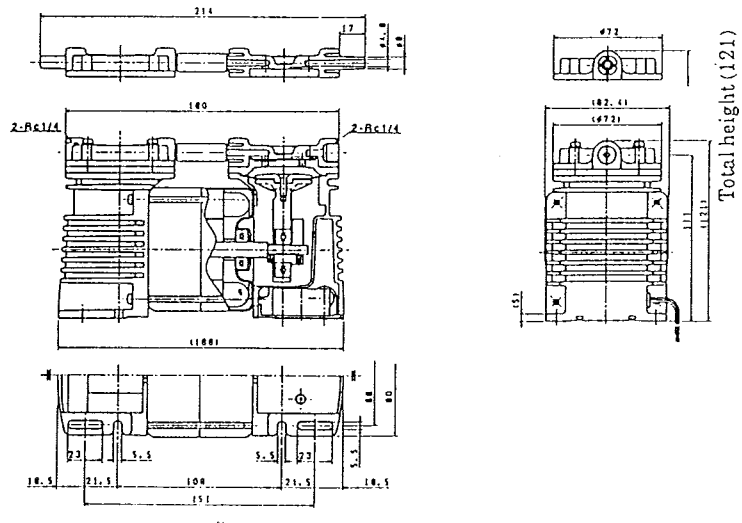
● APN-P085H type



● APN-P085L type

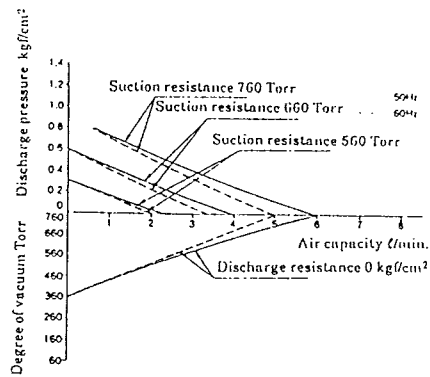


● APN-S085L type

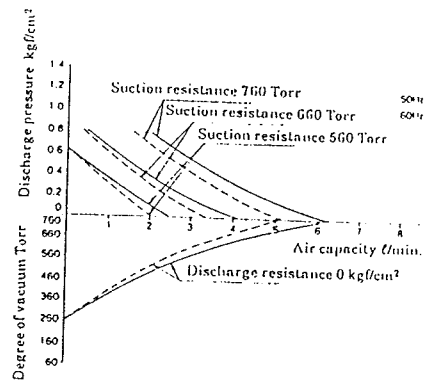


■ Performance curves

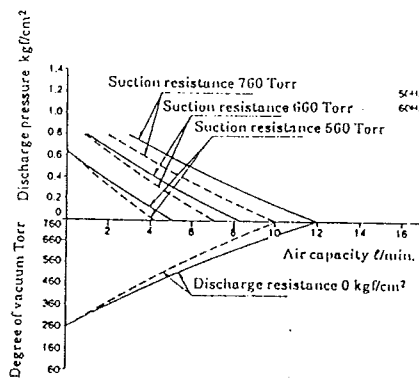
● APN-085 type



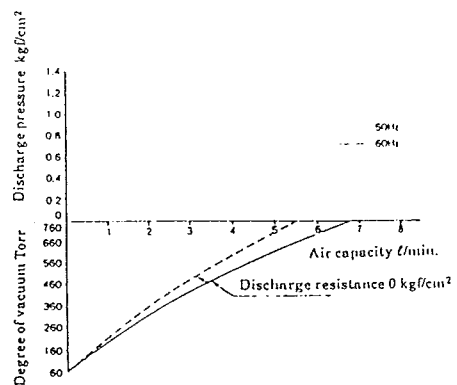
● APN-085L/H type



● APN-P085L/H type



● APN-S085L type



13.6 DRÄGER POLYTRON 7000

Dräger Docking Station, Installation Instructions

Operation of the Dräger Polytron 3000 or Polytron 7000 measuring unit or of the Dräger Docking Station (Part No. 83 17 990) requires full understanding and strict observance of the Instructions for Use of the Dräger Polytron 3000 or Polytron 7000!

Installing the Docking Station

- If the transmitter is to be installed in a Zone 2 explosion-hazard area, select a location with low exposure to mechanical risk.
- Docking station is installed vertically (transmitter with sensor facing down) in an area with low vibrations and stable temperatures – near the possible leak.
- A space of at least 15 cm (6") must be maintained above the transmitter for installation of the measuring unit.
- A clear space of at least 10 cm – recommended 30 cm – must be maintained below the transmitter to ensure accessibility for maintenance.

- Unpack the docking station.
- 1 Remove the raincover (protection against dust and splash-water).

If using the Polytron 3000:

- 2 Remove the 2-pin connecting terminal. Keep it in a safe place and refit it when installation is complete.

If using the Polytron 7000:

- 3 Remove the 4-pin connecting terminal. Keep it in a safe place and refit it when installation is complete.

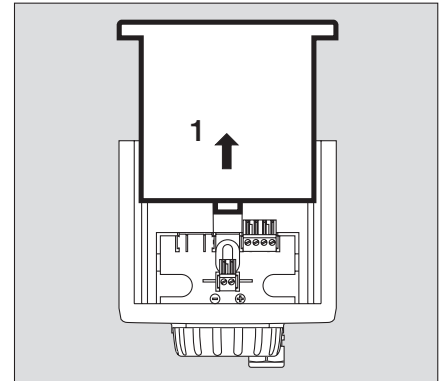
- Screw the docking station into place (drilling template: see page 6).
Spacing between holes: 66 ± 4 mm.

Attention:

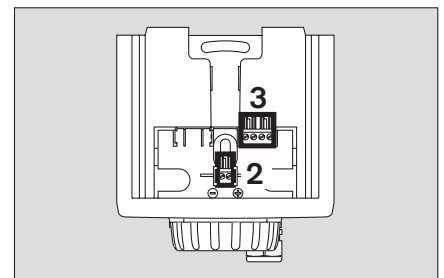
Spacers (e.g. mounting bracket 68 09 772) must be used to prevent any twisting of the housing when installed on uneven surfaces.

If the Dräger Polytron 3000/7000 measuring unit is not yet installed:

- refit the raincover (protection against dust and splashing water).



00123760_4.gps



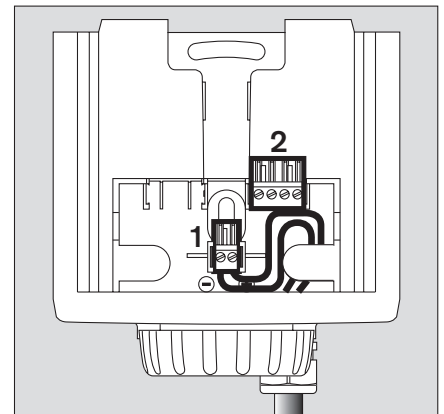
00223760_4.gps

Installing the electrical connections – Dräger Polytron 3000

- Connection to central device with at least 2-wire cable, AWG, 0.5 to 2.5 mm² (e.g. LiY, LiYCY).
- For currents of 0 to 22 mA, a DC voltage between 12.0 V DC and 30 V DC must be present at the transmitter.

Install the 4 to 20 mA current loop

- Fit 2-wire connecting cable in cable gland, cut to length and strip ends (approx. 80 mm / 3.15").
- Shorten the shield (if installed) to prevent short-circuiting:
- Connect cable
- 1 2-pin terminal for Dräger Polytron 3000 – check polarity. Cut excess wires short or
- 2 Fasten in 4-pin terminal.
- 1 Slide connecting terminal back into holder.
- Secure cable in holder.
- Fold up these Installation Instructions and place them inside the Dräger Docking Station ready for commissioning/start-up.
- Refit raincover (protection against dust and splashing water).



00623760_4.gps

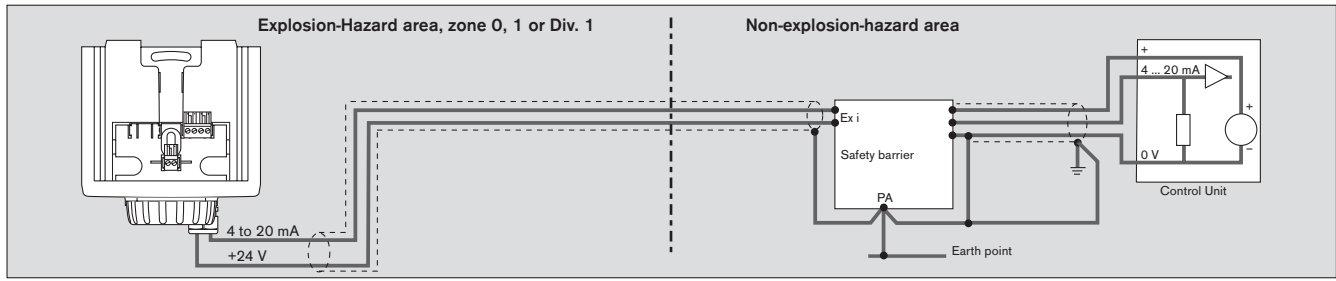
Connection to central unit

Connect the shield to the earth of the central unit (e.g. housing, earthing rail etc.)

If installing the transmitter in Zone 0 or Zone 1 explosion-hazard areas:

- Install a safety barrier with the appropriate explosion protection approval (category 1, 2 or Div. 1) between the transmitter and the control unit.
- Only safety barriers with the following parameters may be used: $U_o (V_{oc}) \leq 30$ V, $I_o (I_{sc}) \leq 0.3$ A, $P_o \leq 700$ mW.
- Take care that the maximum permissible capacitance and inductance of connections to the safety barrier are not exceeded, also taking the cable into account. The safety-related input parameters of the transmitter are: $C_i = 0$ μ F, $L_i = 50$ μ H

- Connect shield to the equipotential bonding or to 0 V (Ex-i).



00423760_4_en.eps

If installing the transmitter in explosion-hazard areas of Zone 2 or 22:

- Use only supply units of the device category 3.
- Take care that the maximum permissible capacitance and inductance of connections to the supply unit are not exceeded, also taking the cable into account. The safety-related input parameters of the transmitter are: $C_i = 0 \mu\text{F}$, $L_i = 50 \mu\text{H}$.

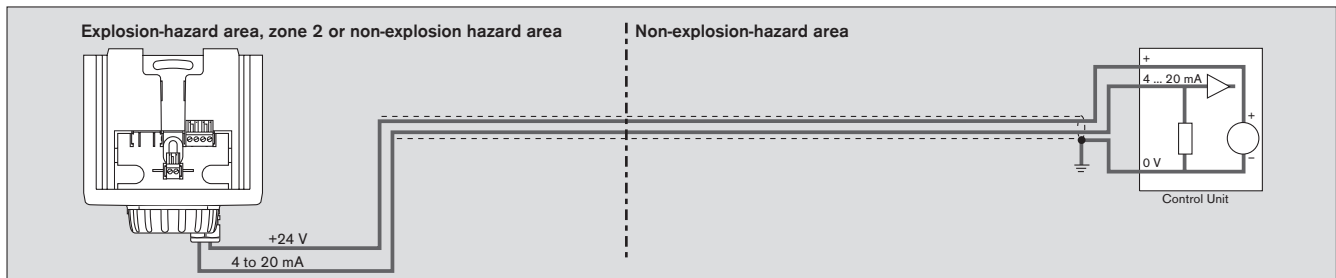
Caution:

The category 1 marking has to be cut out from the rating-plate label. Once the unit has been used after installation in the above manner, it may never be installed in explosion-hazard areas of zone 0 or zone 1 (device category 1 or 2). Explosion hazard!

If installing the transmitter in areas not exposed to explosion hazard:

Caution:

The explosion-protection markings has to be removed from the transmitter. Once the transmitter has been used after installation in this manner, it may never be installed in explosion-hazard areas. Explosion hazard!



00323760_4_en.eps

Installing the electrical connections – Dräger Polytron 7000

Caution:

If a Polytron 7000 is subsequently equipped with the relay module and/or the pump module, the complete unit loses its explosion-protection approval. The user must ensure that no related approval markings are left on the Polytron 7000. Remove or cut away any existing approval label.

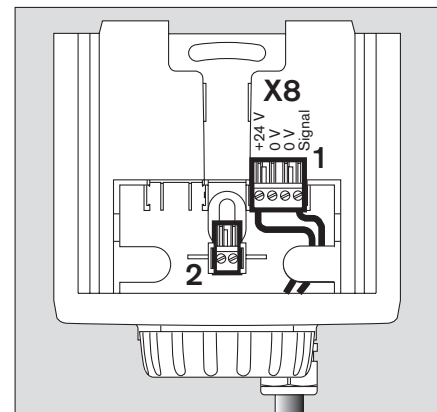
The use of the Polytron 7000 with a pump module and/or relay module installed is not permitted in explosion-hazard areas! Explosion hazard!

2-core connection

- Connection to central device with at least 2-wire cable, AWG, 0.5 to 2.5 mm² (e.g. LiY, LiYCY).

Install the 4 to 20 mA current loop

- For currents between 3 and 22 mA, a DC voltage between 16.5 V DC (3 mA), or 8.0 V DC (22 mA) and 30 V DC must be present at the transmitter.
- Insert the 2-wire connecting cable in the cable gland, cut it to length and strip the insulation (approx. 80 mm).
- Shorten the shield (if installed) to prevent short-circuiting:
- Connect cable
- 1 4-pin terminal (X8) for Dräger Polytron 7000 – observe polarity. Cut excess wires short or
- 2 Fasten in the middle terminals.
- 1 Slide terminal block back into holder.
- Secure cable in holder.
- Fold up these Installation Instructions and place them inside the Dräger Docking Station ready for commissioning/start-up.
- Refit raincover (protection against dust and splashing water).



01023760_4_en.eps

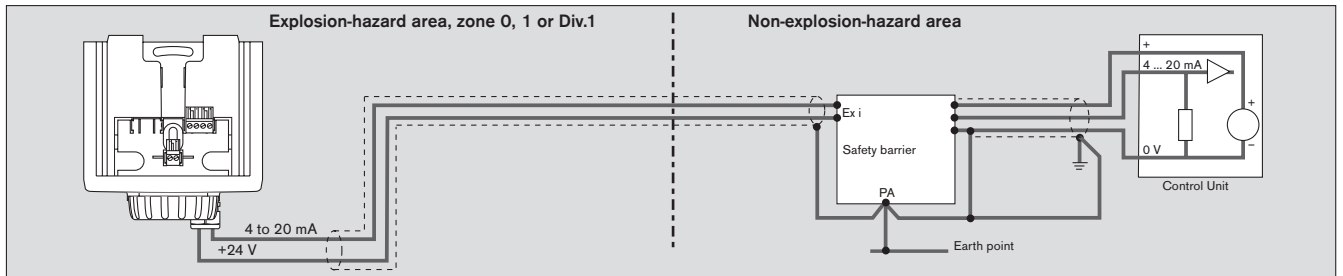
Connection to central unit

Connect the shield to the earth of the central unit (e.g. housing, earthing rail etc.)

If installing the transmitter in Zone 0 or Zone 1 explosion-hazard areas:

Install a safety barrier with the appropriate explosion protection approval (category 1, 2 or Div. 1) between the transmitter and the control unit. Only safety barriers with the following parameters may be used: $U_o (V_{oc}) \leq 30 \text{ V}$, $I_o (I_{sc}) \leq 0.3 \text{ A}$, $P_o \leq 700 \text{ mW}$.

- Take care that the maximum permissible capacitance and inductance of connections to the safety barrier are not exceeded, also taking the cable into account. The safety-related input parameters of the transmitter are: $C_i = 5 \text{ nF}$, $L_i = 50 \text{ }\mu\text{H}$.
- Connect shield to the equipotential bonding or to 0 V (Ex-i).



If installing the transmitter in explosion-hazard areas of Zone 2 or 22:

- Use only supply units of the device category 3.
- Take care that the maximum permissible capacitance and inductance of connections to the supply unit are not exceeded, also taking the cable into account. The safety-related input parameters of the transmitter are: $C_i = 5 \text{ nF}$, $L_i = 50 \text{ }\mu\text{H}$.

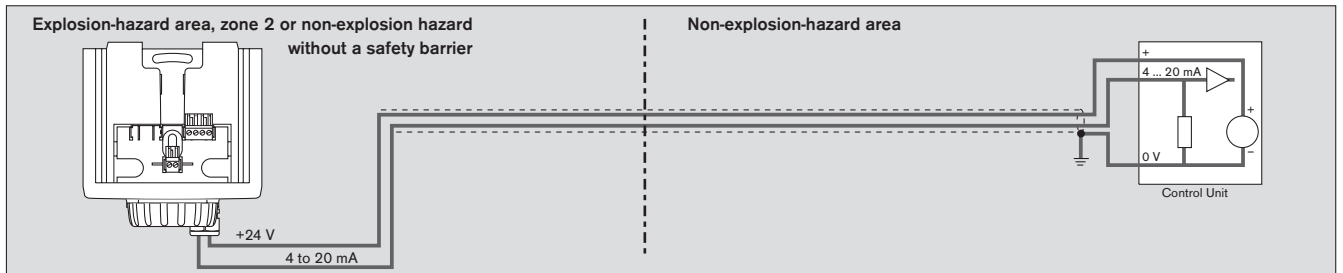
Caution:

Cut out the category 1 marking from the rating-plate label. Once the unit has been used after installation in the above manner, it may never be installed in explosion-hazard areas of zone 0 or zone 1 (device category 1 or 2). Explosion hazard!

For transmitter installations in areas not exposed to explosion hazard

Caution:

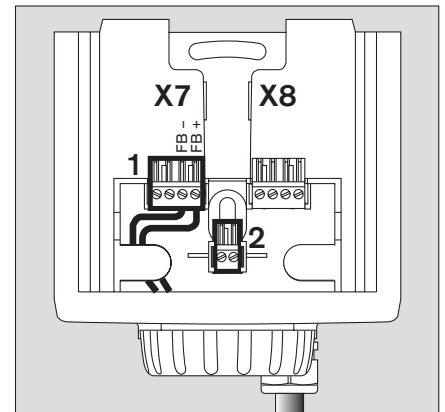
Remove the explosion-protection markings from the transmitter. Once the transmitter has been used after installation in this manner, it may never be installed in explosion-hazard areas. Explosion hazard!



Installing fieldbus communication on the transmitter

- The transmitter can be connected to a certified intrinsically safe fieldbus system, which supports FISCO (Fieldbus intrinsically safe concept).
- The PROFIBUS transmission technology for intrinsically safe applications is MBP. MBP stands for: Manchester Coding (M), Bus Powered (BP)
- 5 transmitters can be connected to a segment with a typical segment current of 100 mA.
- Install the 2-wire connection cable in the cable gland, cut it to length and strip off the insulation (approx. 80 mm).
- Shorten the shield (if installed) to prevent short-circuiting. Connect cable:
 - 1 Use a 4-pole terminal block (X7), Part No. 83 16 268, for the Dräger Polytron 7000 – Observe the polarity of the connections. Cut excess wires short or
 - 2 secure them in center terminals (Part No. 83 16 422).
- 1 Slide terminal block back into holder and fix cable in holder.
- Fold up the installation notes and place them in the Dräger docking station for future use during commissioning.
- Refit raincover (protection against dust and splashing water).

Caution: Insert a 4-pole (X7) terminal block into the left holder.



Installing the transmitter in areas subject to explosion hazards of Zone 0 or Zone 1:

- Only safety barriers with the following characteristics may be used:
 $U_{\max} \leq 24 \text{ V}$, $I_{\max} \leq 0.38 \text{ A}$, $P_{\max} \leq 5.32 \text{ W}$ or those which correspond to the FISCO model.
- The transmitter may only be connected in 2-wire connection to the left 4-fold terminal block (X7) of the docking station. No electrical connections may be made to the right 4-fold terminal block (X8).

Installing the transmitter in areas subject to explosion hazards of Zone 2:

- Make sure that the supply unit corresponds with the FINCO model and that the maximum permissible capacitance and inductance of connections to the supply unit are not exceeded, (also take the cable into account).
- The safety-related input parameters of the transmitter are: $C_i = 5 \text{ nF}$, $L_i = 10 \text{ }\mu\text{H}$.
- The transmitter may only be connected in 2-wire connection to the left 4-fold terminal block (X7) of the docking station. No electrical connections may be made to the right 4-fold terminal block (X8).

Caution: The category 1 marking has to be cut out from the rating-plate label. Once the unit has been used after installation in the above manner, it may never be installed in explosion-hazard areas of Zone 0 or Zone 1 (device category 1 or 2). Explosion hazard!

Connecting to the central unit

- Connect shield to earth of central unit (e.g. housing, earth bar, etc.).

Caution:

In the case of PROFIBUS devices, the shield must only be connected on one side of the cable to earth.

If installing more than one transmitter and HART multidrop-capable central unit

- Observe the installation instructions in the Instructions for Use of the Dräger Polytron 7000.

Connection with 3-wire technology

Attention:

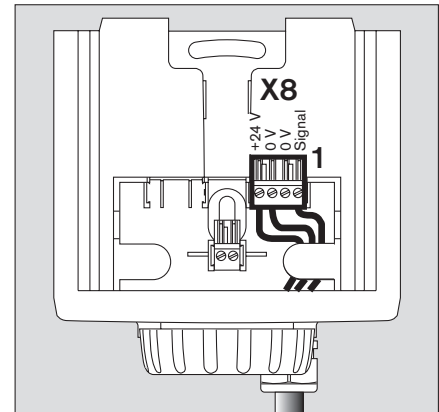
The supplied ferrite sleeves are to be used when installing the transmitter in three-wire technology. A ferrite sleeve must be pushed onto each core prior to connecting the cable to the four-pole terminal in the docking station.

Install the 4 to 20 mA current loop

- Insert the 3-wire connecting cable in the cable gland, cut it to length and strip the insulation (approx. 80 mm).
- Shorten the shield (if installed) to prevent short-circuiting:
- Connect cable
- 1 Fasten in the terminals of the 4-pin terminal block – check correct polarity.
Slide connecting terminal back into holder.
- Secure cable in holder.
- Fold up these Installation Instructions and place them inside the Dräger Docking Station ready for commissioning/start-up.
- Refit raincover (protection against dust and splashing water).

Connection to central unit

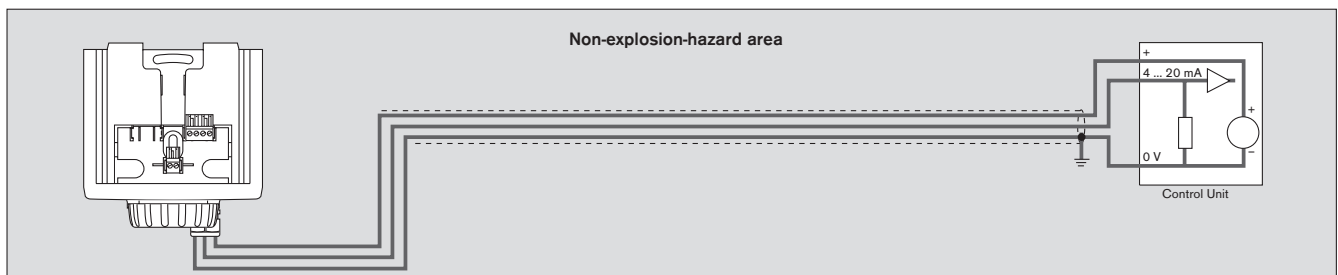
Connect the shield to the earth of the central unit (e.g. housing, earthing rail etc).



If installing the transmitter in areas not exposed to explosion hazard:

Caution:

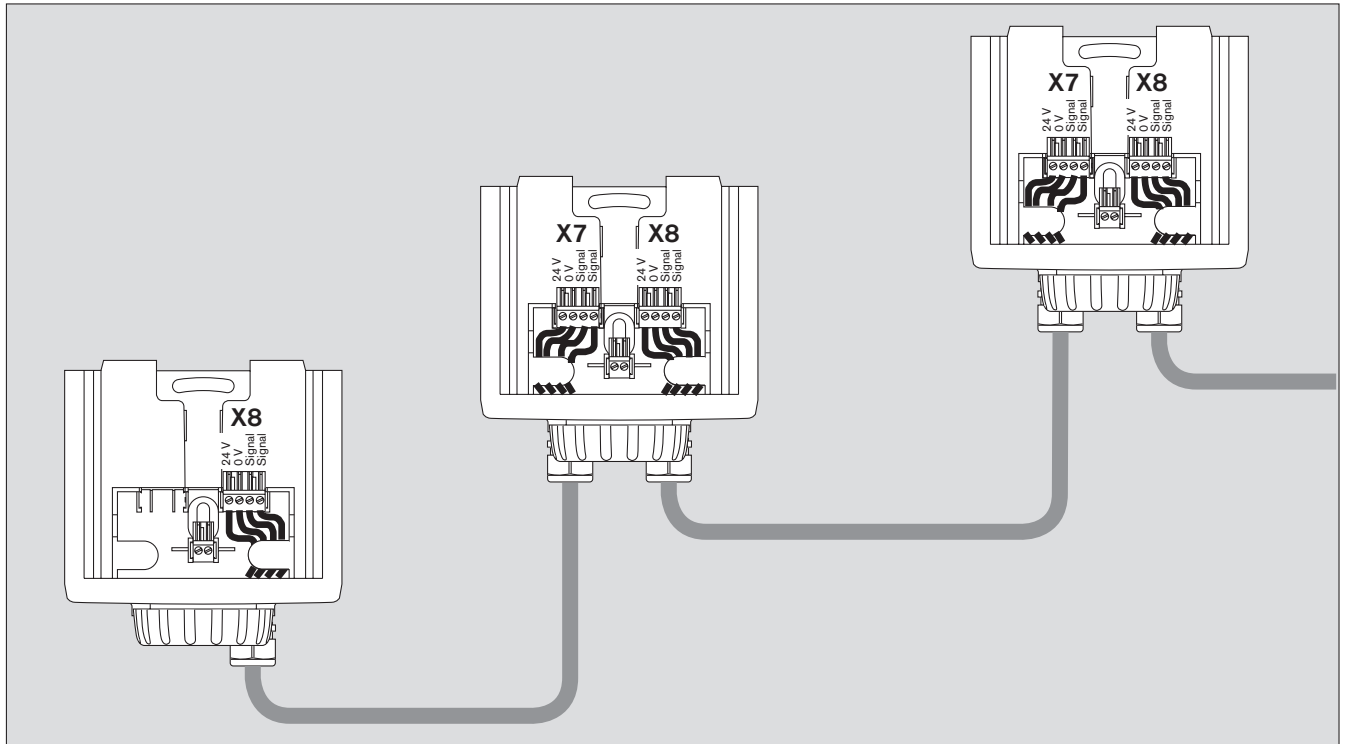
Remove the explosion-protection markings from the transmitter. Once the transmitter has been used after installation in this manner, it may never be installed in explosion-hazard areas. Explosion hazard!



4-core connection

Install the LON Communication

- For installation using LON communication up to 63 Polytron 7000 can be connected to a four wire cable in any configuration including bus, star, loop and mixed.



- Insert the 4-wire connecting cable in the cable gland, cut it to length and strip the insulation (approx. 80 mm).
- Shorten the shield (if installed) to prevent short-circuiting:
- Connect cable
- 1 Fasten in the terminals of the 4-pin terminal block – check correct polarity. Slide connecting terminal back into holder.
- Secure cable in holder.
- Fold up these Installation Instructions and place them inside the Dräger Docking Station ready for commissioning/start-up.
- Refit raincover (protection against dust and splashing water).

If installing the transmitter in 4-core connection:

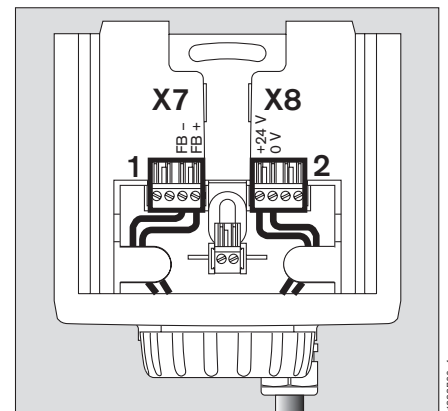
Caution:

With 4-core connection the transmitter has no Ex protection. Once the transmitter has been used after installation in this manner, it may never be installed in explosion-hazard areas. Explosion hazard!

Installing fieldbus communication on the transmitter

- The PROFIBUS transmission technology for intrinsically safe applications is MBP.
MBP stands for:
 - Manchester Coding (M)
 - Bus Powered (BP)
- 5 transmitters can be connected to a segment with a typical segment current of 100 mA.

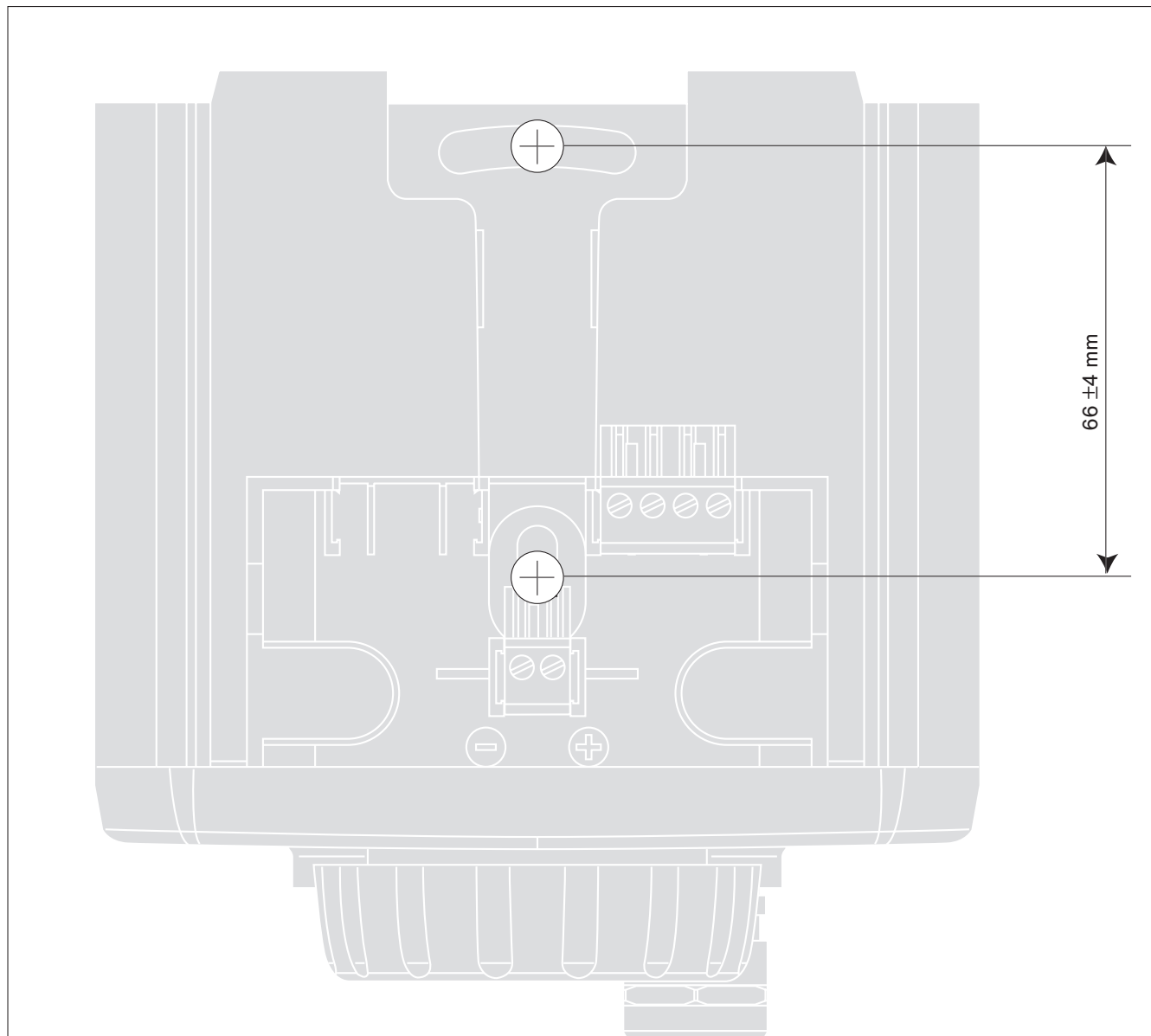
- Install the 4-wire connection cable in the cable gland, cut it to length and strip off the insulation (approx. 80 mm).
- Shorten the shield (if installed) to prevent short-circuiting.
- Connect cable:
- 1 4-pin terminal block for the Dräger Polytron 7000, observing the polarity.
- 2 4-pin terminal block for the Dräger Polytron 7000, observing the polarity.
- Slide connecting terminal back into holder.
- Secure cable in holder.
- Fold up the installation notes and place them in the Dräger docking station for future use during commissioning.
- Refit raincover (protection against dust and splashing water).



Technical data

Cable type	Min. 2-core cable
Wire cross-section	0.5 mm ² (AWG 20) to 2.5 mm ² (AWG 14)
Cable inlet	M20x1.5 for cable diameter 6 mm to 12 mm

Drilling template



01523760_4.eps

Dräger Polytron 7000 Measuring Unit, Installation Instructions



Operation of the Dräger Polytron 7000 or Dräger Docking Station (Part No. 83 17 990) requires full understanding and strict observance of the Instructions for Use of the Dräger Polytron 7000 (Part No. 90 23 758)!

Dräger Polytron 7000 Measuring Unit – Installation

- Remove the rain cover from the previously installed docking station.
 - Examine seal for signs of dirt and clean if necessary.
- 1 Check position of eccentric catches and correct if necessary. The eccentric opening must point upwards, engaged position.

Caution! Use only a 5 mm Allen key without a ball head.

- Check the polarity and cable routing and check that the connector is securely seated; rectify as necessary (see the installation notes for the Polytron docking station).
- Unpack the Dräger Polytron 7000 measuring unit.

Setting the switch for the backup battery

- Check the position of the switch on the bottom of the unit.
This switch must be set to "on"; otherwise, the time, date and data saved in the Datalogger and the Event Logger will be lost in the case of a power failure.
- 2 Insert the measuring unit about halfway up the docking station and slide it in as far as it will go.
 - 3 Lower the unit along the front edge of the docking station. About 5 mm before it hits the stop, the resistance will increase as the connector engages with the socket on the printed circuit board.

Note!

Check that the terminals in the docking station are correctly aligned if the connector does not engage correctly!

Note!

Ensure that the front bottom of the measuring unit is flush with the bottom of the Docking Station. Apply pressure to the measuring unit until it "clicks" into place. If the fronts are not flush, the measuring unit is not completely sealed and could get water inside the transmitter!

- 1 Turn the eccentric catches clockwise with an Allen key to lock the measuring unit (🔓 ⇒ 🔒 = approx. 180°).

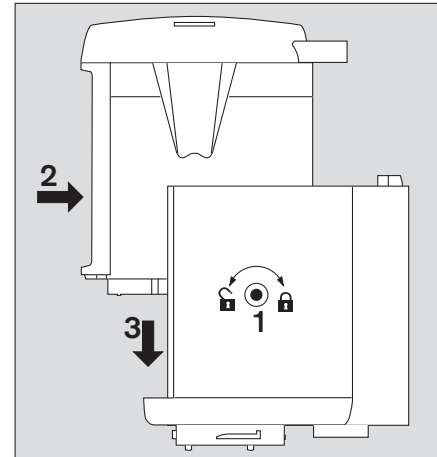
Then insert the sensor as follows:

- 4 Remove bayonet ring from transmitter; remove cover plate.
- Remove sensor from packaging.
 - Remove the short-circuit strap from the sensor (if it is fitted).
 - There is a coded connector on the back of the sensor. Place the sensor in the opening with the connector at the back and the Dräger logo at the front.
Before plugging the connector in the socket, ensure that they are identically coded.
Incorrect connection can damage the sensor!
 - Secure sensor in transmitter with bayonet ring.

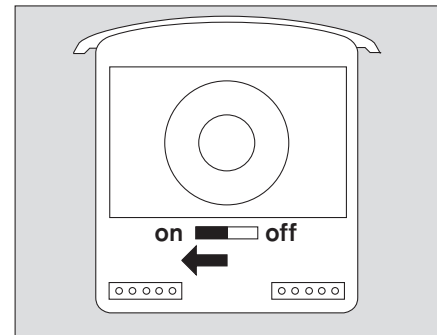
Attention:

For use in Zone 22, tighten the locking screw (2 mm Allen screw) of the sensor bayonet ring tight enough to ensure that the bayonet ring is secured against unintended loosening.

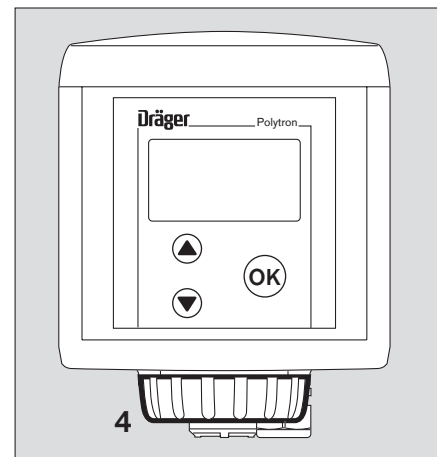
- If necessary, calibrate the sensor.
- If pre-calibrated sensors are used, the alarm chain must be tested with, for example, the bump test.



0023758_1_ega



05423758_1_en.ega



0023758_1_ega

Instructions for Use

For your safety

Strictly follow the Instructions for Use

The operation of stationary Dräger gas measuring devices with the gas supply adapter requires a precise knowledge of and adherence to the instructions for use of the Dräger gas measuring device used.

Intended Use

Gas supply adapter (order no. 68 06 978) for stationary gas measuring devices with Dräger sensors. For the calibration and continuous supply of measuring gases. The gas supply adapter cannot be used for gas measuring devices with the following Dräger sensors:

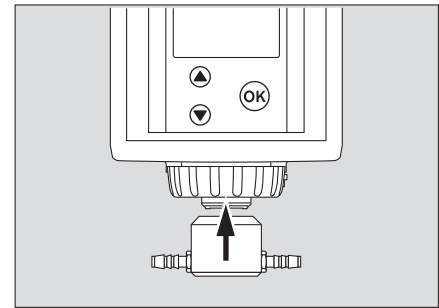
DrägerSensor HF/HCl/BF ₃ L – 68 09 360	DrägerSensor NF ₃ – 68 09 310
DrägerSensor Cl ₂ L – 68 09 370	DrägerSensor NF ₃ – 68 11 125
DrägerSensor AC L – 68 09 375	DrägerSensor PFC – 68 11 500
DrägerSensor AC – 68 10 595	DrägerSensor PFC – 68 11 120

Connect gas supply adapter to the gas measuring device

- Attach gas supply adapter onto the sensor using a slight turning movement (of approx. $\pm 30^\circ$).
- Connect hoses or pipes. Inlet and outlet freely selectable.
- The gas supply adapter (materials used: PE) is fitted with hose nozzles for a Viton hose 6 x 1 mm as standard. When using other hoses or pipes the hose nozzles can be changed – connection thread ISO 228 - G1/8).

CAUTION

Note the adsorption effects for the measuring gas used.
Unsuitable hose material can adsorb the measuring gas and thereby create false readings.
Use a suitable material for the measuring gas used. Silicone hoses are not suitable; preferably use Viton or Teflon hoses.



00133016_01.epa

Gas supply using a pump

- Recommendation: Use Dräger PSD 3000 (order no. 83 19 270) or Polytron sampling unit (order no. 83 13 680).
- The rate of flow across the sensor must be approx. 0.5 L/min.

CAUTION

Ensure free flow across the sensor.
Blocked inlet or outlet lines can generate a vacuum or overpressure during pump operation damaging the sensor and causing false readings.

Calibration

- Note the detailed information in the instructions for use of the gas measuring device or sensor used.

13.7 APP-TEK ODALOG LOW RANGE



Thank you for purchasing the OdaLog[®] portable gas instrument manufactured by App-Tek International Pty Ltd.

As part of our quest to continually improve the product we make, we are interested in hearing your feedback in relation to the OdaLog's performance in different environments and applications as well as the usefulness of the information you collect using its data-logging function.

If you have any suggestions or comments please pass them back through our distributors or e-mail us direct on sales@odalog.com

OdaLog[®] Low Range Gas Logger

COPYRIGHT© 2004


The sole purpose of this document is to assist in the operation of the OdaLog[®] Logger Low Range instruments.

We do not convey any right to use this information for any purpose other than in the operation or maintenance of the OdaLog[®] Low Range Logger.

Software Copyright ©2004 App-Tek International Pty Ltd

App-Tek International Pty Ltd does not accept liability for any damages arising as a result of any errors or omissions in this manual.

Table of Contents

1	Certifications / Conformity	3
1.1	ELECTROMAGNETIC COMPATIBILITY (EMC) – COMPLIANCE STATEMENT	3
1.2	QUALITY STATEMENT	3
2	WARNINGS AND CAUTIONS.....	3
3	DESCRIPTION.....	4
4	ODALOG® LOW RANGE SPECIFICATIONS.....	5
5	SENSOR OPERATION.....	6
5.1	EFFECTS OF ENVIRONMENTAL CHANGES ON MEASUREMENTS	6
5.1.1	Temperature	6
5.1.2	Humidity	6
5.2	LONG TERM EXPOSURE TO HIGH GAS LEVELS.....	6
5.3	SENSOR CROSS-SENSITIVITY	6
6	INTRODUCTION.....	7
6.1	INSTRUMENT OVERVIEW	7
6.2	ABBREVIATIONS.....	7
6.2.1	STEL (Sample Time End Level)	7
6.3	MAIN BUTTON & MAGNETIC SWITCHES	8
6.3.1	Main Button	8
6.3.2	Magnetic Switches	8
6.4	DISPLAY ANNUNCIATORS.....	8
6.4.1	BATT ()	8
6.4.2	STEL.....	8
6.4.3	INST	8
6.4.4	Numeric Display	8
6.4.5	%	8
6.4.6	°C	8
6.4.7	PPM (ppm).....	8
7	OPERATION.....	9
7.1	GENERAL OPERATION	9
7.2	OVER-RANGE INDICATION	9
7.3	SWITCHING ON	9
7.4	SWITCHING OFF	9
7.5	DISPLAY SCREENS.....	10
7.5.1	Main Structure	10
7.5.2	StAt (Status Menu)	11
7.5.3	OFF.....	11
7.6	LOW BATTERY INDICATION & CONTROL	12
7.7	IRDC (INFRA RED DATA COMMUNICATION MODE).....	12
7.7.1	To Enter “IrdC” mode.....	12
7.7.2	To Exit “IrdC” mode.....	12
7.7.3	Precautions required when using OdaLog I.R communication.....	12
7.7.4	Steps to ensure reliable I.R communication.....	13
7.7.5	Communications Set-up.....	13
7.7.6	Data-logging	14
7.8	TEST MODE.....	14
7.9	KEY LOCK	14
7.10	TRAINING	14
8	MAINTENANCE.....	15
8.1	PUMP BATTERY REPLACEMENT	15
8.2	CPU BATTERY REPLACEMENT.....	15
8.3	DUST FILTER REPLACEMENT.....	16
8.4	SERVICE	17
9	CALIBRATING THE OdaLog® Low Range	18
9.1	INTRODUCTION.....	18
9.2	REQUIREMENTS FOR CALIBRATION	18

9.3	ADSORPTION OF CALIBRATION MIXTURE.....	18
9.4	TOOLS AND TEST EQUIPMENT	18
9.5	CALIBRATION MIXTURE APPLICATION TIMES & RATES.....	19
9.6	PREPARING FOR CALIBRATION	19
9.7	ENTERING CALIBRATION MODE	19
9.8	INITIAL PRE USE CHECKING.....	20
10	WARRANTY	21
11	PATENTS, TRADE MARKS AND REGISTERED DESIGNS.....	21
12	OPTIONAL ACCESSORIES AND SPARES	22
12.1	ACCESSORIES	22
12.2	SPARE PARTS	22
12.3	GAS TEST KITS.....	22
12.4	TEST GAS CYLINDERS	22
APPENDIX A – Glossary of Terms and Abbreviations.....		23
APPENDIX B – Declaration of Conformity		24

1 Certifications / Conformity

1.1 Electromagnetic Compatibility (EMC) – Compliance Statement

The OdaLog® Type IV Gas Logger complies with the emission requirements of:

Standard Number	Standard Title	Compliance
BS EN 50270: 1999	Electromagnetic compatibility – Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen	Fully

1.2 Quality Statement

App-Tek International Pty Ltd produces all products in accordance with our accredited ISO9002 Quality System (Certification No. QEC13816).

2 WARNINGS AND CAUTIONS

- ◆ DO NOT USE SOLVENTS TO CLEAN THE ODALOG® (A DAMP CLOTH WILL SUFFICE)
- ◆ DO NOT INSERT OBJECTS (INCLUDING FINGER) INTO SENSOR INLET AS THE FILTER MAY BE DAMAGED
- ◆ DO NOT ATTEMPT TO DISASSEMBLE SENSORS AS THEY ARE POTENTIALLY CORROSIVE
- ◆ DO NOT PLACE MAGNETIC I.R LINK STAND OR ALLEN TOOLS NEAR COMPUTER DISCS AS DATA MAY BE CORRUPTED
- ◆ ALKALINE BATTERIES SHOULD NOT BE LEFT IN ODALOG® FOR PERIODS OF OVER SIX MONTHS
- ◆ THE BATTERIES SHALL ONLY BE REMOVED OR REPLACED IN A NON-HAZARDOUS AND CLEAN AREA ENVIRONMENT.
- ◆ THE ODALOG® LOW RANGE LOGGER IS NOT AN 'INTRINSICALLY SAFE' APPARATUS AND SHOULD NOT BE USED IN POTENTIALLY FLAMMABLE OR OXYGEN ENRICHED ATMOSPHERES.
- ◆ ANY RAPID UP-SCALE READING FOLLOWED BY A DECLINING OR ERRATIC READING MAY INDICATE A GAS CONCENTRATION BEYOND UPPER SCALE LIMIT WHICH MAY BE HAZARDOUS.
- ◆ THE ODALOG® LOW RANGE LOGGER IS NOT DESIGNED TO OPERATE AS A SAFETY DEVICE. WHEN ENTERING CONFINED SPACES AND TOXIC HAZARD ENVIRONMENTS ALL APPROPRIATE REGULATIONS AND OCCUPATIONAL HEALTH AND SAFETY PRECAUTIONS SHOULD BE STRICTLY ADHERED TO. IF UNSURE OF POTENTIAL HAZARDS OR SAFETY STANDARDS, SEEK ADVICE FROM YOUR WORK PLACE OCCUPATIONAL HEALTH AND SAFETY DEPARTMENT.

3 DESCRIPTION

The OdaLog® Low Range is a portable gas data-logger, primarily designed to log gas levels over extended periods of time. Due to the nature of the environments in which the instrument is likely to operate, it has been designed to be splash resistant and robust with double O-ring seals in a durable, corrosion resistant body with stainless steel fittings. An Infra Red Data Communication link as well as magnetic switches enables the OdaLog® to be downloaded, calibrated, and configured without having to open the case. The OdaLog's large LCD display shows Gas reading, Time of day, Temperature, Battery Volts, % of Log used, and Low Battery Symbol. Please note appropriate software package is required to set instrument parameters and configuration.

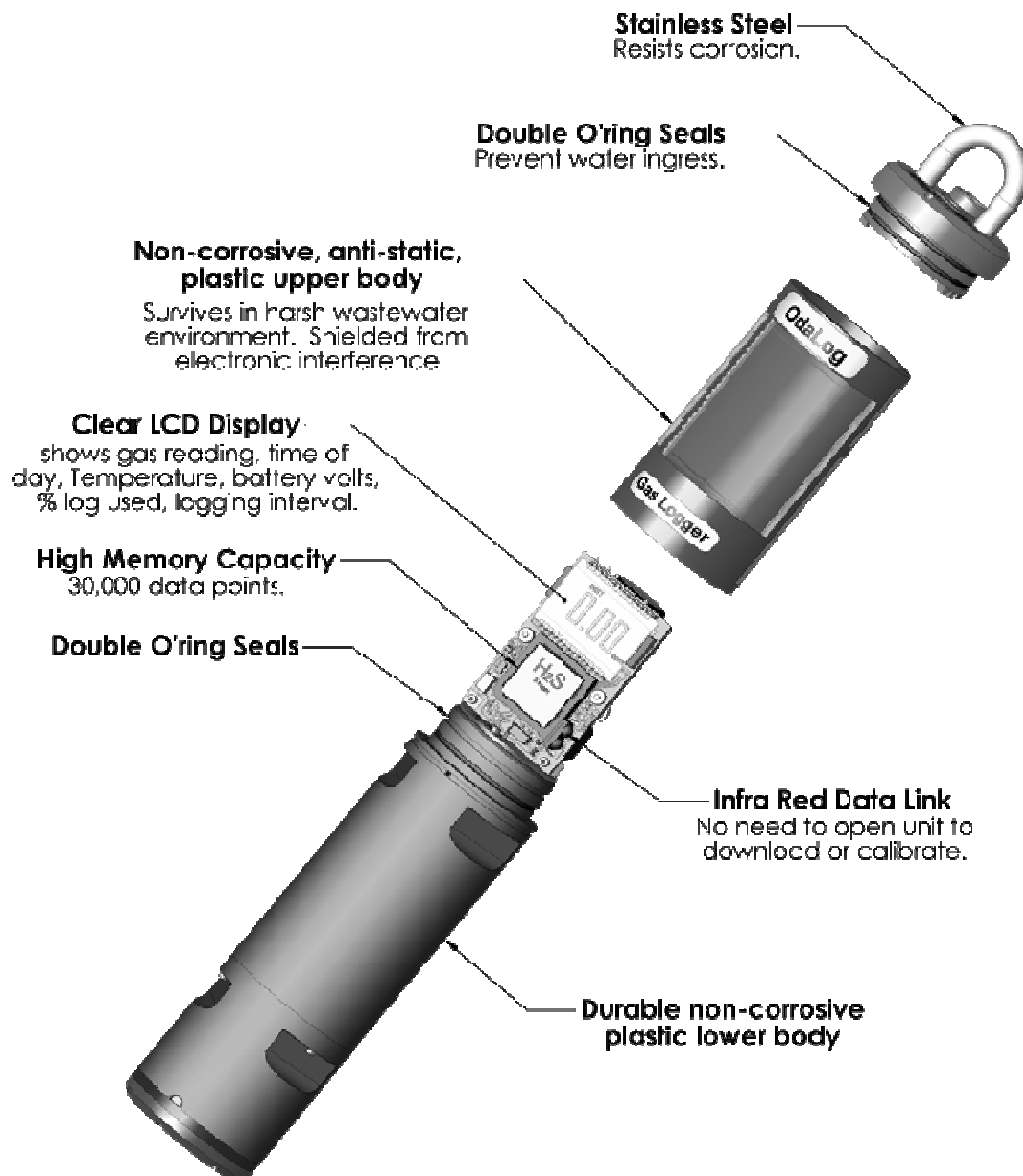


Figure 1: Instrument Description

4 ODALOG[®] LOW RANGE SPECIFICATIONS

Measurement Range	0.00 to 2.00ppm H ₂ S
Zero Drift (NTP)	+/- 0.01ppm Conditions: NTP, fresh air, taken over 10 consecutive sample cycles
Precision	5% Relative Standard Deviation Conditions: NTP, 0.20ppm H ₂ S applied, Taken over 10 consecutive sample cycles.
Accuracy	+/- 10% of reading 0.10ppm to 2.00ppm Conditions: NTP, Calibrated at 0.50ppm
Linearity	Tested over the range 0.00ppm to 1.00ppm +/-9%TG at 0.25ppm, +/-6%TG at 0.75ppm Conditions: NTP, Calibrated at 0.50ppm, tolerances as defined by NATA
Sample Flow Rate	Evaluation Phase Sample Flow Rate – 100 to 150ccm. Total accuracy not maintained at flow rates below 100ccm.
Environmental Protection	IP54 (dust and splash protected) Uses OdaLog [®] double O-ring sealing technology
Instrument Temperature Range	0° C to 40° C and 6° C change / Hr maximum (32° F to 104° F and 11° F change / Hr maximum)
Logging / sampling interval	10 minutes to 1 hour
Memory capacity	30000 data points
Relative Humidity Range	15-90% (non-condensing)
Pressure Range	Atmospheric ±10%
External Dimensions	62mm (2.44") diameter X 307mm (12.1") long
Weight	Approximately 900grams (2.0lb)
Battery life (and type)	CPU battery: 2 Months (2/3AA size Lithium cell) Pump battery: 7 Days (C size Alkaline cell)
Warranty	12 Months (see section 10)

Notes:

NTP defined as: Temperature = 20°C, Pressure = 1 Atmosphere

-OS- Indicates measurement outside the OdaLog's Sensor range. (Firmware display Limit)

TG defined as: True Gas or actual gas concentration

5 SENSOR OPERATION

The OdaLog[®] uses a custom electrochemical sensor to detect levels of a specific gas in ppm (parts per million).

The sensor consists of electrolyte and electrodes packaged in a small container with a diffusion barrier through which the gas sample passes.

A subsequent chemical reaction creates current flow within the sensor relative to changes in the level of gas passing through the diffusion barrier.

This current output is then interpreted within the OdaLog, displayed on the LCD (ppm) and recorded in the OdaLog's data-logging chip.

Whilst the sensor is designed to react to its specific gas type, there are other gases that will also cause chemical reactions within the sensor. (See section 5.3)

5.1 Effects of Environmental Changes on Measurements

5.1.1 Temperature

The operating temperature range of the sensor is 0°C to +40°C (32°F to 104°F) and within this range the sensors are temperature compensated. Extreme temperature swings may however cause sensor drift and give incorrect readings until the temperature sensor stabilises or a full sample cycle has completed.

5.1.2 Humidity

The H₂S sensor can be used continuously in atmospheres of 15% to 90% relative humidity (RH), and can be used intermittently between 0 to 15% and 90 to 99% RH. If used for extended periods of time at low humidity, a H₂S sensor may dry out. Conversely at high humidity it may take up water and leak acid.

5.2 Long Term Exposure to High Gas Levels

The OdaLog[®] Low Range Logger uses a built in carbon filter. Long term exposure to high levels of H₂S may require early replacement of this filter. It is anticipated that under normal operating conditions, the filter should last six months before requiring replacement by an authorised App-Tek service centre as part of a regular maintenance program.

For advice on the carbon filter, contact your authorised App-Tek distributor.

5.3 Sensor Cross-Sensitivity

The presence of other gases can affect the readings of the OdaLog Low Range instrument. The table below shows how the instrument is likely to respond to 50ppm of various interfering gases. There may be gases not listed on this table which also interfere with the OdaLog Low-Range instrument.

Table 1

Approximate response to Interfering Gas at 50ppm after 3min sample					
CO	SO ₂	NO	NO ₂	NH ₃	CL ₂
0.02ppm	0.23ppm	0.03ppm	~-0.40ppm (-US-)	0.01ppm	-0.05ppm

(-US-) - Under Scale, Instrument is reading under scale i.e. less than -100ppb.

6 INTRODUCTION

6.1 Instrument Overview

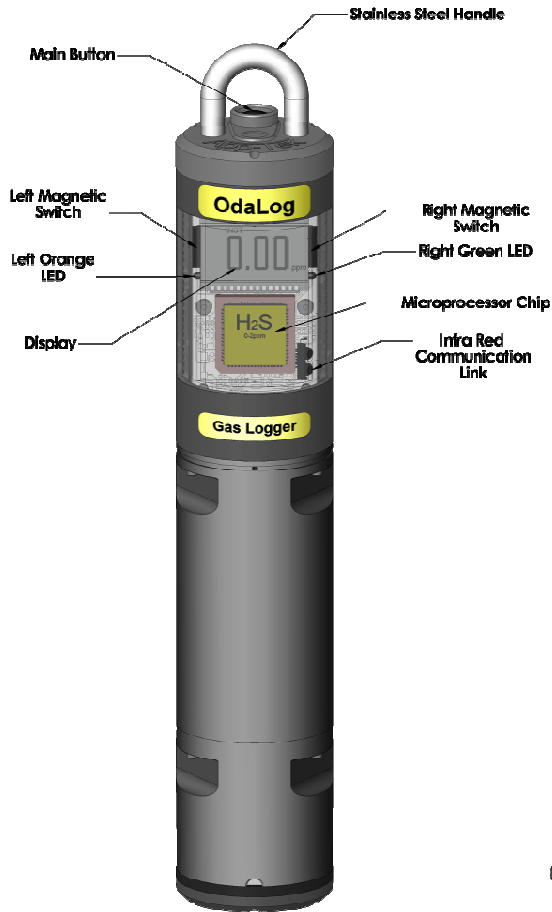


Figure 2: Instrument Overview 1

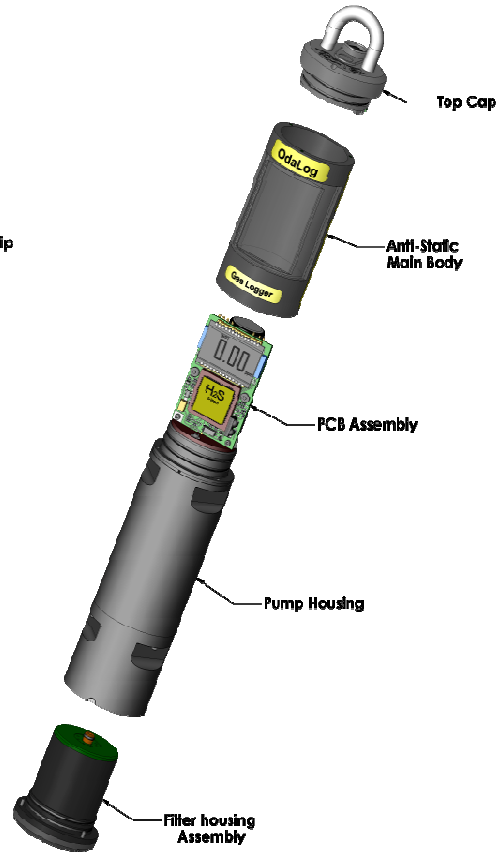


Figure 3: Instrument Overview 2

6.2 Abbreviations

A full list of terms & abbreviations can be found in Appendix A.

6.2.1 STEL (Sample Time End Level)

Current gas reading updated at the end of each measurement cycle. This is the normal display mode.

6.3 Main Button & Magnetic Switches

To simplify the OdaLog[®] Low Range Logger's operation the instrument is fitted with only one button that performs all the necessary main functions. (See Figure 2) The OdaLog[®] Low Range is also fitted with two magnetic switches for less commonly used functions. The supplied Allen key tool (P/N: 11-0000) has a magnetic top that is used to activate these switches.

6.3.1 Main Button

The button is on the top of the instrument behind the handle. It is used to turn the instrument on and off, move between screens, and to select the desired menu choice where applicable.

6.3.2 Magnetic Switches

The magnetic switches are constructed of blue plastic and are located on the left and right hand side of the LCD display. They allow answering the prompted Yes "Y", No "N" questions and exiting the Key Lock mode.

6.4 Display Annunciators



Figure 4

6.4.1 BATT ()

Low Battery indication. (Refer Section 0)

6.4.2 STEL

Sample Time End Level. Current gas reading updated at the end of each measurement cycle.

6.4.3 INST

Instantaneous evaluation phase output.

6.4.4 Numeric Display

Displays selected exposure concentration

6.4.5 %

Units: % (Log percentage full)

6.4.6 °C

Units: Deg C.

(Note: Units configured to display °F, will display an "F" after the temperature value in the Status Menu).

6.4.7 PPM (ppm)



Units: Parts per million.

7 OPERATION

7.1 General Operation

The measurement cycle consists of a zeroing period (also known as Null phase) followed by a measurement period (also known as Evaluation phase) and will take at least 10 minutes to complete. At the end of the measurement cycle the latest obtained reading will be displayed on the STEL screen.

One press of the button will display the Cycle Progress Screen. Each phase of the sample cycle is displayed in this screen. A solid 'n' indicates the Null phase and an 'E' indicates the evaluation phase. The time remaining, in seconds, for the current sample cycle phase is flashed on the display.

- Null in progress: for example the value for the count down time with a measurement cycle of 10 minutes would appear as , where 420 is the time remaining in seconds.
- Evaluation in progress: the maximum value for the count down value would appear as , where 180 is the time remaining in seconds.

Note that the Cycle Progress Screen will revert back to the STEL screen after 60 seconds.

The measurement cycle can be adjusted to 10, 15, 20, 30, 40, & 60 minutes via the software by adjusting the logging interval in the Instrument Parameters dialog box.

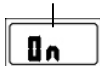
7.2 Over-Range Indication

When instrument range is exceeded, the "STEL" screen will display "-OS-" to indicate that the concentration of the gas is higher than the maximum range of the instrument. This indication will remain until the end of the next measurement cycle, where the display will be updated with the latest measurement taken. The display will continue to display "-OS-" until the concentration of the gas being measured falls below the maximum range of the instrument.

7.3 Switching on

Press & hold button down, release on the word "On".

Press and hold button Release button Test Screen



The OdaLog[®] LCD display will show (consecutively)

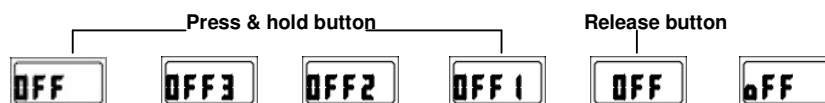
- (Test Screen) "8.8.8.8"
- OdaLog[®] Type
- Installed OdaLog[®] Firmware Version
- Last Calibration Date

The display will then revert to display Sample Time End Level gas reading "STEL" screen.

In sequence, moving from one screen to the next is achieved by pressing & releasing the button (refer Figure 3).

7.4 Switching off

At the "OFF" screen Press & hold button down. "OFF" will count down from 3 until "OFF" is displayed and shifted one place to the right. Release button. The display will show "oFF" and the instrument is switched OFF.



Note: Releasing the button during the countdown routine will cause exit to off menu screen.

7.5 Display Screens

7.5.1 Main Structure

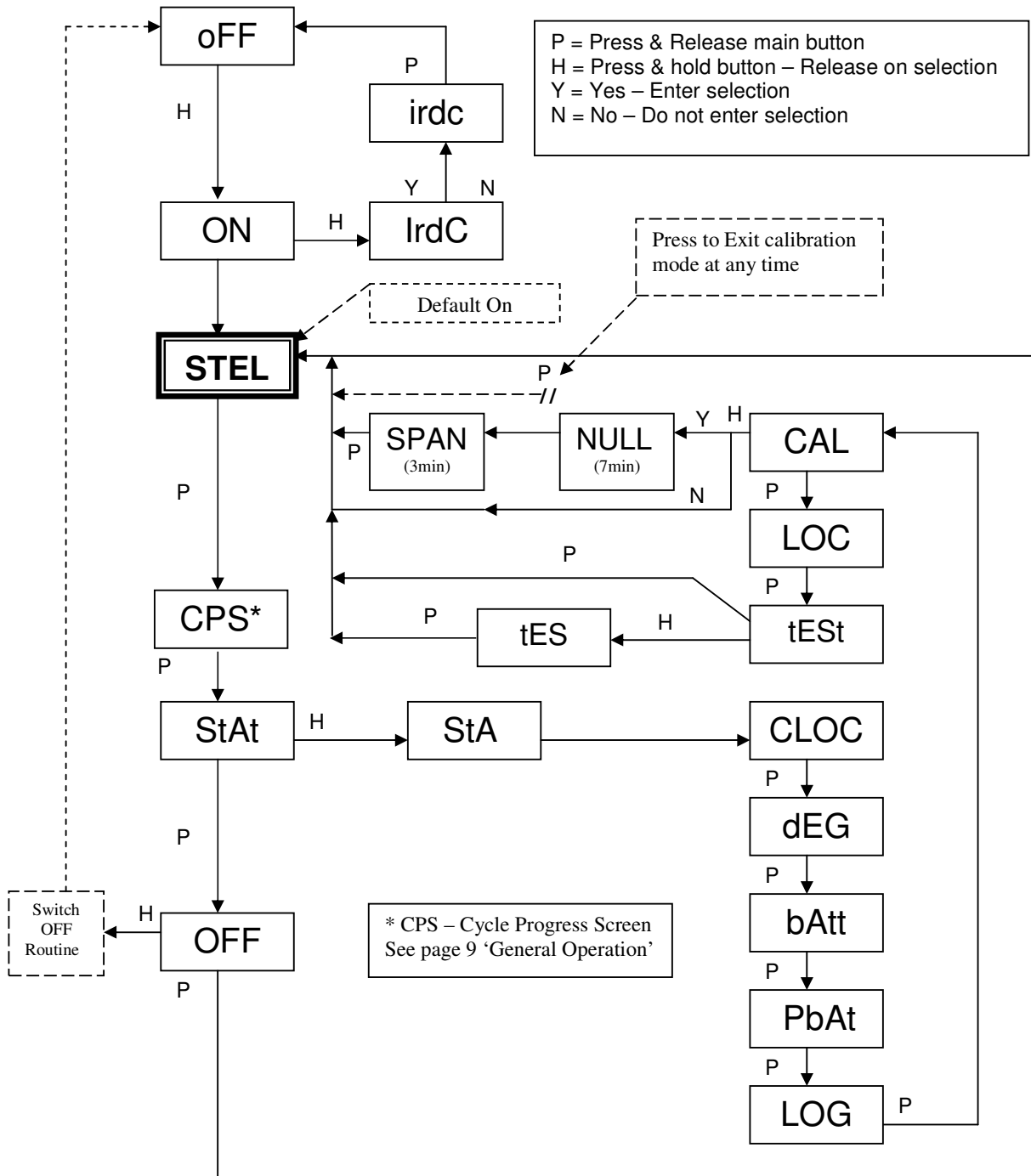
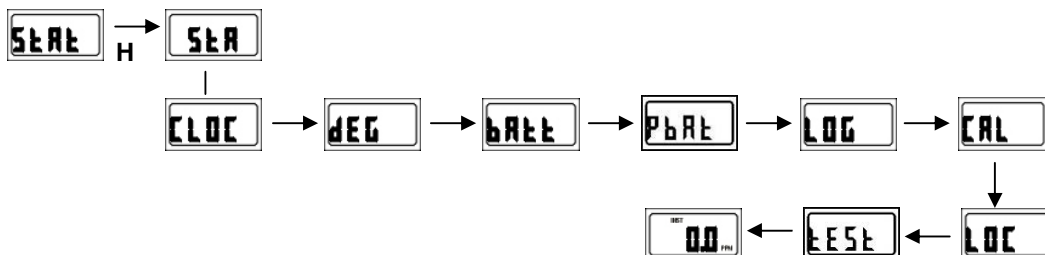


Figure 5

7.5.2 StAt (Status Menu)

Allows access to the “StAt” menu.

At the “StAt” screen, Press & Hold button until “StA”, then release button. The display will now step through each of the following screens each time the button is pressed.

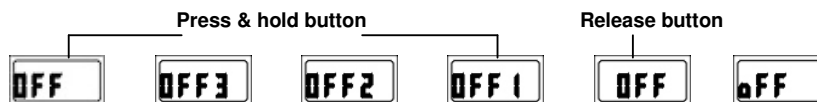


Instrument Information & Status

- **CLOC (Time)**
Shows time of day. This screen alternates between “CLOC” and the time of day.
- **DEG (Temperature)**
Shows the temperature. This screen alternates between “dEG” and current instrument temperature. Shown in Deg C or F.
- **batt (Battery Status)**
Shows current CPU battery status in Volts. This screen alternates between “bAtt” and the battery voltage.
- **Pbat (Pump battery status)**
Shows current Pump battery status in Volts. This screen alternates between “Pbat” and the battery voltage.
- **LOG (% Remaining)**
Shows % of log remaining. This screen alternates between “LOG” and the % log remaining.
- **CAL (Entry to calibration mode)**
Press and hold the switch to enter calibration mode. (Refer section 9 CALIBRATING THE OdaLog® Low Range)
- **LOC (Display locking mode)**
Included in the StAt menu if the Key Lock mode is enabled by the PC software package refer to software package help. When “LOC ” is displayed, pressing and holding the main button activates the Key Lock mode. Key Lock mode allows the user to lock (disable) the main button and hide the gas reading. Data logging continues normally. (Refer section 7.9)
- **tEst (Entry to Test mode)**
When “tEst” is displayed, pressing and holding the switch starts the test mode. In test mode the Evaluation phase runs continuously. When the test mode is activated, the LCD alternates between “tEst” and the latest obtained reading, updated once per second. Press the switch once to leave the test mode and start the normal sample cycle again. (Refer section 7.8)


7.5.3 OFF

Allows the user to turn the instrument OFF, refer to section 7.4 for details.




7.6 Low Battery Indication & Control

While the instrument is switched on, battery expiry is handled through the following LCD screen messages.

 On stable – CPU Battery Low. The low battery icon will be shown on the LCD when this battery voltage falls to 3.40V.

FLAt – CPU Battery Flat. The OdaLog[®] will turn off when this voltage falls to 3.20V.

 Flashing – Pump Battery Low. The low battery icon will flash on the LCD when the pump battery voltage falls to 1.06V.

PbFL – Pump Battery Flat. The OdaLog[®] will turn off when this voltage falls to 0.96V.

7.7 IrdC (Infra Red Data Communication Mode)

Allows access to the IrdC mode used to communicate with the OdaLog[®] software.

7.7.1 To Enter “IrdC” mode

Switch instrument “off”. Press & hold button whilst “On” is displayed and **continue holding** until “IrdC” appears on screen. Release button.

“Y” and “N” will appear on the display. With the magnetic base of the Allen Tool provided select “Y” to enter IrdC mode or “N” to abort back to “off” state.

If “Y” is selected the display will start flashing the word “irdc” to indicate that the OdaLog[®] is in Infra Red Communication Link Mode.



Flashing = Comm. Link operating

7.7.2 To Exit “IrdC” mode

The OdaStat[®] software will automatically exit the “IrdC” mode and return to ‘OFF’ mode when the program is closed, or when ‘Disconnect’ is clicked. Otherwise you may exit this mode by pressing the top button, which will return the OdaLog to the ‘OFF’ mode. The OdaLog will also “time out” after 60 seconds of non-communication when in ‘IrdC’ mode, and will also return to ‘OFF’ mode.

7.7.3 Precautions required when using OdaLog I.R communication

The Infra Red communications system used by the OdaLog to communicate and transfer data to a computer has been designed as a fast and convenient method of data communication that does not compromise the durability of the OdaLog construction. Like all communication systems, the Infra Red system has some vulnerabilities that can interfere with normal communications.

As more portable devices are utilising Infra Red technology to communicate, the possibility for interference between devices is increasing and precautions should be taken to ensure that communications between the OdaLog and the PC are reliable and trouble free.

Conditions that have the potential to disrupt OdaLog to computer communications are:

- Infra Red ports on notebook computers and desktop PC's other than the Infrared Data Communication Link supplied with the OdaLog. These built-in or add on ports are usually active even when not in use.
- Infra Red ports on organisers, phones, modems etc. that have been activated or are in use.
- Infra Red ports on printers.
- Strong light sources such as holding the OdaLog very close to a bright light while in the “IrdC” mode.
- Infra Red remote control devices from TV's, air conditioners etc.

Note: The OdaLog is only susceptible to communication interference when it has been placed into “IrdC” mode. It is not possible for any other device or source of Infra Red interference to affect the OdaLog if the user has not placed the OdaLog into the “IrdC” mode.

7.7.4 Steps to ensure reliable I.R communication

- Position the OdaLog correctly with respect to the supplied Infrared Data Communication Link as described in the user manual.
- If you are using a computer with an Infra Red port attached (other than the Infrared Data Communication Link supplied with the OdaLog), disable this port to prevent any Infra Red transmissions from it. **Never attempt to use a built-in Infra Red port on a computer or other infrared ports. Always use the Infrared Data Communication Link supplied with the OdaLog.**
- Ensure that other devices with Infra Red ports (phones, other computers, organisers etc) that are within about 10 metres of the OdaLog do not have their Infra Red ports activated.
- Ensure that strong light sources are not directed onto the OdaLog while the instrument is in “IrdC” mode.
- When changing the configuration of the OdaLog using the PC software, always read back the settings from the OdaLog after they have been changed to ensure that they have been received correctly.

Note: In severe cases of Infra Red interference, the OdaLog may stop responding. If this occurs, contact your nearest OdaLog distributor or service centre for advice on restoring normal operation to the OdaLog.

7.7.5 Communications Set-up

- Connect I.R device to your PC and install the software package.
- Open the software package on your PC, and ensure communication settings are configured correctly to communicate with your OdaLog instrument (refer to software package help).
- Place OdaLog into *IrdC* Mode
- Position I.R device between 25-150mm (1-6”) from the OdaLog Instrument, ensuring line-of-sight between I.R device and the I.R module on the OdaLog, as shown in Figure 6.
- Disconnect instrument when finished.

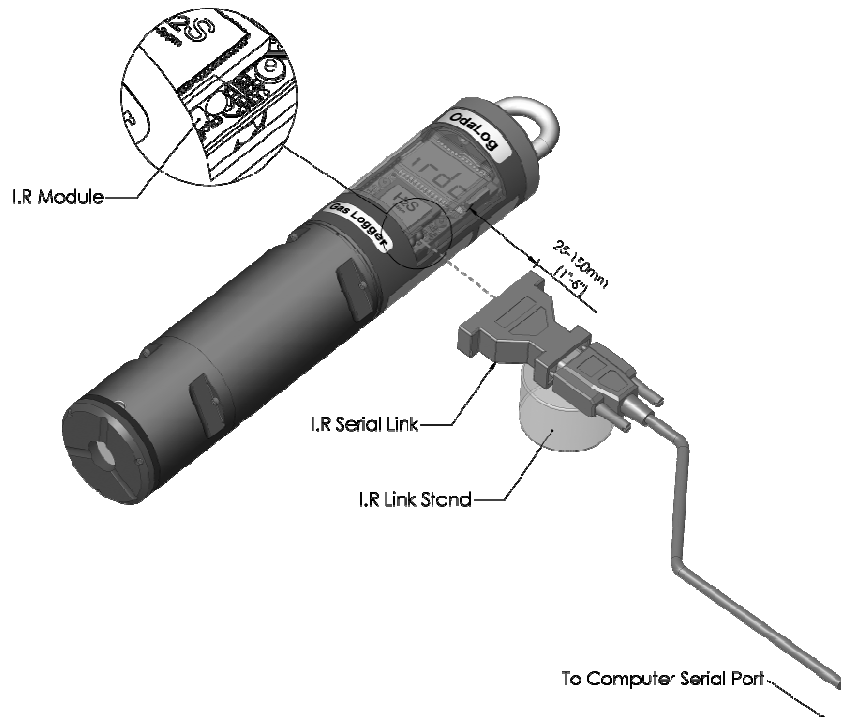


Figure 6: I.R Communications Set-Up

7.7.6 Data-logging

The logging function in the OdaLog[®] is fully transparent to use, in that the process of logging the exposure data does not interfere in any way with the use of the OdaLog.

The logging function has the capacity to store around 30000 data points that can be stored either as a fixed log (logging stops when log memory is full), or as a continuous log (logging continues after the memory is full by overwriting the oldest data).

Each time the OdaLog[®] is switched on, a new logging session will start. The logging session may be ended by one of the following ways: Switching the OdaLog[®] Off, Entering Calibration mode, *Entering Test mode, when the log becomes full in “Stop when log full mode” and when ever either of the batteries are flat. When exiting the Calibration mode, a new logging session will be started.

*** Note:** A new log will be started on entering and exiting test mode.

The length of time for which the OdaLog[®] will record data will depend on the logging interval selected. As a guide, with no data in the logging memory, temperature logging selected, and a 10 minute logging interval, the OdaLog[®] will be able to store approximately 100 days of data in memory. To setup the logging parameters refer to the software package help.

The logged data can be downloaded and analysed via the software package, developed and sold by App-Tek International Pty. Ltd. For more information on I.R communication, download and analysis of logged data, and set up of the instrument refer to software package help.

7.8 Test Mode

Warning: This mode is not recommended for normal use. This function has only been provided as a qualitative odour source location tool and will most likely not maintain accuracy over the 10 minute operating window.

In test mode the Evaluation phase runs continuously. When the test mode is active, the LCD alternates between “tEst” and the latest obtained reading, updated once per second. On entering the test mode the current logging session will cease and a new log will begin with a logging interval of 1 second. The test mode log will cease on exiting this mode and a new normal mode log will start with the user selected interval (Default 10min). Press the switch once to exit the test mode and start the normal sample cycle again.

Note: Test mode will time out automatically after 10 minutes and return to the STEL screen starting a new normal sample cycle.

7.9 Key Lock

This feature enables the user to lock the top button and disable the display. This feature works as follows:

1. To Lock the OdaLog[®] instrument.

Select from the “StAt” menu the option called “LOC”. On the “LOC” menu option press & hold button until “LOC” is displayed one place to the right. Release button. “Y” and “N” will appear on the display. Place the magnetic base of the Allen Tool provided next to the left magnetic reed switch to select “Y” (Yes). The display will now show the word “LOGG” alternating with “ING” representing the word “LOGGING”. The top button is now locked.

Placing the magnetic base of the Allen Tool provided above the right reed switch to select “N” (No) will return the screen to the “LOC” menu option.

2. To Un-Lock the OdaLog[®] instrument:

Place the magnetic base of Allen Tool provided on the left magnetic switch. Press the top button and the display will return to the “CPS” screen. The instrument is now unlocked and can be operated normally.

7.10 Training

To locate your nearest App-Tek International training centre please contact us at the address shown on the back of this manual or refer to our web site www.app-tek.com

8 MAINTENANCE

Routine maintenance of the OdaLog[®] instrument is an extremely important factor affecting the reliability of the unit. Only through a dedicated maintenance programme will optimum instrument performance and reliable operation be achieved. To ensure reliable measurements, the OdaLog[®] should be checked at regular intervals with test gas as described in section 9.8.

The OdaLog[®] should be switched off when not in use and stored in a clean and dry environment as found in a normal office.

At least once every 6 months a full service should be performed at an authorised App-Tek service centre where the sensor can also be calibrated and firmware/software can be upgraded.

8.1 Pump Battery Replacement

CAUTION: ENSURE THE FOLLOWING PROCEDURE IS CARRIED OUT IN A NON-HAZARDOUS AREA ONLY

- Switch OdaLog[®] off (Section 7.4)
- Using the Allen Tool [Part No. 11-0000] remove the three retaining screws that secure the top cap to the OdaLog[®] body.
- Grasp OdaLog[®] body in one hand and with the other firmly and carefully pull the stainless steel ring fitting until the top cap is removed from the body.
- Reach inside and remove the “C” size Alkaline pump battery. (Refer to Figure 7(a), Pg 16)
- Remove and retain Dry pack (moisture absorption pack) [Part No. 12-0129]
- Fit the replacement cell with the positive end (+) facing downwards towards the bottom of the OdaLog.
- The negative end (-) of the cell should now be at the open end of the OdaLog[®] body so that the top cap will make contact with it when placed back.
- Place Dry pack down one side of the “C” size battery.
- Apply O-ring grease if necessary to the top cap O-rings.
- Replace top cap rotating slightly backward and forward to align the three screw holes.
- Fit the screws, DO NOT OVERTIGHTEN.

8.2 CPU Battery Replacement

CAUTION: ENSURE THE FOLLOWING PROCEDURE IS CARRIED OUT IN A NON-HAZARDOUS AREA ONLY

- Switch OdaLog[®] off (Refer section 7.4)
- Using the Allen Tool [Part No. 11-0000] remove the three retaining screws that secure the top cap to the OdaLog[®] body.
- Grasp OdaLog[®] body in one hand and with the other firmly and carefully pull the stainless steel ring fitting until the top cap is removed from the body.
- Use the Allen Tool to remove the three retaining screws that secure the sensor housing to the OdaLog[®] body (Refer to Figure 7(b), Pg 16).
- Grasp OdaLog[®] body in one hand and the sensor housing in the other. Firmly and carefully pull until the OdaLog[®] body is removed from the sensor housing.
- Remove and retain Dry Pack (moisture absorption pack) [Part No. 12-0129]
- Remove and replace 2/3 AA Lithium battery observing correct polarity (See Figure 7(b), Pg 16).
- Smear a thin film of grease (Part No. 12-0001) on the O-rings of the
- Sensor housing (if req).
- Wipe off any excess grease with a lint free cloth.
- Reattach the OdaLog[®] body to the sensor housing, aligning screw holes.
- Fit the screws, DO NOT OVERTIGHTEN.
- Place Dry Pack (moisture absorption pack) down one side of the “C” size battery.
- Apply O-ring grease if necessary to the top cap O-rings.
- Replace top cap rotating slightly backward and forward to align the three screw holes.
- Fit the screws, DO NOT OVERTIGHTEN.
- Reset OdaLog[®] Date and Time (Refer to software package help)

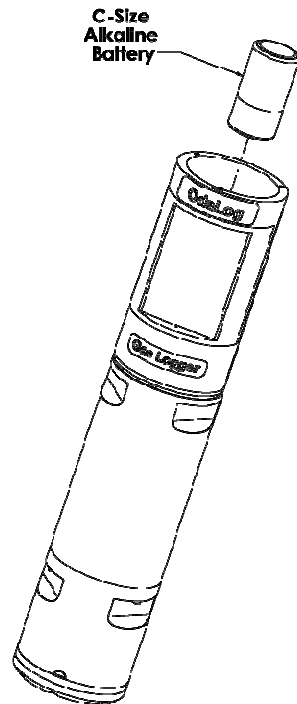
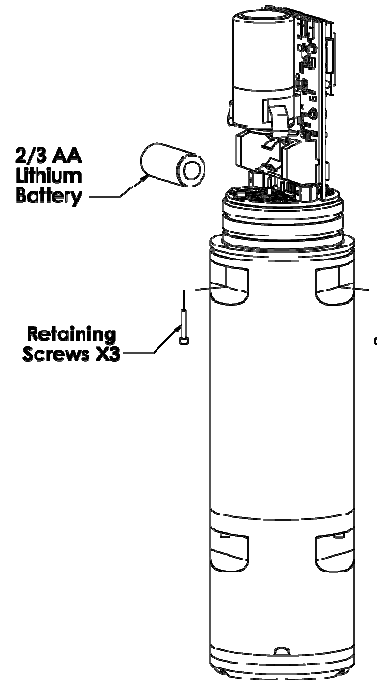


Figure 7 (a) Pump Battery Replacement



(b) CPU Battery Replacement

8.3 Dust Filter Replacement

CAUTION: ENSURE THE FOLLOWING PROCEDURE IS CARRIED OUT IN A NON-HAZARDOUS AREA ONLY

- Switch OdaLog[®] off (Section 7.4)
- Using the Allen Tool [Part No. 11-0000] remove the three retaining screws from the filter housing assembly.
- Carefully remove filter retaining cap
- Remove and retain o-ring
- Remove filter
- Replace filter with 'shiny' side facing outwards
- Replace O-ring. DO NOT GREASE O-RING
- Replace filter housing assembly on OdaLog[®] body (aligning screw holes)
- Replace the three filter retaining cap, retaining screws. DO NOT OVERTIGHTEN

WARNING

Ensure hands are free of dirt and grease prior to handling new filter

Note: Filter orientation is important. Ensure that the replacement filter is correctly placed with the 'shiny' side facing outward.

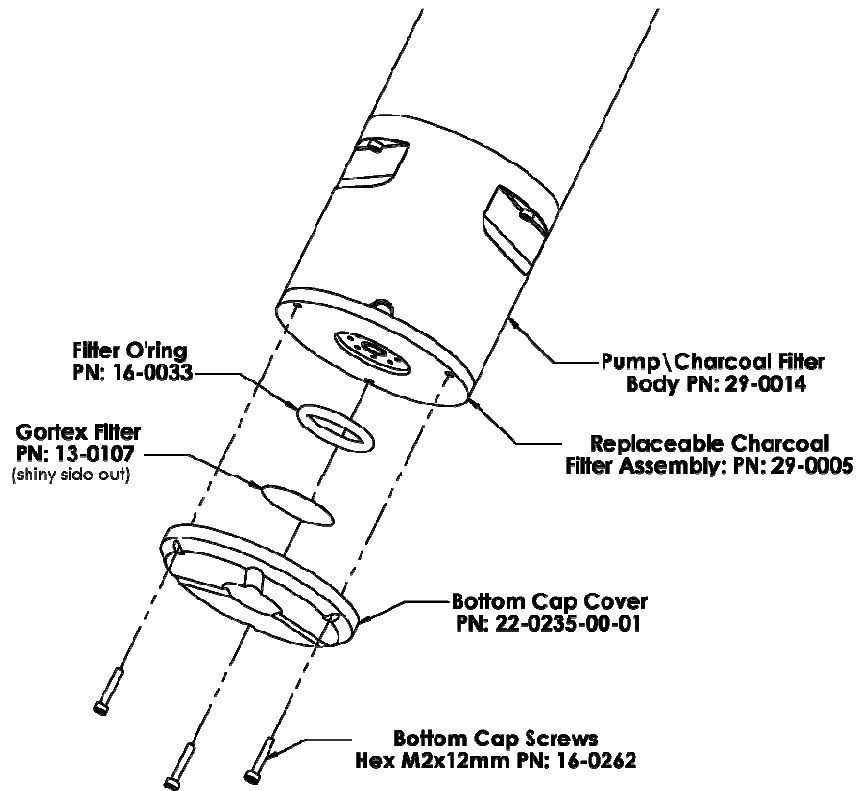


Figure 8: Filter Replacement

8.4 Service

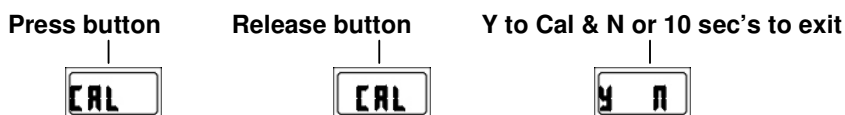
To locate your nearest App-Tek International service centre please contact us or refer to our web site www.app-tek.com

9 CALIBRATING THE OdaLog® Low Range

CAUTION: ODALOG® INSTRUMENTS MUST BE CALIBRATED BY AUTHORISED COMPETENT PERSONNEL USING THE CORRECT EQUIPMENT. IF UNSURE, OR THE CORRECT EQUIPMENT IS NOT AVAILABLE, RETURN THE INSTRUMENT TO APP-TEK INTERNATIONAL OR AN AUTHORISED DISTRIBUTOR / TECHNICAL WORKSHOP FOR CALIBRATION.

9.1 Introduction

To prevent accidental access to the Calibration mode, the OdaLog® will prompt the user to answer a Yes / No question. If answered, “Yes”, then access to calibrate the instrument can be gained, or if answered “No” or 10 seconds pass before the question is answered the instrument will return to the Calibration screen.



9.2 Requirements for Calibration

Calibration of an OdaLog® must take place in a known clean, fresh air environment at an ambient temperature of between 20°C and 25°C (68- 77°F).

A clean, fresh air environment is one that is free of flammable gases and interfering or contaminating substances (hereafter known as ‘Clean Air’).

Cigarette smoking, the use of butane lighters or solvents nearby, industrial fumes and vehicle exhaust can cause an incorrect and potentially inaccurate calibration.

Ensure the OdaLog® has a fresh set of batteries and that filters are uncontaminated and undamaged.

9.3 Adsorption of Calibration Mixture

Care should be taken when selecting the regulator and material type & length of tubing used for calibration. For certain calibration gas mixtures, instead of the gas passing freely through the gas regulator & tubing, molecules of test gas can attach themselves on to the regulator & tubing walls, thus reducing the concentration of calibration mixture that reaches the instrument sensor. This effect is known as adsorption and is more noticeable with certain calibration mixtures than others, particularly hydrogen sulphide.

Advice in relation to suitability of regulators & tubing should be sought from the calibration mixture supplier.

9.4 Tools and Test Equipment

The following equipment is required to perform a calibration on an OdaLog® instrument:

- Calibration Gas (hereafter known as Calibration Mixture). Calibration Mixture (to match sensor type, refer Table 2) equivalent to 25-50 percent of full-scale concentration, preferably near mid-scale. Calibration Mixture should be certified or analysed to be accurate to at least ± 5 percent of the actual labelled concentration.
- Gas bottle regulator to suit gas type & flow rate. (Refer to Table 2)
- Or optional equipment: Gas Dilution System, or EZ-Dlute to suit application, as shown. (Contact your local distributor for selection advice)
- Calibration fitting/adaptor complete with tubing of suitable type, size & length.(11-0001)
- Magnetic ended Allen Tool part number (11-0000).
- Calibration procedure document, section 9 of this manual.

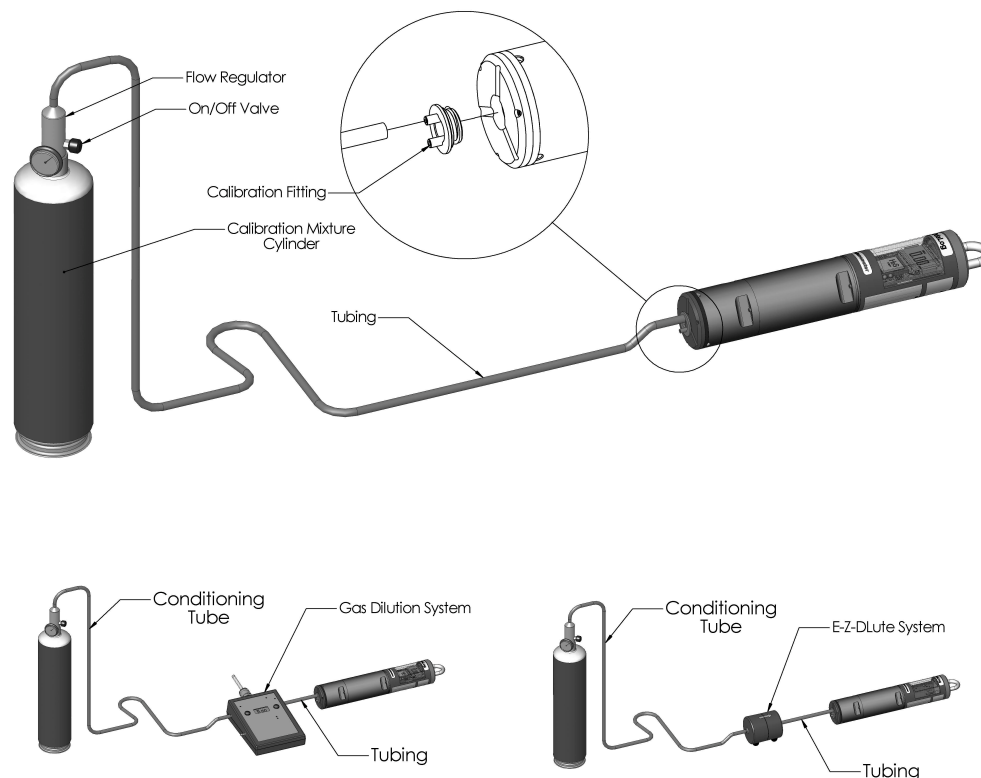


Figure 9: Calibration Mixture Connections

9.5 Calibration Mixture Application Times & Rates

This table shows the ideal calibration mixture flow time & flow rate necessary for calibration. In particular, be sure that the correct flow rate and time is used.

Table 2

Calibration Mixture Type	Suggested Gas Level (ppm)	Calibration Gas Range (ppm)	Sensor Type	Recommended Flow Rate (ml/min)	Gas flow time (min)
Hydrogen sulphide (Balance: Air)	0.5	0.1 to 0.5	H ₂ S	250	10

9.6 Preparing for Calibration

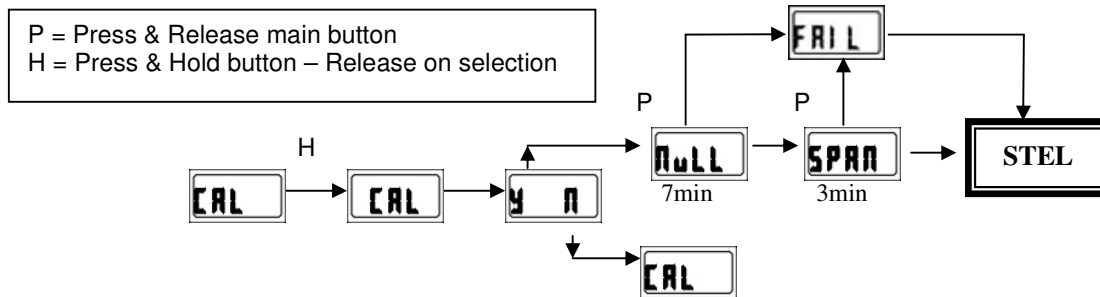
Set the calibration level via the software package (“Instrument Parameters” section) to correspond with the level being applied during calibration. Connect the appropriate Calibration Mixture (Table 2) as shown in Figure 9 to the OdaLog using the adapter cap provided. Do not open the gas valve until in “CAL” mode. To enter “CAL” mode follow the steps shown in section 9.7 Entering Calibration Mode.

9.7 Entering Calibration Mode

Calibration mode is entered as follows.

From the “StAt” menu select “CAL”, then Press and hold the button until the word “CAL” moves one place to the right. Release the button. The display will now show Yes & No (“Y N”). Place the magnetic base of the Allen Tool provided above the left hand reed switch to select Yes. Turn on the valve for the calibration gas mixture. The display will now show the word “nuLL” alternating with calibration seconds remaining and the current sensor measurement. After 7 minutes the screen will show the word “SPAn” alternating with calibration seconds remaining and the current sensor measurement. The “SPAn” cycle takes 3 minutes. If the calibration is unsuccessful the message ‘FAIL’ will appear and the display will return to the STEL screen. If the calibration is

successful the display will automatically return to the STEL screen. Pressing the main button during the “nuLL” or “SPAn” cycles will exit calibration mode.



9.8 Initial Pre Use Checking

Initial pre use checking of the instrument is of the utmost importance to ensure that the OdaLog[®] is in a proper state of operation.

1. Visual Inspection: Check the instrument for signs of physical damage to the outer body and internal workings. Ensure that the sensor's filter and filter cavity is free of obstructions or coatings, which could interfere with the gas or vapour reaching the sensor.
2. Calibration: Ensure instrument has been recently calibrated.
3. Fresh Air Zero Reading: Check instrument reads correctly in Clean Air. At the end of the measurement cycle, 0.00 should be displayed on the LCD.
4. Response Test: The response of the instrument to a known, appropriate calibration mixture (Table 2) should be verified. Response testing is performed as follows:
 - a. Connect the appropriate Calibration Mixture (Table 2) to the OdaLog as shown in Figure 9.
 - b. Turn the calibration mixture on and allow calibration mixture to flow at the flow rate and for the flow time as detailed in Table 2.
 - c. Enter test mode (through the STAT menu) and note the reading after 3 minutes.

If the sensor's response to the gas is not within $\pm 10\%$ of the correct reading, the instrument should be re-calibrated (refer section 9).
5. Check battery status.
6. Check logging capacity remaining

Note: Gas Testing Kits including gas cylinder, regulator, tubing, calibration fitting and carry case can be sourced from your nearest OdaLog[®] distributor.

10 WARRANTY

The OdaLog® Low Range, including sensor and all components, is warranted for 12 months from date of despatch from App-Tek International Pty Ltd's premises, provided it is used in accordance with this manual as well as any technical notes issued by App-Tek International Pty Ltd either directly or to its distributors.

Repairs performed under warranty must be carried out by App-Tek International Pty Ltd or its authorised distributor and do not include shipping costs or calibration costs associated with gas sensors installed.

11 PATENTS, TRADE MARKS AND REGISTERED DESIGNS

The following Authorities have granted Patent, Registered Design and Trade Mark certification to the OdaLog.

Britain and Northern Ireland	Registered Trade Mark	2203862
Britain and Northern Ireland	Registered Design	2089795
Commonwealth of Australia	Registered Trade Mark	785920
Commonwealth of Australia	Registered Design	140375
European Community	Registered Trade Mark	001330356
Germany (Deutschland)	Registered Design	4 00 01 216.2
New Zealand	Registered Trade Mark	313661
United States of America	Patent	Des.432,037
United States of America	Patent	US 6,198,400

12 OPTIONAL ACCESSORIES AND SPARES

12.1 Accessories

Part Number	Description
11-0000	Allen Tool with Magnetic Base
11-0001	Calibration Fitting
11-0003	OdaLog [®] Software Kit (includes Infra Red Data Communication Link & Stand)

12.2 Spare Parts

Part Number	Description
02-0003	Size "2/3 AA" Lithium battery, 3.6V
02-0004	Size "C" Alkaline battery, 1.5v
12-0129	Desiccant Satchel Pack,
12-0001	O-ring Grease
10-0004	User Manual
12-0002	Infra Red Data Communication Link
12-0003	Stand for Infra Red Data Communication Link
70-0250	Gas regulator 250ml/min
22-0002	Moulded Button Cover

12.3 Gas Test Kits

Part Number	Description
All Gas Test Kits Include Test Gas, Regulator, Calibration Fitting, Plastic Carry Case & Tubing	
30-0041	Gas Test Kit Hydrogen sulphide 1ppm


12.4 Test Gas Cylinders

Part Number	Description
33-0041	Test Gas Cylinder Hydrogen sulphide 1ppm

Note: App-Tek International recommends that test gas cylinders are sourced locally to avoid the cost and increased delivery time incurred when shipping hazardous materials overseas. For Australian customers, please contact App-Tek Safety for your test gas cylinder requirements.

APPENDIX A – Glossary of Terms and Abbreviations

The following abbreviations and terminology are used in this manual and / or appear on the OdaLog[®] display screen, label and software.

	Battery warning
bAtt	Battery Volts
-OS-	Over scale – Measurement outside the instruments range
Cloc	Time of day
Clr	Clear logged data
C-Tick	Australian EMC compliance marking.
DonE	Selected process completed
Err	Error during process, process not completed
ESD	Electrostatic discharge
FAIL	Instrument Failed selected task
Full	Data log memory full
INST	Instantaneous measurement
IrdC	Infra Red Data Communication
LOG	% Logging memory used
LED	Light emitting diode
LCD	Liquid crystal display
LHS	Left Hand Side
Flat	CPU Battery Flat. The OdaLog [®] will turn off when this voltage falls to 3.20V.
PbFL	Pump Battery Flat. The OdaLog [®] will turn off when this voltage falls to 0.96V.
Null	Fresh air zero
Oda	OdaLog [®] raw data file name extension
OFF	Displayed when switching unit off & while unit is off
ON	Displayed when switching unit on
OncE	Stop log when memory full
Roll	Continuous logging, over write oldest data
RS232	Serial communication protocol
SPAn	Span set
StAt	Status
STEL	Current gas reading (sample time end level)
StoP	Stop logging
-US-	Under Scale: - Instrument is reading under scale.

APPENDIX B – Declaration of Conformity



App-Tek International Pty Ltd
PO Box 5523 (13/6 Pinnacle Street) Brendale 4500 Australia
Telephone +61 7 3881 3850 Facsimile +61 7 3881 2713
Email sales@odalog.com Web Page <http://www.app-tek.com>
ABN 28 089 678 339



EC Declaration of Conformity

Product Type: OdaLog Type IV "Low Range Logger".

We, Manufacturer:

App-Tek International Pty Ltd
13/6 Pinnacle Street
Brendale, Qld Australia 4505

Declare under our sole responsibility that the product(s) listed below

Product(s): OdaLog Type IV "Low Range Logger"

Is / are in conformity with the relevant provisions of:

Council Directive 89/336/EEC (EMC Directive as amended by 91/263/EEC, 92/31/EEC and 93/68/EEC)

EMC Test Lab: ITACS - EMC Test Lab

736-740 Ingham Road,
Mount Louisa, Queensland,
Australia, 4814

e-mail: don.terrace@itacslab.com
web: www.itacslab.com

Conformity has been demonstrated with reference to the following documentation:

EMC Compliance Reports: EMC0362E dated 2003-08-15 and EMC0362I dated 2003-12-02

Compliance with the Essential Health & Safety Requirements has been assessed by reference to the following standards:

BS EN50270: 1999 (Electromagnetic compatibility – Electrical apparatus for the detection and measurements of combustible gases, toxic gases or oxygen)


Signature:

Name: Brian Worth
Title: Technical Director
Date: June 13, 2003

Rev: 1, 2003/12/03

X:\Approval Drawings\EMC documents\OdaLog Type IV\ATEX\EC Declaration of Conformity Type IV ATEX Rev1.doc



 13/6 Pinnacle St Brendale QLD 4500 Australia			TITLE		DOCUMENT NUMBER
			Specification Document OdaLog® CEM Low Range Logger – External Power and 4–20 mA Current Loop		03-P-0008 SHEET 1 OF 2 STOCK No. 25-0002
BY	CHK. BY	DATE			
AJG	SCA	2005-04-18			

1 SPECIFICATIONS

EXTERNAL POWER	
Supply requirements	5 V to 12 V d.c. if supply is regulated ¹ 5 V to 9 V d.c. if supply is unregulated ² 100 mA minimum
Minimum operating voltage	4.5 V d.c.
Absolute maximum voltage	13.0 V d.c.

4–20 mA CURRENT LOOP	
Loop supply voltage Normal operating range: Minimum operating voltage: Absolute maximum voltage:	12 V d.c. to 24 V d.c. - must be regulated ¹ 8.0 V d.c. 28 V d.c. Note: The 4–20 mA current loop circuit is powered from the loop – no additional power supply is required for the loop
Maximum loop resistance	112 ohms at 12 V d.c. 602 ohms at 24 V d.c.
0% full scale current	4.0 mA
100% full scale current	20.0 mA
Under-range limit current, -2.5% full scale	3.6 mA
Over-range limit current, +20% full scale	23.2 mA
Fault signal current	3.5 mA

¹ A regulated supply is electronically regulated to maintain the output voltage constant with varying input voltage, load and temperature. This also results in an output voltage with no ripple.

² An unregulated supply rectifies and filters a transformer secondary winding. It does not have additional electronic regulation to maintain the output voltage constant and will typically supply its nominal output voltage at full load. Therefore its output voltage when lightly loaded can be significantly higher than its nominal output voltage. The output can also have significant ripple.

2 CONNECTION DETAILS

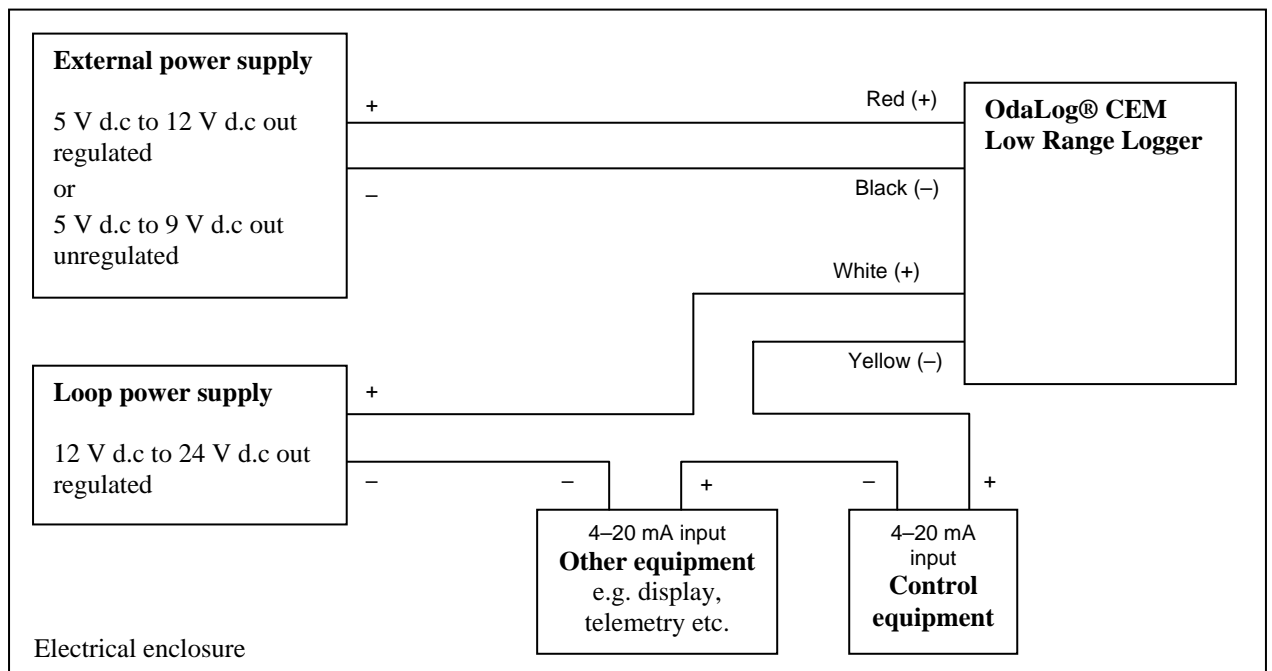
Table 1 shows the function and colours of the wires connected to the external plug supplied with the OdaLog® CEM Low Range Logger.

Figure 1 shows how the OdaLog® CEM Low Range Logger is wired into a system.

Table 1 - Wiring details of external plug

Pin	Function	Wire colour
1	External power positive	Red
2	External power negative	Black
3	4–20 mA current loop positive	White
4	4–20 mA current loop negative	Yellow

Figure 1 - Typical wiring of system



WARNING

The external power supply for the OdaLog® CEM Low Range Logger must be as specified in the Specifications section.

If the supply falls below the specified minimum operating voltage, the OdaLog® CEM Low Range Logger may not function correctly.

If the supply rises above the specified absolute maximum voltage, there is the risk of permanent damage to the OdaLog® CEM Low Range Logger.

The power supply for the 4–20 mA current loop must be as specified in the Specifications section.

If the supply falls below the specified minimum operating voltage, the 4–20 mA current loop may not function correctly. The lowest voltage across the loop leads at the low range logger will occur when the loop current is 23.2 mA.

If the supply rises above the specified absolute maximum voltage, there is the risk of permanent damage to the OdaLog® CEM Low Range Logger.

DOCUMENT NUMBER	SHEET	OF	REV DATE
03-P-0008	2	2	Rev 2. 2005-04-18

SIEMENS

Operations Log for Odour Control Unit

Site Details:

Name of Site:	SP320 Old Toowoomba Rd, Leichhardt.
Acclimation Completion Date:	15th November 2012

System Setup Description:

Odour Control Unit model	Zaboc	5000	No. of units:	2
Arrangement:	<input type="checkbox"/> Series <input checked="" type="checkbox"/> Parallel			
Nutrient Tank Working Volume	1000 litres			
Design Air Flow:	Design air flow rate, [normal operation] 420 l/sec or 210 l/sec per unit Design air flow rate, [maximum rate for wet well entry] 840 l/sec or 420 l/sec per unit			
Acclimation Start up Notes:	Timer operates nutrient pump & water irrigation 4 min every hr (start at 28 mins & stop at 32 mins /hr). Nutrient Pump set at 50% (2.3 lph). Water irrigation flow rate, 23 lpm.			

Operating Log

Logged by (name):									
Log Date:									
Log Time:									
MONTHLY									
Air Flow Rate									
Nutrient Tank Volume									
Nutrient Pump Dose Rate									
Make Up Water Dilution Rate									
Inlet H2S									
Outlet H2S									
pH of drain water, Unit 1									
pH of drain water, Unit 2									
ANNUALLY									
Pressure drop, Unit 1									
Pressure drop, Unit 2									
Other:									

Remarks:

--