



Client :

BRISBANE WATER

Document Title : **Tufnell Road SP68 Pump Station Upgrade**



Issue : ***Book 1 of 1***

Date of Issue : ***3/9/04***

Author : ***Brett Lawrence***





Brisbane City



SP68

TUFNELL ROAD PUMP STATION

REFURBISHMENT

COMMISSIONING REPORT

26/8/2004

Brett Lawrence

CONTENTS

1	INTRODUCTION	1
2	PROJECT SCOPE SUMMARY.....	1
3	PLANNING & COMMISSIONING	1
3.1	Project Deliverables.....	1
3.2	Scope of Commissioning.....	1
3.3	Commissioning Team	1
3.4	Review of Pre-commissioning Tests.....	2
3.5	Commissioning Activities.....	2
4	COMMISSIONING RESULTS	2
4.1	Pumps.....	2
4.2	Switchboard.....	3
4.3	SCADA.....	3
4.4	O & M Manuals	3
5	FINDINGS & DISCUSSIONS	4
5.1	Pumps.....	4
5.2	Switchboard.....	4
5.3	SCADA.....	4
5.4	O & M Manuals	4
6	DEFECTS	4
7	RECOMMENDATIONS.....	4

COMMISSIONING REPORT

1 INTRODUCTION

Tufnell Road Pump Station (SP68) is located in Banyo. The existing pumps have an existing duty of 22 l/s and standby duty of 22 l/s. It has been determined that the ultimate population of the SP68 catchment is 1985 EP and the required duty of SP68 at Peak Wet Weather Flow (PWWF) is 28 l/s.

2 PROJECT SCOPE SUMMARY

The scope of works for this project involves:

- Arrange for the supply of two (2) new pumps for Tufnell Road Pump Station SP68.
- Tag new pumps and switchboard with BW identification
- (tags supplied by BW)
- Configure switchboard for new pumping units
- Upgrade electrical Consumers main to suit the increased load induced by the upgrade, if required.
- Replace the two existing 7.5 kW pumps (one at a time to avoid the need for flow diversion) and replace switchboard.
- Configure telemetry and screens at Cullen Ave
- Commission upgraded pump station

3 PLANNING & COMMISSIONING

3.1 Project Deliverables

A fully commissioned and operational facility.
Complete set of As Built drawings and O&M Manuals.
All defects to be rectified.
All necessary and agreed training.

3.2 Scope of Commissioning

The commissioning tests will confirm the project deliverables will achieve the performance as specified in the Project Delivery Document.

3.3 Commissioning Team

Brett Lawrence – BW Project Branch
Mark Cowper - BW Networks Branch
Peter Rennex - BW Projects Branch
Matthew Duncan - BW Networks Branch
Alan Ruff – BW Networks Branch
Geoff Timms - BW Networks Branch
Ross Sehmish - BW Networks Branch
George Kaluza - BW Networks Branch

3.4 Review of Pre-commissioning Tests

Precommissioning tests results for the control systems and pump flows are attached in Appendix A.

3.5 Commissioning Activities

Commissioning activities will include confirmation of the pump flows and confirmation of the control systems and alarms.

4 COMMISSIONING RESULTS

4.1 Pumps

The Grundfos S1-174-H4A 17kW pumps were checked and the flows were measured.

There were no sewage leaks on the pumps (Fig 1) or pipework and the refluxes and delivery valves were replaced.



Fig 1

4.2 Switchboard

The new switchboard has been installed and the single phase and three phase outlet were repositioned to the distribution board because of the location of the soft starters see Fig 2.



Fig 2

4.3 SCADA

The Alarms were checked and operated correctly

4.4 O & M Manuals

The O & M Manuals are being compiled and will be distributed as soon as the As Constructed drawings are completed.

5 FINDINGS & DISCUSSIONS

5.1 Pumps

The bends did not have the correct lifting or chain attachment positions.

5.2 Switchboard

The soft starters did not leave enough room in the front of the switchboard for the power outlets. The cable entry gland was not installed as the chamber is gas tight.

5.3 SCADA

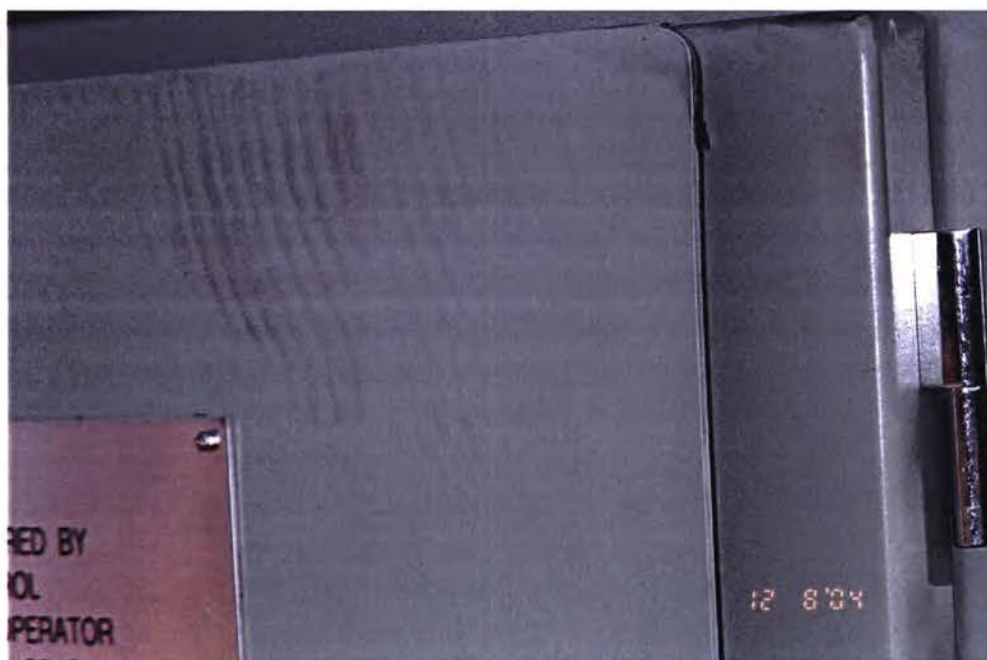
No problems were found.

5.4 O & M Manuals

There were no issues with the O&M Manuals.

6 DEFECTS

There are no outstanding defects for the installation although there was some slight damage to the switchboard on the installation see Fig 3.



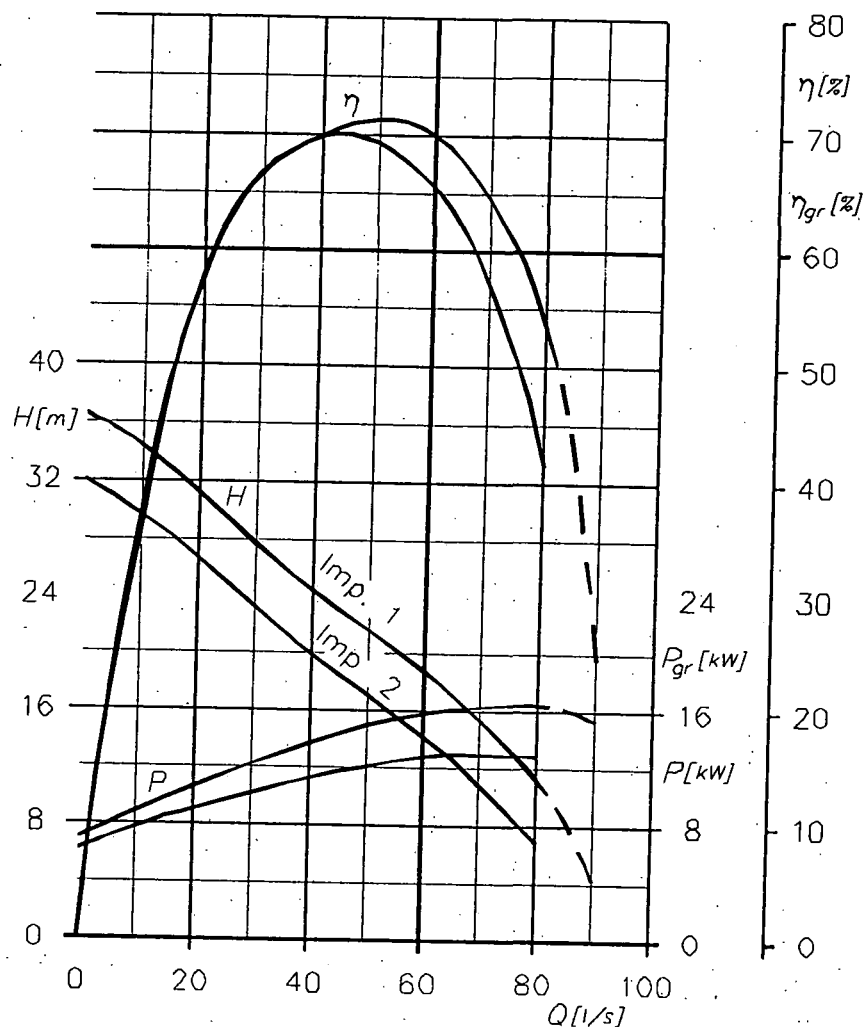
7 RECOMMENDATIONS

The standard pump bends are to be modified to suit the different sized pumps.

Appendix A – Commissioning Checklist

Tufnell Rd Pump Station Upgrade Commissioning		
Date: 16/6/04		
	Pump 1	Pump 2
Pimms No:	PUS318	PUS319
Hours Run	0.1	0.1
Current @ 50 Hz	30.8	30.8
Red Phase		
Blue Phase		
White Phase		
Volts @ 50 Hz		
Red Phase	430	430
Blue Phase	430	430
White Phase	433	433
Static Head		
Static Head on Rising Main		
Dynamic Head		
Dynamic Head on Rising Main		
Flow	33	33
Time to pump down (Secs)		
VSD operation	Soft Starter	Soft Starter
Alarms		
Pump Blockage	ok	ok
Water in oil	ok	ok
Reflux operation	Replaced	Replaced
Valves operation	Replaced	Replaced
Bleeder operations	ok	ok
Oil Level	ok	ok
Vibrations	ok	ok
Generator Start Up	n/a	n/a
O&M Manual		
As Constructed		
Attended on site:	Alan Ruff Geoff Timms Brett Lawrence Peter Rennex	
Mark Cowper		
Ross Sehmish		
Matthew Duncan		
George Kaluza		
Comments:	Pump tilts when hose full and hits the wall - hose was replaced with 10 bar hose which solved the problem Switchboard had marks from the sling on the front which were noted	

Appendix B – Pump Curve and Flow Tests



Q = Volume rate of flow
H = Pump total head
P_{gr} = Motor power input
η_{gr} = Overall efficiency
P = Pump power input
η = Pump efficiency

Tilavuusvirta
Pumpun nostokorkeus
Moottorin ottama teho
Kokonaishyötysuhde
Pumpun ottama teho
Pumpun hyötysuhde

Testing and tolerances: ISO 9906 (Annex A)
Testaus ja toleranssit: ISO 9906 (Liite A).

PERFORMANCE CURVES P_N = 17,0 kW

OMINAISKÄYRÄT
S1(A) 174 H
ver. 1 -Z
50 Hz

n_N = 1455 r/min



Oy Grundfos
Environment
Finland Ab

Piirt. 09.07.2004 EL

Tark.

Hyv.

Code E L

D-946582



START-UP & COMMISSIONING PROCEDURES

1.0 GENERAL

Suitably qualified personnel must install the Switchboard assembly. The following check procedures as a minimum, are recommended after installation and prior to initial power-up.

A thorough visual inspection should be made to every aspect of the Switchboard on arrival. This includes checking the Switchboard for any obvious external damages, loose wire connections, loose cabling, loose equipment (relays, contactors, meters etc.), panels damage in transit etc.

All problems must be rectified immediately as they could cause incorrect operation or permanent damage to the equipment.

1.1 INITIAL POWER-UP CHECKLIST

Only authorised and appropriately trained personnel should carry out the inspection and testing tasks specified, included below but not limited to.

1. Check all cable connections are firmly fastened and secured.
2. Check cable entries are adequately sealed and glanded.
3. Check all clearances.
4. Check main incoming cables are correctly terminated.
5. Check main earth connection for continuity.
6. Check switchboard is free from any impurities (dust, filings etc.).
7. Check all doors and covers are secure and functioning properly.
8. Perform an insulation resistance test on the Switchboard ensuring the results complied with the relevant requirements.

If all inspection and checks have been made, you are now ready to power-up the Switchboard.

1.2 POWER-UP PROCEDURE

Suitably qualified personnel should perform these procedures. These are suggested procedures only, and if specific procedures are available or issued, they **MUST** prevail.

WARNING

Fatalities have been caused by incorrect connection of Mains services. Correct polarity must be ensured as the wrong connection will energise the earthing system of the installation and create a hazardous situation.

Do not connect or re-connect supply to an installation unless correct polarity has been proven by recognised tests.

1. Ensure the main incoming isolator or circuit breaker is isolated.
2. Ensure starter modules are isolated.
3. Energised mains cabling.
4. Turn main circuit breaker on.
5. Ensure that all phase voltages are present and correct.
6. Individual starter modules can now be energised.

PREVENTATIVE MAINTENANCE INSTRUCTIONS

2.0 GENERAL

The Switchboard requires proper care to ensure normal operation at all times. Periodic inspections must be made to determine the exact condition of the Switchboard equipment.

A regular program of systematic maintenance must be established for proper operation of all Switchboard systems. A periodic maintenance schedule must be followed and an inspection log maintained for ready reference. At a minimum, the log must record:

1. inspection interval
2. inspection procedure performed
3. maintenance performed, if any, as a result of inspection
4. name of inspector performing task

2.1 PREVENTATIVE MAINTENANCE

Perform preventative maintenance as instructed in Table 1 below

TABLE 1

Preventative Maintenance Schedule

SCHEDULE REQUIREMENT	PARAGRAPH	Reference:
Monthly	Visual inspection	2.2
Six Monthly	Paintwork Maintenance	2.3
Yearly	Mains connections	2.4
Yearly	Switchboard assembly	2.5

2.2 VISUAL INSPECTION

In conjunction with the annual maintenance test, frequent visual inspection should be carried out. To verify the perfect functioning of the signalling system is to guarantee the immediate indication of any abnormal occurrence in the equipment or its components.

1. Check that all labelling and schedules are complete, up to date and in their correct places
2. Inspect paintwork for signs of corrosion and for any blemishes, which might be susceptible to corrosion in the near future. If inspection indicates areas of rust or corrosion are present, immediately clean and repaint the area. (See section 2.3)
3. Check that the load balance on final subcircuits and incomer corresponds to the specifications

2.3 PAINTWORK CARE AND MAINTENANCE

As a general rule, cleaning of externally located powder coating surfaces must take place every six months. Where salts/pollutants are more prevalent such as seaside or industrial areas, a cleaning program should be carried out more frequently. ie. every three months.

THREE STEPS TO CLEANING POWDER COATED SURFACES

1. Remove loose deposits with a wet sponge (avoid scratching the surface by dry dusting).
2. Using a soft cloth and mild detergent in warm water, clean the powder coating to remove any dust, salt or other deposits.
3. Always rinse after cleaning with fresh water to remove any remaining detergent.

Warning: -

In some cases strong solvents recommended for thinning various types of paints and also for cleaning up mastic's/sealants are harmful to the extended life of the powder coated surface. These solvents should not be used for cleaning purposes. If paint splashes and sealants/mastic's need to be removed then the following solvents can be used safely. Methylated Sprits, Turpentine, White Spirits, Ethyl Alcohol, Isopropanol.

2.4 MAINS CONNECTIONS

WARNING

When inspecting or cleaning any of the equipment mentioned below, all due care must be taken to de-energise the circuits associated with the location being serviced.

All mains connections must be thoroughly inspected on an annual basis.

1. Inspect the tightness of all bolted connections making sure they are firmly secure so that they cannot work themselves loose;
2. Ensure all connections and fixings remain free from dust and dirt build ups and that there is no sign of corrosion;
3. Check that all cable supports and their corresponding fixings are in good working order and are firmly secure;

REPAIRS

Immediately replace all damaged or missing parts found during inspection by personnel who are qualified to carry out the repairs.

CLEANING OF EQUIPMENT

All equipment should be cleaned either with a dry soft brush, a feather duster or an equivalent device depending upon the circumstances. If possible, clean with a jet of dry clean air taking care to avoid any damage to components.

2.5 SWITCHBOARD ASSEMBLY

WARNING

When inspecting or cleaning any of the equipment mentioned below, all due care must be taken to de-energise the circuits associated with the location being serviced.

In order for the safe and continued working order of all parts and components within the Switchboard a full maintenance inspection should be carried out annually.

1. First, remove all access panels of the Switchboard being careful of any earth wires attached (if applicable).
2. Brush or wipe clean, all accumulated dust out of the enclosure.
3. Check that all bolted connections are tight and free from corrosion
4. Inspect all incoming and outgoing terminations are firmly secure.
5. Make sure all C.F.S. units, isolators, contactors, relays, etc. and controls are fully operational.
6. Ensure that all instruments are functioning correctly and that their connections and fixings are securely held.
7. Ensure that all hinges locks, keys, handles, etc. are secure and functioning properly.
8. Check gaskets are intact and providing a suitable seal.
9. Make sure that the main earth connections have not come loose and remain secure. Test the Switchboard for continuity.
10. Carry out a test to ensure full automatic operation of control circuits.
11. Follow manufactures maintenance and inspection procedures on essential equipment. Eg. VFD's, ACB's etc.

REPAIRS

Immediately replace all damaged or missing parts found during inspection by personnel who are qualified to carry out the repairs. If you find that a component, such as a relay, is not working properly due to the fact that there is dirt on any of its contacts or moving parts, an immediate replacement of that part is highly recommended. Also double-check all other components in the general vicinity, as it is highly probable that if one component is affected with dirt others will be also. Since replacements of components are simple, refer to equipment schedule and equipment specification.

SWITCHBOARD ASSEMBLY CONT:**CLEANING OF EQUIPMENT**

All equipment enclosed inside the motor control centre should be cleaned with either a dry soft brush, a feather duster or an equivalent device depending upon the circumstances. If possible, clean with a jet of dry clean air taking care to avoid any damage to components.

In the case of grommets, connectors, contactors, etc., cleaning of the contact area can be done in its place using a lint-free cloth moistened with a solvent such as **CRC LECTRA-CLEAN** or an approved electrical cleaning solvent. Removal of corrosion should be with a cleaning solvent and dry thoroughly with a lint-free cloth.

NOTE: -

Take particular care when using industrial solvents, as some of these can be both injurious and flammable. Before using any solvent, establish whether it has been approved for use in the electrical industry and for the particular task.

Warning: - Be sure to follow all safety data sheet instructions on solvent.

If volatile solvents are used for cleaning switchboards, all traces of solvent must be completely evaporated and blown away before the switchboard is re-energised.

SAFETY DIRECTIONS FOR CRC LECTRA-CLEAN

Vapour is harmful to health on prolonged exposure, avoid breathing vapour, use with adequate ventilation. Avoid contact with skin. Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal. Possible risk of irreversible effects. Use only as directed.

First Aid.

If poisoning occurs contact a doctor or poisons information centre.

If swallowed do not induce vomiting – give a glass of water.



POWER ELECTRIC Switchboards PTY LTD

ABN 73 052 204 118

Manufacturers of Engineered Switchboards for Mining, Industrial and Commercial Projects

FINAL CHECKING PROCEDURE FOR ALL SWITCHBOARDS

SWITCHBOARD TITLE: Tufnell Road Sewage Pump Station

JOB NUMBER: M0473

✓	1. Check switchboard has been built as per the approved drawing. (KA Rating, IP Rating, Form of Segregation)
✓	2. Check all control functions.
✓	3. Check all connections.
✓	4. Check all clearances.
✓	5. Check hinges, locks, keys, handles etc, to ensure that they are secure and function properly
✓	6. Check operations of all CFS units, circuit breakers, isolators, contactors, etc.
✓	7. Check main earth connections and continuity.
✓	8. Check that all the neutrals are accessible.
✓	9. Check that all labeling and schedules are in place.
✓	10. Check general condition of switchboard (paintwork, etc)
✓	11. Check switchboard has been cleaned out.
✓	12. Megger switchboard

CIRCUIT	RESULT-1000V MEGGER
R-E	$\geq 200M \Omega$
W-E	$\geq 200M \Omega$
B-E	$\geq 200M \Omega$
R-W	$\geq 200M \Omega$
R-B	$\geq 200M \Omega$
W-B	$\geq 200M \Omega$
NEUT-E	$\geq 200M \Omega$

COMMENTS:

Tested Okay

CHECKED BY:

Stephen McLachlan

DATE: 11/05/04

Telephone: (07) 3274 3922 * Facsimile: (07) 3274 3929

Email: POWERELECTRICSWBD@BIGPOND.COM

 PO Box 6176, Fairfield Gardens, BRISBANE, QUEENSLAND 4103, Australia
 70 Flanders Street, SALISBURY, QUEENSLAND 4107

TERASAKI

Circuit Breaker Products

Operator's Manual



This manual contains instructions for installation, use and maintenance of Sarlin submersible pumps of frame sizes 50 and 54 comprising the following pumps:

50 Hz				
Frame size 50			Frame size 54	
SV 072 BH	S1 054 L	S1 074 H	S1 134 M	S2 134 E
SV 092 BH	S1 054 M	S1 074 S	S1 134 H	S2 134 L
SV 122 BH	S1 054 H	S1 124 AE	S1 174 L	S2 174 E
SS/SR 038	S1 074 E	S1 124 BM	S1 174 M	S2 174 L
SS/SR 066	S1 074 CM	S1 124 AH	S1 174 H	S1 212 H
SR 210				S1 212 S
60 Hz				
Frame size 50			Frame size 54	
SV 092 BH	S1 094 AM	S1 134 AL	S1 164 L	S1 204 L
SV 122 BH	S1 094 AH	S1 134 AM	S1 164 M	S1 204 M
S1 094 AL	S1 114 AH	S1 134 AH	S1 164 H	S1 204 H

The manual also contains specific instructions for the pumps in this range executed in explosion-proof construction. The pumps are further specified in the applicable Sarlin pump preselection sheet and in the individual pump data and curve sheets. These documents are available on request from Oy E. Sarlin Ab at the address below or from your nearest Sarlin dealer.

Table of Contents

Page ii

GRUNDFOS®
SARLIN PUMPS

Table of Contents

1. Definitions	1
1.1. About this manual	1
1.2. Measurement Units	1
1.3. CE Marking	1
1.4. Notes, Attentions and Warnings	1
2. Pump Information	1
2.1. Type Designation Code	1
2.2. Rating Plate Information	3
2.3. Pump Noise Emission	3
3. Safety	1
3.1. Regulations and Standards	1
3.2. Duties of Owner and Operator	1
3.3. Duties of the Personnel	1
3.4. Qualifications	2
3.5. Dangers	3
3.6. Transportation	3
3.7. Installation and Connection	3
3.8. Commissioning	4
3.9. Operation and Control	4
3.10. Servicing	4
3.11. Disposal and Environment Protection	6
4. Pump Handling	1
4.1. Pump Weight and Dimensions	1
4.2. Pump Lifting and Site Transportation	1
4.3. Pump Accessories	1
4.4. Pump Storage	2
5. Pump Installation	1
5.1. Installation Versions	1
5.2. Installation of Foundations for Versions 1 and 2	3
5.3. Pump Installation Version 1 and 2	5
5.4. Pump Installation Version 3 and 6	6
5.5. Pump Installation Version 4 and 5	9
5.6. Pump Installation Version 7	10
5.7. Pump Installation Type SR	11
5.8. Pump Electrical Connection	12
6. Pump Use and Operation	1
6.1. Pump Usage	1



Table of Contents

Page iii

6.2. Pump Function	1
6.3. Pump Description	1
6.4. Pump Direction of Rotation	3
6.5. Pump Starting	3
6.6. Pump Commissioning	4
6.7. Pump Operation	4
7. Pump Maintenance	1
7.1. Oil Check and Change	1
7.2. Inspection and Adjustment of Suction Clearance	2
7.3. Pump Cleaning and Visual Inspection	3
8. Impeller Replacement	1
8.1. Impeller Removal	1
8.2. Impeller Mounting	2
8.3. Impeller Screw Tightening Torques	3
8.4. Component Fastener Tightening Torque	3
9. Explosion-proof Pumps	1
9.1. General	1
9.2. Certification and Classification	1
9.3. Certification Plate	2
9.4. Motor Construction and Performance	3
9.5. Motor Protection Device Circuit	3
9.6. Motor Operating Requirements	3
9.7. Overhaul and Repair Requirements	4
10. Troubleshooting	1
11. Declaration of Conformity	1

1. Definitions

Page 1 (1)

GRUNDFOS®
SARLIN PUMPS



1. Definitions

1.1. About this manual

This instruction manual has been prepared by the Technical Department of the Pump Division of Oy E. Sarlin Ab. It provides instructions on the installation, commission, function, operation and maintenance of Sarlin submersible pumps.

The manual is directed at pump and municipal engineering professionals. These professionals are expected to have working knowledge of pumps and pumping in general as well as of pump operation and maintenance.

The illustrations in this manual may not exactly depict all pumps covered but are provided as general reference on dimensions and as an illustration of a particular operation being described.

1.2. Measurement Units

The SI system of measurement units, as implemented for pumping use by the ISO standard 2548, is used in this manual wherever reference is made to dimensions or other quantities. The unit used in drawings for the length dimension is millimetre (mm).

1.3. CE Marking

The Sarlin submersible pumps bear the CE marking according to the Declaration of Conformity forming the Section 11. The CE marking is presented on the pump rating plate affixed to the pump top cover.



1.4. Notes, Attentions and Warnings

Notes, attentions and warnings are provided throughout this manual to provide important information to the reader.

NOTE

A note is used to convey special information or to highlight an operating procedure or practice that requires specific information, knowledge, tools or equipment in order to achieve the desired result.

ATTENTION

An attention is used to convey special information or to highlight an operating procedure or practice where non-compliance could lead to damage of the unit or other equipment.



A warning or safety instruction provides instructions on an operating procedure or practice where nonobservance may lead to serious personal injury or cause danger to the life of operation personnel or others.



A warning of the presence of dangerous voltage is provided with this symbol. Disregard of the warning may lead to electrical shock with consequent risk of serious personal injury or death of the operational personnel.



2. Pump Information

2.1. Type Designation Code

Each Sarlin pump is identified by the type designation code provided in full on the order acknowledgement and other documentation accompanying the pump upon delivery. The code comprises 15 items in the following fashion:

S	1	X	100	4		H	1	A		5	11	P	Z	R
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

The shaded code items are provided on the rating plate of the pump.

Code Item	Description																											
1. Pump type	S Sarlin S-type																											
2. Impeller	V Vortex 1 Single channel 2 Double-channel 3 Three-channel 4 Four-channel N Multi-channel A Axial S Semi-axial																											
3. Motor specification	<input type="checkbox"/> Standard X Explosion-proof																											
4. Motor power	Motor power in kW																											
5. Motor pole number	Indicates motor speed at <table><tr><th></th><th>50 Hz</th><th>60 Hz</th></tr><tr><th></th><th>rpm</th><th>rpm</th></tr><tr><td>2 2-pole</td><td>3000</td><td>3600</td></tr><tr><td>4 4-pole</td><td>1500</td><td>1800</td></tr><tr><td>6 6-pole</td><td>1000</td><td>1200</td></tr><tr><td>8 8-pole</td><td>750</td><td>900</td></tr><tr><td>10 10-pole</td><td>600</td><td>720</td></tr><tr><td>12 12-pole</td><td>500</td><td>600</td></tr><tr><td>14 14-pole</td><td>428</td><td>514</td></tr></table>		50 Hz	60 Hz		rpm	rpm	2 2-pole	3000	3600	4 4-pole	1500	1800	6 6-pole	1000	1200	8 8-pole	750	900	10 10-pole	600	720	12 12-pole	500	600	14 14-pole	428	514
	50 Hz	60 Hz																										
	rpm	rpm																										
2 2-pole	3000	3600																										
4 4-pole	1500	1800																										
6 6-pole	1000	1200																										
8 8-pole	750	900																										
10 10-pole	600	720																										
12 12-pole	500	600																										
14 14-pole	428	514																										
6. Generation marker	<input type="checkbox"/> 1st generation A 2nd generation B 3rd generation, etc. The generation indicator differentiates between structurally different pumps that have the same power rating.																											
7. Impeller classification	<input type="checkbox"/> No classification F Ultra low head E Extra low head L Low head M Medium head H High head S Super high head																											

2. Pump Information

Page 2 (3)

GRUNDFOS
SARLIN PUMPS



- | 8. Installation version | <p>1 Submerged with baseplate and guide rails.</p> <p>2 Submerged with baseplate and guide rails.
May operate continuously with motor exposed.</p> <p>3 Vertical dry with stand.</p> <p>4 Submerged portable.</p> <p>5 Submerged portable.
May operate continuously with motor exposed.</p> <p>6 Horizontal dry with stand.</p> <p>7 Submerged in column</p> | | | | | | | | | | | | | | | | | | | | |
|---------------------------|--|-------|-------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|--------------|---------------|--|
| 9. Interchangeability | <p>Interchangeability letter (A, B, C...) indicates interchangeability limitation of parts between otherwise identical pumps. Pumps with no or the same letter have full interchangeability of all parts and use the same spare parts catalogue.</p> | | | | | | | | | | | | | | | | | | | | |
| 10. Supply phase number | <p>[] 3-phase</p> <p>1 1-phase</p> | | | | | | | | | | | | | | | | | | | | |
| 11. Supply frequency | <p>5 50 Hz</p> <p>6 60 Hz</p> | | | | | | | | | | | | | | | | | | | | |
| 12. Voltage and starting | <table border="0"> <thead> <tr> <th style="text-align: left;">50 Hz</th> <th style="text-align: left;">60 Hz</th> </tr> </thead> <tbody> <tr> <td>01 400 V, DOL</td> <td>01 460 V DOL</td> </tr> <tr> <td>11 400 V, Y/D</td> <td>11 460 V Y/D</td> </tr> <tr> <td>02 230 V, DOL</td> <td>03 500 V DOL</td> </tr> <tr> <td>12 230 V, Y/D</td> <td>13 500 V Y/D</td> </tr> <tr> <td>03 415 V, DOL</td> <td>05 380 V DOL</td> </tr> <tr> <td>13 415 V, Y/D</td> <td>15 380 V Y/D</td> </tr> <tr> <td>04 500 V, DOL</td> <td>07 220 V DOL</td> </tr> <tr> <td>14 500 V, Y/D</td> <td>17 220 V Y/D</td> </tr> <tr> <td>06 690 V, DOL</td> <td></td> </tr> </tbody> </table> | 50 Hz | 60 Hz | 01 400 V, DOL | 01 460 V DOL | 11 400 V, Y/D | 11 460 V Y/D | 02 230 V, DOL | 03 500 V DOL | 12 230 V, Y/D | 13 500 V Y/D | 03 415 V, DOL | 05 380 V DOL | 13 415 V, Y/D | 15 380 V Y/D | 04 500 V, DOL | 07 220 V DOL | 14 500 V, Y/D | 17 220 V Y/D | 06 690 V, DOL | |
| 50 Hz | 60 Hz | | | | | | | | | | | | | | | | | | | | |
| 01 400 V, DOL | 01 460 V DOL | | | | | | | | | | | | | | | | | | | | |
| 11 400 V, Y/D | 11 460 V Y/D | | | | | | | | | | | | | | | | | | | | |
| 02 230 V, DOL | 03 500 V DOL | | | | | | | | | | | | | | | | | | | | |
| 12 230 V, Y/D | 13 500 V Y/D | | | | | | | | | | | | | | | | | | | | |
| 03 415 V, DOL | 05 380 V DOL | | | | | | | | | | | | | | | | | | | | |
| 13 415 V, Y/D | 15 380 V Y/D | | | | | | | | | | | | | | | | | | | | |
| 04 500 V, DOL | 07 220 V DOL | | | | | | | | | | | | | | | | | | | | |
| 14 500 V, Y/D | 17 220 V Y/D | | | | | | | | | | | | | | | | | | | | |
| 06 690 V, DOL | | | | | | | | | | | | | | | | | | | | | |
| 13. Special features | <p>P Indicates that protection circuitry is included in motors on models where this feature is optional.</p> <p>U Flanges drilled to ANSI specifications.
Protection circuitry provided.</p> | | | | | | | | | | | | | | | | | | | | |
| 14. Non-standard items | <p>D Trimmed impeller</p> <p>C Cable length</p> <p>Z Combination of D and C or other.
Refer to order acknowledgement for details</p> | | | | | | | | | | | | | | | | | | | | |
| 15. Construction material | <p>[] Standard materials</p> <p>R All stainless steel</p> <p>S Wet parts, including volute, impeller, oil housing and guide shoe (version 1 & 2) stainless steel</p> <p>Q Impeller stainless steel</p> | | | | | | | | | | | | | | | | | | | | |

GRUNDFOS®
SARLIN PUMPS


2. Pump Information

Page 3 (3)

2.2. Rating Plate Information

All pumps can be identified by the rating plate (located on the top cover of the motor). If the rating plate is missing or damaged the pump can be identified by the serial number stamped in the casting located under the rating plate.

1. Type designation
2. Serial number
3. Nominal motor power
4. Mains voltage for delta (D) and star (U) connection. If the value for star connection is given in brackets, the pump can be connected in delta only
5. Frequency, 50 or 60 Hz
6. Nominal drawn current for delta and star connection
7. Mains phase number
8. Fuse rating in delta connection
9. Nominal motor speed
10. Volume rate of flow range
11. Maximum submergence
12. Head range
13. Gross weight
14. CE Marking
15. Year of manufacture
16. Encapsulation class IEC

Pumps rated for use in an explosive environment (EX-pumps) are fitted with additional nameplates (located on the side of the motor stator housing). Please refer to the Section 10 for information on the rating plates.

2.3. Pump Noise Emission

Without taking account of installation effects the noise level emitted from the pump proper is less than 70 dB(A) when it is measured according to the following procedures:

- The noise level is measured for various load conditions with readings taken at different pump duty points on the entire operating range.
- Submersible pump noise is measured at a point 1.6 m above the wet well rim with the pump submerged to minimum depth according to installation version requirement.
- Dry-installed pump noise is measured at a distance of 1 m from the pump and at 1.6 m above floor level at four points in different direction quadrants. Highest measured value is used for assessment.

3. Safety

Page 3 (6)

GRUNDFOS
SARLIN PUMPS



3.5. Dangers



Disregard of the warnings in these instruction may lead to equipment damage and/or personal injury or death of the operating personnel.

3.6. Transportation

Lifting devices must be used for the handling of all pumps and other equipment weighing more than 50 kg. Items weighing between 35 kg and 50 kg may be lifted only without lifting device but not carried or positioned for installation by a person.

Suitable pallets or other cargo securing devices must be used if fork lifting devices are used.

The equipment must be properly secured to floor or wall surfaces if hoists are used for pump lifting and lowering into wells. The hoist rating must not exceed under any circumstances.

All hooks, chains and slings used with a hoist must have a suitable rating and must only be used according to instructions. The submersible pump may only be lifted from its lifting handle unless expressly advised otherwise in these instructions.



Submersible pumps must never be lifted by the electric supply cable, the delivery pipework or the hose. The risk of the damage to equipment or electric shock with consequent risk of serious personal injury or death may follow.



Do not walk under hoisted pumps or attempt to work on pumps supported by hoist only. The risk of serious injury may follow to operating or servicing personnel.

Pumps must be handled with suitable care during all phases of transportation. Do not bump pumps or leave unsupported on uneven or slanting surfaces. Protect pumps from falling objects at construction sites.

ATTENTION

Do not remove pump cable free end protection sleeve until necessary for electrical connection work. Never subject cable free end, protected or unprotected, to moisture or water. Non-compliance may lead to moisture seepage into cable with consequent risk of damage to motor.

3.7. Installation and Connection

Make sure before commencing installation work that the site is cleared from construction debris and that the site is suitably prepared for work. Install protective barriers around openings to wet wells and elsewhere where required. Restrict access to the site to necessary installation crew only.

Observe all safety rules at installation site, such as the usage of blowers for the supply of fresh air to well sites.

Fasten pump lifting chains and power cables so as to prevent them from being sucked into pump suction during pump testing.

Use only approved pipework assembling practices when connecting pumps with flanged joints.

All electrical connection work, either for testing purposes during work or final, may be done by suitably qualified and certified electrician only.



Electrical switchgear and supply lines may be live at all times. Touching and working with electrical equipment may lead to electrical shock with consequent risk of serious injury or death of personnel.



Do not insert hands or tools in pump inlet or outlet openings after the pump has been connected to the electrical supply without prior isolation of pump by removal of fuses. The pump may start with consequent serious injury to personnel.

3.8. Commissioning

Check the pump after completion of installation work for possible safety shortcomings according to these instructions.

Check that all safety installations on site are completed according to site and installation plans of all associated equipment. Do not attempt commissioning the pump if the installation of the specified safety equipment on the site, such as wet well access covers and barriers, switchgear enclosures, fire extinguishers, etc., is incomplete.

All installed equipment must be protected against damage from contact with equipment used on site, i.e. vehicles and hoisting equipment.

3.9. Operation and Control

Make sure that no persons work on the pumps or in areas where danger may arise from running the pumps whenever manually starting pumps or switching them to the automatic control.

Check the pump operation for abnormal noise or vibrations while the pump is running. Compare the actual output and the metered data with the data on the rating plate or supplied in the pump specifications.

ATTENTION

Stop the pumps immediately if you note abnormal noise or vibrations from the pumps or any other problems with the pump operation or the electric supply. Do not attempt to restart the pumps before the reason for the problems has been established and the problems solved.

The operation of the pumps should always be governed by established routines with scheduled controls of pump monitoring equipment and accessories (valves, etc.). Make sure that the pump and equipment settings are not tampered or otherwise adjusted without authorisation.

3.10. Servicing

Servicing may be undertaken only after the pumps have been effectively isolated from the electric supply. Pumps may be disconnected only by a certified electrician. The responsible operator must always be notified before any work on the pumps may begin.

4. Pump Handling

Page 1 (2)

GRUNDFOS®
SARLIN PUMPS



4. Pump Handling

4.1. Pump Weight and Dimensions

The pump gross weight is stated on the pump rating plate located on the top cover of the pump motor. Complete pump weight and dimension information is given on the individual pump data sheets. Installation dimensions of pump baseplates and stands are found in section 5. For weights of separate parts please refer to the transportation and delivery documents or project specifications.

4.2. Pump Lifting and Site Transportation

The pumps in this manual may be lifted and positioned using an appropriate lifting aid or hoist only. All lifting equipment must be rated for the intended load and checked for damages before any attempts are made to lift pumps. Use only adequate chains, shackles, hooks and bands as required. Make sure that enough room is available for safe handling of the pumps along the transport route and at the end location. Items weighing less than 35 kg may be lifted and positioned for installation by hand. Figure 4.1 shows correct pump lifting method.



Figure 4.1 Lifting pump using hoist

ATTENTION



Do not attempt to lift pump at any other point than the lifting handle unless expressly advised otherwise in these instructions. Tipping over of the pump may lead to damage to pump or other equipment.

Do not lift the pump from the electric cable under any circumstances. An electric short and risk of shock to the personnel may follow if the pump is connected to the mains. The cable and cable inlet may be damaged, leading to loss of watertightness and consequent severe damage to the motor.

New pumps should not be unpacked from their transport crates until brought to the installation site. Secure other pumps to pallets or otherwise if transported by fork lifting equipment. Handle pumps with care whenever handling or lifting.

The pumps covered by this manual are delivered from the factory completely assembled and no further assembly is required (except with the frame sizes 74 and 78 which are delivered in two parts).

4.3. Pump Accessories

The pump delivery may contain various accessories as required by the installation. Depending on pump installation version and scope of delivery these may include the pump baseplate, guide rails and upper guide rail holders, lifting chains with the suspension equipment, access covers and the control equipment. It is essential that these items are checked against delivery documents and stored safely until needed for installation.

**4.4. Pump Storage**

The pumps are prepared and packed at the factory for overland transportation by covered carriage. Upon delivery the pumps should be stored in a dry and covered area if storage for a prolonged period is foreseen.

ATTENTION

Do not remove the original watertight closure of the pump cable free end during storage. Make sure that the cable is coiled and secured to the pump and protected from exposure to water. Otherwise the water may seep into the cable and reach the motor with a consequent risk of causing severe damage to the motor windings.

ATTENTION

If new pumps are being stored for a period longer than 2 months the pump impeller should be turned by hand at least every two months to prevent the lower mechanical seal faces from possibly bonding from drying. Failure to do so may lead to seal damage when the pumps are started. If the impeller cannot be turned by hand the pump must be referred to an authorised shop for service before being commissioned.

5. Pump Installation

Page 1 (16)

GRUNDFOS®
SARLIN PUMPS



5. Pump Installation

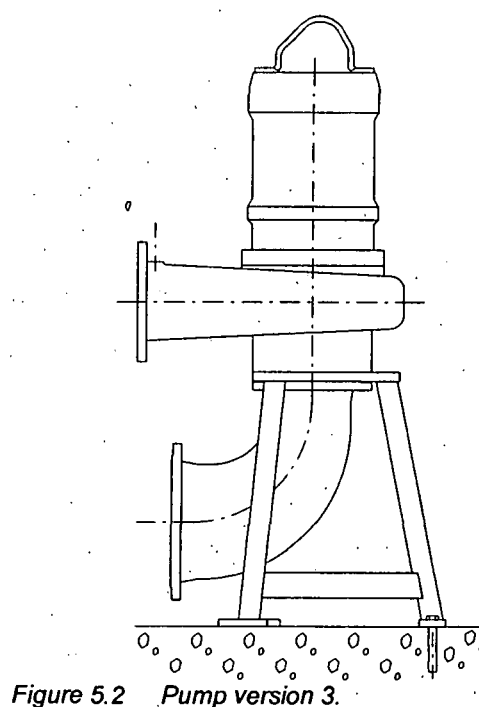
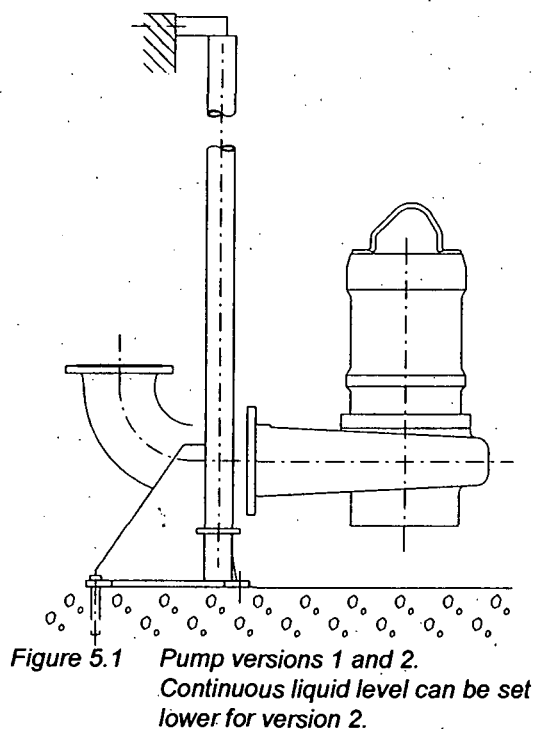
ATTENTION

Always read and observe the safety instructions in section 3.7 before beginning to install pumps.

5.1. Installation Versions

The pumps are configured for different installations, either submerged or dry according to the following schedule of installation versions:

- Version 1** Submerged with baseplate and guide rails. Permanent installation in wet well where the pump can be easily withdrawn from and lowered into the wet well along guide rails. A guide shoe, bolted to the pressure flange connects automatically to a matching baseplate mounted on the wet well floor where the pump is kept in place by its own weight. The pump motor cooling is by submergence in the liquid requiring that the lowest continuous liquid level in the wet well is set at half motor level. Please refer to figure 5.1.
- Version 2** Similar to version 1 but with motor cooling independent of submergence in the pumped liquid by means of a cooling jacket encasing the motor stator housing. The lowest continuous liquid level in the wet well may be set lower. Please refer to figure 5.1.
- Version 3** Vertical dry installation with stand. Permanent installation in dry well with pump connected to suction line and rising main by bolted flange connections. Pump motor cooling is by means of a cooling jacket encasing the motor stator housing. Please refer to figure 5.2.





- Version 4** Submerged with stand for portable use in wet wells or for temporary use. The pump is equipped with a hose coupling for connection to delivery hose. The pump motor cooling is by submergence in the liquid requiring the pump is submerged to at least half motor level when operating. Please refer to Figure 5.3 for details.
- Version 5** Similar to version 4 but with motor cooling independent of submergence in the pumped liquid by means of a cooling jacket encasing the motor stator housing. Pump must be submerged sufficiently for the required suction head only. Please refer to Figure 5.3 for details.
- Version 6** Horizontal dry installation with stand. Permanent installation in dry well with pump connected to suction line and rising main by bolted flange connections. Pump motor cooling is by means of a cooling jacket encasing the motor stator housing. Please refer to Figure 5.4 for details.

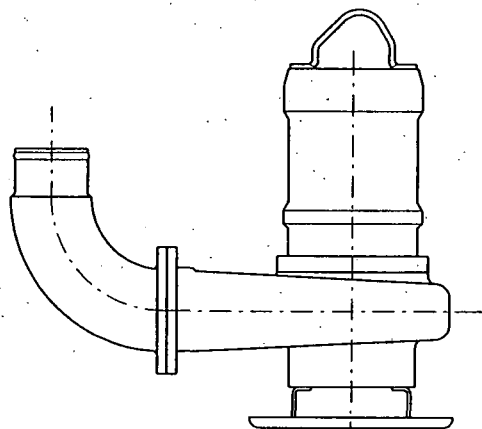


Figure 5.3 Pump versions 4 and 5.
Continuous liquid level can be set lower for version 5.

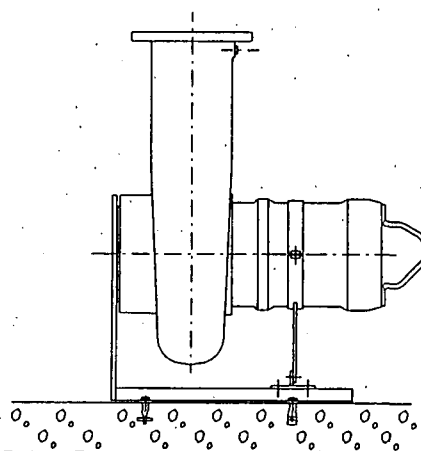


Figure 5.4 Pump version 6.

- Version 7** Vertical column installation. Permanent submersible installation in steel tube or concrete shaft. The circular pump casing fits onto a seat ring installed at the shaft or tube bottom opening and the pump stays in place by its own weight and from the reaction forces from the pumping action. The pump casing is special for the version and is open with trailing vanes. The version finds applications in low head installations for large pumped volumes. Please refer to figure 5.7 below.

5. Pump Installation

Page 3 (16)

GRUNDFOS®
SARLIN PUMPS



5.2. Installation of Foundations for Versions 1 and 2

Make sure before commencing installation work the construction work is finished according to specifications. It is especially important that the surface under the baseplates is level and even.

Begin the work by fastening the upper guide rail holder (figure 5.5, use Sarlin part according to table 5.1 or equivalent third party fitting) in its final position relative to the wet well access opening. Use appropriate fasteners only. Lower the baseplate(s), selected according to table 5.1 as required, onto the wet well floor and place them approximately in their final position. Please refer to figures 5.6, 5.7, 5.8 and 5.9 below for reference on dimensions.

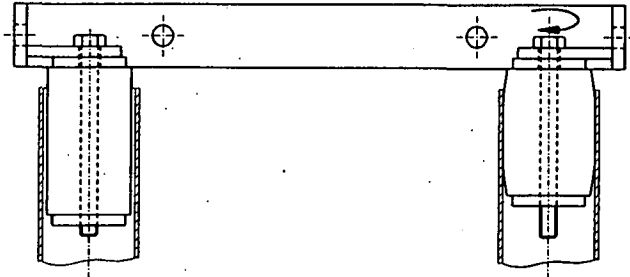


Figure 5.5 Upper guide rail holder with expanding dowels.

NOTE

Using a plumb line suspended from the upper guide rail holder the baseplates can be positioned exactly. The baseplate integral lower guide rail ears are used for correct line-up reference.

Mark the foundation bolts on the wet well floor and remove the baseplate. Install the baseplate bolts or sleeves using appropriate expansion elements or by grouting. Use M 20 or M 24 installation sleeves (Sarlin part No. FMTZ 20070 or FMTZ 24130) as required, or equivalent foundation bolts. Fix the baseplate to the floor and tighten the bolts or nuts to the torque specified in the fastener specifications.

Install the pressure pipework in the wet well according to project plumbing specifications. Use ISO PN 10 flanged joints for the baseplate delivery bend connection.

Table 5.1 Selection of upper guide rail holders and baseplates

Pump size	Upper guide rail holder	Baseplate
DN 80	71-32462 D	UK 35692
DN 80/100	71-32462 D	UK 35693
DN 100	71-32462 C	UV 35586
DN 150	71-32462 E	UK 35402
DN 150/200	71-32462 E	UK 35552
DN 200	71-32462 F	UK 35524

NOTE

Make sure that the pipework is installed without the use of undue force. The use of pipe joints with loose flanges is recommended for ease of installation and to avoid pipe tension at flanges and bolts.

Mark the correct length of the guide rails considering that the upper guide rail holder rubber dowels will go into the guide rail. Cut the guide rails to length and install them by removing the upper guide rail holder dowels and slide the rails into the lower guide rail ears on the baseplate. Reinstall the guide rail holder dowels and tighten the nuts so as to expand the rubber elements. The guide rails are now installed and the pumps can be lowered into the wet well.

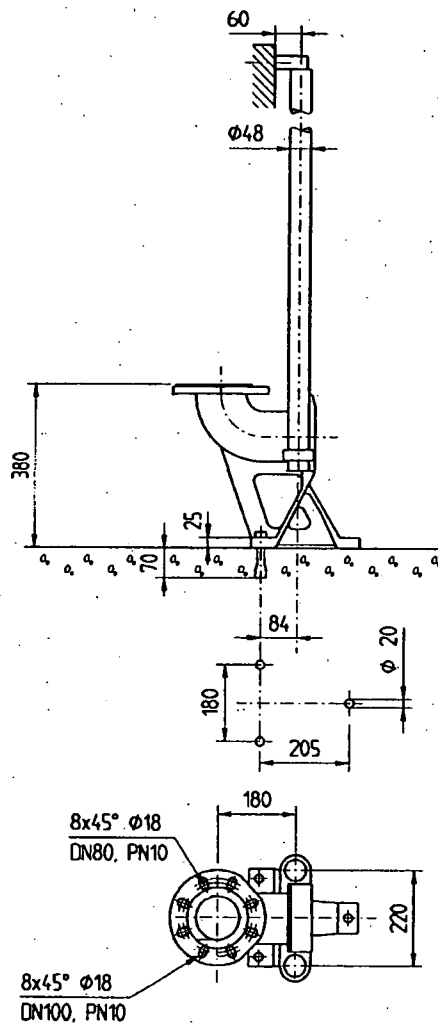


Figure 5.6 DN 100 guide rail system installation dimensions

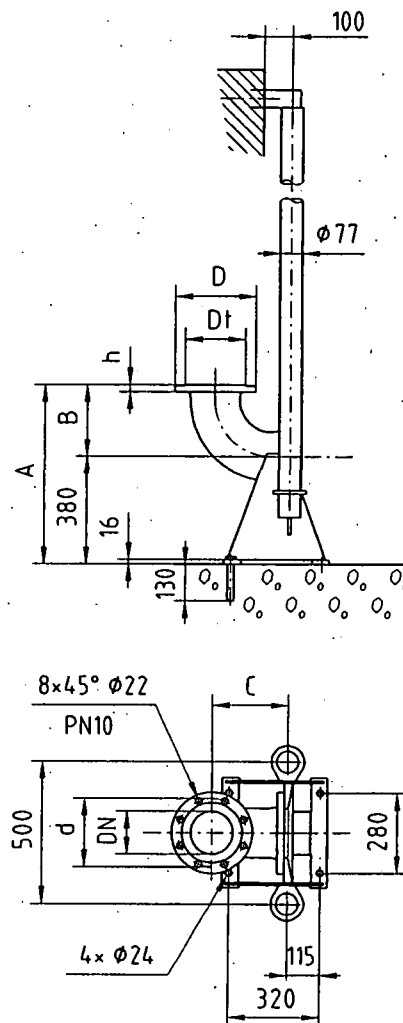


Figure 5.7 DN 150 and DN 150/200 guide rail system installation dimensions. The variable dimensions are given in table 5.2.

Table 5.2 DN 150 and DN 150/200 baseplate dimensions

Baseplate	DN	D	Dt	d	h	A	B	C
UK 35402	150	285	212	240	24	630	250	265
UK 35552	200	340	268	295	26	680	300	315

Table 5.3 DN 80 and DN 80/100 baseplate dimensions

Baseplate	DN	D	Dt	d	d ₁	h	A	B	C
UK 35692	80	200	138	160	18	22	440	180	203
UK 35693	100	220	158	180	18	22	460	200	223

5. Pump Installation

Page 5 (16)

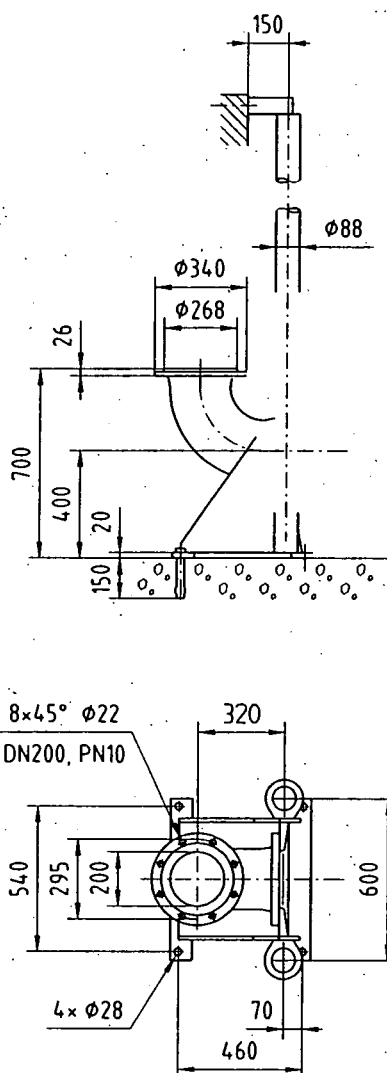
GRUNDFOS
SARLIN PUMPS

Figure 5.8 DN 200 guide rail system installation dimensions

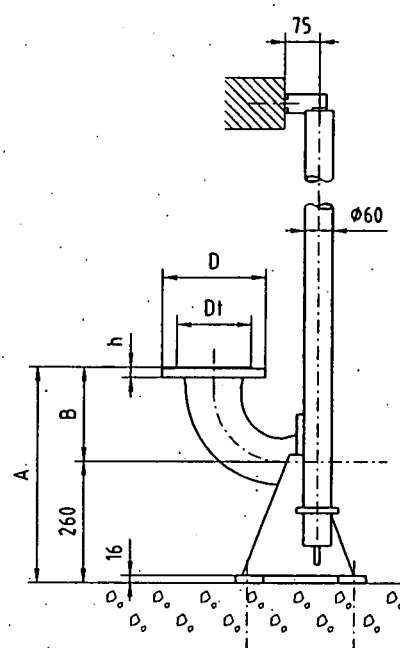
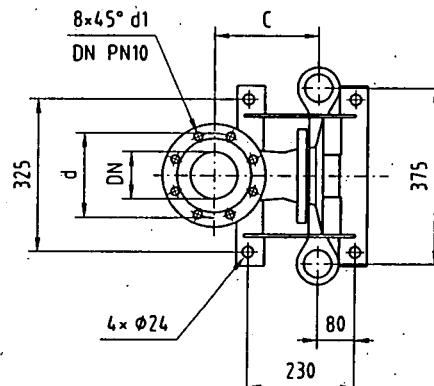
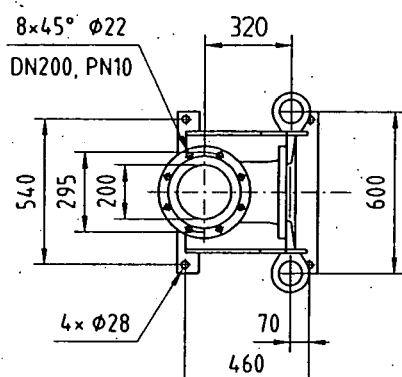


Figure 5.9 DN 80 and DN 80/100 guide rail system installation dimensions. The variable dimensions are given in table 5.3.



5.3. Pump Installation Version 1 and 2

Prepare the pump for lowering into the wet well by fastening the lifting chain to the pump handle and by uncoiling the electric cable. Make sure your lifting device is in working order.

ATTENTION

Use only the original lifting chain and shackle or if third-party components are used make sure that these are rated for the pump weight. Inferior components may break and cause the pump to fall with risk of severe damage to the pump and the accessories.

Lift the pump and position the guide shoe between the guide rails at the access opening. Please refer to figure 5.10 for reference. Lower the pump slowly along the guide rails onto the baseplate. Make sure that the pump cable can move freely and does not seize or fall into the well. Attach the upper end of the lifting chain to a suitable hook or eye bolt at or near the upper guide rail holder. Remove chain slack by cutting off the surplus length if necessary.

Route the pump cable through a suitable conduit to the control panel and secure with clamps where necessary. Do not unnecessarily remove the protective sleeve on the pump free end. The pump cable should not be cut to length, but laid in loops so that the end easily reaches the terminal blocks. Connection to the control panel terminals may be completed by authorised electrician only. Please refer to section 5.8 for information on pump wiring.

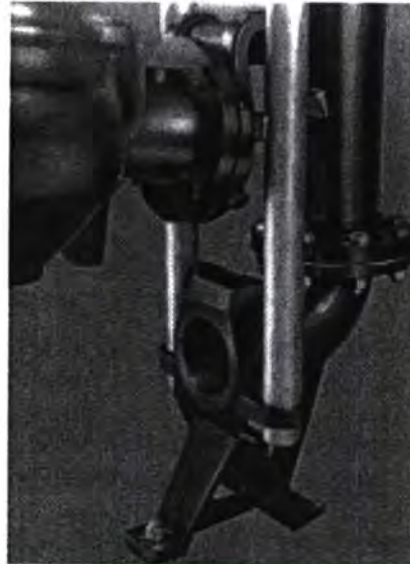


Figure 5.10 Pump being lowered onto submersible baseplate.

5.4. Pump Installation Version 3 and 6

Before commencing installation work make sure that the construction work is finished according to specifications. It is especially important that the surface under the pump stands is level and even.

Begin work by marking the location of the pump and stand in relation to the suction pipe and rising main to the extent these are installed or according to the site drawings. Use a mock-up arrangement to secure a good fit of the components if required. Please refer to Figure 5.11 and Figure 5.12 for reference.

NOTE

For ease of installation, it is advisable to separate pump and stand, especially in cramped locations. The pump should be supported when the fastening screws are loosened to prevent tipping over. The use of a water level is recommended for adjustment.

Table 5.4 DN 150 and DN 200 pump stand dimensions

Stand	DN	A	B	C	D
DN 150	150	300	600	150	240
DN 200	200	325	700	200	295

Mark the foundation bolts on the dry well floor using the stand as a template. Remove the stand. Install the stand bolts or ground sleeves using expansion elements or by grouting. Use M 24 installation sleeves (Sarlin part No. FMTZ 24130) as required or equivalent foundation bolts. Fix the stand to the floor and tighten the bolts or nuts to the torque specified for the bolts used. Shims may be used to ensure stand is level and to adjust the height to fit the pipework.

5. Pump Installation

Page 7 (16)

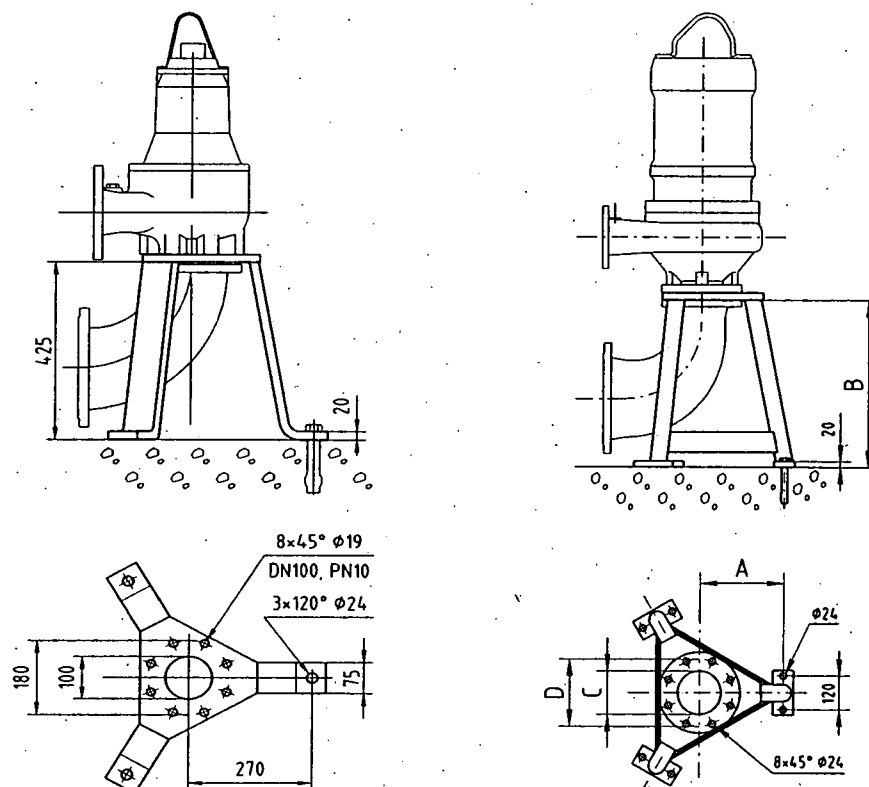
GRUNDFOS®
SARLIN PUMPS


Figure 5.11 Vertical dry installation stand dimensions. The variable dimensions are given in table 5.4.

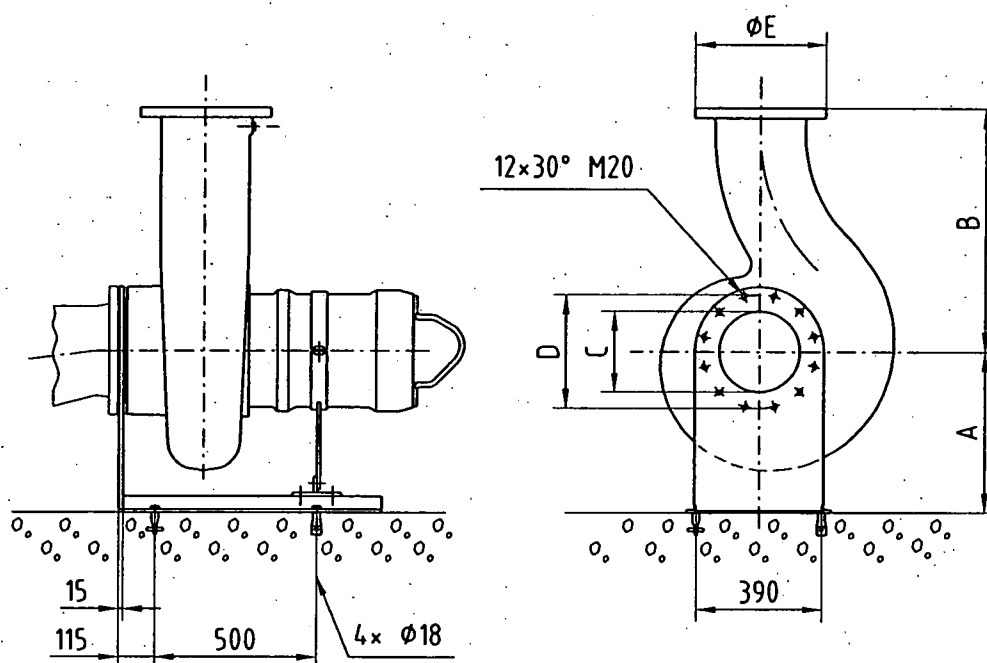


Figure 5.12 Horizontal dry installation stand dimensions. The variable dimensions are given in table 5.5.

Table 5.5 Variable installation dimensions for pump version 6

Pump suction inlet size	DN (C)	A	B	D	DN (E)	M
Frame size 50, DN 100	100	300	285	180	100	M16
Frame size 50, DN 150	150	300	310	240	100	M20
Frame size 50, DN 200	200	350	460	295	200	M20
Frame size 54, DN 150	150	375	355	240	100	M20
Frame size 54, DN 150	150	375	360	240	125	M20
Frame size 54, DN 200	200	375	500	295	200	M20
Frame size 54, DN 250	250	500	750	350	250	M20

For vertical pumps (version 3) install the bend between the suction pipework and the stand. Use reducing bends wherever required by the pipework dimensions. For horizontal pumps (Version 6) install a connection pipe or reducer for the same purpose. Please refer to figures 5.13 and 5.14 for reference.

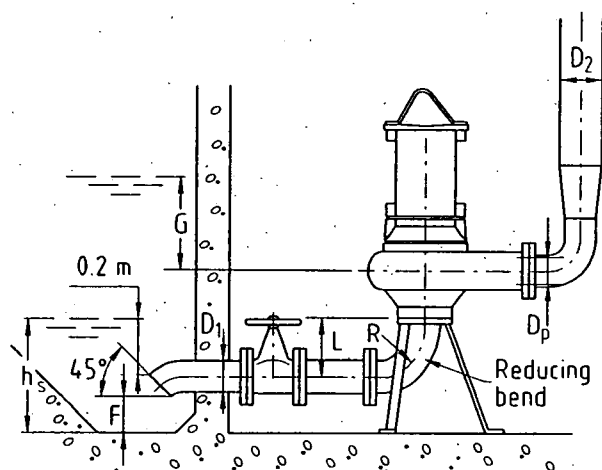


Figure 5.13 Recommended pipework dimensions for vertical dry-installed pumps. $F = 0.5 \times D_1$, $v_{max} = 2.0 \text{ m/s}$, $G = D_p$, $L \geq D_1 + 100 \text{ mm}$, $R \approx L$.

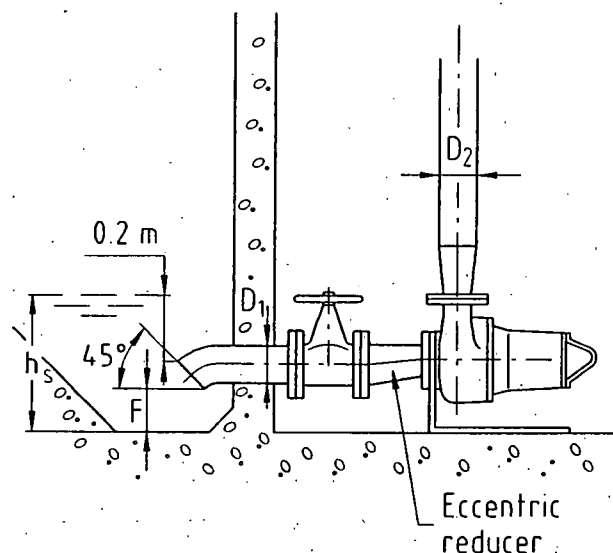


Figure 5.14 Recommended pipework dimensions for horizontal dry-installed pumps. $F = 0.5 \times D_1$, $v_{max} = 2.5 \text{ m/s}$.

ATTENTION

If a reducer is used between the suction pipework and the pump in horizontal installations it must be of the eccentric type and installed so that the straight edge is upwards. This way the accumulation of air in the suction pipeline and possible pump blockage is prevented.

Reinstall the pump onto the stand, using the original fastening bolts. Install the pressure pipework including valves and bends according to the project plumbing specifications. Connect the pump to the

5. Pump Installation

Page 9 (16)

GRUNDFOS
SARLIN PUMPS



rising main using ISO PN 10 flanged joints for the pump delivery connection. Use gaskets at all joints to ensure tightness.

NOTE

Make sure that the pipework is installed without the use of undue force. No loads from the pipework weight must be carried by the pump. The use of pipe joints with loose flanges is recommended for ease of installation and to avoid tension at flanges and bolts. The use of elastic elements or bellows in the pipework is not recommended and these elements should never be used as a means to align the pipework.

Uncoil the electric cable and route it to the control panel. Use cable trays and cable clamps where necessary. Do not unnecessarily remove the protective sleeve on the pump cable free end. The pump cable should not be cut to length, but laid in loops so that the end easily reaches the terminal blocks. Connection to the control panel terminals may be completed by authorised electrician only. Please refer to section 5.8 for information on pump wiring.

5.5. Pump Installation Version 4 and 5

Prepare the pump installation location by levelling the floor or ground under the pump to prevent the pump from tipping over when placed.

Ready the pumps for installation by connecting the delivery hose to the hose connector on the pump. Use stainless clamps of suitable size only. Uncoil the electric cable and route it to the control panel. Attach a suitable lifting chain or wire to the pump handle and lower the pump into the well or pit using a suitable lifting device. Make sure that the pump is standing upright on its integral stand.

Protect the cable and fasten it using clamps or cable ties as appropriate to prevent it from falling into the pumping pit or well and to keep it out of way during pump usage.

NOTE

If the pump is shifted frequently and used at different locations it is good practice to install a cable connector at the free end of the power cable to simplify electrical connection. Please refer to section 5.8 for detailed information.



5.6. Pump Installation Version 7

Make sure before commencing installation work the construction work is finished according to specifications. The seat ring, supplied with the pump, is either welded in place in the riser pipe lower opening or grouted into the concrete shaft at the bottom opening. The seat rings should be specified for either installation method when ordering pumps. Please refer to figure 5.15.

Prepare the pump for lowering into the wet well by fastening the lifting chain to the pump handle and by uncoiling the electric cable. If preferred, the site hoist can be hooked directly to the pump lifting bail and used for lifting and lowering the pumps into the wet well.

With the seat ring in place the assembled pump is inserted in the pump shaft and lowered in place. Make sure that the sealing O-ring (item 031) is located in the groove on the outside of the pump casing. The O-ring seals between pump casing and seat ring preventing back flow and loss of pumping efficiency. Three dowel pins in the seat ring guide the pump to correct position and prevents the pump from turning in the seat when running.

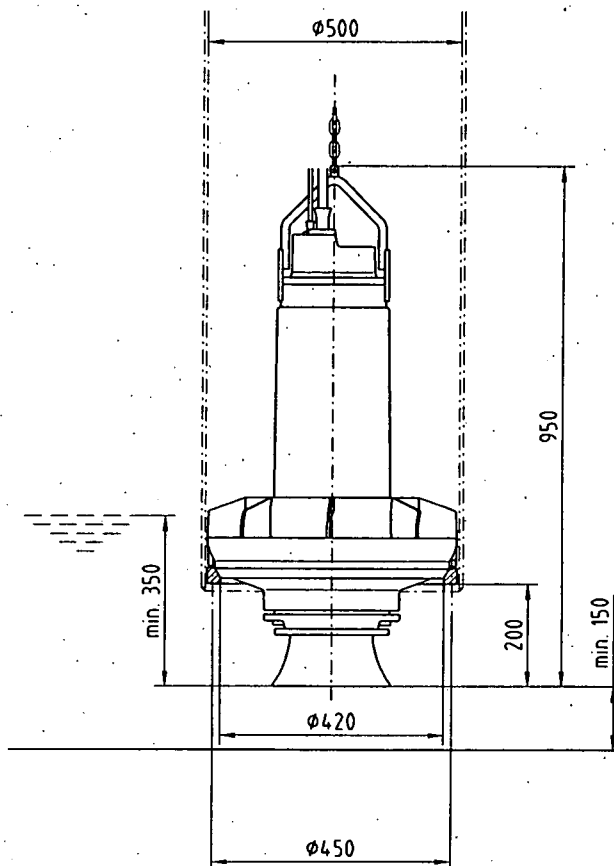


Figure 5.15 Vertical column installation dimensions

ATTENTION

Use only the original lifting chain and shackle or if third-party components are used make sure that these are rated for the pump weight. Inferior components may break and cause the pump to fall with risk of severe damage to the pump and the accessories.

Make sure that the pump cables can move freely and do not seize or fall into the shaft. Attach the upper end of the lifting chain to a suitable hook or eye bolt at or near the shaft upper entry cover. Remove chain slack by cutting off the surplus length if necessary.

Route the pump cables through a suitable conduit to the control panel. Remove slack from the cable in the column and clamp at the conduit only. The cable conduit through the shaft wall may be watertight if called for by the installation. Secure cable with clamps along route to the panel where necessary. Do not unnecessarily remove the protective sleeves on the free end of the pump cables. The pump cables should not be cut to length but instead laid in loops so that the ends easily reach the terminal blocks. Connection to the control panel terminals may be completed by authorised electrician only. Please refer to section 5.8 for information on pump wiring.

5. Pump Installation

Page 11 (16)

GRUNDFOS
SARLIN PUMPS



5.7. Pump Installation Type SR

The circulation pumps of type SR are installed submerged on a wall thimble with guide rails. They are intended for permanent installation in basins, and the pump can easily be hoisted from and lowered down into the basin along guide rails. A guide shoe bolted to the propeller nozzle guides the pump down onto a matching flange on a pipe cast into the wall. The guide shoe en-gages automatically with the pipe flange and the pump is kept in place by its own weight. Pump motor cooling is by submergence in the liquid, requiring that the lowest liquid level does not fall below the motor centre line. Please refer to Figure . Minimum dimensions: $a = 400 \text{ mm}$, $b = 1000 \text{ mm}$.

The guide rails are installed according to the instructions given in section 5.1. The thimble is fit-ted with a girdle flange and is grouted in place in the hole in the wall separating the basin sec-tions. The thimble must be horizontal and the mating flange in a vertical position and level with the upper guide rail holder.

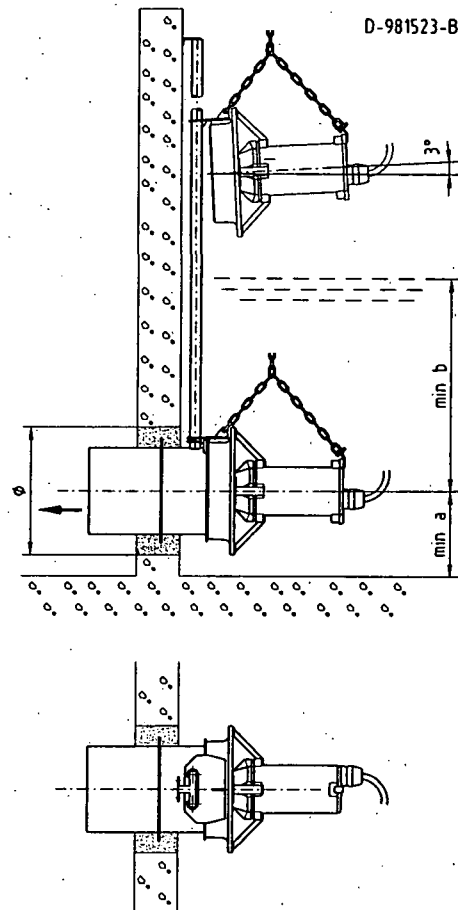


Figure 5.16 Circulation pump type SR.
Installation on wallpipe and
with guide rails.

NOTE

Using a plumb line suspended from the upper guide rail holder, the thimble flange can be positioned exactly. The integral lower guide rail hollows on the flange are used for correct line-up reference.

Attach the lifting chain at both lifting lugs using the shackles provided and uncoil the electric cable. Make sure your lifting device is in working order.

ATTENTION

Use only the original lifting chain and shackle or, if third-party components are used, make sure these are rated for the pump weight. Inferior components may break and cause the pump to fall with risk of severe damage to the pump and the wall thimble or other components.

Lift the pump and position the guide shoe between the guide rails. Please refer to Figure for reference. Lower the pump slowly along the guide rails onto the mating flange. Make sure that the pump cable can move freely and does not seize or fall into the basin. Attach the upper end of the lifting chain to a



suitable hook or eye bolt at or near the upper guide rail holder. Remove chain slack by hanging in loops and cut off surplus length if necessary.

Route the pump cable through a suitable conduit to the control panel and secure with clamps where necessary. Do not unnecessarily remove the protective sleeve on the pump cable free end. The pump cable should not be cut to length, but laid in loops so that the end easily reaches the terminal blocks. Connection to the control panel terminals may be completed by authorised electrician only. Please refer to section 5.8 for information on pump wiring.

5.8. Pump Electrical Connection

Electrical supply and control of the pumps is provided by the control panel. Control panel specifications vary greatly with the intended pump duty and installation. Panels may include circuitry for pump duty alternation, level control, alarm detection and transfer, and other functions. However, the pump start and stop circuitry must always be executed according to the scheme presented in figures 5.17 and 5.18 below for DOL and Y/D start respectively.

ATTENTION

The control panel starter must include overload protection relays adjustable according to the pump nominal current and provisions for the pump moisture and overheat protection devices whenever these are fitted. Usage of non-complying control panels increases the risk of motor damage and voids the pump warranty.



Make sure that the control panel is isolated from the electrical supply before beginning to work. Turn off the mains switch or remove the main fuses. Non-compliance to do so may lead to electrical shock with consequent serious personal injury or death of the personnel.

Insert the cable through the control panel cable gland and remove the protective sleeve. Note the markings on the leads and connect according to the cable identification and connection chart in figures 5.19 and 5.20. If the markings are missing or if the cable has been cut the leads can be identified with the help of the identification chart as follows:

- Strip back the cable sheath and identify the yellow/green ground wire
- Identify your cable according to the schedule of the connection charts
- Keeping the cable in the position of the chart the leads can be identified
- Mark the leads and proceed with the connection procedure

Tighten the cable clamp of the control panel (if fitted) and finish the cable routing to the panel using clamps where required.

5. Pump Installation

Page 13 (16)

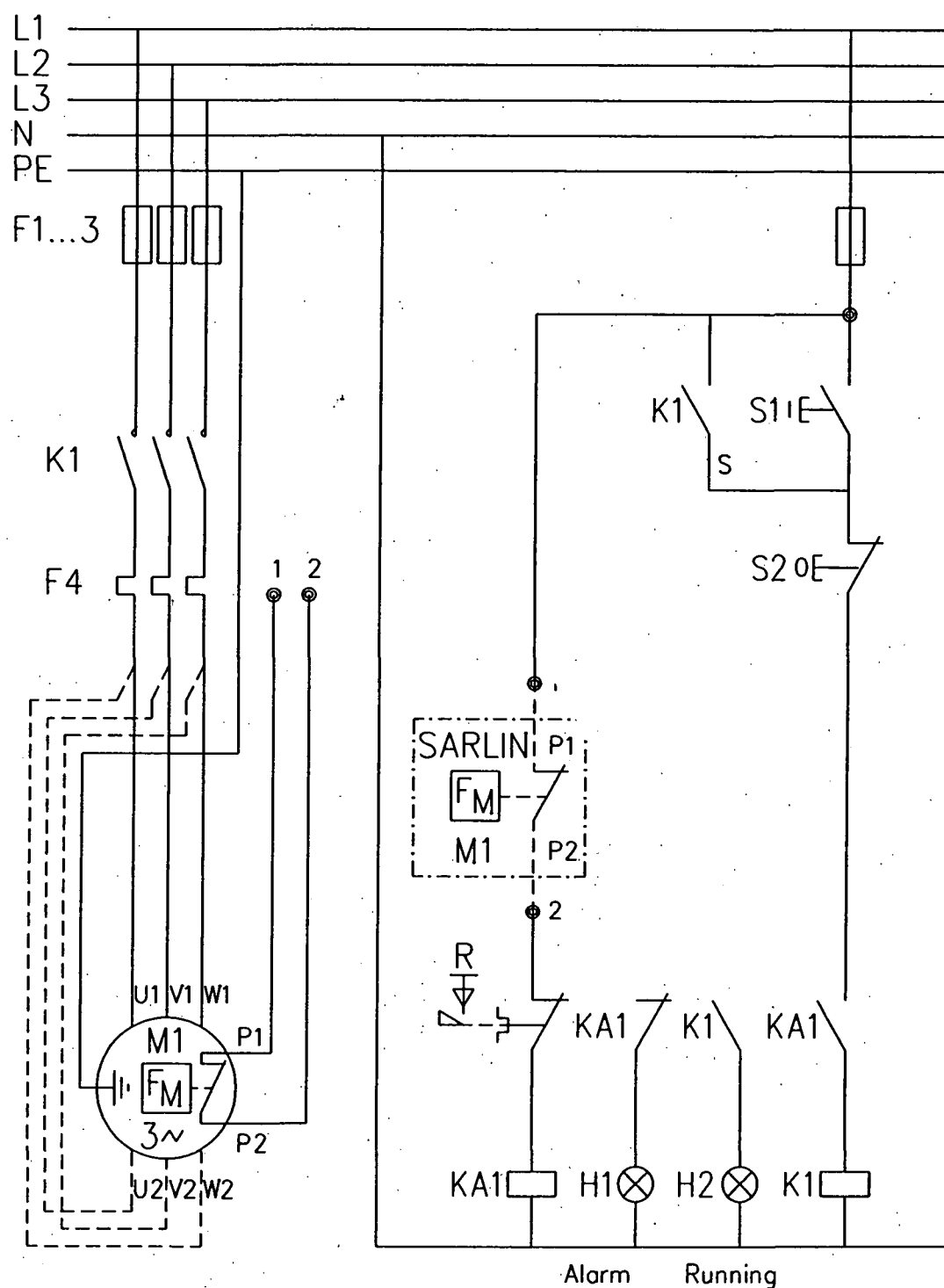
GRUNDFOS
SARLIN PUMPS

Figure 5.17 Pump wiring diagram for DOL start. F_M = internal motor protection device (moisture switch and winding thermal protectors)

GRUNDFOS
SARLIN PUMPS



5. Pump Installation

Page 14 (16)

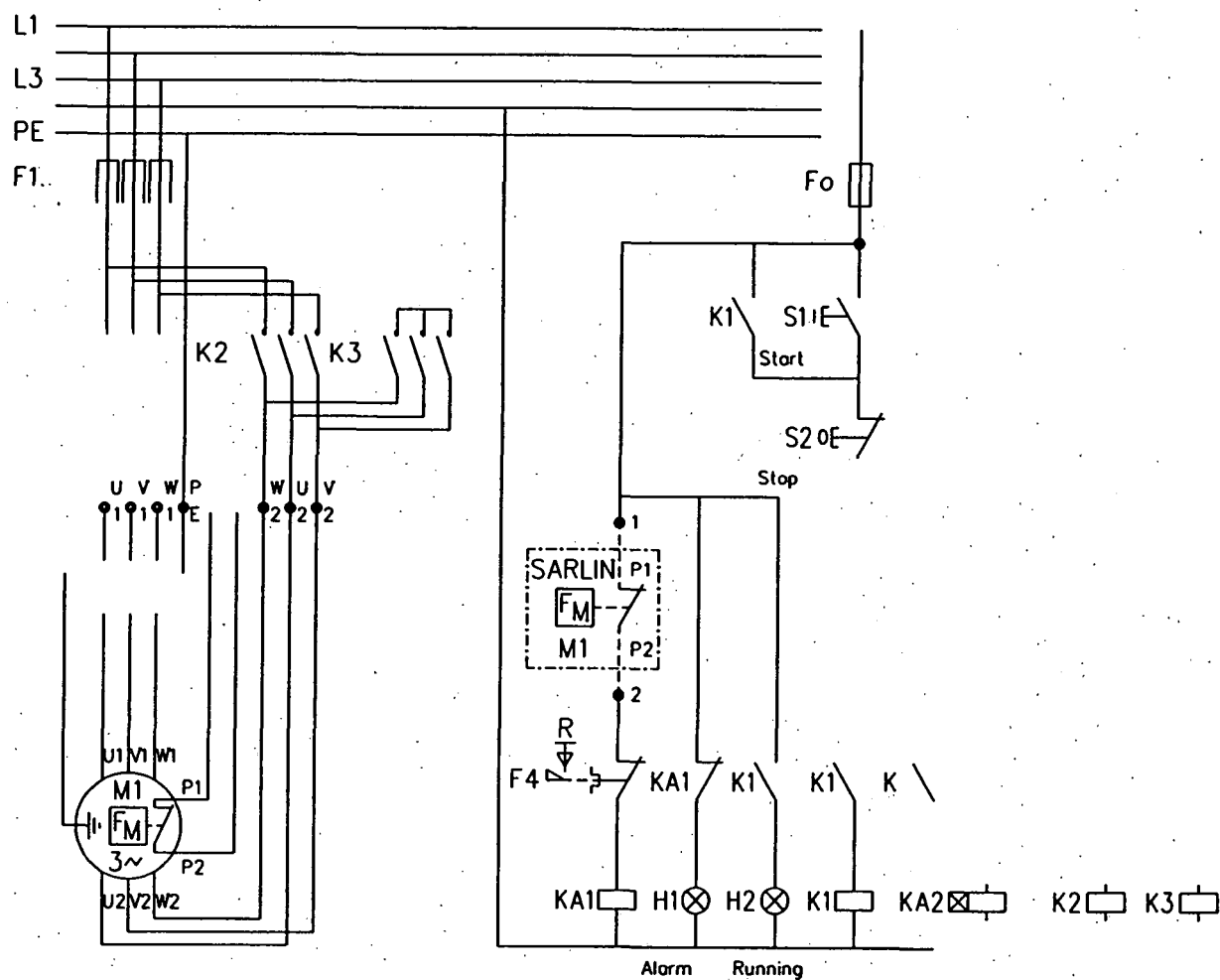


Figure 5.18 Pump wiring diagram for Y/D start. F_M = internal motor protection device (moisture switch and winding thermal protectors)

5. Pump Installation

Page 15 (16)

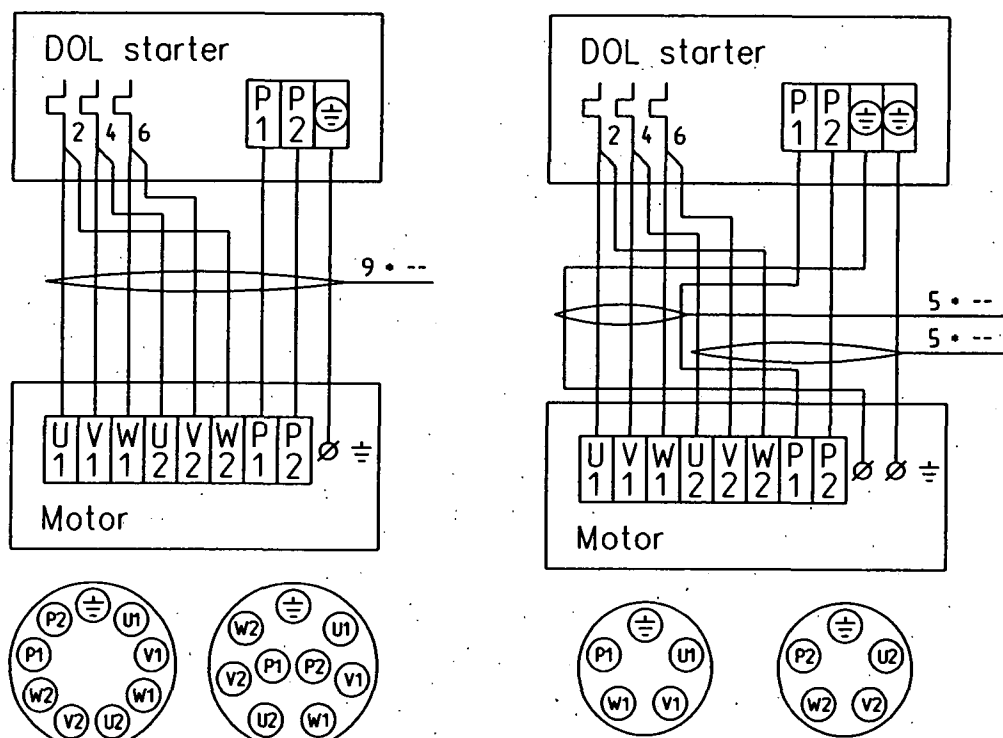
GRUNDFOS
SARLIN PUMPS

Figure 5.19 Pump cable connection diagrams for DOL and cable identification schedules

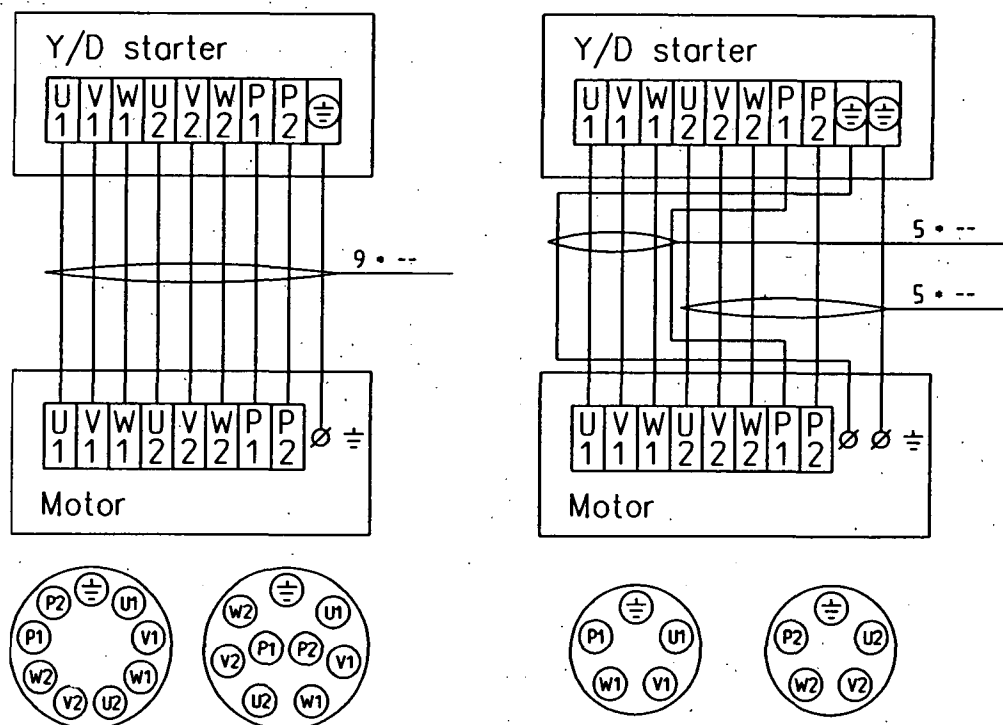


Figure 5.20 Pump cable connection diagrams for Y/D start and cable identification schedules

NOTE

A cable connector on the cable simplifies pump removal and reconnection. The use of a SARLIN pump cable connector, part No. PKL 9-25, is recommended for its suitability for the pump cables and complete watertightness. Figure 5.21 shows the use of the cable connector in a submersible pump installation.

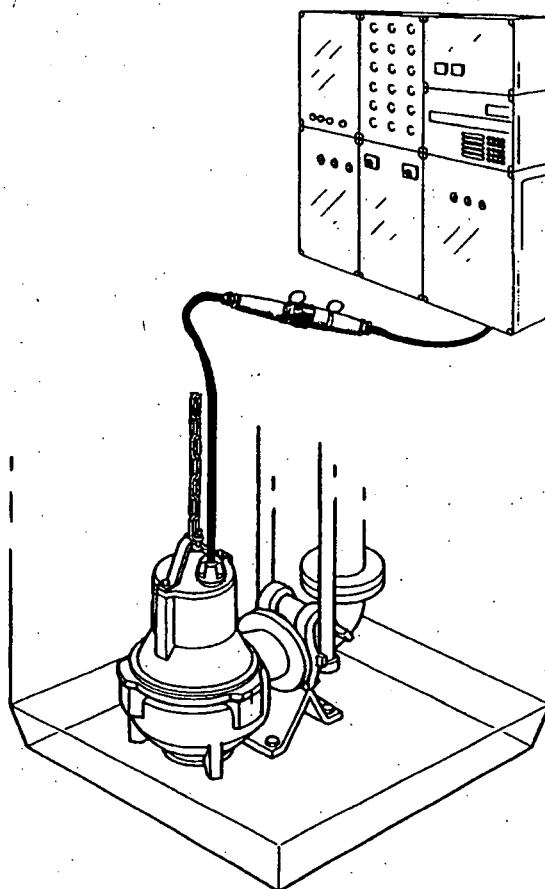


Figure 5.21 A pump cable connector simplifies pump installation and removal.

6. Pump Use and Operation

Page 1 (4)

GRUNDFOS
SARLIN PUMPS



6. Pump Use and Operation

ATTENTION

Always read and observe the safety instructions in sections 3.8 and 3.9 before beginning to operate pumps.

6.1. Pump Usage

The Sarlin submersible pumps are designed for pumping of unscreened wastewater in municipal and industrial installations and for low to medium density sludge pumping in sewage treatment plants. The pumps are also suitable for various raw water pumping duties where the conditions call for submersible pumps to be installed. The pumps have the capacity to handle unscreened sewage containing solids of 80 mm or 100 mm in spherical size depending on model. The impeller design allows stringy matter and long fibres to pass through the pump. Different pump material specifications are available for use in corrosive liquids.

Pump usage is restricted by the following ambient conditions used as design criteria limits:

- Maximum ambient and pumped liquid temperature is 40 °C
- Storage temperature range is -30 °C...+60 °C
- Maximum allowable voltage fluctuation is $\pm 5\%$ of nominal voltage (U_N)

ATTENTION

Usage of the pumps in installations where conditions exceed those allowed in the pump specifications may lead to pump malfunction and damage.

6.2. Pump Function

The Sarlin submersible pumps are short-coupled centrifugal pumps with the pump connected to a proprietary electric motor. The pumps are installed submerged in the pumped liquid or alternatively dry-installed. Submerged pump motors are cooled by submergence in the pumped liquid or independently of submergence by encasing the motor stator housing with a cooling jacket. In these a part of the pumped liquid is diverted through channels from the pump casing and circulated in the jacket. Dry-installed motors are always cooled by means of a cooling jacket.

The pump impellers are of vortex or channel type with one or two vanes, and they are available in a number of standard diameters making up a range of pumps within each frame size.

ATTENTION

Only complete pumps of specified installation versions are delivered from the factory. Unauthorised pump conversion may lead to pump or motor damage from overheating, corrosion or leakage, and voids all factory guarantees.

6.3. Pump Description

The pump unit consists of pump (hydraulic) parts and motor. Sections showing vortex and single-channel pumps are presented in figure 6.1 and figure 6.2 below.

Vortex pumps feature a recessed impeller working in a slightly volute shaped pump casing. The pump casing is fixed to the submersible motor with three fastening screws and can easily be removed for impeller inspection and removal. The open pump casing offers a large unobstructed passage for solids and fibrous matter. The impeller features between two and four vanes with winglets for symmetry and good pumping efficiency.

Channel-impeller pumps feature an impeller with one or two vanes and a patented axial suction clearance between the impeller and the pump casing. The pump casing is fixed to the motor with six



fasteners and three set screws for impeller clearance adjustment. The long vane in single-channel impellers offers a single passage through the impeller for solids and fibrous matter. The asymmetric impeller includes counterweight masses for balance and offers excellent pumping efficiency. Double-channel impellers have wider passages than the one-channeled impellers for solids and fibrous matter. These impellers are symmetric and inherently balanced.

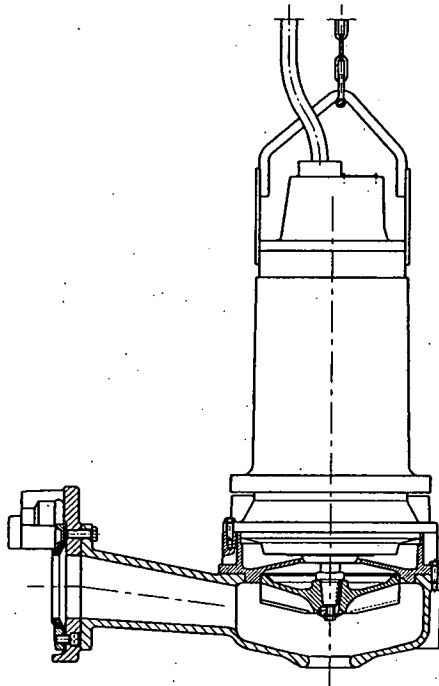


Figure 6.1 Section of vortex pump showing spacious casing.

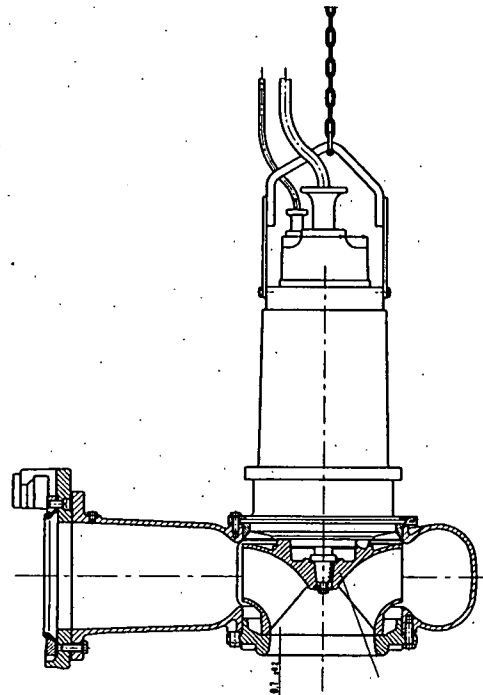


Figure 6.2 Section of single-channel pump showing impeller clearance at suction opening.

The pump motor includes independent double shaft seal with an oil chamber at the motor lower end. The oil serves as a lubricant and a coolant for the shaft seals. The oil chamber is accessible through inspection and fill holes. The state of the lubrication oil serves as an indicator of seal wear and is inspected according to the service schedule. Please refer to section 7 for information on seal oil inspection and replacement procedure.

The pump motor is totally enclosed (IEC IP 68) and may be opened for service only by workshops authorised by Sarlin in order to ensure that the watertight integrity remains intact. The motor may be fitted with internal moisture and winding temperature switches wired in series to a common circuit. The moisture switch is non-reversing and breaks the circuit in case of moisture entering the motor. The thermal switches, one in each phase of the windings, open when the temperature reaches a predetermined, set limit value of 150 °C, breaking the circuit. Upon cooling these switches reset and close the circuit.

The pump control panel must include circuitry for the protection devices, and set to break the pump motor current in the event of the protection circuit opening. The control panel specifications may call for either manual or automatic restarting of the motor after the protection circuit has closed. This, of course, is possible only if the circuit was broken by the thermal switches. The principle of the protective circuit is shown in figure 5.17 and figure 5.18 in section 5.

6. Pump Use and Operation

Page 3 (4)

GRUNDFOS®
SARLIN PUMPS



Pump motors for dry installation (version 3 and version 6) are generally identical to those for submerged installation. The motor casing and oil housing flanges are designed for efficient heat transport and dissipation into the pumped media. This cooling system may require that these pumps are rated lower than the largest submersible pumps and, for some models, may have stator casings made of aluminium in lieu of cast iron for enhanced heat conductivity. Therefore, they cannot always serve as motors for a submersible pump of the same type.

6.4. Pump Direction of Rotation

Whenever a pump has been connected to the mains during commissioning the direction of rotation must be ascertained. The pump impeller direction of rotation is clockwise when observed from the driving end. An arrow cast in the pump casing shows the direction. All new pumps have a large sticker clearly showing the direction of rotation.

The direction of rotation of a squirrel-cage electric motor is dependent of the order the three phases were connected at the control panel. Despite the phase markings on the leads the phases may be confused at the panel and the pump may run in the wrong direction when started. The direction of rotation can be controlled with the following procedure:

- With the submersible pump suspended from a lifting device either freely or in the wet well and guided by the guide rails the pump is started briefly from the control panel. By observing the direction the pump spins or "kicks" at the starting moment the direction of rotation can be determined.

NOTE

The pump kicks in the opposite direction of the direction of rotation. With the right direction of rotation being clockwise when observed from the driving end the pump should kick counterclockwise when started. If this is not the case the pump should be reconnected at the control panel with two of the phase leads changing place.

ATTENTION

The pump may be run briefly only when suspended. Make sure that the pump cable does not become twisted or strained during the operation. Failure to observe caution may lead to cable damage. Prolonged dry running of pumps may damage the primary shaft seal and cause motor overheating.

Pumps of version 3 and 6 installed dry shall be controlled for direction of rotation according to the procedure above before final installation.

6.5. Pump Starting

The pumps are started from the control panel manually or automatically. Control panel specifications vary according to installation requirements and local regulations but most control panels have at least the following components:

- Mains switch and fuses
- Motor starter contactors with overload relays
- Selector switch or buttons for pump manual and automatic starting and stopping
- Circuitry for pump motor protective devices
- Level control system
- Pump on/off indicator lamps

and control functions:



- Mains on/off
- Pump off
- Pump manual start
- Pump automatic start
- Overload relay reset

The pump is started from the control panel manually or automatically as controlled by the level control equipment.



Pump controls must always be switched off or to manual control whenever handling or servicing pumps or when personnel is entering the wet well. Pumps in automatic control mode may start unexpectedly from level control or resetting protective devices leading to pump damage or serious injury to the service personnel.

The pumps can be started manually or switched to automatic operation as required for commissioning after the opening of all valves in the suction and pressure sections of the pumping station pipework and final visual inspection.

6.6. Pump Commissioning

Pump commissioning to production follows the conclusion of the project work. Begin the procedure with a safety check of the pump installation checking all site work is completed according to specifications and cleared of debris. The function of the level control system is dry-checked against specifications to the extent possible.

Use manual operation to get all the pumps started and check their function and performance using the instrumentation installed. If necessary, portable instruments such as ammeters and voltmeters are used. The pumps are checked for unusual noise and vibrations and possible causes are established and reported or corrected.

Actual pumping station duty point should be established as accurately as possible in order to confirm that the pump operating conditions are the intended. If the installation includes a flow meter or a manometer the duty point can easily be established or picked off the pump curve. If these are not available actual pump performance can be approximated using the volumetric method. In this method the pump is timed when pumping a known quantity such as the wet well volume between start and stop level. The method is simple and offers an acceptable approximation of the volume rate of flow.

Commissioning is completed with the pumps switched to automatic operation and a final inspection of the pipework for leaks and vibrations. After it the project is ready for handing over to the owner and the pumping station is subject to regular operation and maintenance routines.

6.7. Pump Operation

Pump operation should be governed by established maintenance and check routines. Please refer to Section 7 for recommendations on pump check and maintenance schedules.

ATTENTION

Pump starting frequency may not be greater than 20 starts per hour. If started more frequently the motor windings may be damaged from overheating.

7. Pump Maintenance

Page 1 (4)

GRUNDFOS
SARLIN PUMPS



7. Pump Maintenance

Regular pump maintenance is a prerequisite for dependable long-term pump operation. With a few simple operator-performed maintenance actions the pump performance can be assured.

ATTENTION

Always read and observe the safety instructions in sections 3.10 and before beginning to work on pumps.

The operator-performed maintenance steps should be performed every 2000 hours of operation and include the following actions:

- Oil check and change if required
- Axial clearance inspection and possible adjustment
- Pump and component cleaning and visual inspection

7.1. Oil Check and Change

The volume of oil contained in the chamber between the double mechanical shaft seals is essential for the function of the pump providing lubrication for and cooling of the shaft seals.

Another intended purpose of the oil is to absorb by emulsification the minute amounts of water leaking across the lower seal into the oil chamber. By following the condition of the oil the lower seal can be monitored and scheduled for replacement before failure and damage to the pump motor will occur.

Lay the pump flat on a work bench and locate the oil plugs. Position the pump so that one of the plugs is pointing upwards. Clean the area around the oil plugs.

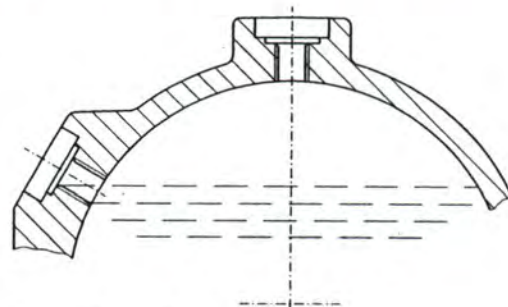


Figure 7.1 Correct oil level

Use a 24mm socket wrench to open the upper plug slowly and let possible excess pressure escape before the plug is removed. Place a clean oil trough under the pump to collect all drained oil. Open the plug pointing to the side and observe the fluid level. The escaped fluid indicates leakage over the lower mechanical seal which may be normal. Please refer to figure 7.1.

Turn the pump using a hoist and let all the fluid drain into the collecting trough. Pour a sample amount of the oil into a glass container and observe the condition of the oil using figure 7.3 for reference.

Clear oil can be reused always discard and dispose of emulsified oil. Low oil level may indicate upper seal failure and the pump should be referred to an authorised repair shop for further checks and possible repair.



Figure 7.2 Oil draining

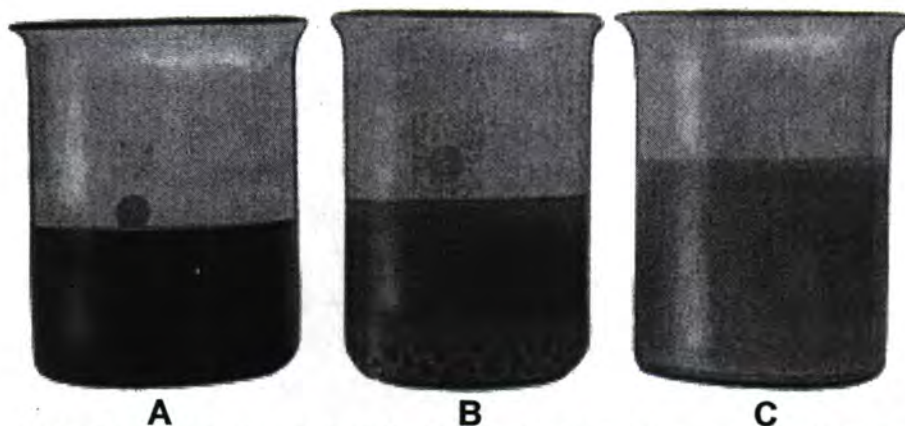


Figure 7.3 Condition of lubrication oil. Sample A: Oil in good condition. Sample B: Oil moderately emulsified. Change oil. Sample C: Excess water in oil. Change oil and check primary seal condition.

When the pump is flat on the bench the oil chamber is refilled from the top plug hole until the oil reaches the correct level. Use regular SAE 10 W 30 motor oil. Replace the O-rings, close the plugs and tighten carefully.

ATTENTION

Never lubricate the O-rings with grease. Greased O-rings may leak and allow the oil to escape from the oil chamber with consequent damage to the shaft seals.

7.2. Inspection and Adjustment of Suction Clearance

Adjustment of the impeller suction clearance is relevant for pumps with single-channel impellers only.

The correct setting value for the axial clearance is $0.7 \text{ mm} \pm 0.2 \text{ mm}$. The suction clearance should be reset if it is worn to 1.2 mm or more. The method for resetting the clearance is different for withdrawable submersible pumps (pumps version 1, 2, 4 or 5) and dry-installed pumps (pumps version 3 or 6). Both methods are described here.

For pumps with semi-axial impellers (pumps type SS), available in version 1 only, the adjustment procedure is different and described separately.

Lay the pump flat on a workbench. Locate the six screws fastening the pump casing to the motor and the three set screws. Please refer to figure 7.5. Check the clearance between impeller and casing all around the perimeter of the suction opening using a feeler gage. Turn the impeller by hand and check at several points. Please refer to figure 7.6.



Figure 7.4 Oil filling

7. Pump Maintenance

Page 3 (4)

GRUNDFOS
SARLIN PUMPS



If the clearance needs adjustment proceed as follows. Loosen all fasteners and set screws between the pump casing and the motor. Use a mallet to tap the casing and close the clearance. Open the clearance to specified by turning the three set screws. Check that the clearance is uniform around the perimeter of the suction opening. Tighten the fastening screws and check that the clearance is stable.

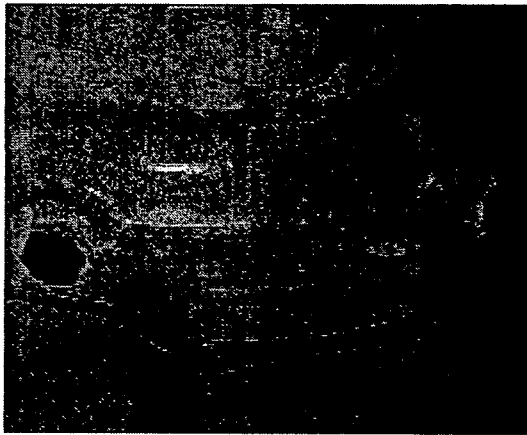


Figure 7.5 Pump casing fasteners and impeller clearance set screw.

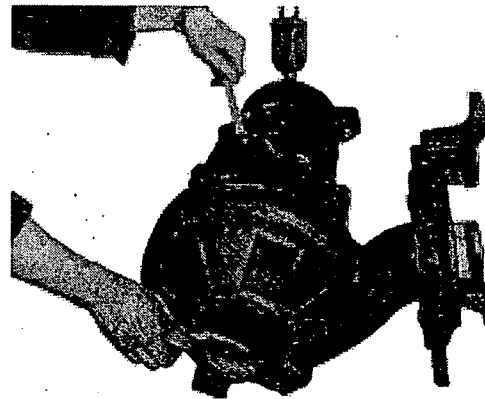


Figure 7.6 Setting impeller clearance using the set screws and feeler gages.

For dry-installed pumps the suction clearance can be inspected with the pump installed on the pump stand and connected to the pipework. Loosen all fasteners and set screws between pump casing and motor. Use a mallet to tap around the casing to break any bonding between casing and motor. Close the impeller clearance by tightening three of the fastening screws. Do not use unnecessary force. Measure and make a note of the distance X between pump casing and motor flange with feeler gages at three points next to the set screws. Please refer to Figure 7.7.

Loosen the fasteners and back up the motor $0.7 \text{ mm} \pm 0.2 \text{ mm}$ using the three set screws and the distance X as reference. Tighten all fasteners and check that the distance X at the three reference points are stable at their new set of values.

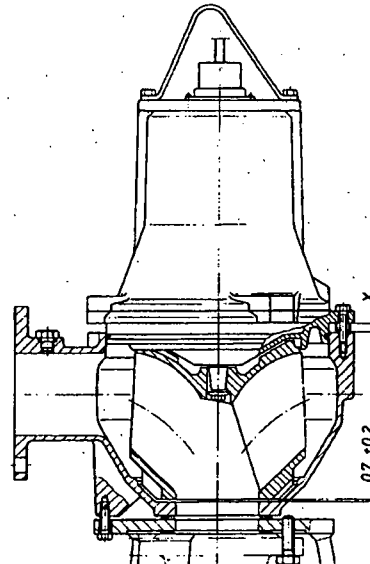


Figure 7.7 Axial clearance reference dimension X.

7.3. Pump Cleaning and Visual Inspection

A simple maintenance measure is to clean the pumps at regular intervals. The pumps may be cleaned in situ at the pumping station when withdrawn from the wet well. The pump is hosed down externally using a high pressure jet cleaner (maximum pressure 100 bar). Caked dirt on the motor must be removed to ensure good heat conductivity. A mild detergent, approved for disposal into the sewerage system may be used. The pumps may be scrubbed, using a soft brush, if necessary.

GRUNDFOS
SARLIN PUMPS

7. Pump Maintenance

Page 4 (4)

Visual inspection of the pump should include search for cracks or other external damages. The lifting handle and lifting chain should be expected for wear and corrosion. The pump cable should be inspected for cracks or lacerations in the sheath, kinks or for other damage. Visible parts of the cable inlet must be inspected for cracks and that they are firmly screwed down onto the top cover or junction box.

8. Impeller Replacement

Page 1 (3)

GRUNDFOS
SARLIN PUMPS



8. Impeller Replacement

ATTENTION

A damaged or badly worn impeller must always be replaced without delay when observed. A damaged impeller is out of balance and will cause damage or premature failure of the pump bearings. Always read and observe the safety instructions in the sections 3.10 and before beginning to work on pumps.

NOTE

Make sure before beginning to work on dry-installed pumps that all closing valves in both the suction pipework and rising main are closed and that the pump is drained.

8.1. Impeller Removal

Loosen and remove all fastening screws between pump casing and motor. Use a mallet to tap around the casing to break any bonding between casing and motor. Use a hoist to lift the pump motor out of the pump casing and place on a work bench. Clean the work area around the impeller and the impeller screw.

Loosen and remove the impeller screw. Be sure to locate and remove all washers. Please refer to the impeller specifications table below for list of components.

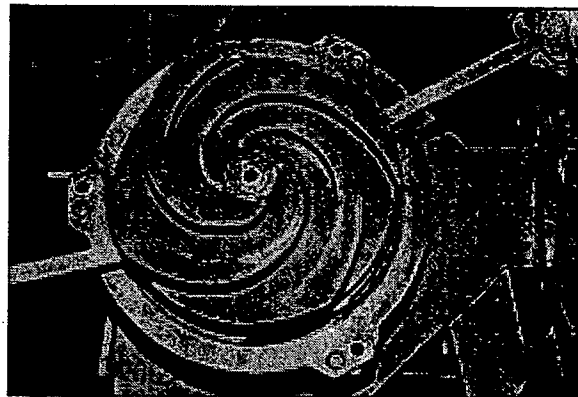


Figure 8.1 Removing vortex impeller using levers

The impeller can be removed using leverage applied behind the impeller by inserting suitable tools, such as tire irons, into clearance between impeller and motor flange. Apply the leverage evenly on both sides of the impeller. Please refer to figure 8.1. With the leverage applied apply a blow to the impeller using a soft mallet. The impeller breaks loose from the tapered shaft and can easily be removed. Remove and store the impeller key.

ATTENTION

Do not apply one-side leverage when removing impeller. One-sided force on the impeller may distort the tapered fit on the shaft end or bend the shaft.

For pumps with large impellers the use of an impeller puller is recommended. Use a two-clawed puller with claws long enough to reach behind the impeller upper shroud. On pumps with impeller screws screw a hex or Allen head bolt of the same dimension into the shaft end for thread protection before applying the puller. Please refer to the impeller specifications table below for list of screw dimensions. Apply the puller and tighten up until the impeller breaks loose from the tapered shaft end. Remove the protective bolt from the shaft end and remove the impeller. Remove and store impeller keys or drive pins. Please refer to figure 8.2.

Clean the shaft end and the area behind the impeller with the impeller removed from the shaft. Check the shaft end for damages or taper distortion from impeller looseness. Do not attempt to install new impeller on damaged or distorted shaft. Instead send the pump to authorised workshop for repair.

ATTENTION

Sling heavy impellers to a hoist while removing. Dropping the impeller may cause damage to the impeller or work area floor.

NOTE

For pumps with semi-axial impellers (SS-pumps) the order of component removal is reversed and the impeller is removed before the pump casing. For impeller replacement the casing does not have to be removed at all.

After the impeller is removed from the shaft clean the shaft end and the area behind the impeller. Check the shaft end for damages or taper distortion from impeller looseness. Do not attempt to install new impeller on damaged or distorted shaft but send pump to authorised workshop for re-pair instead.

8.2. Impeller Mounting

Lubricate the threads (internal or external) of the shaft end using oil. The specified tightening torque for the impeller requires the threads to be lubricated to attain sufficient screw tension. Install the impeller key or drive pin. Install the new impeller onto the shaft end. Make sure that the key stays in place in keyway in shaft and impeller. Make sure that the pin recess slides home onto the drive pin where a drive pin is employed to.

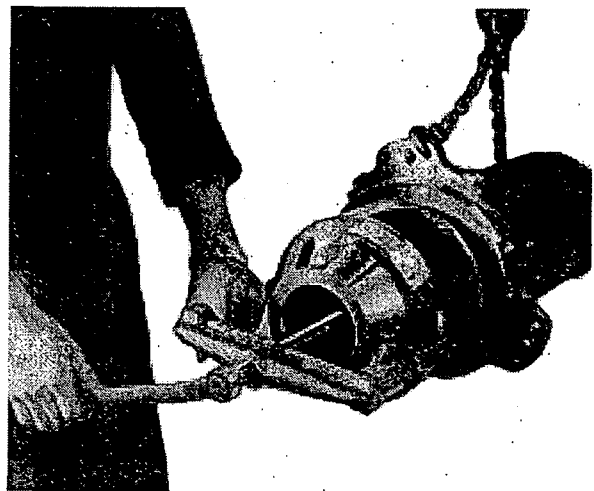


Figure 8.2 Removing single-channel impeller using puller

Install the impeller screw or nut using new locking washers where required. Tighten to prescribed fastening torque using torque wrench. Please refer to impeller screw torque table for the correct torque for your pump model. Turn the impeller by hand to make sure it rotates freely and straight. Please refer to figure 8.3.

Reinstall the pump casing in reverse order of the above. Adjust the single-channel pump's impeller suction clearance according to the instructions in section 7.2.

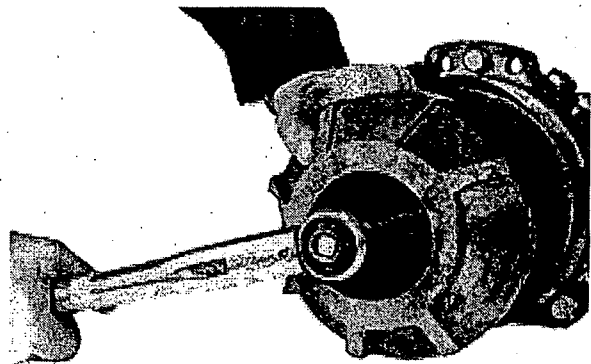


Figure 8.3 Installing impeller using torque wrench

8. Impeller Replacement

Page 3 (3)

GRUNDFOS®
SARLIN PUMPS



8.3. Impeller Screw Tightening Torques

The table below contains information on the impeller fastening components for each pump covered by this manual as well as the fastening torque to be applied in each case.

Pump frame size	Screw dimension, part number	Torque, Nm	Note
50	M10, D-32437	90	Special screw
54	M12, D-32438	120	Special screw

8.4. Component Fastener Tightening Torque

The different fasteners opened in the course of the service measures described above should be tightened to specified torque upon reassembly. The torques are as follows:

Screw Dimension	Torque, Nm
M 8	20
M 10	40
M 12	70
M 16	170
M 20	330

9. Explosion-proof Pumps

9.1. General

This section provides specific information for owners and operators of Sarlin submersible pumps built and certified for use in explosive environments. The range of explosion-proof pumps include the following pump types:

50 Hz				
Frame size 50			Frame size 54	
SVX 072 BH	SVX 092 BH	SVX 122 BH	S1X 134 AL	S1X 134 AM
S1X 054 L	S1X 054 M	S1X 054 H	S1X 134 AH	S2X 134 AL
S1X 074 E	S1X 074 CM	S1X 074 H	S2X 134 AE	S1X 174 AL
S1X 074 S	S1X 124 AE	S1X 124 BM	S1X 174 AM	S1X 174 AH
S1X 124 AH			S2X 174 AL	S2X 174 AE
60 Hz				
Frame size 50			Frame size 54	
SVX 092 BH	SVX 122 BH	S1X 094 BM	S1X 164 AL	S1X 164 AM
S1X 094 AH	S1X 114 AH	S1X 134 BM	S1X 164 AH	S1X 204 AL
S1X 134 AH			S1X 204 AM	S1X 204 AH

The contents of these instructions are provided as information for the pump owners and operators only and as a requirement of the certifying body. Actual repair measures on the pump motor should be referred to an authorised workshop only.

The instructions concerning the pump part of an explosion protected (ex-proof) submersible pump do not differ from the instructions for standard pumps. Consequently this instruction deals only with the structural differences, operation restrictions and special instructions of the pump motor.

ATTENTION

These instructions must be read as a general safety measure in their entirety and understood before any work on or operation of explosion-proof pumps. These instructions do not supersede the safety instructions in section 3 but constitute an complement to these and a stand-alone instruction on explosion-proof pumps. The BASEEFA Regulations governing Flameproof Submersible Motors should also be read in conjunction with these instructions.

9.2. Certification and Classification

The Sarlin explosion-proof pump motors are certified by the British Approval Services for Electrical Equipment in Flammable Atmospheres (BASEEFA) in compliance with the harmonised European Standards EN 50014 and EN 50018. The motor is certified for use in potentially explosive atmospheres

9. Explosion-proof Pumps

Page 2 (6)

GRUNDFOS
SARLIN PUMPS



requiring electrical apparatus of class dII B T3 or dII B T4. A certification marking compliance is affixed to the motor and is located on the side of the stator casing..



9.3. Certification Plate

The certification plates for class dII B T3 and dII B T4.

SARLIN	
EEx dIIB T4	
T _{amb} = -25°C-+40°C	
BAS No	Ex
TYPE	HU
Serial No	
CAUTION: Do not open any part of motor within 30 min. of disconnection!	
ZZ 287A	

SARLIN	
EEx dIIB T3	
T _{amb} = -25°C-+40°C	
BAS No	Ex
TYPE	HU
Serial No	
ZZ 287B	

SARLIN	
EEx e II T3	
VTT No	Ex
Type	HU
Ser. No	
t _E	
I _A /I _N	
ZZ 320	

The information on the plates reads as follows:

EEx	Apparatus explosion protected according to Euronorm
d	Apparatus withstands explosion pressure
II	Intended for other potentially explosive locations than mines
B	Intended for use in connection with gases of subcategory B
T3	Maximum surface temperature of the apparatus is 200 °C
T4	Maximum surface temperature of the apparatus is 135 °C
T _{amb.}	Allowable ambient temperature range is -25 °C ... +40 °C
BAS No.	Approval certificate No. EEx —
Type HU	Motor type number HU... (Sarlin type code HU...)



Serial No

Manufacturing serial No

NOTE

When using the motor in locations requiring Temperature Class T4 the motor may not be opened until 30 minutes after de-energising. When the motors are operated at variable frequency, the Temperature Classification is of Class T3.

9.4. Motor Construction and Performance

The explosion-proof enclosure comprises the following specially-designed items:

- Motor access cover or plug
- Cable inlet
- Stator housing
- Lower bearing bracket
- Lower bearing bracket cover
- Joint between motor body and oil housing

NOTE

This enclosure may be opened by authorised personnel only.

An external ground contact is located on the top cover to ensure the connection to earth. Electrical installation must include external connection from this contact to true ground. Grounding wires must satisfy all valid electrical safety requirements. Ground wire cross section must be at least 6 mm² and less than 70 mm².

For motor characteristics please refer to section 2.2.

9.5. Motor Protection Device Circuit

The motor is provided with two separate moisture switches and the stator is provided with three thermal switches connected in series, one for each phase. In single-phase motors two thermal switches are used, one in the main and one in the auxiliary phase. Thermal switch operating temperature is not higher than 150 °C. The protection devices are connected in series in a separate circuit motor cable leads 1 and 2.

ATTENTION

The control panel starter must include circuitry for automatic disconnection of the mains supply in the event of the pump protective circuit opening.

9.6. Motor Operating Requirements

Motor modifications or other measures that include drilling, welding, fastening etc., possibly affecting or weakening the structure must not be carried out to any parts of the explosion-proof enclosure.

9. Explosion-proof Pumps

Page 4 (6)

GRUNDFOS
SARLIN PUMPS



The motor must not be opened when energised. The work on the motor, including opening and dismantling, must only be carried out by qualified personnel at a workshop authorised by the manufacturer. Plate on motor serves as reminder, refer to Figure 9.1.

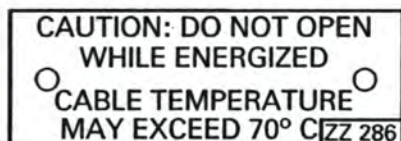


Figure 9.1 Warning plate

Overhauled and repaired motors are marked with a repair plate showing the following items:

- The repair symbol R
- Name or registered trade mark of the repairing workshop
- Workshop reference number relating to the repair
- Date of overhaul or repair

In the event of subsequent repairs the earlier plate should be replaced by a new updated one and earlier markings be recorded.

The repairing workshop is liable to keep records of performed overhauls and repairs and further records of all previous repairs, overhauls and possible modifications. Copies of the repairing workshop's detailed records should be filed by owner or operator together with the original type certificate of the explosion-proof motor in question.

9.7. Overhaul and Repair Requirements

Fasteners

Only screws complying with manufacturers specifications as to type, strength and dimensions, are allowed for fastening and securing of motor parts and components. The external fastener strength class is A2-80 or A4-80 and the internal fastener strength class is 8.8.

Wiring

Only cables approved by the manufacturer and complying with the requirements of the cable inlet as to diameter, number of leads, conductor area and sheath material, are allowed for the motor.

The compression seals (grommets) of the cable entry must be marked EExd and their aperture should correspond to the cable diameter. The corresponding cable dimension marking is stamped on the inlet or the entry device.

The cable entry device is secured to the motor cover by tightening the screws evenly in turn until the device bears against the motor cover.

Access Opening

The access openings are primarily intended for motor tightness tests in connection with overhaul. The openings may be used for inspection, should the presence of leakage water in the motor be suspected.

The prescribed time delay before opening the motor applies also to the access openings (screws).

ATTENTION

The access opening cover screw must always be locked with an original-issue Allen head locking screw M4 x 8.

Lower bearing bracket cover

In motors having a separate bearing bracket cover the flanged joint between them constitutes an explosion proof joint where the joint gap must not exceed 0.15 mm. If the cover has been opened the joint must always be checked in connection with the assembly. The joint is controlled with a 0.15 mm feeler gage which must not fit into the gap from any one of three radial directions.

Condition of Parts

When assembling, especially the components of the explosion-proof enclosure, must be carefully checked for:

- Faultlessness of machined surfaces
- Condition of threaded holes
- Approval markings

Spare parts

Damaged parts should always be replaced by new and approved parts. Parts must not be refurbished by machining, re-tapping, welding, etc.

The components and spare parts of the explosion-proof enclosure must have the following approval markings:

Part	Item No.	Marking
Motor cover	230	Ex 1 PH or Ex 2 PH
Cable entry	236/404	Ex 1 PH or Ex 2 PH
Stator housing	302	Ex 1 PH or Ex 2 PH
Bearing bracket	213	Ex 1 PH or Ex 2 PH
Bracket cover	206	Ex 1 PH or Ex 2 PH
Oil housing (up to 5,2 kW)	257	Ex 1 or Ex 2
Rotor	201	Ex 1 or Ex 2

NOTE

Make sure before assembly that the parts carry the adequate markings.

Stator Rewinding

If a motor stator has to be rewound the directions of the manufacturer must be observed. Thermal switches and winding insulation must completely correspond to original.

ATTENTION

The thermal switches must be embedded in the windings before varnishing and curing.

Testing After Stator Rewinding

After partial or complete repair the stator should be subjected, preferably with the apparatus assembled, to the following tests:

- A. The resistance of each winding should be measured at room temperature and verified. In case of three phase windings the resistance of each phase or between line terminals should be balanced. Maximum allowable phase resistance difference is 2 %.

9. Explosion-proof Pumps

Page 6 (6)



B. Insulation resistance should be tested measuring the resistance between:

- windings - ground
- windings - windings
- windings - auxiliaries (i.e. thermal switches)
- auxiliaries - ground

A minimum test voltage of 500 V DC is recommended.

Minimum acceptable insulation resistance is a function of rated voltage, temperature, type of apparatus and whether the rewind is partial or complete. However for example, the insulation resistance should not be less than 100 M Ω at 20 °C on a completely rewound apparatus intended for use at up to 660 V.

C. A high voltage test in accordance with a relevant standard (i.e. IEC 34-1) should be conducted between:

- windings - earth
- windings - windings
- windings - auxiliaries attached to the windings

Test voltage is $2 \times U_N + 1000$ V, minimum 2000 V.

Testing After Repair

Before a repaired motor is put back into service, it should be put through the following tests:

- Motor tightness test, using the access opening
- Internal motor protection circuit function control
- Test run at normal full speed for abnormal vibrations or noise
- Testing of the earth connection between the earth lead at the control panel and the pump body

Overhauled and repaired motor should be marked with a visible plate. The marking should be permanent using corrosion-resistant plate material.



10. Troubleshooting

ATTENTION

Always read and observe the safety instructions in section 3.10 and 3.11 before beginning to troubleshoot pumps.

Trouble	Possible cause	Check and remedy
Pump fails to start or stops without visible reason.	No power to motor.	Check power supply and fuses. Operate manual start and check contactor operation.
Pump fails to start or stops. Control panel indicates tripped overcurrent relay or protection devices.	Loss of one phase of power supply.	Check power supply and fuses.
	Pump momentary overloaded.	If condition not self-corrective, check for cause.
	Impeller jammed.	Check impeller and clear as necessary.
	Overcurrent relay incorrectly set.	Check and reset as necessary according to nominal current.
	Thermal switches tripped. Pump inadequately cooled.	Allow motor to cool. Ensure adequate cooling by immersion for pumps version 1 and 4.
	Moisture switch in motor tripped.	Refer to authorised repair shop.
	Motor cable damaged.	Check for visual damages. Refer to authorised repair shop.
	Fluctuating voltage.	Check voltage. Allowable deviation is +/- 5%.
Pump runs but does not deliver rated volume flow.	Pump runs backwards.	Check direction of rotation and rectify as necessary.
	Impeller loose or worn.	Check impeller and replace as necessary.
	Pump or pipework clogged.	Check and clear as necessary.
	Pump head too high.	Check by pressure gauging and redesign rising main or install other pump.
	Valves closed or clogged. Check valve not operating.	Check valve position, clean as necessary. Relocate or replace check valve.
	Air accumulated in pump casing or suction pipeline.	Remove air. Raise wet well stop level or redesign suction pipeline.
	Pumped liquid too dense.	Dilute or redesign process.
	Pump not properly connected to submersible baseplate.	Pump down wet well level, lift pump and relocate onto baseplate.
	Leaking pipework.	Check pipework for leaks and fix as necessary.
	Pump wet well flushing system inadvertently activated.	Check for function and repair as necessary.

10. Troubleshooting

Page 2 (2)

GRUNDFOS®
SARLIN PUMPS


Trouble	Possible cause	Check and remedy
Pump starts but shuts off.	Clogged pump causes overload to trip.	Check and clear pump as necessary.
	Motor overheated, tripping thermal switches.	Allow pump to cool; check for cause as above.
	Insufficient liquid in wet well.	Allow wet well to fill.
	Level control failure.	Clean or reset level control equipment or replace as necessary.
Pump vibrating or emitting excessive noise.	Pump partially clogged.	Check and clear pump as necessary.
	Pump runs backwards.	Check direction of rotation and rectify as necessary.
	Pump operates outside designed operation range.	Check pump head. Redesign rising main or select other pump.
	Pump mechanical failure.	Check pump for damages. Repair or submit to authorised repair shop as necessary.
	Pump not correctly engaged to submersible baseplate.	Pump down wet well level, lift pump and relocate onto baseplate.
	Pump cavitates.	Check pump for partial suction blockage and clear as necessary. Check duty point and adjust as necessary.
	Pump stand, baseplate or guide rails not securely installed.	Check installation and tighten bolts where necessary.
Oil watery or emulsified.	Lower seal leakage.	Refer to authorised workshop.
Low oil level.	Upper seal leakage.	Refer to authorised workshop

GRUNDFOS
SARLIN PUMPS**11. Declaration of Conformity**

Page 1 (1)

11. Declaration of Conformity

Oy E. Sarlin Ab
Division Pumps
Kaivokselantie 3-5
01610 Vantaa
Finland

We herewith declare that the

Sarlin Submersible Pumps, Series S, to which this declaration relates, are in conformity with the provisions in the EU Council Directive **89/392/EEC** as amended by **91/368/EEC**, **93/44/EEC** and **73/23/EEC** as amended by **93/68/EEC**, and EU Council Directive **89/336/EEC** and the following standards stipulated by said directives:

EN 292-1:1991	Safety of Machinery. Basic concepts, general principles for design. Basic terminology, methodology.
EN 292-2/5:1991	Safety of Machinery. Basic concepts, general principles for design. Technical principles and specifications.
prEN 809:1992	Pumps and Pump Units for Liquids - Safety Requirements
EN 60335-2-41	Safety of household and similar electrical appliances. Particular requirements for electrical pumps.
EN 50082-1	Electromagnetic compatibility. Generic immunity standard. Generic standard class: Residential, commercial and light industry.
EN 55014	Limits and methods of measurement of radio interference characteristics of household electrical appliances, portable tools and similar electrical apparatus.

Vantaa, Finland
20.02.1996

Anne Tallgren
Quality Manager

DS
30/250 A

IP55

INLET & ACCESSORIES

These products are also available for many other voltages and frequencies. See page 7

WALL MOUNTING APPLIANCE INLET



415 V

WALL BOX

CABLE GLAND NOT INCLUDED



(1) and (2)

30° WALL BOX

ENTRY REFERENCE

70° WALL BOX

ENTRY REFERENCE

DS1

Pe M20 31 1A053

Pe (1) 51 8A058

DS3

Pe M25 31 3A053

Pe (2) 51 CA058

DS6

Pe M40 31 6A053

Pe (2) 51 DA058

DS9

Pe M40 39 6A053

Pe M40 87 6A053

DS2

Pe M50 39 9A053

Pe M50 87 9A053

For other tappings, please consult us

(1) 4 knock-out entries (2 x M16 to M32 + 2 x PG11 to PG29)
(2) 4 knock-out entries (2 x M16 - M25 to M40 + 2 x PG11 - 21 to PG36)

INLET



220/250V

380/440V

SPNE SPNE+Aux 3PE 3PE+Aux 3PNE 3PNE+Aux

P 31 18015 31 18015 972 31 18013 31 18013 972 31 18017 31 18017 972

P 31 38015 31 38015 972 31 38013 31 38013 972 31 38017 31 38017 972

P 31 68015 31 68015 972 31 68013 31 68013 972 31 68017 31 68017 972

P 31 98015 31 98015 972 31 98013 31 98013 972 31 98017 31 98017 972

P 39 28015 39 28015 972 39 28013 39 28013 972 39 28017 39 28017 972

suffix 172/972 = 2 a
suffix 264 = 4 a

INCLINED APPLIANCE INLET



415 V

INCLINED SLEEVE



REFERENCE

REFERENCE

DS1

Pe 31 1A027

Pe 51 BA757

DS3

Pe 31 3A027

Pe 51 CA757

DS6

Pe 31 6A027

Pe 51 DA757

DS9

Pe 31 9A027

Pe 87 9A087

DS2

Pe 39 2A027 (60°)

INLET



220/250V

380/440V

SPNE SPNE+Aux 3PE 3PE+Aux 3PNE 3PNE+Aux

P 31 18015 31 18015 972 31 18013 31 18013 972 31 18017 31 18017 972

P 31 38015 31 38015 972 31 38013 31 38013 972 31 38017 31 38017 972

P 31 68015 31 68015 972 31 68013 31 68013 972 31 68017 31 68017 972

P 31 98015 31 98015 972 31 98013 31 98013 972 31 98017 31 98017 972

P 39 28015 39 28015 972 39 28013 39 28013 972 39 28017 39 28017 972

suffix 172/972 = 2 a
suffix 264 = 4 a

PLUG

HANDLE

INLET



CABLE GLAND NOT INCLUDED

STANDARD HANDLE

Ø mm REFERENCE

FLOWER POT HANDLE

ENTRY REFERENCE

DS1

Pe 5-21 31 1A013

Pe M20 31 1A253 417

DS3

Pe 10-30 31 3A013

Pe M25 31 3A253 418

DS6

Pe 13-36 31 6A013

Pe M40 31 6A253 420

DS9

Pe 20-36 31 6A013 03

Pe M40 31 6A953 420

DS2

Pe 25-45 31 9A013

Pe M50 31 9A253 429

For other tappings, please consult us

220/250V

380/440V

SPNE SPNE+Aux 3PE 3PE+Aux 3PNE 3PNE+Aux

P 31 18015 31 18015 972 31 18013 31 18013 972 31 18017 31 18017 972

P 31 38015 31 38015 972 31 38013 31 38013 972 31 38017 31 38017 972

P 31 68015 31 68015 972 31 68013 31 68013 972 31 68017 31 68017 972

P 31 98015 31 98015 972 31 98013 31 98013 972 31 98017 31 98017 972

P 39 28015 39 28015 972 39 28013 39 28013 972 39 28017 39 28017 972

suffix 172/972 = 2 a
suffix 264 = 4 a

Closing Mechanisms

CLOSING HANDLE SET BASE ONLY LEVER ONLY

DS9 M 39 9A346 = 39 9A396 + 39 9A376

DS2 M 39 2A346 = 39 2A396 + 39 2A376

IP55 Inlet cap

DS1 DS3 DS6 DS9 DS2

REFERENCE 31 1A126 31 2A126 31 6A126 31 9A126 31 2A126

Example for a plug DS1 30A/230V SPNE



PLUG



HANDLE



INLET

P POLYEST
Pe POLYAM
N NEOPRE
M MET

IP55 INLET & ACCESSORIES

DS
30/250 A

IP55

OUTLET & ACCESSORIES

These products are also available for many other voltages and frequencies. See page 7

WALL MOUNTING SOCKET



415 V

WALL BOX

CABLE GLAND NOT INCLUDED



(1) and (2)

ENTRY REFERENCE

ENTRY REFERENCE

SOCKET-OUTLET



220/250V

380/440V

220/250V

380/440V

SPNE

SPNE+Aux

3PE

3PE+Aux.

3PNE

3PNE+Aux.

DS1

Pe M20 31 1A053

Pe (1) 51 BA058

P 31 14015 31 14015 972 31 14013 31 14013 972 31 14017 31 14017 972

DS3

Pe M25 31 3A053

Pe (2) 51 CA058

M25 87 3A053

P 31 34015 31 34015 972 31 34013 31 34013 972 31 34017 31 34017 972

31 34015 264 31 34013 264 31 34017 264

DS6

Pe M40 31 6A053

Pe (2) 51 DA058

M40 87 6A053

P 31 64015 31 64013 31 64013 172 31 64017 31 64017 172

39 64015 39 64013 39 64013 172 39 64017 39 64017 172

DS9

M50 39 9A053

M50 87 9A053

P 31 94015 31 94013 31 94013 172 31 94017 31 94017 172

39 94015 39 94013 39 94013 172 39 94017 39 94017 172

DS2

M50 39 2A053 (60°)

39 24015 39 24015 972 39 24013 39 24013 972 39 24017 39 24017 972

For other tappings, please consult us

(1) 4 knock-out entries (2 x M16 to M32 + 2 x PG11 to PG29)
(2) 4 knock-out entries (2 x M16 - M25 to M40 + 2 x PG11 - 21 to PG36)

suffix 172/972 = 2 aux

suffix 264 = 4 aux

INCLINED SOCKET



415 V



REFERENCE

REFERENCE

SOCKET-OUTLET



220/250V

380/440V

220/250V

380/440V

SPNE

SPNE+Aux

3PE

3PE+Aux.

3PNE

3PNE+Aux.

DS1

Pe 31 1A027

Pe 51 BA757

P 31 14015 31 14015 972 31 14013 31 14013 972 31 14017 31 14017 972

DS3

Pe 31 3A027

Pe 51 CA757

87 3A087

P 31 34015 31 34015 972 31 34013 31 34013 972 31 34017 31 34017 972

31 34015 264 31 34013 264 31 34017 264

DS6

Pe 31 6A027

Pe 51 DA757

87 6A087

P 31 64015 31 64013 31 64013 172 31 64017 31 64017 172

39 64015 39 64013 39 64013 172 39 64017 39 64017 172

DS9

Pe 31 9A027

87 9A087

P 31 94015 31 94013 31 94013 172 31 94017 31 94017 172

39 94015 39 94013 39 94013 172 39 94017 39 94017 172

DS2

39 2A027 (60°)

39 24015 39 24015 972 39 24013 39 24013 972 39 24017 39 24017 972

suffix 172/972 = 2 aux

suffix 264 = 4 aux

CONNECTOR



415 V



CABLE GLAND NOT INCLUDED

Ø mm

REFERENCE

ENTRY

REFERENCE

SOCKET-OUTLET



220/250V

380/440V

220/250V

380/440V

SPNE

SPNE+Aux

3PE

3PE+Aux.

3PNE

3PNE+Aux.

DS1

Pe 5-21 31 1A013

Pe M20 31 1A253 417

P 31 14015 31 14015 972 31 14013 31 14013 972 31 14017 31 14017 972

DS3

Pe 10-30 31 3A013

Pe M25 31 3A253 418

P 31 34015 31 34015 972 31 34013 31 34013 972 31 34017 31 34017 972

DS6

Pe 13-36 31 6A013

Pe M40 31 6A253 420

M40 31 6A953 420

P 31 64015 31 64013 31 64013 172 31 64017 31 64017 172

39 64015 39 64013 39 64013 172 39 64017 39 64017 172

DS9

N 25-45 31 9A013

Pe M50 31 9A253 429

M50 31 9A953 429

P 31 94015 31 94013 31 94013 172 31 94017 31 94017 172

39 94015 39 94013 39 94013 172 39 94017 39 94017 172

DS2

N 40-58 39 2A013

Pe M63 39 2A253 463

Pe M75 39 2A253 475

39 24015 39 24015 972 39 24013 39 24013 972 39 24017 39 24017 972

suffix 172/972 = 2 aux

suffix 264 = 4 aux

For other tappings, please consult us

Stop button

Add suffix 453 to socket-outlet part number

Optional padlocking

See page 16

Example for a wall mounting socket DS1 30A 400V SPNE



=



+



WALL MOUNTING SOCKET

WALL BOX
51 BA058SOCKET-OUTLET
31 14 017

P POLYESTER

Pe POLYAMIDE

N NEOPRENE

Pe META

use Terminal Blocks with Disconnect Lever K...-HESI



The particular feature of the fuse terminal blocks, UK 5-HESI and UK 6,3-HESI is the angled disconnect lever with limit stop for fine settings.

These terminal blocks are available with and without light indicator. The latter signals when the fuse insert has blown. The light indicator in the disconnect lever contains light emitting diodes connected in antiparallel for the voltage range 15-30 V and a glow lamp for the voltage range 110-250 V.

Several disconnect levers can be coupled by means of the connection pin 3-UK 10,3-HESI in order to switch a three-phase circuit on or off, for example.

The UK 10,3-HESI is a fuse terminal block with disconnect lever for 10.3 x 38 mm fuses, which are used mainly in the USA. With one moving of the lever, the fuse can be switched off load and without any risk.

When selecting and using cartridge fuse terminal blocks and inserts,

IEC 127 6/DIN EN 60 127 6 and DIN VDE 0611 part 6 should be observed.

Cartridge fuse inserts are supplied by:

Wickmann-Werke GmbH

Postfach 2520

D-58415 Witten

Phone: ++ / 23 02 / 66 20

Fax: ++ / 23 02 / 66 22 19

ELU

Postfach 101054

D-44010 Dortmund

Phone: ++ / 23 1 / 55 70 30 0

Fax: ++ / 23 1 / 55 70 30 9

SIBA

Postfach 1940

D-44509 Lünen

Phone: ++ / 23 06 / 70 01-0

Fax: ++ / 23 06 / 70 01-10

Schurter GmbH

Postfach 1253



D-79343 Endingen

Phone: ++ / 76 42 / 68 2-0

Fax: ++ / 76 42 / 88 20

Higher ambient temperatures

are an additional strain on fuse inserts. In applications of this kind, the shift of the rated current should be taken into consideration accordingly.

Description	Light indicator: Voltage [V AC/DC]	Current [mA]
Fuse terminal block , for mounting on  , for cartridge fuse inserts 5 x 20, 5 x 25, 5 x 30 mm for 5 x 20 mm cartridge fuse inserts		
Fuse terminal block , for mounting on  , for cartridge fuse inserts 6.3 x 32 mm (1/4" x 1 1/4") for 10.3 x 38 mm cartridge fuse inserts		
Fuse terminal block? , as above, however with light indicator for:	15 - 30 110 - 250	3.5 - 8.1 0.5 - 1.0
(1) Fixed bridge , for cross connections in the terminal center, screw heads with insulating collar, 10-position, divisible, with 10 screws		
(2) Insertion bridge , fully insul., fully insulated, divisible, insulated spine,	2-pos. 3-pos. 10-pos.	
(3) Insertion bridge , divisible, insulated spine 56-pos., 1-phase insulated spine 56-pos., 3-phase		
(4) Connection pin , for interconnecting three fuse terminal blocks, plastic, orange		
(5) Zack marker sheet , flat, 50-section, for labeling the marker groove		
(6) Zack strip , 10-section, white		
(7) Screwdrivers		

Dimensions	
Width / length	[mm]
Height (NS 35:7.5 / NS 35:15 / NS 32)	[mm]
Technical data in accordance with IEC / DIN VDE	
Fuse type / dimensions	- / [mm]
Max. power dissipation	
at 23°C based on E DIN VDE 0611-6: 2001-04	[W]
Max. cross section with insertion bridge (solid/stranded)	[mm²]
Rated surge voltage / contamination class	[kV] / -
Surge voltage category / insulation material group	- / -
Connection capacity	
Stranded with ferrule without / with plastic sleeve	[mm²]
Multi-conductor connection (2 cond. with same cross section)	
Solid / Stranded	[mm²]
Stranded with ferrule without plastic sleeve	[mm²]
Stranded with TWIN ferrule with plastic sleeve	[mm²]
Stripping length	[mm]
Internal cylindrical gauge (IEC 60 947-1)	
Thread / torque	- / [Nm]
Insulation material	
Inflammability class acc. to UL 94	
Approval data (UL and CSA/CUL)	
Nom. voltage / nom. current / conduc. sizes	UL: [V] / [A] / AWG
	CSA/CUL: [V] / [A] / AWG

Note:
Further fuse terminal blocks for other voltage ranges are available on request!



UK 5-HESI

for cartridge fuse inserts 5 x 20, 5 x 25, 5 x 30 mm with and without light indicator

Terminal width 8.2 (IEC) [mm²]	rigid solid	flexible stranded	AWG	I [A]	U [V]
DIN VDE 0611 as disconnect t. b. with fuse	0.2-4 0.2-4	0.2-4 0.2-4	24-12 24-12	6.3 1)	800 1)

Type	Order No.	Pcs Pkt.
UK 5-HESI	30 04 10 0	50
UK 5-HESILED 24	30 04 12 6	50
UK 5-HESILA 250	30 04 14 2	50
EBS 2-8	31 18 15 1	100
EBS 3-8	31 18 14 8	50
EBS 10-8	31 18 13 5	10
ZB 8 (for order data, see page 337)		
SZS 0,6 x 3,5	12 05 05 3	10

8.2 / 72.5
56.5 / 64 / 61.5
G / 5 x 20, 5 x 25, 5 x 30
1)
4 / 4
6 / 3
III / I
0.25 - 4 / 0.25 - 4
0.2 - 1.5 / 0.2 - 1.5
0.25 - 1.5
0.5 - 2.5
8
A 4
M 3 / 0.5 - 0.8
PA
V2
600 / 6.3 / 26 - 10
600 / 6.3 / 28 - 10

1) See table page 83 (The current is determined by the fuse used, the voltage by the light indicator).



UK 2,5 N



UK 3 N



UK 5 N

Terminal width 5.2

(IEC) [mm ²]	rigid solid	flexible stranded	AWG	I [A]	U [V]
IEC 60 947-7-1	0.2-4	0.2-2.5	24-14	24	800
EN 50 019*	0.2-4	0.2-2.5	24-14	28/22	550

* EC Prototype certificate no.: KEMA 98ATEX1651U²⁾

Terminal width 5.2

(IEC) [mm ²]	rigid solid	flexible stranded	AWG	I [A]	U [V]
IEC 60 947-7-1	0.2-4	0.2-2.5	24-12	32	800
EN 50 019*	0.2-4	0.2-2.5	24-12	28/22	750

* EC Prototype certificate no.: KEMA 98ATEX1651U²⁾

Terminal width 6.2

(IEC) [mm ²]	rigid solid	flexible stranded	AWG	I [A]	U [V]
IEC 60 947-7-1	0.2-6	0.2-4	24-10	41	800
EN 50 019*	0.2-6	0.2-4	24-10	38/30	750

* EC Prototype certificate no.: KEMA 98ATEX1651U²⁾

UL KEMA CCA B P R BV/LR/NV/PRS
KEMA FTZU

UL KEMA CCA B P R BV/LR/NV/PRS/RS/NK
KEMA FTZU/KDB

UL KEMA CCA B P R BV/LR/NV/PRS/RS/NK
KEMA FTZU/KDB

Type	Order No.	Pcs. Pkt.
UK 2.5 N ²⁾	30 03 34 7	50
UK 2.5 N BU ²⁾	30 03 35 0	50
D-UK 2.5	30 01 02 2	50
D-UK 2.5 BU	30 01 10 3	50
FBR1 10-5 N	I _{max} : 24 A 27 70 64 2	10
EBL 2-5	I _{max} : 24 A 23 03 14 5	100
EBL 3-5	24 A 23 03 15 8	100
EBL 10-5	24 A 23 03 13 2	10
USBR 2-7	I _{max} : 18 A 23 03 23 9	1
TS-KK 3	27 70 21 5	50
ATP-UK	30 03 22 4	50
PSB 3/10/4	06 01 29 2	100
PSBJ 3/13/4	02 01 30 4	100
ZB 5 (for order data, see page 335)		
SZS 0.6 x 3.5	12 05 05 3	10

Type	Order No.	Pcs. Pkt.
UK 3 N ²⁾	30 01 50 1	50
UK 3 N BU ²⁾	30 01 51 4	50
D-UK 4/10	30 03 02 0	50
D-UK 4/10 BU	30 03 10 1	50
FBR1 10-5 N	I _{max} : 30 A 27 70 64 2	10
EBL 2-5	I _{max} : 24 A 23 03 14 5	10
EBL 3-5	24 A 23 03 15 8	10
EBL 10-5	24 A 23 03 13 2	10
TS-K	13 02 21 5	50
ATP-UK	30 03 22 4	50
PSB 3/10/4	06 01 29 2	100
PSBJ 3/13/4	02 01 30 4	100
ZB 5 (for order data, see page 335)		
SZS 0.6 x 3.5	12 05 05 3	10

Type	Order No.	Pcs. Pkt.
UK 5 N ²⁾	30 04 36 2	50
UK 5 N BU ²⁾	30 04 38 8	50
D-UK 4/10	30 03 02 0	50
D-UK 4/10 BU	30 03 10 1	50
FBR1 10-6	I _{max} : 41 A 02 03 25 0	10
EB 2-6	I _{max} : 32 A 02 01 15 5	100
EB 3-6	32 A 02 01 14 2	100
EB 10-6	32 A 02 01 13 9	10
ISSBI 10-6	I _{max} : 30 A 03 01 50 5	10
IS-K 4	13 02 33 8	100
USBR 2-7	I _{max} : 34 A 23 03 23 9	1
TS-K	13 02 21 5	50
ATP-UK	30 03 22 4	50
PSB 3/10/4	06 01 29 2	100
PSBJ 3/13/4	02 01 30 4	100
ZB 6 (for order data, see page 335)		
SZS 0.6 x 3.5	12 05 05 3	10

5.2 / 42.5 / 1.5
42 / 49.5 / 4724 / 2.5
2.5 / 2.5
8 / 3
III / I

0.25 - 2.5 / 0.25 - 1

0.2 - 1 / 0.25 - 1
0.25 - 1
0.5 - 1.5
7
A 3
M 3
0.6 - 0.8
PA
V2300 / 20 / 30 - 12
300 / 20 / 28 - 125.2 / 42.5 / 1.8
47 / 54.5 / 5232 / 4
4 / 2.5
8 / 3
III / I

0.25 - 2.5 / 0.25 - 1.5

0.2 - 1.5 / 0.2 - 1.5
0.25 - 1.5
0.5 - 1
8
A 3
M 3
0.6 - 0.8
PA
V2600 / 20 / 28 - 12
600 / 20 / 28 - 126.2 / 42.5 / 1.8
47 / 54.5 / 5241 / 6
4 / 4
8 / 3
III / I

0.25 - 4 / 0.25 - 2.5

0.2 - 1.5 / 0.2 - 1.5
0.25 - 1.5
0.5 - 2.5
8
A 4
M 3
0.6 - 0.8
PA
V0600 / 30 / 30 - 10
600 / 40 / 28 - 10



UK 5-MTK-P/P

with female test connector screws



MTK-LOE

with screw / solder connection



MTK-TP

with screw, WW or TP connection

Terminal width 6.2

(IEC) [mm ²]	rigid solid	flexible stranded	AWG	I [A]	U [V]
Connection data	0.2-4	0.2-4	24-12	16	500

Terminal width 5.2

(IEC) [mm ²]	rigid solid	flexible stranded	AWG	I [A]	U [V]
Connection data	0.2-4	0.2-2.5	24-12	12	400
Solder connection	0.2-1.5	0.2-1.5	24-16	12	400
Slip-on connection	2.8 x 0.8 mm			2)	2)

Terminal width 5.2

(IEC) [mm ²]	rigid solid	flexible stranded	AWG	I [A]	U [V]
Connection data	0.2-4	0.2-2.5	24-12		
WW conn. [mm]	1 x 1		26-20	10	25
TP conn. [mm]	1.6 x 0.8		28-22	10	25
TP conn. [mm]	2.4 x 0.8		24-20	10	12



Type	Order No.	Pcs. Pkt.
UK 5-MTK-P/P	30 04 03 2	50
Closed housing, without cover		
EB 2-6	I_{max} : 12 A 02 01 15 5	100
EB 3-6	12 A 02 01 14 2	100
EB 10-6	12 A 02 01 13 9	10
ATP-UK 5-MTK 2 mm thick	30 04 21 0	50
SZG 0,6 x 3,5	12 05 12 1	10
ZB 6 (for order data, see page 335)		



Type	Order No.	Pcs. Pkt.
MTK-LOE/LOE	31 05 01 2	50
MTK-LOEL 1)	31 07 01 0	50
MTK-LOE/LOE	31 09 01 8	50
D-MTK D-MTK BU	31 01 02 9	50
	31 01 09 0	50
ATS-MTK	31 01 22 3	50
SZS 0,6 x 3,5	12 05 05 3	10
ZB 5 (for order data, see page 335)		

Type	Order No.	Pcs. Pkt.
MTK-WW (1 x 1) 1	31 10 11 7	5
MTK-TP (2,4 x 0,8) 1L	31 10 41 8	50
MTK-TP (2,4 x 0,8) 1Q	31 10 51 5	50
D-MTK D-MTK BU	31 01 02 9	50
	31 01 09 0	50
EBL 2-5	I_{max} : 11 A 23 03 14 5	10
EBL 3-5	11 A 23 03 15 8	10
EBL 10-5	11 A 23 03 13 2	10
ATS-MTK	31 01 22 3	50
SZS 0,6 x 3,5	12 05 05 3	10
ZB 5 (for order data, see page 335)		

6.2 / 51 / -
58.5 / 66 / 63.516 / 4
4 / 4
6 / 3
III / I

0.25 - 4 / 0.25 - 2.5

0.2 - 1.5 / 0.2 - 1.5
0.25 - 1.5
0.5 - 2.5
8
A 4
M 3
0.5 - 0.6
PA
V0600 / 15 / 22 - 12
600 / 15 / 18 - 10MTK-LOE... // MTK-LOE/LOE
5.2 / 57.5 / 1 // 5.2 / 69 / 1
51.5 / 59 / 5612 / 4
-
6 / 3
III / I

0.25 - 2.5 / 0.25 - 2.5

0.2 - 1.5 / 0.2 - 1.5
0.25 - 1
0.5 - 1.5
7
A 3
M 3
0.5 - 0.6
PA
V0300 / 10 / 28 - 12
-5.2 / 46 / 1
67 / 74.5 / 7210 / 4
4 / 4
4 / 3
III / I

0.25 - 2.5 / 0.25 - 2.5

0.2 - 1.5 / 0.2 - 1.5
0.25 - 1
0.5 - 1.5
7
A 3
M 3
0.5 - 0.6
PA
V0

-

-

Phoenix Contact

AC Power Devices

TD DINLINE Surge Diverter



TD™ DINLINE

Transient Discriminating™ (TD™) Technology represents a quantum leap in transient suppression technology for mains powered equipment. It offers a new level of safety and reliability, yet retains optimum protection levels critical for sensitive electronic equipment.

FEATURES

- TD™ Technology for superior service life
- Low let-through voltage
- UL1449 Edition 2 Recognised
- Extra fast transient withstand
- High over-voltage withstand
- Meets international EMC/RFI specifications
- Multipulse capability

ORDERING INFORMATION

Item Number	Description
TDS 140-2S-120	DINLINE SPD, TDS, 1Ph, 40kA, 120V
TDS 140-2S-277	DINLINE SPD, TDS, 1Ph, 40kA, 277V
TDS 180-4S-120	DINLINE SPD, TDS, 1Ph, 80kA, 120V
TDS 180-4S-277	DINLINE SPD, TDS, 1Ph, 80kA, 277V
TDS 1160-8S-120	DINLINE SPD, TDS, 1Ph, 160kA, 120V
TDS 1160-8S-277	DINLINE SPD, TDS, 1Ph, 160kA, 277V
TDS 50-120	DINLINE SPD, TDS, 1Ph, 3M, 20+20+10kA, 120V
TDS 50-240	DINLINE SPD, TDS, 1Ph, 3M, 20+20+10kA, 240V

SPECIFICATIONS

Operation

	TD\$1xx-xS-120	TD\$1xx-xS-277
Nominal Line Voltage:	100-120 Vrms	220-277 Vrms
Frequency:	50 / 60 Hz	50 / 60 Hz
Leakage Current:	< 4 mA	
MCOV (Ph-N, Ph-E, N-E):	240 Vrms	480 Vrms
Max Surge Rating:		
8/20µs	40kA 80kA 160kA	40kA 80kA 160kA
10/350µs	8kA 16kA 32kA	8kA 16kA 32kA
Energy Rating:	1920J 3840J 7680J	1920J 3840J 7680J
Aggregate Surge Material:		
8/20µs	80kA 160kA 320kA	80kA 160kA 320kA
Let-through Voltages:		
@ 3kA 8/20µs	< 480V	< 750V
Let-through Voltages:		
@ 20kA 8/20µs	< 760V	< 980V
Surge Rated to Meet:	ANSI/IEEE C62.41-1991 Cat A, B and C Zone 0/1, Class B/C	

Operation

	TD\$50-120	TD\$50-240
Nominal Line Voltage:	100-120 Vrms	220-277 Vrms
Frequency:	50 / 60 Hz/DC	50 / 60 Hz
Leakage Current:	< 0.2 mA	
MCOV (Ph-N, Ph-E, N-E):	170 Vrms	340 Vrms
Max Surge Rating:		
8/20µs	50kA (20+20+10kA) (L-N, L-G, N-G)	50kA (20+20+10kA) (L-N, L-G, N-G)
Energy Rating:	1390J	1390J
Aggregate Surge Material:		
8/20µs	58kA	
UL1449 SVR Rating:		
@ 500A	330V	700V
Let-through Voltages:		
@ 3kA 8/20µs	< 500V	< 800V
Surge Rated to Meet:	ANSI/IEEE C62.41-1991 Cat A, B Zone 2, Class C	

Alarms and Indicators

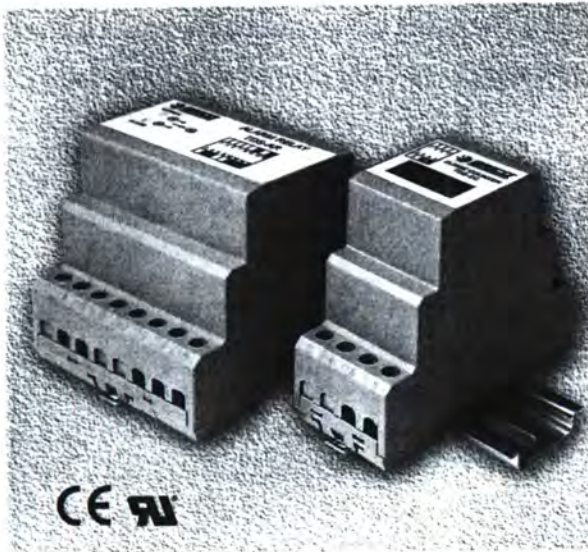
Status Indication:	Staged LED, opto coupler Voltage free contact 2A @ 250VAC Available with Alarm relay module
--------------------	---

Physicals

Temperature and Humidity:	-35°C to +55°C, 0-90%
Terminals:	1.0mm ² to 6.0mm ²
Dimensions (WxDxH):	2M (36mm), 4M (72mm), 8M(144mm)
Weight:	200g (2M), 350g (4M), 700g (8M)
Listing:	UL Recognized Component AS3260, IEC950, C Tick
Warranty:	5 years

AC Power Devices

DINLINE Accessories



FEATURES

TDS Alarm Relay accessory

- For use with external alarm & monitoring systems
- Potential free change-over contacts
- Electronic indicators ideal for poorly illuminated locations
- UL 1449 Edition 2 Recognised

TDS Surge Counter accessory

- No power supply or batteries required to maintain counter
- Multiple diverters can be monitored by a single TDS-SC
- Accidental erasure prevented by non-resettable counter

Alarm Relay & Surge Counter

ERICO's TDS-AR Alarm Relay is an accessory to the TDF and TDS series of surge protection devices. These provide internal monitoring and visual indication of their protection status. The TDS-AR connects to a opto-output and provides a fully isolated potential free changeover alarm contact.

In addition, where the supply voltage is stable the DINLINE Alarm Relay (DAR-275) can be installed. Not only does it provide the same level of internal monitoring and visual indication as the TDS-AR, it has the added benefit of being more cost effective.

The TDS Surge Counter (TDS-SC) is a companion product to the surge diverters and can be used for site monitoring, building information management and predictive maintenance. The TDS-Surge Counter allows accurate and reliable recording of the number of impulses diverted by monitoring the surge current flow. It is powered by the surge energy - no additional power supply or batteries are required. A current transformer provides isolation from the measured circuit and allows monitoring of multiple diverters/filters.

ORDERING INFORMATION

Item Number	Description
TDS-AR	DINLINE ALARM RELAY,TDS, 90-275V
TDS-SC	DINLINE SURGE COUNTER,TDS WITH CT
DAR-275V	DINLINE ALARM RELAY,90V TO 275V
DSC-150V	DINLINE SURGE COUNTER,150V
DSC-275V	DINLINE SURGE COUNTER,275V

SPECIFICATIONS

Operation

Nominal line voltage V_{rms} :
Contact types:

TDS-AR

90-275
Change over,
2A 30VDC,
250VAC

DAR-275

90-275
Change over,
2A 30VDC,
250VAC

Physicals

Enclosure style:
Dimensions (W x D x H):
Warranty:
Listing:

DIN 43880
36 x 88 x 70mm
5 years
UL Recognized

DIN 43880
36 x 88 x 70mm
5 years
-

Operation

Maximum count:
Sensitivity:

TDS-SC

9999
300A 8/20 μ s

DSC

9999
300A 8/20 μ s

Physicals

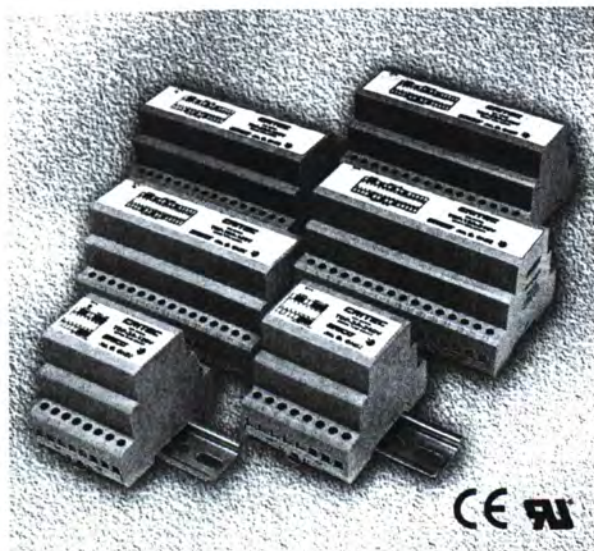
Enclosure style:
Dimensions (W x D x H):
Warranty:
Listing:

DIN 43880
36 x 88 x 70mm
5 years
UL Recognized

DIN 43880
36 x 88 x 70 mm
5 years
-

AC Power Devices

Transient Discriminating™ Filter



FEATURES

- Transient Discriminating™ Technology ensures safe operation during abnormal over-voltage events
- Remote protection status monitoring and LED indication
- Compact design fits into most switch and distribution boards
- Models available for all power distribution system types
- High surge rating 50kA ensures long service life
- Optional Alarm Relay and Surge Counter can be retrofitted
- Easy installation - simply clips onto 35mm DIN rail
- UL1449 Edition 2, UL1283 recognised CSA 22.2, C-Tick
- Surge rated to meet ANSI / IEEE C62.41 Cat A, Cat B, Cat C, AS / NZS 1768-1991 Cat A, B, C

TDF

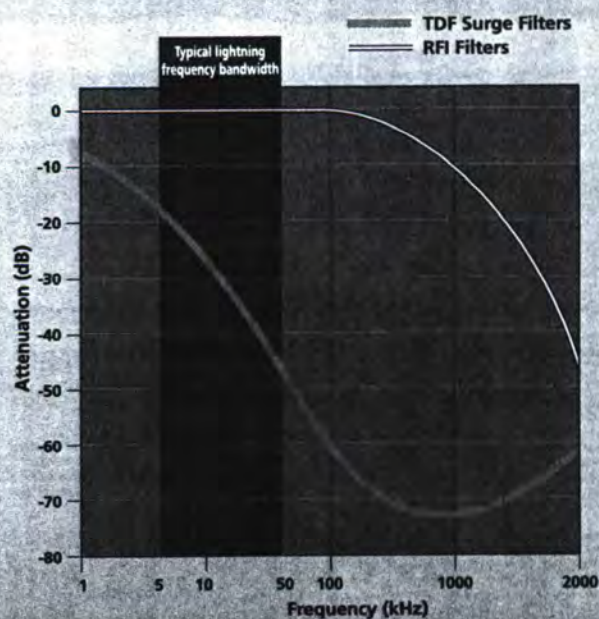
The new Transient Discriminating™ Filter family of two port (or series) SPDs offers high performance and reliable protection from power transients with the convenience of easy installation on 35mm DIN rail mountings. The TDF series has been specifically designed and strongly recommended for protection of critical electronic equipment with the advantage of a robust performance against poor voltage regulation.

The space efficient TDF provides some 65dB attenuation to transients, which not only improves the products residual voltage performance, but assists greatly in reducing the steep rates of voltage and current rise, providing superior protection for sensitive electronic equipment.

Units are available for 3A, 10A and 20A loads and in a range of voltages including 110-120V AC/DC and 240V AC.

ORDERING INFORMATION

Item Number	Description
TDF-3A-240V	TDF,1 PHASE,3A,240V
TDF-10A-240V	TDF,1 PHASE,10A,240V
TDF-20A-240V	TDF,1 PHASE,20A,240V
TDF-3A-120V	TDF,1 PHASE,3A,120V
TDF-10A-120V	TDF,1 PHASE,10A,120V
TDF-20A-120V	TDF,1 PHASE,20A,120V



Frequency Performance of TDF-20A Filter

Lightning frequency transients generally occur in the 5-50kHz bandwidth. The TDF is designed to provide effective filtering for frequencies across the spectrum, from lightning up to RFI frequencies. A low pass filter with cut-off frequency above this bandwidth, will offer no filtering to such a transient.



Protector Trip Relays

250 Series DIN Rail and Wall Mounted - Phase Balance

Application:

- >> Motor protection
- >> Motors - Single Phasing
- >> Gensets - correct engine rotation
- >> All portable equipment
- >> All rotating machines



The Crompton Protector Phase Balance module provides continuous surveillance of a 3 phase, 3 or 4 wire system and protects against:

- Phase Loss, Reversal or Sequence
- Phase Unbalance
- System Under Voltage

Introduction

This Crompton Protector is designed to comprehensively monitor the three phase supply. It monitors the correct phase rotation or sequence of three phase supply systems. Rotating machines are particularly vulnerable to incorrect phase sequence. Three phase motors can rotate in the wrong direction, potentially leading to physical damage or the risk of injury to personnel, yet voltage and current readings may appear normal. If one phase is lost because of a blown fuse, electric motors can continue to operate (single phasing) which can result in severe electrical or mechanical damage.

This relay has the added advantage that it will detect the phantom or regenerated phase that can be caused by a single phase failure on some equipment or when running motors at low load levels.

An unbalanced supply voltage can lead to temperature rises in motors. An unbalance voltage as little as 10% can increase operating temperature to 150% of normal.

For permanent installations, this relay should be used to monitor the incoming supply, protecting all equipment against incorrect connection at initial installation or after maintenance work. Rotating machines that cannot tolerate reverse rotation or pose significant risk to personnel under this condition should be individually protected with this relay. The possibility of incorrect supply connection is much more likely in portable equipment or marine applications.

We also manufacture front of panel mounting phase sequence indicators



Product Function

The protector continuously monitors the three phase supply. With the correct phase sequence applied and all three voltages are balanced within the required limits, the front panel LED will illuminate and the output relay will be energized. An incorrect sequence, missing phase, out of balance or under voltage condition will de-energize the relay, and the LED will be extinguished.

The setpoint control allows adjustment of the voltage matching between 5% and 15%.

The time delay function operates only for the voltage unbalance condition. The delay can be used to prevent nuisance tripping due to short term unbalance situations. Incorrect phase rotation, a missing phase or an under voltage condition trip the relay immediately.

Protection against:

- Incorrect phase sequence
- Loss of one phase
- Under voltage
- Unbalanced voltage
- A phantom or regenerated phase voltage

Protector Trip Relays

250 Series DIN Rail and Wall Mounted - Phase Balance

Specification

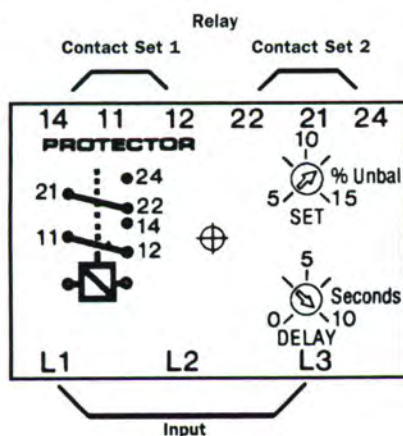
Approvals:	U.L. recognised CSA approved up to 480V.	Set Points:	
System:	3 phase, 3 or 4 wire Frequency: 50 or 60Hz	Unbalance:	Adjustable 5% to 15%
Nominal Voltage:	100, 110, 120, 208, 277, 220, 230, 240, 380, 400, 415, 440 & 480V	Time Delay:	Up to 10 seconds adjustable
Burden:	3VA approx.	Under Voltage (Type 252-PSG only):	Internally preset at 15% of nominal voltage (other values between 10% and 30% available on request) (not operative if voltage falls below 70% of the nominal voltage or set point on type 252-PSG)
Voltage Withstand:	1.2 x continuously 1.5 x for 10 x 10 seconds		

Product Code Examples

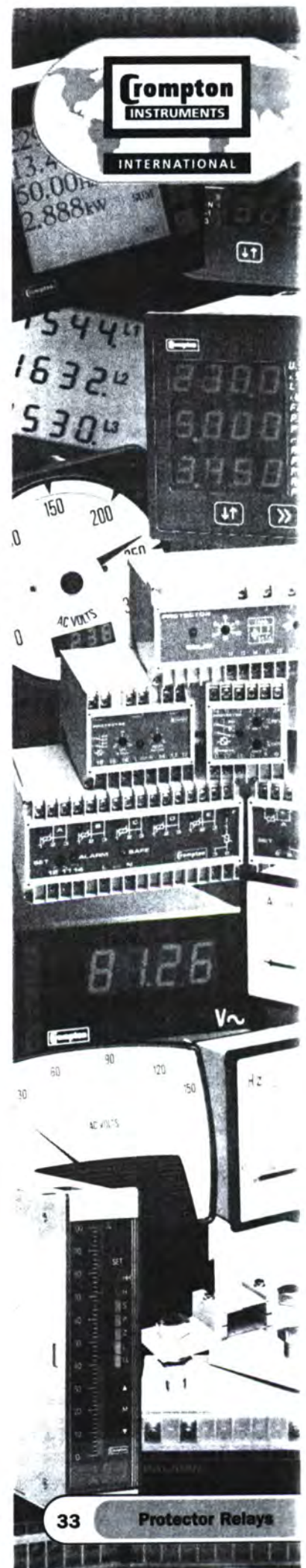
Relay	Input	Protection	ANSI No.	Catalogue No.
3 Phase 3 or 4 Wire	120V L-L 60Hz	Phase loss & unbalance	47	252-PSFU-PQBX-C6
	480V L-L 60Hz	Phase loss & unbalance	47	252-PSFU-SEBX-C6
	120V L-L 60Hz	Phase loss, unbalance, under voltage	47/27	252-PSGU-PQBX-C6-T1-IA
	480V L-L 60Hz	Phase loss, unbalance, under voltage	47/27	252-PSGU-SEBX-C6-T1-IA

Connection Diagrams

252-PSF
252-PSG



Note: No neutral connection is required





Features

- » For high frequency or linear full scale A.C. measurements
- » These instruments measure average values of sinusoidal waveforms and are scaled in r.m.s. values
- » The high quality silicon bridge rectifier gives a linear scale down to near zero, where some compression occurs



Features

- » The two instruments in one case can be used to measure a wide range of Currents or Voltages

Benefits

- » Dual Instruments save both panel space and assembly time

Application

- » For independent measurement of 2 parameters in one case or the comparison of the two inputs. For example, when an A.C. generator is to be connected in parallel with mains supply where voltage, phase and frequency must coincide



240 Series DIN Panel Meters

Moving Coil Rectified A.C. Ammeters and Voltmeters



Model

Bezel Size mm	48	72	96	144
Scale length mm	42	65	94	145
Product Code				
Ammeters	242-89B	243-01B	244-01B	246-10B
Voltmeters	242-89W	243-01W	244-01W	246-10W

Accuracy: 1.5% ES

Ratings:

Ammeters: Model 242 from 250 μ A to 20mA
Model 243 from 250 μ A to 1A
Models 244/246 from 250 μ A to 20A

Voltmeters:

15V to 600V a.c. direct connected
Models available for use with V.T.s
50/60Hz, (Single Frequencies
25Hz to 3kHz on request)

Frequency:



Model

Bezel Size mm	48	72	96	144
Scale length mm	72	112	150	230
Product Code				
Ammeters	242-05B	243-05B	244-05B	246-05B
Voltmeters	242-05W	243-05W	244-05W	246-05W

Accuracy: 1.5 % ES

Ratings:

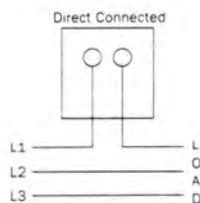
Ammeters: 250 μ A to 1A A.C.
Up to 30A on models 244/246-05B

Voltmeters:

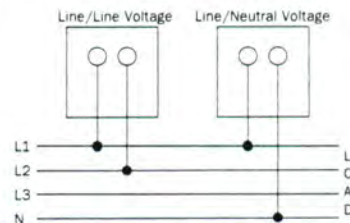
15V to 600V Direct connected
Models available for use with V.T.s
50/60Hz, (Single frequencies
25Hz to 3kHz on request)

Frequency:

A.C. Ammeter



A.C. Voltmeter



Dual A.C. Ammeters and Voltmeters



Model

Bezel Size mm	96
Scale length mm	65

Product Code

Ammeters	244-80F
Voltmeters	244-80L

Accuracy: 1.5% ES

Ratings:

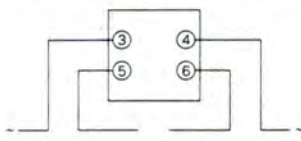
Ammeter: 250 μ A to 10A A.C.

Voltmeter:

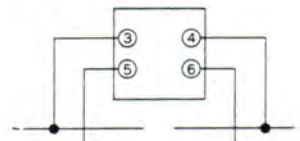
Frequency:

15 to 600V direct connected
50/60Hz (single frequencies
25Hz to 3kHz on request)

Dual A.C. Ammeter Direct Connected



Dual A.C. Voltmeter






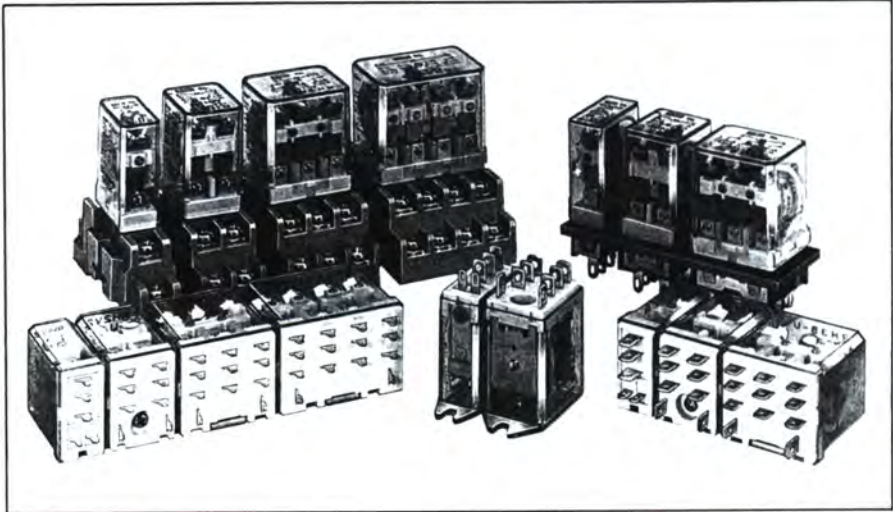
RH SERIES POWER RELAYS

Midget Power Type Relays













































Large Capacity 10A — 1, 2, 3, and 4 Poles

The RH series is a miniature power relay with large capacity. The RH series features 10A contact capacity as large as RR series and the same size as IDEC's miniature relays. Compact in size, the RH series is ideal for installation in small equipment.

- , , and  represent UL recognized, CSA certified and TÜV approved models, respectively.
- Each coil voltage indication is color-coded for identification.
 24V AC: Brown,
 100V AC, 100-110V AC: Blue
 120V AC, 110-120V AC: Pink,
 200V AC, 200-220V AC: Red
 220V AC: White,
 240V AC, 220-240V AC: Purple
 12V DC: Black, 24V DC: Brown
 100-110V DC: Blue



TYPES

Terminal Style	Type	Contact Configuration	SPDT	DPDT	3PDT	4PDT
Blade Terminal 	Basic Type	  RH1B-U	  RH2B-U	  RH3B-U	  RH4B-U	
	With Indicator	RH1B-L	  RH2BU-L	  RH3B-UL	  RH4B-UL	
	With Check Button	—	  RH2B-UC	  RH3B-UC	  RH4B-UC	
	Top Bracket Mounting Type	  RH1B-UT	  RH2B-UT	  RH3B-UT	  RH4B-UT	
	With Diode (DC coil only)	RH1B-D	RH2B-D	RH3B-D	RH4B-D	
	With Indicator and Diode (DC coil only)	—	RH2B-LD	RH3B-LD	RH4B-LD	
	With Resistor and Capacitor (100V AC and over coil)	RH1B-R	RH2B-R	—	—	
	With Indicator and RC (100V AC and over coil)	RH1B-LR	RH2B-LR	—	—	
PC Board Terminal (2mm-wide) 	Basic Type	  RH1V2-U	  RH2V2-U	 RH3V2-U	 RH4V2-U	
	With Indicator	RH1V2-L	  RH2V2-UL	 RH3V2-UL	 RH4V2-UL	
	With Check Button	—	  RH2V2-UC	 RH3V2-UC	 RH4V2-UC	
	Top Bracket Mounting Type	—	—	—	—	
	With Diode (DC coil only)	RH1V2-D	RH2V2-D	RH3V2-D	RH4V2-D	
	With Indicator and Diode (DC coil only)	—	RH2V2-LD	RH3V2-LD	RH4V2-LD	
	With Resistor and Capacitor (100V AC and over coil)	RH1V2-R	RH2V2-R	—	—	
	With Indicator and RC (100V AC and over coil)	RH1V2-LR	RH2V2-LR	—	—	

• ORDERING INFORMATION

When ordering, specify the type No. and rated coil voltage.

[Example]

RH2B-U AC100-110

Type No. Rated Coil Voltage

RH SERIES POWER RELAYS

COIL RATINGS

Rated Voltage (V)					Rated Current (mA) ±15% at 20°C								Coil Resistance (Ω) ±10% at 20°C				Operation Characteristics (against rated values at 20°C)		
	SPDT	DPDT	3PDT	4PDT	50Hz				60Hz								Max. Continuous Applied Voltage	Min. Pickup Voltage	Dropout Voltage
					SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT			
AC (50/60Hz)	6	6	6	6	170	240	330	387	150	200	280	330	18.8	9.4	6	5.4	110%	80% maximum	30% minimum
	12	12	12	12	86	121	165	196	75	100	140	165	76.8	39.3	25.3	21.2			
	24	24	24	24	42	60.5	81	98	37	50	70	83	300	153	103	84.5			
	50	50	50	50	20.5	28.9	39.5	47	18	24	34	40	1,280	680	460	340			
	100	100-110	100	100	10.5	10.3-11.8	20	23.5	9	9.1-10.0	17	20	5,220	3,360	1,940	1,560			
	110	—	110	110	9.5	—	18.1	21.6	8.4	—	15.5	18.2	6,950	—	2,200	1,800			
	115	110-120	115	115	8.9	9.4-10.8	17.1	20.8	7.8	8.0-9.2	14.8	17.5	7,210	4,290	2,620	1,910			
	120	—	120	120	8.6	—	16.4	19.5	7.5	—	14.2	16.5	8,100	—	2,770	2,220			
	—	200-220	200	200	—	5.1-5.9	9.8	11.8	—	4.3-5.0	8.5	10	—	13,690	8,140	6,360			
	—	—	220	220	—	—	8.8	10.7	—	—	7.7	9.1	—	—	10,800	7,360			
	—	220-240	230	230	—	4.7-5.4	8.5	10.3	—	4.0-4.6	7.4	8.7	—	18,820	11,500	8,520			
	—	—	240	240	—	—	8.2	9.8	—	—	7.1	8.3	—	—	12,100	9,120			
DC	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	110%	80% maximum	10% minimum
	6	6	6	6	128	150	240	250	47	40	25	24	—	—	—	—			
	12	12	12	12	64	75	120	125	188	160	100	96	—	—	—	—			
	24	24	24	24	32	36.9	60	62	750	650	400	388	—	—	—	—			
	48	48	48	48	18	18.5	30	31	2,660	2,600	1,600	1,550	—	—	—	—			
	—	100-110	100	100	—	8.2-9.0	14.5	15	—	12,250	6,900	6,670	—	—	—	—			
	—	—	110	110	—	—	—	12.8	15	—	—	8,600	7,340	—	—	—			

Note: For other rated voltages, contact IDEC.

CONTACT RATINGS

Type	Switching Voltage (V)	Continuous Current (A)	Maximum Contact Capacity				Rated Load (A)	
			Allowable Contact Power		Voltage (V)	Resistive Load	Inductive Load $\cos\phi=0.3$ L/R=7 msec	
			Resistive Load	Inductive Load				
SPDT	250 AC 125 DC	10	1540VA AC 300W DC	990VA AC 210W DC	110 AC	10	7	
					220 AC	7	4.5	
					30 DC	10	7	
DPDT 3PDT 4PDT	250 AC 125 DC	10	1650VA AC 300W DC	1100VA AC 225W DC	110 AC	10	7.5	
					220 AC	7.5	5	
					30 DC	10	7.5	

• UL Ratings

Voltage	Resistive			General Use			Horse Power Rating		
	RH1 RH2	RH3	RH4	RH1 RH2	RH3	RH4	RH1 RH2	RH3	RH4
240V AC	10A	7.5A	7.5A	7A	6.5A	5A	1/3HP	1/3HP	—
120V AC	—	10A	10A	—	7.5A	7.5A	1/6HP	1/6HP	—
30V DC	10A	10A	—	7A	—	—	—	—	—
28V DC	—	—	10A	—	—	—	—	—	—

• CSA Ratings

Voltage	Resistive				General Use				Horse Power Rating
	RH1	RH2	RH3	RH4	RH1	RH2	RH3	RH4	
240V AC	10A	10A	—	7.5A	7A	7A	7A	5A	1/3HP
120V AC	10A	10A	10A	10A	7.5A	7.5A	—	7.5A	1/6HP
30V DC	10A	10A	10A	10A	7A	7.5A	—	—	—

SPECIFICATIONS

Contact Material	Silver cadmium oxide
Contact Resistance	50m Ω maximum (initial value)
Minimum Applicable Load	24V DC/30mA, 5V DC/100mA (reference value)
Operate Time	SPDT/DPDT: 20 msec maximum (at the rated voltage) 3PDT/4PDT: 25 msec maximum (at the rated voltage)
Release Time (Note 1)	SPDT/DPDT: 20 msec maximum (at the rated voltage) 3PDT/4PDT: 25 msec maximum (at the rated voltage)
Power Consumption (Approx.)	SPDT AC: 1.1 VA (50Hz), 1 VA (60Hz) DC: 0.8W
	DPDT AC: 1.4 VA (50Hz), 1.2 VA (60Hz) DC: 0.9W
	3PDT AC: 2 VA (50Hz), 1.7 VA (60Hz) DC: 1.5W
	4PDT AC: 2.5 VA (50Hz), 2 VA (60Hz) DC: 1.5W
Insulation Resistance	100M Ω minimum (500V DC megger)
Dielectric Strength	SPDT Between live and dead parts: 2,000V AC, 1 minute (Note 2) Between contact and coil: 2,000V AC, 1 minute Between contacts of the same pole: 1,000V AC, 1 minute
	DPDT Between live and dead parts: 2,000V AC, 1 minute 3PDT Between contact and coil: 2,000V AC, 1 minute 4PDT Between contacts of different poles: 2,000V AC, 1 minute Between contacts of the same pole: 1,000V AC, 1 minute
Maximum Frequency Response	Electrical 1,800 operations/hour
	Mechanical 18,000 operations/hour
Temperature Rise	Coil: 85 deg maximum, Contact: 65 deg maximum
Vibration Resistance	Operating extremes Frequency: 10 to 55Hz, Amplitude: 1.0mm p-p
	Damage limits Frequency: 10 to 55Hz, Amplitude: 1.0mm p-p
Shock Resistance	Operating extremes SPDT/DPDT: 200 m/sec ² (Approx. 20G) 3PDT/4PDT: 100 m/sec ² (Approx. 10G)
	Damage limits 1,000 m/sec ² (Approx. 100G)
Life	Electrical DPDT: 500,000 operations minimum (110V AC, 10A) SPDT/3PDT/4PDT: 200,000 operations minimum (110V AC, 10A)
	Mechanical 50,000,000 operations minimum
Operating Temperature	SPDT: -25 to +50°C DPDT/3PDT/4PDT: -25 to +40°C (Note 3)
Weight (Approx.) (Basic type)	SPDT: 24g, DPDT: 37g, 3PDT: 50g, 4PDT: 74g

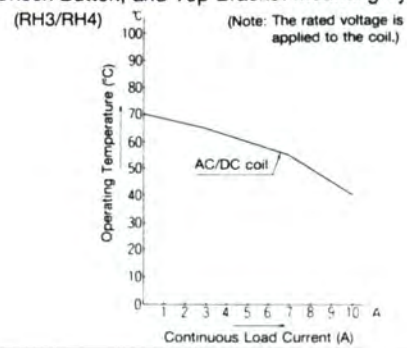
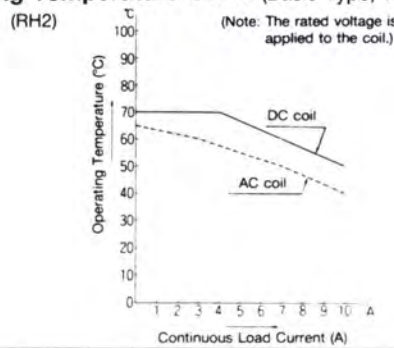
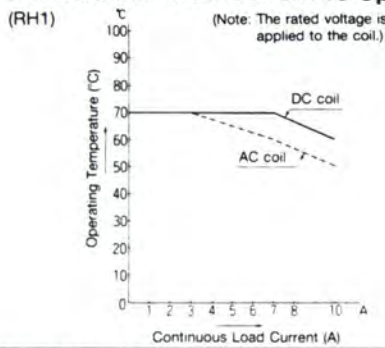
Note 1: Relay with diode: 40 msec

Note 2: Relay with indicator or diode: 1,000V AC, 1 minute

Note 3: For use under different temperature conditions, refer to Continuous Load Current vs Operating Temperature Curve. The operating temperature of RH series power relays with indicator, diode, resistor and capacitor ranges from -25 to +40°C.

RH SERIES POWER RELAYS

• Continuous Load Current vs Operating Temperature Curve (Basic Type, With Check Button, and Top Bracket Mounting Type)



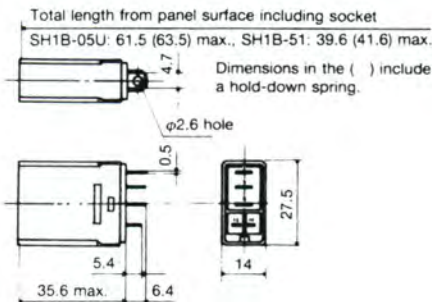
DIMENSIONS

All dimensions in mm.

RH1B-U/RH1B-L/RH1B-D



(Photo: RH1B-U)



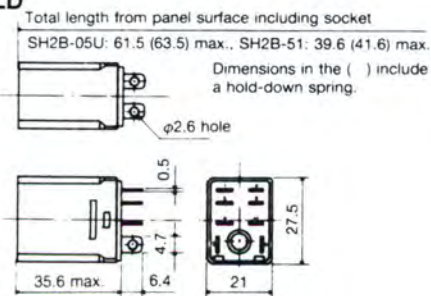
• Applicable Sockets & Hold-down Springs

Socket		Hold-down Spring
Mounting Style	Type No.	
DIN Rail Mount Socket	SH1B-05U	SFA-101
	SH1B-05C	SFA-202
Panel Mount Socket	SH1B-51	SY4S-51F1
PC Board Mount Socket	SH1B-62	SFA-301
		SFA-302

RH2B-U/RH2B-UL/RH2B-D/RH2B-LD



(Photo: RH2B-U)



• Applicable Sockets & Hold-down Springs

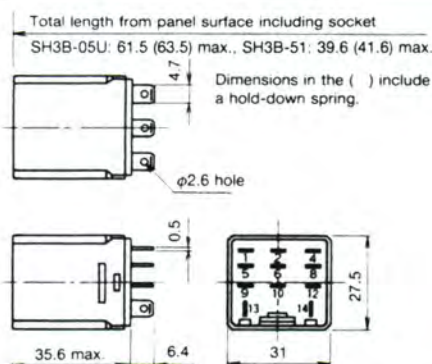
Socket		Hold-down Spring
Mounting Style	Type No.	
DIN Rail Mount Socket	SH2B-05U	SFA-101
	SH2B-05C	SFA-202
Panel Mount Socket	SH2B-51	SY4S-51F1
PC Board Mount Socket	SH2B-62	SY4S-02F1
		SFA-301
		SFA-302

Note 1: (SY4S-02F1) is for the relay with check button.
Note 2: SFA-302 and SFA-301 are not applicable to SH2B-62.

RH3B-U/RH3B-UL/RH3B-D/RH3B-LD



(Photo: RH3B-U)



• Applicable Sockets & Hold-down Springs

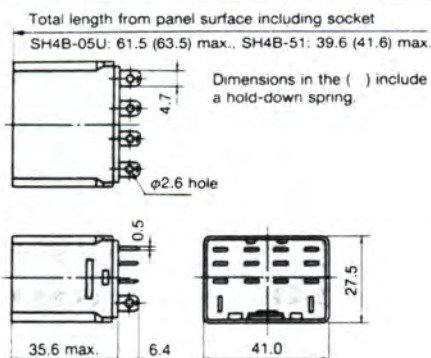
Socket		Hold-down Spring
Mounting Style	Type No.	
DIN Rail Mount Socket	SH3B-05U	SFA-101
	SH3B-05C	SFA-202
Panel Mount Socket	SH3B-51	SY4S-51F1
PC Board Mount Socket	SH3B-62	(SH3B-05F1)
		SFA-301
		SFA-302

Note: (SH3B-05F1) is for the relay with check button.

RH4B-U/RH4B-UL/RH4B-D/RH4B-LD



(Photo: RH4B-U)

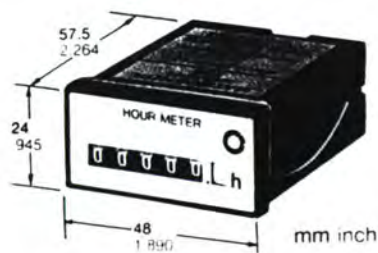


• Applicable Sockets & Hold-down Springs

Socket		Hold-down Spring
Mounting Style	Type No.	
DIN Rail Mount Socket	SH4B-05U	SFA-101
	SH4B-05C	SFA-202
Panel Mount Socket	SH4B-51	SY4S-51F1
PC Board Mount Socket	SH4B-62	(SH4B-02F1)
		SFA-301
		SFA-302

Note 1: (SH4B-02F1) is for the relay with check button.

Note 2: SH4B-51 requires two hold-down springs (SY4S-51F1).

NAISDIN HALF SIZE
HOUR METER**TH63·TH64
Hour Meters**

TH63 (without reset function)



TH64 (with reset function)

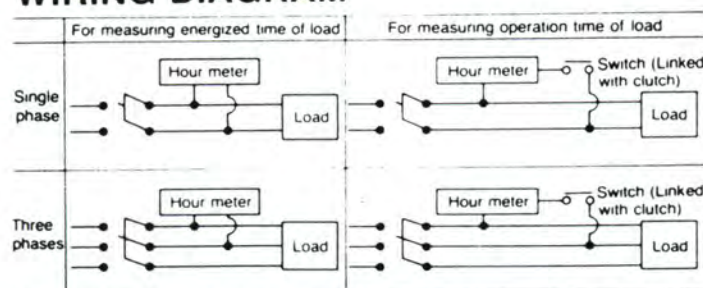
- Compact size offers more panel space.
- Wide measurement range.
- Simple installation.
- High performance motor with 50/60 Hz selection.
- Rotary indicator.
- Time measurement of leased equipment, management of compact equipment operation, maintenance management of various equipment, etc.

PRODUCT TYPE

	Part No.	Rated operating voltage	Max. power consumption	Counting range
TH63 types (without reset)	TH633	12 V AC	Approx. 1.5 W	0 to 99999.9 hours
	TH634	24 V AC		
	TH635	48 V AC		
	TH631	100 V AC		
	TH636	110 V AC		
	TH637	115 to 120 V AC		
	TH632	200 V AC		
	TH638	220 V AC		
	TH639	240 V AC		
TH64 types (with reset)	TH643	12 V AC	Approx. 1.5 W	0 to 9999.9 hours
	TH644	24 V AC		
	TH645	48 V AC		
	TH641	100 V AC		
	TH646	110 V AC		
	TH647	115 to 120 V AC		
	TH642	200 V AC		
	TH648	220 V AC		
	TH649	240 V AC		

SPECIFICATIONS

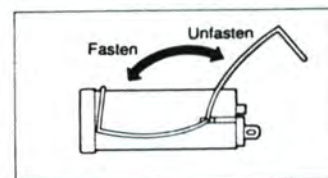
Type	TH63 (without reset)	TH64 (with reset)
Rated operating voltage	12 V AC, 24 V AC, 48 V AC, 100 V AC, 115 to 120 V AC, 200 V AC, 220 V AC, 240 V AC	
Operating voltage range	85 to 115% of rated operating voltage	
Rated frequency	50/60 Hz (selectable by switch)	
Initial insulation resistance (At 500 V DC)	Min. 100 MΩ	
Initial breakdown voltage	Between live and dead metal parts	
Shock resistance	Functional	10 G (4 times on 3 axes)
	Destructive	100 G (5 times on 3 axes)
Vibration resistance	Functional	10 to 55 Hz; 1 cycle/min double amplitude of 0.5 mm (10 min on 3 axes)
Max. temperature rise	55 deg.	
Ambient temperature	-10 to +50°C -14 to +122 F	
Storage temperature	-30 to +60°C -22 to +140 F	
Ambient humidity	Max. 85% RH	
Counting direction	Addition (UP)	

WIRING DIAGRAM

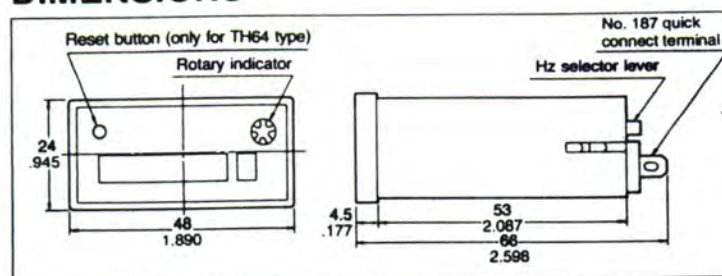
Note: Before operation, check that the Hz selector is set to the power line frequency at the installation site.

MOUNTING

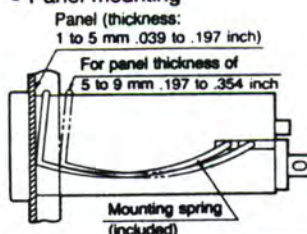
1. Cut a $22.2^{+0.3}_{-0.12} \times 45^{+0.6}_{-0.25}$ mm ($874^{+0.7}_{-0.3} \times 1.772^{+0.24}_{-0.098}$ inch) opening in the panel.
2. Swing the mounting spring to the rear of the hour meter and fit the hour meter into the panel opening. (There is no need to detach the mounting spring from the hour meter.) If the panel is 5 to 9 mm (.197 to .354 inch) thick, move the mounting spring to the other hole toward the rear of the hour meter.
3. Swing the mounting spring to the front of the hour meter to secure the hour meter to the panel.
4. Wire the supplied quick connectors and connect to the hour meter. Be sure to use the supplied insulating sleeves to cover the connectors.

**DIMENSIONS**

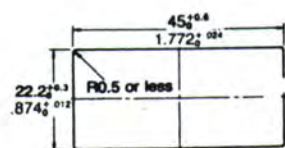
mm inch



• Panel mounting










• Panel cutout dimensions



Complete panel mounted standard units



Now with colour coded contact block

- Protection class IP 66
- Individually packaged



Description	Contact	Cat. No.
Pushbuttons		
Start (green)		N/O
Stop (red)		N/C
Reset (blue)		N/O
Green (blank)		N/O
Red (blank)		N/C
Blue (blank)		N/O
Stop (red extended)		N/C

Illuminated pushbuttons

max 130 V, 3 W filament lamp or 230 240 V neon lamp (lamp not included) ¹⁾






Green		N/O	D5P-LF33DL0X10
Red		N/C	D5P-LF43DL0X01

with series diode and resistor element D5-RL7 for operating voltage 240 V AC using 130 volt filament lamp (lamp not included) ²⁾



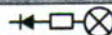

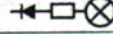
Green		N/O	D5P-LF33RL7X10
Red		N/C	D5P-LF43RL7X01

Pilot lights

max 130 V, 3 W filament lamp or 230 240 V neon lamp (lamp not included) ¹⁾ ²⁾ ³⁾

Green		D5P-P33DL0
Red		D5P-P43DL0
Yellow		D5P-P53DL0
Blue		D5P-P63DL0
Clear		D5P-P73DL0

with series diode and resistor element D5-RL7 for operating voltage 230 240 V AC using 130 volt filament lamp (lamp not included) ¹⁾ ²⁾ ³⁾

Green		D5P-P33RL7
Red		D5P-P43RL7
Yellow		D5P-P53RL7
Blue		D5P-P63RL7
Clear		D5P-P73RL7

- Notes:**
- ¹⁾ Lamps refer to page 76.
 - ²⁾ For spare lens caps refer page 79.
 - ³⁾ New integrated LED lamp block also available. Refer page 76.

Cat. No. D5P-F...
pushbutton with
plastic front ringCat. No. D5P-LF...
illuminated pushbutton
with plastic front ringCat. No. D5P-P...
pilot lamp

Pilot lights

- Protection class IP 66
- Individually packaged

Description	Standard lens cap & diffuser Cat. No.	Standard lens cap & diffuser/metal body Cat. No.
Standard pilot lights – pre-assembled front elements ¹⁾		
Green	D5P-P3	D5M-P3
Red	D5P-P4	D5M-P4
Yellow	D5P-P5	D5M-P5
Blue	D5P-P6	D5M-P6
Clear	D5P-P7	D5M-P7

Description	No diffuser possible plastic body Cat. No.	No diffuser possible metal body Cat. No.
Optically enhanced Pilot lights – pre-assembled front element ²⁾		
Green	D5P-PL3	D5M-PL3
Red	D5P-PL4	D5M-PL4
Yellow	D5P-PL5	D5M-PL5
Blue	D5P-PL6	D5M-PL6
Clear	D5P-PL7	D5M-PL7

Pre-assembled clip-on rear elements with coupling plate ³⁾ ⁴⁾

Standard		D5-3DL0
With series diode and resistor 230/240 V AC		D5-3RL7

Eco-pilot lights

Description	Contact	Standard Cat. No.	Optically enhanced Cat. No.
Complete Eco-pilot light ²⁾ ³⁾ ⁵⁾			
Green		D5P-PM3D0	D5P-PLM3D0
Red		D5P-PM4D0	D5P-PLM4D0
Yellow		D5P-PM5D0	D5P-PLM5D0
Blue		D5P-PM6D0	D5P-PLM6D0
Clear		D5P-PM7D0	D5P-PLM7D0

DL 3-15 indicator lamps

Indicator lamp full voltage ²⁾
for BA 15d lamp ⁶⁾

	Standard lens cap & diffuser/metal body Cat. No.
Green/red/yellow	DL3-15-GRY-M
Blue	DL3-15-B-M
White (clear)	DL3-15-W-M

Notes: ¹⁾ For operating voltage 230/240 V AC using 130 V 3 W filament lamp, order separately, coupling plate **D5-A2L**, series diode and resistor **D5-3R7** and contact block **D5-3LX10**. Refer pages 72 and 73.

²⁾ Order lamps separately refer page 76.

³⁾ Max. 110 V, 3 W, use only neon lamps if 230/240 V is required. For lamps refer page 76.

⁴⁾ For metal rear elements and screw down 2 across contact blocks for D5M operators refer page 78.

⁵⁾ For spare lens caps refer page 79.

⁶⁾ Lamps refer page 76.

⁷⁾ For use in metal enclosures.

Complete panel mounted standard units

Incandescent lamps for use with full-voltage lamp block

Ba9S Style for full-voltage lamp blocks D5-3D0 and D5-3DB0

Nominate voltage 6, 12, 24, 36, 48, 60V - eg Ba9S-I36 V-1.2 W = 6 V.

Description	Cat. No.
1.2 watts	BA9S-I3...V-1.2W
2 watts	BA9S-I3...V-2W

Incandescent lamps for use with resistor diode lamp block

Ba9S Style for full-voltage lamp blocks D5-3R7 and D5-3RL7

Description	Cat. No.
130 V 2.4 W (long life expectancy)	BA9S-I3-130V-2.4W
130 V 2.6 W	BA9S-I3-130V-2.6W

Neon lamps for use with resistor diode lamp block

Ba9S Style for full-voltage lamp blocks D5-3R7 and D5-3RL7

Description	Cat. No.
110 V...127 V clear	BA9S-CN3-110V
220 V...240 V clear	BA9S-CN3-240V

Integrated LED lamp blocks - extended life (100,000+ hours)

Available colours **Red (R), Green (G), Amber (A), Blue (B), White (W)**

Insert corresponding letter at the end of part number eg. D5-3NL3R = RED

Voltage	Approximate permissible leakage current	Description	Cat. No.
24 V AC/DC	3 mA	Lamp block with operator latch	D5-3NL3_
120 V AC	3 mA	Lamp block with operator latch	D5-3NL5_
240 V AC	3 mA	Lamp block with operator latch	D5-3NL7_
24 V AC/DC	3 mA	Lamp block without operator latch	D5-3N3_
120 V AC	3 mA	Lamp block without operator latch	D5-3N5_
240 V AC	3 mA	Lamp block without operator latch	D5-3N7_

LED lamps - Extended life (100,000+ hours) for use with full-voltage lamp block (supplied with built-in shunt resistor)

Ba9S Style for full-voltage lamp blocks D5-3D0 and D5-3DB0

Description	Red Cat. No.	Green Cat. No.	Yellow Cat. No.	Blue Cat. No.
6 V AC/DC	D5-N65R	D5-N65G	D5-N65Y	D5-N65B
12 V AC/DC	D5-N141R	D5-N141G	D5-N141Y	D5-N141B
24 V AC/DC	D5-N157R	D5-N157G	D5-N157Y	D5-N157B
32 V AC/DC	D5-N363R	D5-N363G	D5-N363Y	D5-N363B
48 V AC/DC	D5-N48R	D5-N48G	D5-N48Y	D5-N48B
120 V AC/DC	D5-N321R	D5-N321G	D5-N321Y	D5-N321B

LED multi-chip lamps - Extended life (50,000+ hours) for use with full-voltage lamp block

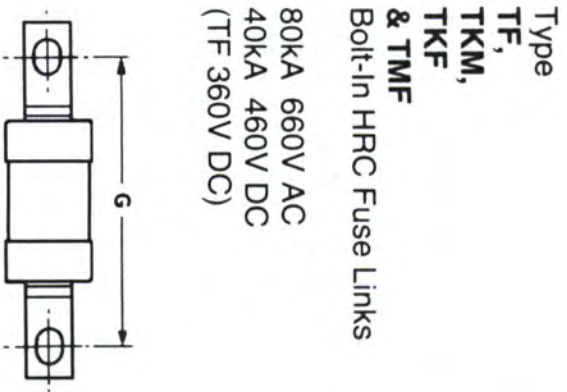
Ba9S Style for full-voltage lamp blocks D5-3D0 and D5-3DB0

Description	Red Cat. No.	Green Cat. No.	Yellow Cat. No.	Blue Cat. No.
8 V AC/DC	BA9S-RL-M-8V ¹⁾	BA9S-GL-M-8V ¹⁾	BA9S-YL-M-8V ¹⁾	
12 V AC/DC	BA9S-RL-M-12V	BA9S-GL-M-12V	BA9S-YL-M-12V	
24 V AC/DC	BA9S-RL-M-24V	BA9S-GL-M-24V	BA9S-YL-M-24V	
32 V AC/DC	BA9S-RL-M-32V	BA9S-GL-M-32V	BA9S-YL-M-32V	
110 V AC/DC	BA9S-RL-M-110V	BA9S-GL-M-110V	BA9S-YL-M-110V	
240 V AC	BA9S-RL-M-240V	BA9S-GL-M-240V	BA9S-YL-M-240V	

Notes: ¹⁾ 8 Volt LED lamps suitable for use with D5 transformer

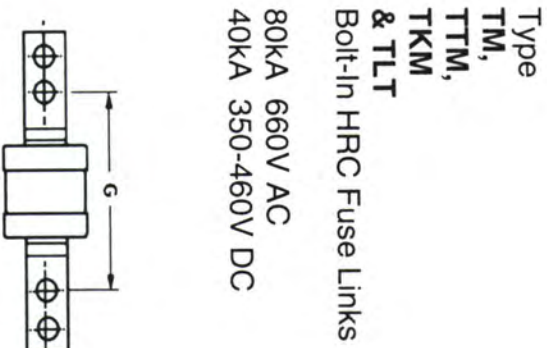
²⁾ Nett price only

Active 29/01/2014



Type	Rating Amp.	Central G-Centre (mm)	Part No.
TF125	125	111.0	5AB9580-020
TF160	160	111.0	5AB9580-030
TF200	200	111.0	5AB9580-040
TF200M250	200/250*	111.0	5AB9581-010
TF200M315	200/315*	111.0	5AB9581-020
TKF250	250	111.0	5AB9590-010
TKF315	315	111.0	5AB9590-020
TKF315M355	315/355*	111.0	5AB9591-010
TMF355	355	111.0	5AB9603-020
TMF400	400	111.0	5AB9603-030
TMF400M450	400/450*	111.0	5AB9604-010

* Motor Start



Type	Rating Amp.	Central G-Centre (mm)	Part No.
TM355	355	133.0	5AB9600-020
TM400	400	133.0	5AB9600-030
TM400M450	400/450*	133.0	5AB9601-010
TTM450	450	133.0	5AB9610-010
TTM500	500	133.0	5AB9610-020
TTM560	560	133.0	5AB9610-030
TTM630	630	133.0	5AB9610-040
TLM670	670	133.0	5AB9620-040
TLM710	710	133.0	5AB9620-050
TLM750	750	133.0	5AB9620-060
TLM800	800	133.0	5AB9620-070
TLT670	670	165.0	5AB9622-040
TLT710	710	165.0	5AB9622-050
TLT750	750	165.0	5AB9622-060
TLT800	800	165.0	5AB9622-070

* Motor Start

GECALSTHOM

Industrial Products Division, GECALSTHOM Australia Limited

25 Princes Road, Regents Park 2143 • PO Box 22 Regents Park NSW 2143 • Telephone (02) 645 0777 • Fax (02) 645 1608

BRISBANE (07) 268 4344 MELBOURNE (03) 544 8344 PERTH (09) 277 4844 ADELAIDE (08) 346 5411 HOBART (002) 34 5133 NEWCASTLE (049) 61 1224

PSP0035



GEC

**HRC
Fuse
Links**

**Selection
Tables**



HRC Cartridge Fuse Links

Type
NS
Clip-In HRC Fuse Links
Off-Set Tags

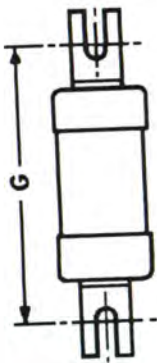
80kA 440V AC
40kA 240V DC



Type
NIT
& TIS
Bolt-In HRC Fuse Links

NIT 80kA 550V AC
40kA 250V DC

TIS 80kA 660V AC
40kA 460V DC



The best known and respected name in Fusegear. All GEC HRC fuse links have excellent protection characteristics.
The GEC range of HRC fuse links comply with BS88-2 1988, AS2005-10, 21-2, 2.9 & IEC269-2-1.

Low voltage industrial Type "T" fuse links are ideal for all general applications.
Motor Start Type GEC fuse links offer unique time/current characteristics which combine superior motor starting performance with low values of let-through current and I^2t on high fault currents.

Type	Rating Amp.	Diameter 'D' (mm)	Part No.
NS2	2	13.9	5AB9500-010
NS4	4	13.9	5AB9500-030
NS6	6	13.9	5AB9500-050
NS10	10	13.9	5AB9500-060
NS16	16	13.9	5AB9500-070
NS20	20	13.9	5AB9500-080
NS25	25	13.9	5AB9500-090
NS32	32	13.9	5AB9500-100
NS20M25	20/25*	13.9	5AB9501-010
NS20M32	20/32*	13.9	5AB9501-020
NS32M40	32/40*	13.9	5AB9501-040

* Motor Start

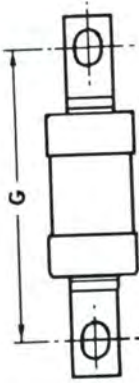
Type	Rating Amp.	Off-Set G-Centre (mm)	Part No.
NIT2	2	44.5	5AB9510-010
NIT4	4	44.5	5AB9510-030
NIT6	6	44.5	5AB9510-050
NIT10	10	44.5	5AB9510-060
NIT16	16	44.5	5AB9510-070
NIT20	20	44.5	5AB9510-080
NIT20M25	20/25*(1)	44.5	5AB9511-010
NIT20M32	20/32*(1)	44.5	5AB9511-020
TIS35	35	73.0	5AB9530-120
TIS40	40	73.0	5AB9530-130
TIS50	50	73.0	5AB9530-140
TIS63	63	73.0	5AB9530-150
TIS63M80	63/80*(1)	73.0	5AB9531-010
TIS63M100	63/100*(1)	73.0	5AB9531-020

* Motor Start

(1) Tags have holes, not slots

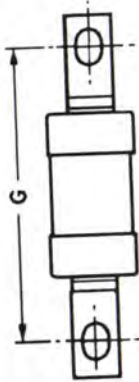
Type
TIA, TCP
& TFP
Bolt-In HRC Fuse Links

80kA 660V AC
40kA 460V DC
(TFP 350V DC)



Type
TB, TBC
& TC
Bolt-In HRC Fuse Links

80kA 660V AC
40kA 460V DC



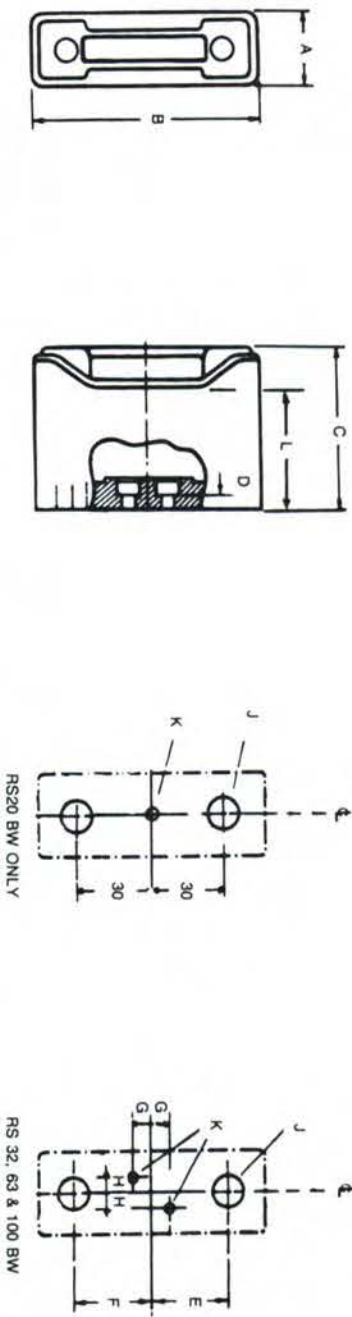
Type	Rating Amp.	Off-Set G-Centre (mm)	Part No.
TIA2	2	73.0	5AB9520-010
TIA4	4	73.0	5AB9520-030
TIA6	6	73.0	5AB9520-050
TIA10	10	73.0	5AB9520-070
TIA16	16	73.0	5AB9520-080
TIA20	20	73.0	5AB9520-090
TIA25	25	73.0	5AB9520-100
TIA32	32	73.0	5AB9520-110
TIA32M35	32/35*	73.0	5AB9521-010
TIA32M40	32/40*	73.0	5AB9521-020
TIA32M50	32/50*	73.0	5AB9521-030
TIA32M63	32/63*	73.0	5AB9521-040
TCP80	80	93.7	5AB9570-060
TCP100	100	93.7	5AB9570-070
TCP100M125	100/125*	93.7	5AB9571-030
TCP100M160	100/160*	93.7	5AB9571-010
TCP100M200	100/200*	93.7	5AB9571-020
TFP125	125	93.7	5AB9583-020
TFP160	160	93.7	5AB9583-030
TFP200	200	93.7	5AB9583-040
TKM250	250	133.4	5AB9593-010
TKM315	315	133.4	5AB9593-020

* Motor Start

Type	Rating Amp.	Off-Set G-Centre (mm)	Part No.
TB2	2	96.9	5AB9540-010
TB4	4	96.9	5AB9540-030
TB6	6	96.9	5AB9540-050
TB10	10	96.9	5AB9540-070
TB16	16	96.9	5AB9540-080
TB20	20	96.9	5AB9540-090
TB25	25	96.9	5AB9540-100
TB32	32	96.9	5AB9540-110
TB35	35	96.9	5AB9540-120
TB40	40	96.9	5AB9540-130
TB50	50	96.9	5AB9540-140
TB63	63	96.9	5AB9540-150
TBC2	2	111.0	5AB9550-010
TBC4	4	111.0	5AB9550-030
TBC6	6	111.0	5AB9550-050
TBC10	10	111.0	5AB9550-070
TBC16	16	111.0	5AB9550-080
TBC20	20	111.0	5AB9550-090
TBC25	25	111.0	5AB9550-100
TBC32	32	111.0	5AB9550-110
TBC35	35	111.0	5AB9550-120
TBC40	40	111.0	5AB9550-130
TBC50	50	111.0	5AB9550-140
TBC63	63	111.0	5AB9550-150
TC80	80	111.0	5AB9560-060
TC100	100	111.0	5AB9560-070

DIMENSIONS

RED SPOT H.R.C. Fuse Fittings
BACK WIRED PANEL MOUNTED



TYPE	Rating Amp	All dimensions in millimetres											Max. Cable Size mm²
		A	B	C	D	E	F	G	H	J D/A	K	L	
RS20BW	20	27	80	54	6	30	30	-	-	8	To suit M5	37	10
RS32BW	32	32	103	70	6	40	40	3,2	6,4	8	M5	49	16
RS63BW	63	35	110	75	6	40	46	3,2	6,4	8	M5	54	35
RS100BW	100	51	140	100	7	50	50	11	9,5	16	M6	74	50

SUGGESTED SPECIFICATION

- All fuse fittings are to be rated 660 Volts and accept bolt-in type HRC fuse links. They are required to be fully shrouded, cable ferrules for front entry type should be supplied as standard.
- The design shall be such that when removing or replacing a fuse carrier, it shall not be possible to touch the top contact (line) when the bottom contact (load) is inserted into the base and therefore alive.
- Fuse fittings are to be from a range having 20A, 32A, 63A, 100A, 200A and 400A rated fittings.
- Associated HRC fuse links shall be rated at 80KA 440/550/660VAC and be ASTA 20 certified.
- Fuse fittings are to be Red Spot type, or equivalent. HRC fuse link shall be either GEC or English Electric Type T or equivalent.

GEC ALSTHOM

A U S T R A L I A

GEC ALSTHOM Australia Limited, Industrial Products Division A.C.N. 000 215 092
25 Princes Road, Regents Park NSW 2143 • P.O. Box 22 Regents Park NSW 2143 • Telex 20729 • Telephone (02) 645 0777 • Fax (02) 645 1608
SYDNEY BRISBANE MELBOURNE PERTH ADELAIDE HOBART NEWCASTLE
(02) 645 0777 (07) 268 4344 (03) 544 8344 (09) 277 4844 (08) 346 5411 (002) 34 5133 (049) 61 1224

PSP001/4ASK0894

RED SPOT

NEW STUD POSITIONS FOR RS20P&PH FUSE FITTINGS

HRC FUSE FITTINGS

RS63BW FUSE FITTINGS NOW WITH 35mm² CABLE ENTRY

Fuse fittings to AS2005.21.2 – 1990 BS88: Part 2: 1988 660 volts A.C./D.C.
Approved by leading Authorities and used in equipment approved by Lloyds.

SAFETY FEATURES

- Full Shrouding for personnel safety and complete compliance with the direct contact electric shock.
- Insulating sleeves are fitted to front connected fuse bases to provide increased protection at the cable entry point.
- Separate base contact insulating shrouds of great strength and flexibility ensure that no 'live' metal is dangerously exposed when the fuse carrier is removed – this enables an outgoing circuit to be cabled with complete safety to personnel and with continuity of supply to other circuits.
- Anti-vibration features protect against release of a fuse-carrier due to vibration in service. In the 400 amp size this includes a safety catch which automatically locks on the insertion of the fuse carrier.

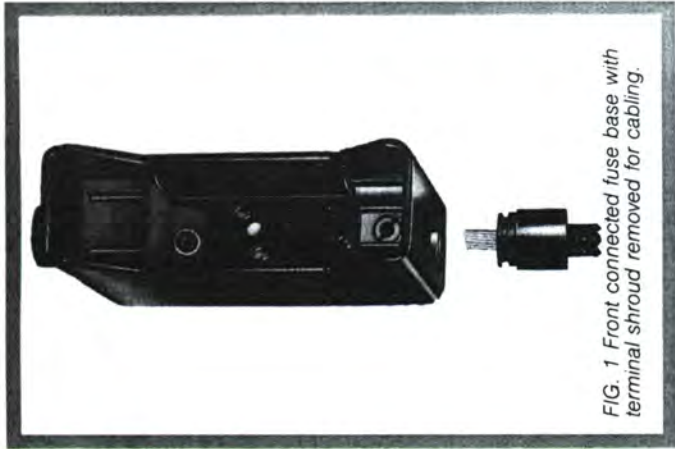


FIG. 1 Front connected fuse base with terminal shroud removed for cabling.

RED SPOT
SPECIAL FEATURES
20, 32, 63 & 100 amp fuse fittings

Perfect alignment of contacts with single-screw fixing achieved by registration on facets in moulding.

Large contact area and anti-vibration feature incorporated in brass contacts of accurate dimensions.

Tapered shank of fuse link fixing screw ensures easy re-entry.

Safety shroud (cut-away to show base contact) made from moulded red nylon of great strength and flexibility.

Patented non-twist cable clamping screw of large diameter.

Lasting contact pressure ensured by backing stirrups which are located by the shape of the base contact and the moulding.

Carrier and base moulded from flame retardant, non-hygroscopic phenolic.

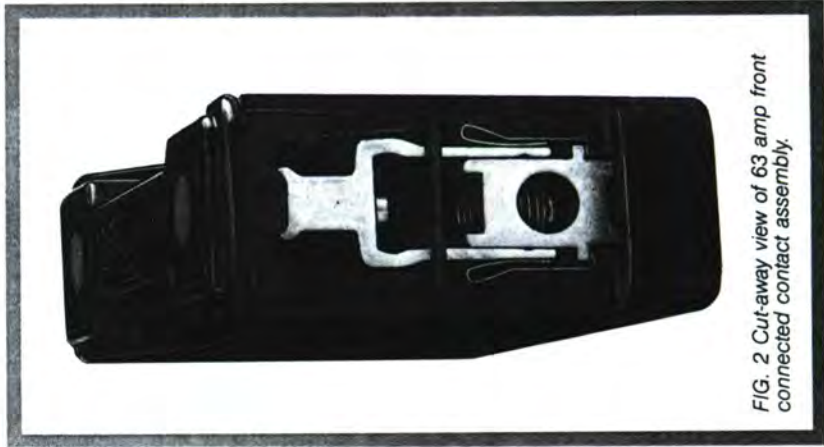
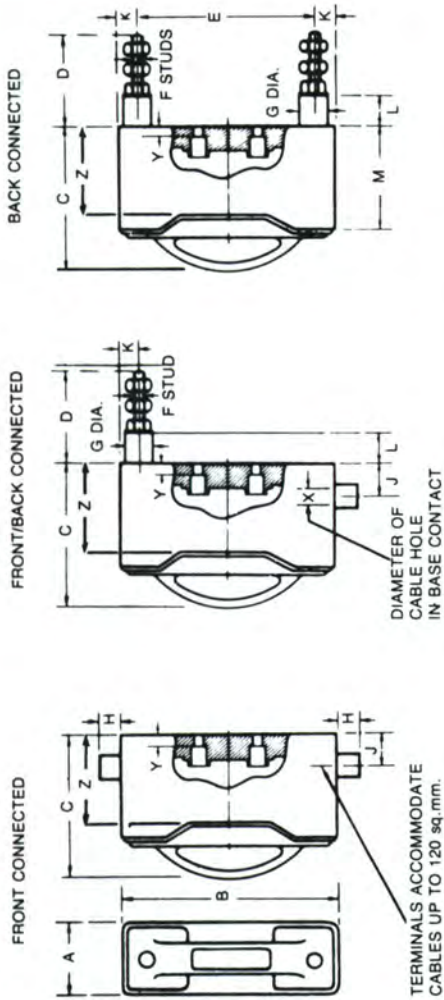


FIG. 2 Cut-away view of 63 amp front connected contact assembly.

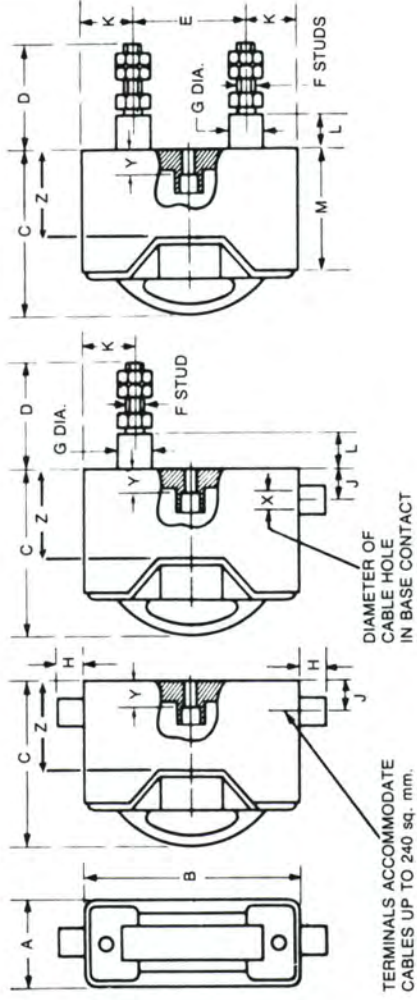
RED SPOT Fuse Fittings

200 amp

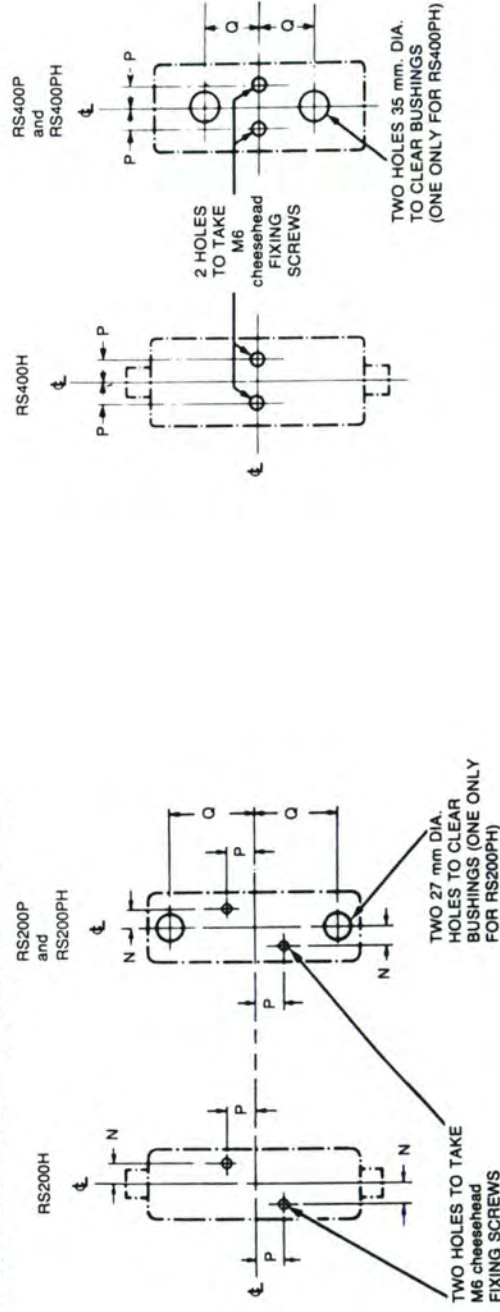


	200 amp	400 amp
	mm	mm
A	70	98
B	216	254.0
C	136.5	192
D	95	114
E	171.5	140
F	M12	M16
G	25	32
H	22	32
J	32	36.5
K	22	57
L	32	38
M	100.0	151
X	16	21
Y	9.5	32
Z	84	130

400 amp



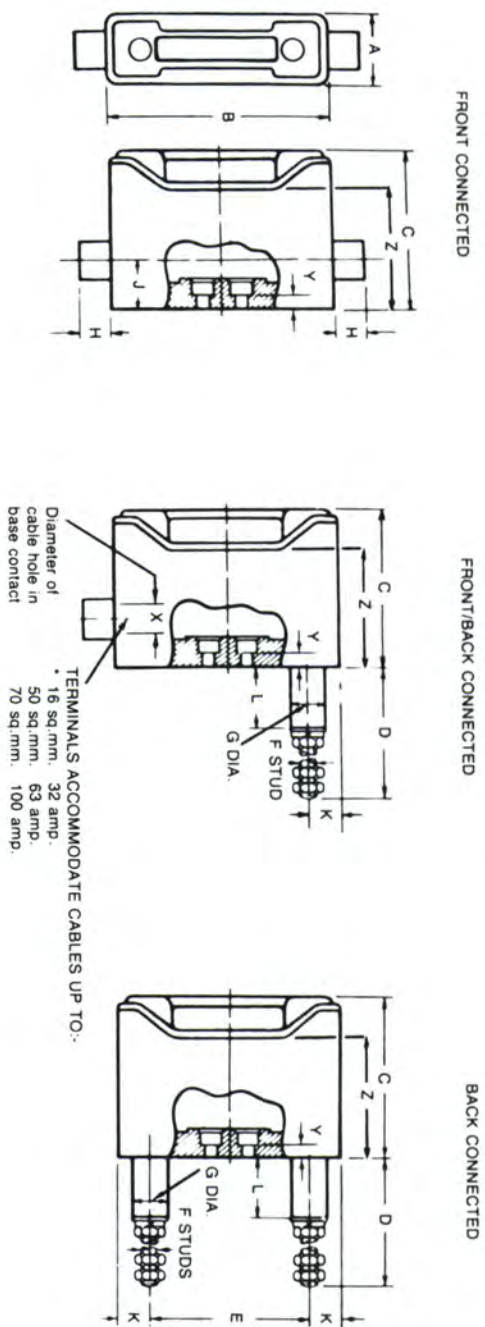
PANEL DRILLING DIMENSIONS
Viewed From Front of Panel



mm	N	P	Q
	19.1	28.6	85.7

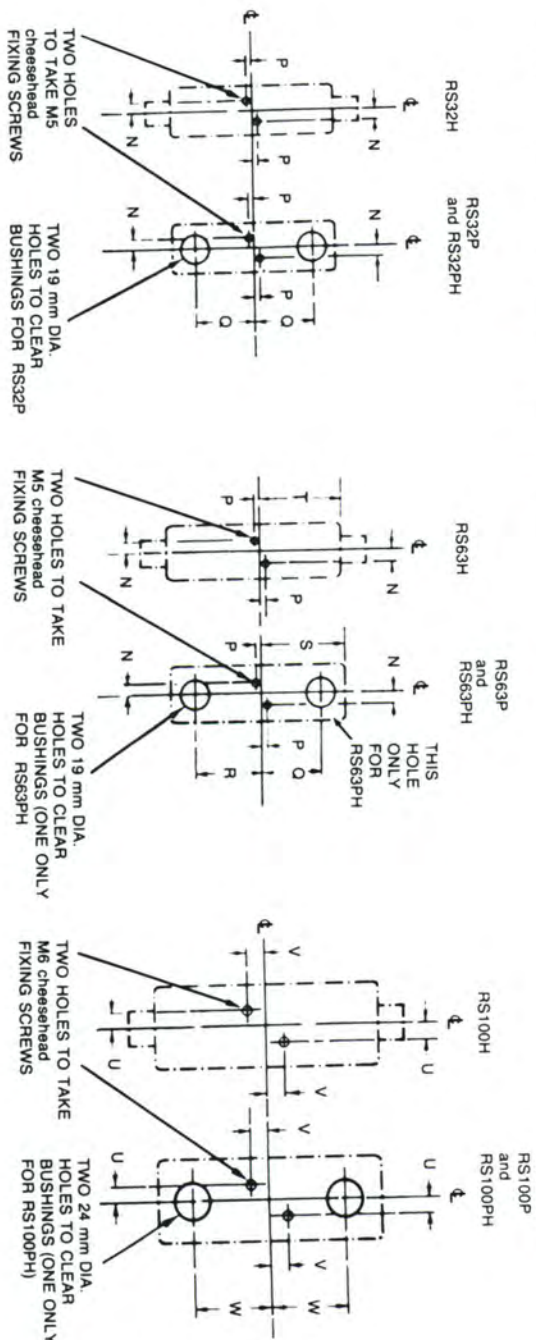
mm	P	Q
	27.0	69.9

32, 63 & 100 amp RED SPOT Fuse Fittings



Rating amp	A	B	C	D	E	F	G	H	J	K	L	X	Y	Z
32	mm	32	103	70	81.0	73	M6	17.5	15	22	29	6.2	5.6	49
63	mm	35	110	75	84.0	78	M8	17.5	15	24	29	9.5	5.6	54
100	mm	51	140	100	87	94	M10	22	15	28	32	12.7	7.2	74

PANEL DRILLING DIMENSIONS
Viewed From Front Of Panel



RED SPOT
200 & 400 amp fuse fittings

High quality mouldings, safety shrouds and precision made copper contacts ensure reliable operation.

Additional special features

- Through grip handle for maximum control.
- Silver plated contacts with generous cross section.
- Guides to ensure parallel action on insertion or withdrawal of fuse carrier.
- Patented non-twist cable clamping screws of large diameter on the 200 amp and cable clamping plate on the 400 amp fuse holders prevent damage to cables.

- Terminal screw locking device, incorporating the principle used in the twelve sided spanner, can be fitted to the hexagon head of the terminal screw, whatever its position when fully tightened, by using one of the two positions provided for locating the captive screw (arrowed in FIG. 3)

FIG. 3 Front connected 200 amp RED SPOT fuse base with shroud removed and with moulding partly cut-away to show silver-plated base contact and terminal screw locking device.

FIG. 4 Front connected 400 amp RED SPOT fuse fitting with moulding partly cut-away to show silver-plated contact, red nylon shroud and cable clamping device.



LIST NUMBERS
for ordering purposes
Standard Colours: Black & White (RS20 – RS100)

Rating amp	Alternative type of connection				
	FRONT	BACK	FRONT/BACK	BACK WIRED	PAD-LOCKABLE INSERTS
20	RS20H*	RS20P	RS20PH	RS20BW	RS20LOCK
32	RS32H	RS32P	RS32PH	RS32BW	RS32LOCK
63	RS63H	RS63P	RS63PH	RS63BW#	RS63LOCK
100	RS100H†	RS100P	RS100PH	RS100BW	RS100LOCK
200	RS200H	RS200P	RS200PH		
400	RS400H	RS400P	RS400PH		

* Available with sealed terminal shrouds. List Nos: RS100H-S

† For Din Rail Mounting order DIN Rail Adapter Part No: 5BB 9020-010

Illustrations & dimensions shown on pages 5, 6, 7 & 8

Also available with front & back wire cable terminals

APPLICATION DATA

H.R.C. FUSE LINKS ACCOMMODATED									
Fuse fitting rating amp	Type 'T' to BS.88:Part 2 & AS2005.21.2		Extended range of Type 'T' to BS.88:Part 2: & AS2005.21.2 for motor circuit protection. (660 volts a.c.)						
	550/660V (550 volts a.c.)	440V AC	LIST No.		Current rating amp	Rating for motor starting amp			
			550/660V	440V AC					
20	NIT2-20A (550 volts a.c.)		NIT20M25 (415 volts a.c.)		20	25			
			NIT20M32		20	32			
32	TIA2-32A	TIA2L-32L	TIA32M35L TIA32M40L TIA32M50L TIA32M63L		32	35 40 50 63			
63	TIA2-32A TIS35-63A	TIA2L-32L TIS35L-63L	TIS63M80 TIS63M100 TIS63M100L		63	80 100			
100	TIA2-32A† TIS35-63A† TCP80 & 100A	TIA2L-32L† TIS35L-63L† TCP80L & 100L	TCP100M125 TCP100M160 TCP100M200		100	125 160 200			
200	TBC2-63A TC80 & 100A TF125-200A	TC80L & 100L	TF200M250 TF200M315*		200	250 315			
400	TBC2-63A# TC80 & 100# TF125-200# TKF250 & 315# TKM250 & 315A TM355 & 400A	TC80L & 100L#	TM400M450		400	450			
† Adaptor plate required Type 'A' 5BB9306-010 # Adaptor plate required Type 'B' 5BB9307-010									
Note: For full details on Type 'T' fuse links, including D.C. performance, please refer to Publication IEF/401 or PSP0000.									



FIG. 5 Front connected 63 amp fuse fitting

METHOD OF CABLING

Front connected fuse fittings

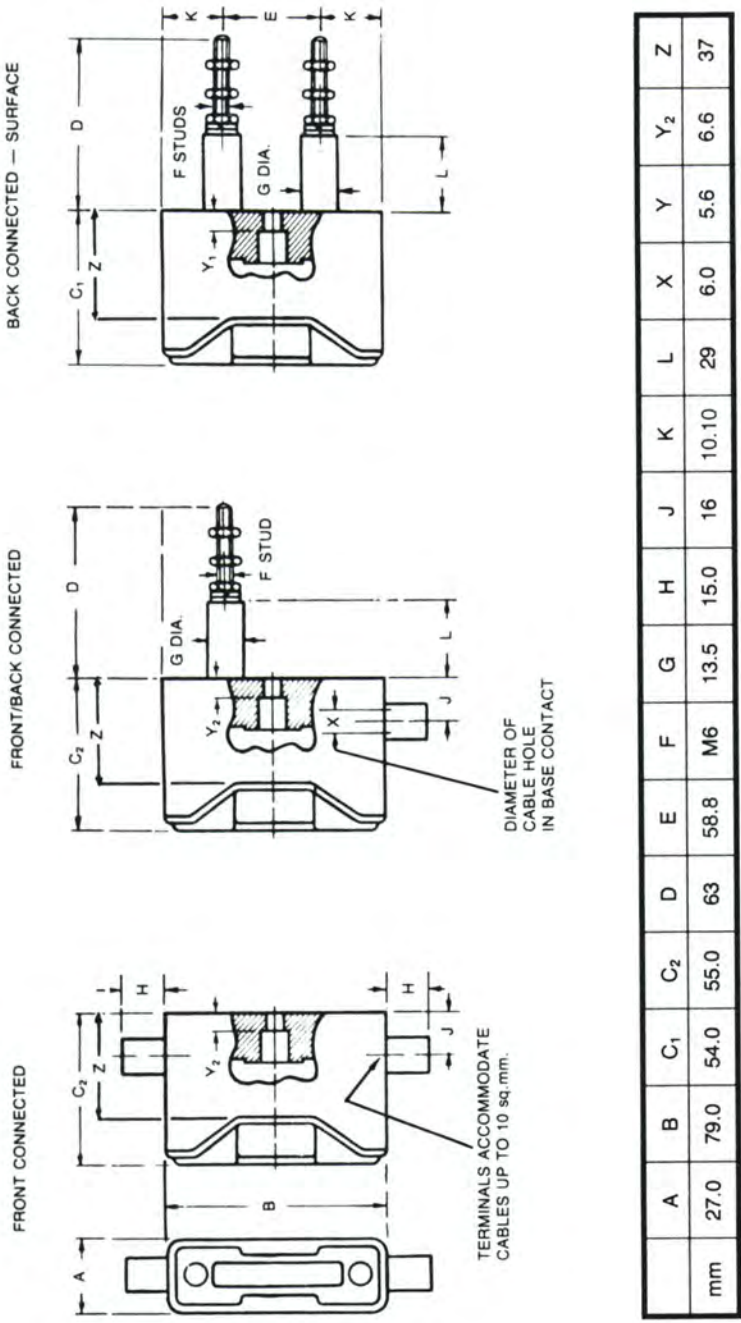
- 1) Remove red nylon insulating shroud to release cable sleeve.
- 2) Remove cable sleeve.
- 3) Fit cable sleeve over cable.
- 4) Fit conductor into fuse base terminal and tighten cable clamping screw to secure. If flexible cables are used, their relatively fine strands may be given increased protection by the use of thin wall copper ferrules over the conductor ends. The following should be taken into account:
 - a) The inside diameter of the thin wall copper ferrule should match that of the bared conductor end as closely as possible.
 - b) The length of the thin wall copper ferrule should match that of the tunnel in the fuse base terminal.
 - c) The wall thickness of the ferrule should be thin enough for the ferrule to be compressed by the tightening of the cable clamping screw. The flexible conductors will then be consolidated within the deformed ferrule.
- 5) Replace red nylon shroud taking care that it holds the cable sleeve in position by locating the shroud in the groove provided in the sleeves.
- 6) Fit nylon screw through the red nylon shroud with the heads of the screws against the shrouds. Fasten the wingnuts on to the fuse fitting base.

RS100 H-S (COUNCIL SEALABLE)

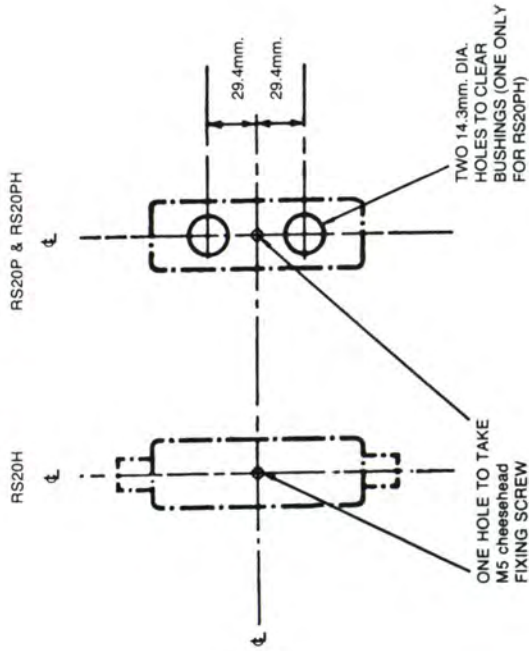
- 6) Fit nylon screw through the red nylon shroud with the heads of the screws against the shrouds. Fasten the wingnuts on to the fuse fitting base.

DIMENSIONS

20 amp RED SPOT Fuse Fittings



PANEL DRILLING DIMENSIONS
Viewed From Front Of Panel





Switch Types

CA4, CA4-1, CA10, CA11, CA20, CA25
CA10B, CA11B, CA20B, CA25B



- compact design with the smallest escutcheon plate size of 30 x 30 mm (1.181" x 1.181")
- finger-proof according to VDE 0106 part 100 and VBG 4
- open terminals which are accessible from both sides
- captive plus-minus screws and screwdriver guide
- high switching capacity
- contacts with gold plating (switch types CA4 and CA4-1)

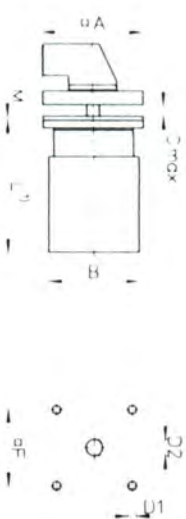
Dimensions
mm
inch

Panel mounting

EF

E22

E/EF



Switch Type	A	B	C	D1	D2	E	F	M
CA4, CA4-1	30	28	4	3.2	8-11	-	-	-
CA10, CA11	1.18	1.10	1.6	1.3	31-43	-	-	-
CA20	48	43	4	5	15-19	30	36	1.5
CA25	1.89	1.69	1.6	2.0	59-75	1.42	06	1.5
CA10B, CA11B	48	45	4	5	15-19	30	36	1.5
CA20B, CA25B	1.89	1.77	1.6	2.0	59-75	1.17	1.42	06

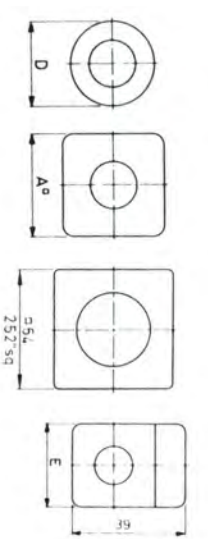
Single hole mounting

FS1/

FS2/

FH3

FS4

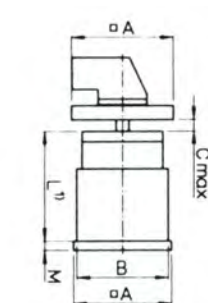


Switch Type	A/E	B	C	D	D1	D2	D3	E	M
CA4, CA4-1	30	28	4	3.2	8-11	-	-	-	-
CA10, CA11	1.18	1.93	1.93	1.93	49	49	49	49	49
CA20	48	43	4	5	15-19	30	36	1.5	1.5
CA25	1.89	1.69	1.6	2.0	59-75	1.42	06	1.5	1.5

Base mounting

Front mounting

Rear mounting



Switch Type	A	B	C	D1	D2	D3	E	M
CA10, CA11	48	43	10.5	4.1	5	8-15	36	4
CA20	1.89	1.69	4.1	1.6	2.0	31-59	1.42	1.6
CA25	48	45	10.5	4.1	5	8-15	36	4

Dimensions L

Switch Type	1	2	3	4	5	6	7	8	9	10	11	12
CA4, CA4-1	30	38	46	54	62	70	78	86	94	-	-	-
CA10	1.18	1.50	1.81	2.13	2.44	2.76	3.07	3.39	3.70	-	-	-
CA11	31.7	41.2	50.7	60.2	69.7	79.2	88.7	98.2	107.7	117.2	126.7	136.2
CA20	1.25	1.62	2.0	2.37	2.74	3.12	3.49	3.87	4.24	4.61	4.99	5.36
CA25	34.9	47.6	60.3	73.0	85.7	98.4	111.1	123.8	136.5	149.2	161.9	174.6
CA10B	1.37	1.87	2.37	2.87	3.37	3.87	4.37	4.87	5.37	5.87	6.37	6.87
CA11B	35.9	84.6	61.3	74	86.7	99.4	112.1	124.8	137.5	150.2	162.9	175.6
CA20B	1.41	1.91	2.41	2.91	3.41	3.91	4.41	4.91	5.41	5.91	6.41	6.91
CA25B	37.2	51.2	65.2	79.2	93.2	107.2	121.2	135.2	149.2	163.2	177.2	191.2

australian solenoid co. pty. ltd.

379 Liverpool Road, ASHFIELD, N.S.W. 2131
P. O. Box 1093, ASHFIELD, N.S.W. 1800
Tel: (02) 9797-7333 · Fax: (02) 9797-0092



Construction Data

The terminals of the CA-series cam switches are accessible from both sides. This is an advantage in cases where the switch is prewired for installation or in cases where the terminal wiring cannot be done in the sequence of the stage. The compact design, the excellent switching capabilities under AC-15, AC-3 resp. AC-23A and the obviously unlimited number of switch developments are characteristic for the CA switches and exceed the requirements of IEC 60947-3 and VDE 0660 part 107.

CA switches of this series are supplied with open terminals and protected against accidental finger contact in accordance with VDE 0106 part 100 (VBG 4). Captive plus-minus terminal screws and integrated screwdriver guides facilitate wiring.

The CA4 and CA4-1 switches offer maximum space saving benefits. A CA4 or a CA4-1 switch in E mounting 1 stage long and 2 contacts fits into 30 x 30 mm cubicle. The additional length of any further stage is 8 mm. CA4 and CA4-1 contacts are supplied standard with gold plating (CA4 = 1 µ, CA4-1 = 35 µ).

Single hole mounting according to EN 50007 with protection IP 65 is suitable for either 16/22 mm (CA4, CA4-1) or 22 mm (CA10-CA25B) diameter holes and is available with key operator, if required.

Switching angle of CA switches may be 30°, 45°, 60° or 90°. Switch types CA4 and CA4-1 are available with up to 18 contacts. CA10-CA25B switches are available with up to 24 contacts.

A wide range of optional extras and enclosures is available.

Your order should include the following data:

- 1. **Switch type** (selection according to the following tables)
- 2. **Switching program** (order a prescribed form for special programs)
- 3. **Mounting type**
- 4. **Escutcheon plate and handle**
- 5. **Optional extras**



Switch Types		CA4 CA4-1	CA10 CA10B	CA11 CA11B	CA20 CA20B	CA25 CA25B
Rated Insulation Voltage U_i	IEC 60947-3 ¹⁾ , EN 60947-3 ¹⁾ VDE 0660 part 107 ¹⁾	440	690	690	690	690
	SEV ³⁾	380	660	660	660	690
	UL/Canada	300	300	600	600	300
	CEE/NEMKO	400/380	400	400	400	-
Rated Impulse Withstand Voltage U_{imp}		kV	4	6	6	6
Rated Thermal Current I_{th}	IEC 60947-3, EN 60947-3 VDE 0660 part 107	A	10	20	25	32
	SEV ³⁾	A	10	20	32	32
	660 V	A	10/-	16/12	25/25	32/32
	UL/Canada	A	10	20 ⁴⁾	30	30
Rated Operational Current I_o Switching of resistive loads including moderate overloads	IEC 60947-3, EN 60947-3 VDE 0660 part 107	A	10	20	25	32
	SEV ³⁾	A	10	16	25	32
	380 V	A	-	12	20	32
	660 V	A	-	-	-	-
AC-1 Resistive or low inductive loads	IEC 60947-3, EN 60947-3 VDE 0660 part 107	A	2.5	5	8	12
	SEV ³⁾	A	1.5	4	5	6
	380 V	A	-	-	-	-
	660 V	A	-	-	-	-
AC-15 Switching of control devices, contactors, valves etc.	IEC 60947-3, EN 60947-3 VDE 0660 part 107	A	300	600	600	300
	UL/Canada ³⁾	A	10	20 ⁴⁾	30	30
	Heavy	A	-	-	-	-
	UL/Canada ³⁾	A	-	-	-	-
Pilot Duty Resistive or low inductive loads	IEC 60947-3, EN 60947-3 VDE 0660 part 107	A	4/2	10/6	16/10	-
	CEE	A	6/4 ²⁾	-	20/10	-
	NEMKO	A	-	-	-	-
	UL/Canada ³⁾	A	-	-	-	-
Short Circuit Protection Max. fuse size Rated short-time withstand current	(gL-characteristic) (1s-current)	A	10	25	35	35
	IEC 60947-3, EN 60947-3 VDE 0660 part 107	A	60	140	280	480
	3 phase	A	-	-	-	-
	3 pole	A	-	-	-	-
Rated Utilization Category	IEC 60947-3, EN 60947-3 VDE 0660 part 107	A	1.5	3	4	5.5
	220 V-240 V	A	2.2	5.5	7.5	11
	380 V-440 V	A	-	5.5	7.5	11
	500 V	A	-	5.5	7.5	11
AC-3 Direct-on-line starting, star-delta starting	IEC 60947-3, EN 60947-3 VDE 0660 part 107	A	0.3	0.6	1.5	2.2
	220 V-240 V	A	0.55	2.2	3	4
	380 V-440 V	A	0.75	3	3.7	5.5
	500 V	A	1.8	7.5	11	15
AC-23A Frequent switching of motors or other high inductive loads	IEC 60947-3, EN 60947-3 VDE 0660 part 107	A	3	7.5	11	15
	220 V-240 V	A	3	7.5	11	15
	380 V-440 V	A	3	7.5	11	15
	500 V	A	3	7.5	11	15
Ratings	UL/Canada	A	-	-	-	-
	Standard motor load	A	0.75	1.5	3	5
	DOL-Rating (similar AC-3)	A	1	3	7.5	10
	120 V	A	-	-	-	-
Max. Permissible Wire Gauge single-core or stranded wire flexible wire (sleeving in accordance with DIN 46228)	IEC 60947-3, EN 60947-3 VDE 0660 part 107	A	0.33	0.5	1.5	2
	240 V	A	0.75	1	3	5
	480 V	A	0.75	2	3	5
	600 V	A	-	-	-	-
Essential Mounting	IEC 60947-3, EN 60947-3 VDE 0660 part 107	A	2x	2x	2x	2x
	SEV ³⁾	A	1.5	2.5	4	6
	UL/Canada	A	14	12	10	8
	CEE/NEMKO	A	-	-	-	-
Switch Types	IEC 60947-3, EN 60947-3 VDE 0660 part 107	A	2x	2x	2x	2x
	SEV ³⁾	A	1.5	2.5	4	6
	UL/Canada	A	14	12	10	8
	CEE/NEMKO	A	-	-	-	-

Essential Mounting	Code	For type	Panel mounting
	E	CA4	Panel mounting
	EF	CA4-1	two hole p/m two hole p/m Protection IP 65
	FS1	CA4	Single hole mounting combined with 16 and 22 mm Protection IP 65 w/o escutcheon plate
	FS2	CA4-1	with escutcheon plate 30 x 30 mm
	FS4	CA4-1	with escutcheon plate 30 x 39 mm
	E22	CA10 CA11 CA20 CA25	Panel mounting Protection IP 65 two hole p/m
	EF	CA10 CA11 CA20 CA25 CA10B CA11B CA20B CA25B	four hole p/m
	FT1	CA10 CA11 CA20 CA25	Single hole mounting 22 mm Protection IP 65 w/o escutcheon plate
	FT2	CA10 CA11 CA20 CA25	with escutcheon plate 48 x 48
	FH3	CA10 CA11 CA20 CA25	with escutcheon plate 64 x 64 mm
	VE	CA10 CA11 CA20 CA25 CA10B CA11B CA20B CA25B	Base mounting Protection IP 40 four hole p/m

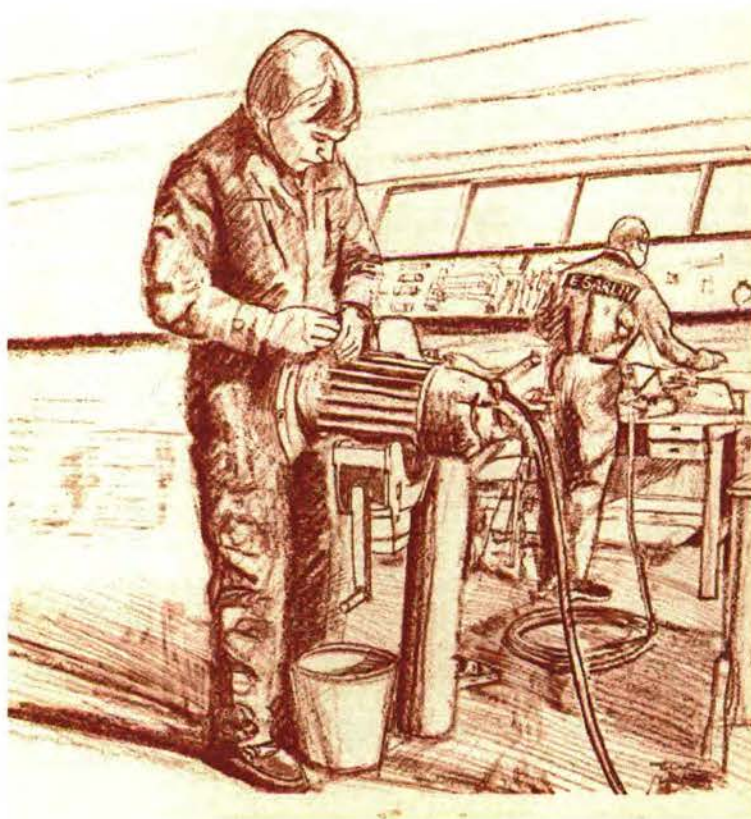
1) Valid for lines with grounded common neutral termination, overvoltage category III, pollution degree 3. Values for other supply systems on request. 2) Valid for CA4 only. 3) International Standards and Approvals, refer to Catalog 100, page 39. 4) Canada max. 15 A.



SARLIN PUMPS

3A

Repair Manual



REPAIR MANUAL**SARLIN**
Pumpout

Section 1 Page 2

TABLE OF CONTENTS**SECTION SUBJECT**

1. Introduction
2. General notes for repair
3. Troubleshooting
4. Procedures and testing when starting work on pump
5. Pump parts dismantling and reassembly
Suction clearance adjustment
6. Oil draining and filling
7. Removing and mounting of cooling jacket
8. Seal dismantling, reassembly and inspection
9. Oil housing dismantling and reassembly
10. Secondary seal dismantling and reassembly
11. Rotor and bearings dismantling and reassembly
12. Top cover, cable inlet and electrical connecting
13. Stator replacement and drying
14. Moisture switch replacement and adjustment
15. Tightness testing
16. Overhauled or repaired pump final inspection

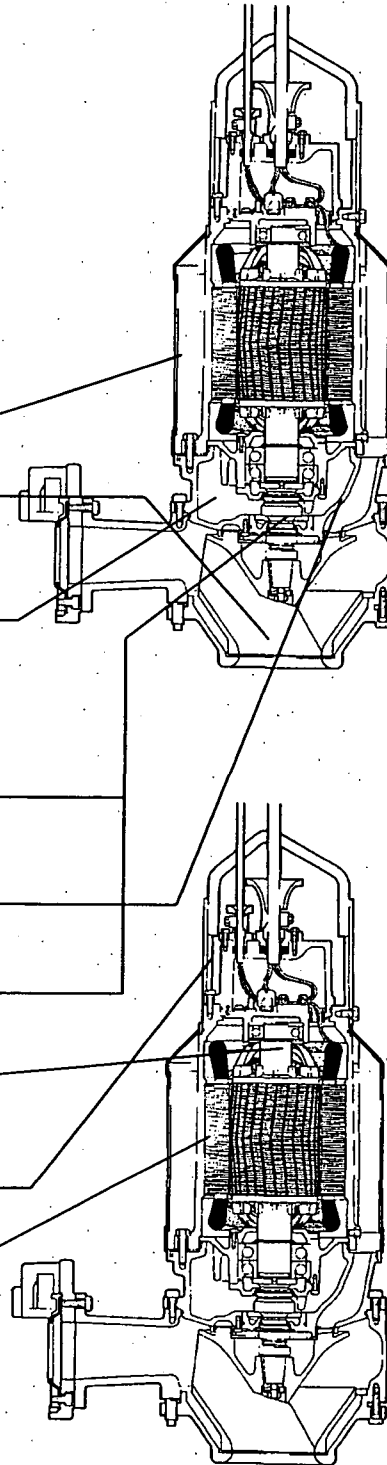




TABLE OF CONTENTS

1	Introduction.....	1-5
2	General Notes for Repair Work.....	2-1
2.1	Tools and Equipment.....	2-1
2.2	Installing Bearings.....	2-1
2.3	Instructions for Placing O-rings.....	2-4
2.4	Lubricating parts During Assembly.....	2-4
2.5	Tightening of Screws.....	2-5
2.6	Handling of Stator.....	2-5
2.7	Handling Machined Parts.....	2-5
2.8	Using Compressed Air.....	2-6
2.9	Be Systematic When Repairing.....	2-6
2.10	Electricity.....	2-6
3	Troubleshooting and Testing.....	3-1
3.1	Troubleshooting.....	3-1
3.2	Electrical Testing.....	3-3
4	Procedures and Testing When Starting Work on pumps.....	4-1
4.1	Cleaning.....	4-1
4.2	Visual Inspection.....	4-1
4.3	Motor Space Inspection.....	4-1
4.4	Electrical Measurements.....	4-2
5	Dismantling and Assembling Pump Parts.....	5-1
5.1	Suction Clearance Inspection and Adjustment, Versions 1, 2, 4 and 5.....	5-1
5.2	Suction Clearance Inspection and Adjustment, Versions 3 and 6.....	5-2
5.3	Removal and Installation of Stand and Connecting Guide Shoe.....	5-3
5.4	Removal and Installation of Suction Cover.....	5-4
5.5	Removal and Installation of Pump Casing.....	5-4
5.6	Impeller Removal and Installation.....	5-5
5.7	Impeller in Frame Sizes 26,30 and 38 and 34 Up to Interchangeability Letter5-6	
5.8	Impeller in Frame Sizes 01 and From 42 to 54 and 34 From Interchangeability Letter D Onwards.....	5-7
5.9	Impeller in Frame Sizes 58 to 74.....	5-8
5.10	Tightening the Impeller Screw.....	5-9
6	Oil Draining and Refilling.....	6-1
6.1	Draining.....	6-1
6.2	Refilling.....	6-2
6.3	Oil Draining and Refilling Pumps in Upright Position	6-2
7	Removing and Installing the Cooling jacket.....	7-1
7.1	Procedure for Removing of Cooling Jacket	7-1
7.2	Cleaning.....	7-1
7.3	Reinstalling the Cooling Jacket.....	7-1
7.4	Working Principle of the Cooling Jacket.....	7-2
8	Dismantling and Assembling and Inspection of Seals.....	8-1
8.1	Dismantling of the Seal Unit (Frame Sizes Up to and Including 46)	8-1
8.2	Assembling Seal Units of Frame Sizes 26, 38 and 34 Up to and Including Pumps with Interchangeability Letter C.....	8-3
8.3	Assembling Seal Units of Frame Size 42 and 34 for Pumps with Interchangeability Letter D and Onwards.....	8-5
8.4	Assembling the Seal Unit for Pumps of Frame Size 46.....	8-7

REPAIR MANUAL**Section 2 Page 4**

8.5	Dismantling the Seal of Frame Sizes 01 and from 50 to 62, Old Model.....	8-9
8.6	Assembling the Seal of Frame Sizes 01 and from 50 to 62, Old Model.....	8-11
8.7	Dismantling the Seal of Frame Sizes 66 and 70 in Pumps with Retaining Sleeve at the Shaft End (No Interchangeability Letter).....	8-13
8.8	Assembling the Seal of Frame Sizes 66 and 70 in Pumps with Retaining Sleeve at the Shaft End (No Interchangeability Letter).....	8-15
8.9	Dismantling the Seal of Frame Sizes from 50 to 70 in Pumps with New Seal Model. Frame Size 66 and 70 Pumps with Interchangeability A and Onwards.....	8-16
8.10	Assembling the Seal of Frame Sizes from 50 to 70 in Pumps with New Seal Model. Frame Size 66 and 70 Pumps with Interchangeability A and Onwards.....	8-17
8.11	Inspecting and Cleaning the Seals.....	8-18
9	Dismantling and Assembling the Oil Housing.....	9-1
9.1	Dismantling.....	9-1
9.2	Assembly.....	9-2
10	Dismantling and Assembling the Secondary Seal.....	10-1
10.1	Dismantling.....	10-1
10.2	Assembly. Old Model.....	10-2
10.3	Assembly. New Model.....	10-3
11	Dismantling and Assembling of Rotor and Bearings.....	11-1
11.1	Upper Bearing.....	11-1
11.2	Removal of Rotor.....	11-1
11.3	Removal of Lower Bearing Bracket.....	11-4
11.4	Assembling Bearings.....	11-7
11.5	Assembling Rotor.....	11-10
12	Top Cover, Cable Inlet and Connection.....	12-1
12.1	Motor Cover Removal.....	12-1
12.2	Dismantling the Cable Inlet.....	12-1
12.3	Cable Drying.....	12-2
12.4	Installing cable Inlet.....	12-2
12.5	Connecting.....	12-3
12.6	Installing the Top Cover.....	12-4
13	Stator; Replacement and Drying.....	13-1
13.1	Replacing Stator, Frame Size 42 Pumps with Cast Iron Housing.....	13-1
13.2	Replacing Stator, Frame Sizes 26, 30 and 42 (Versions 3 and 6) pumps with Aluminium Housings, Frame Size 46 (All Materials).....	13-1
13.3	Replacing Stator, Frame Sizes 34 and 38.....	13-2
13.4	Replacing Stator, Frame Sizes 01, 46 and Larger.....	13-2
13.5	Drying Stator.....	13-3
14	Moisture Switch.....	14-1
14.1	Dismantling.....	14-1
14.2	Inspection and Adjustment.....	14-1
14.3	Installing the Switch.....	14-2
15	Tightness testing.....	15-1
16	Inspection of Overhauled or Repaired Pump.....	16-1

REPAIR MANUAL**SARLIN**
Pumps

Section 1 Page 5

1. INTRODUCTION**Rating plates and pump code**• **Standard rating plate**

Type designation _____

Motor nominal power P_N _____

Serial number _____

Mains voltage for delta and star connection. If the value for star connection is given in brackets, the pump can be connected delta only _____

Nominal drawn current for delta and star connection _____

Frequency, 50 or 60 Hz _____

Mains phase number _____

Fuse rating in delta connection _____

Nominal speed _____

Volume rate of flow range _____

Head range _____

Maximum submergence _____

Gross weight _____

CE marking _____

Year of manufacture _____

Encapsulation class _____

• **ST pumps single-phase**

Type designation _____

Serial number _____

Voltage and drawn current _____

Motor power input P_1 _____

Fuse rating (slow) _____

Maximum head _____

• **ST pumps three-phase**

Type designation _____

Serial number _____

Voltage and drawn current _____

Motor power input P_1 _____

Fuse rating (slow) _____

Maximum head _____



Code designation for sewage pumps series S

S	1	X	100	4		H	1	A		5	11	P	Z	R
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

The shaded code items are provided on the rating plate of the pump.

Code Item	Description	Code Item	Description
1. Pump type	S Sarlin S-type	9. Interchangeability	Interchangeability letter (A, B, C...) indicates interchangeability limitation of parts between otherwise identical pumps. Pumps with no or the same letter have full interchangeability of all parts and use the same spare parts catalogue.
2. Impeller	V Vortex 1 Single channel 2 Double-channel N Multi-channel A Axial S Semi-axial	10. Supply phase number	3-phase 1 1-phase
3. Motor specification	Standard X Explosion-proof	11. Supply frequency	5 50 Hz 6 60 Hz
4. Motor power	Motor power in kW	12. Voltage and starting	50 Hz 60 Hz 01 400 V, DOL 01 460 V DOL 11 400 V, Y/D 11 460 V Y/D 02 230 V, DOL 03 500 V DOL 12 230 V, Y/D 13 500 V Y/D 03 415 V, DOL 05 380 V DOL 13 415 V, Y/D 15 380 V Y/D 04 500 V, DOL 07 220 V DOL 14 500 V, Y/D 17 220 V Y/D
5. Motor pole number	Motor speed at 50 Hz and 60 Hz rpm rpm 2 2-pole 3000 3600 4 4-pole 1500 1800 6 6-pole 1000 1200 8 8-pole 750 900 1 10-pole 600 720	13. Special features	P Indicates that protection circuitry is included in motors on models where this feature is optional. U Flanges drilled to ANSI specifications. Protection circuitry provided.
6. Generation marker	1. generation A 2. generation B 3. generation, etc. The generation indicator differentiates between structurally different pumps that have the same power rating.	14. Non-standard items	D Trimmed impeller C Cable length Z Combination of D and C or other. Refer to order acknowledgement for details
7. Impeller classification	No classification E Extra low head L Low head M Medium head H High head S Super high head	15. Construction material	Standard materials R All stainless steel S Wet parts, including volute, impeller, oil housing and guide shoe (version 1 & 2) stainless steel Q Impeller stainless steel
8. Installation version	1 Submerged with baseplate and guide rails. 2 Submerged with baseplate and guide rails. May operate continuously with motor exposed. 3 Vertical dry with stand. 4 Submerged portable. 5 Submerged portable. May operate continuously with motor exposed. 6 Horizontal dry with stand.		

REPAIR MANUAL

SARLIN
Pumps.

Section 1 Page 7

Code designation for ground-water pumps series SP

S	P	3	01	2		M	5	A	5	21		Z
1	2	3	4	5	6	7	8	9	10	11	12	13

Shaded code items are provided on the rating plate of the pump.

Code Item	Description
1. Pump type	S Sarlin S-type
2. Impeller	P Groundwater
3. Supply phase number	3-phase 1 1-phase
4. Motor power	Motor power in kW
5. Motor pole number	Motor speed at 50 Hz and 60 Hz rpm rpm 2 2-pole 3000 3600 4 4-pole 1500 1800
6. Generation marker	1. generation A 2. generation B 3. generation, etc. The generation indicator differentiates between structurally different pumps that have the same power rating.
7. Impeller classification	No classification L Low head M Medium head H High head
8. Installation version	2 Submerged with baseplate and guide rails. May operate continuously with motor exposed. 5 Submerged portable. May operate continuously with motor exposed.
9. Interchangeability	Interchangeability letter (A , B , C ...) indicates interchangeability limitation of parts between otherwise identical pumps. Pumps with no or the same letter have full interchangeability of all parts and use the same spare parts catalogue.
10. Supply frequency	5 50 Hz 6 60 Hz
12. Voltage and starting	50 Hz 60 Hz 01 400 V, DOL 01 460 V DOL 02 230 V, DOL 07 220 V DOL 03 415 V, DOL 05 380 V DOL
12. Not in use.	
13. Non-standard items	D Trimmed impeller C Cable length Z Combination of D and C or other. Refer to order acknowledgement for details

Code designation for contractor pumps series ST

S	T		02	2		H	1	A	5	21		Z
1	2	3	4	5	6	7	8	9	10	11	12	13

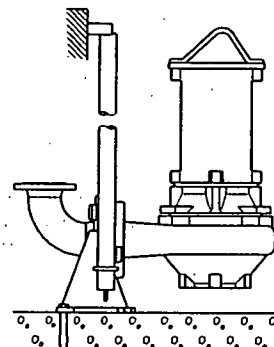
Shaded code items are provided on the rating plate of the pump.

Code Item	Description
1. Pump type	S Sarlin S-type
2. Impeller	T Vortex contractor
3. Motor specification	Standard
4. Motor power	Motor power in kW
5. Motor pole number	Motor speed at 50 Hz and 60 Hz rpm rpm 2 2-pole 3000 3600 4 4-pole 1500 180
6. Generation marker	1. Generation A 2. Generation B 3. Generation, etc. The generation indicator differentiates between structurally different pumps that have the same power rating.
7. Impeller classification	No classification L Low head M Medium head H High head
8. Supply phase number	3-phase 1 1-phase
9. Interchangeability	Interchangeability letter (A , B , C ...) indicates interchangeability limitation of parts between otherwise identical pumps. Pumps with no or the same letter have full interchangeability of all parts and use the same spare parts catalogue.
10. Supply frequency	5 50 Hz 6 60 Hz
11. Voltage and starting	50 Hz 60 Hz 01 400 V, DOL 01 460 V DOL 02 230 V, DOL 05 380 V DOL 03 415 V, DOL 07 220 V DOL
12. Not in use.	
13. Non-standard items	D Trimmed impeller C Cable length Z Combination of D and C or other. Refer to order acknowledgement for details

Installation versions

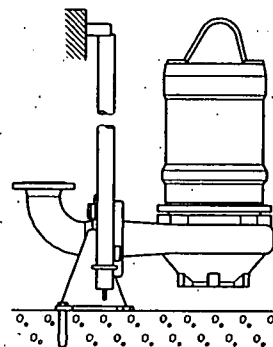
Version 1

Submerged with baseplate and guide rails. Permanent installation in wet well where the pump can be easily withdrawn from and lowered into the wet well along guide rails. A guide shoe bolted to the pressure flange connects automatically to a matching baseplate mounted on the wet well floor, where the pump is kept in place by its own weight. The pump motor cooling is by submergence in the liquid, requiring that the lowest continuous liquid level in the wet well is set at half motor level.



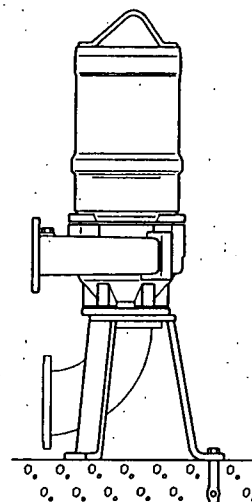
Version 2

Submerged with baseplate and guide rails. Permanent installation in wet well where the pump can be easily withdrawn from and lowered into the wet well along guide rails. A guide shoe bolted to the pressure flange connects automatically to a matching baseplate mounted on the wet well floor, where the pump is kept in place by its own weight. The pump motor cooling is independent of submergence in the pumped liquid by means of motor internal heat conduits (pump of frame sizes 34 through 46) or a cooling jacket encasing the motor stator housing. The lowest continuous liquid level in the wet well may be set lower.



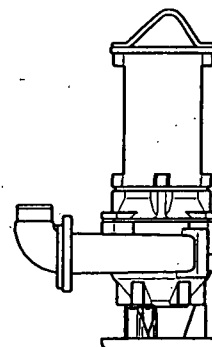
Version 3

Vertical dry installation with stand. Permanent installation in dry well with pump connected to suction line and rising main by bolted flange connections. Pump motor cooling is means of motor internal heat conduits (pump of frame sizes 34 through 46) or a cooling jacket encasing the motor stator housing.



Version 4

Submerged with stand for portable use in wet wells or for temporary use. The pump is equipped with a hose coupling for connection to delivery hose. The pump motor cooling is by submergence in the liquid, requiring that the pump is submerged to at least half motor level when operating.

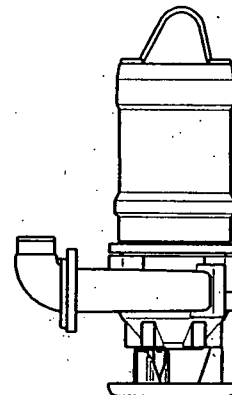


REPAIR MANUAL**SARLIN**
Pumps

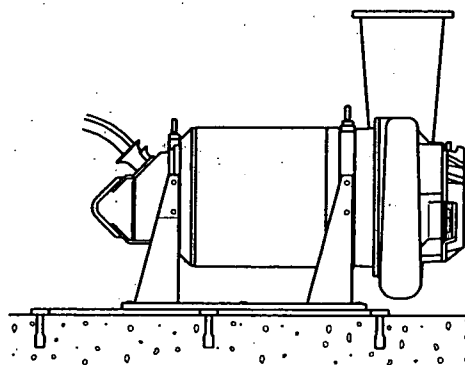
Section 1 Page 9

Version 5

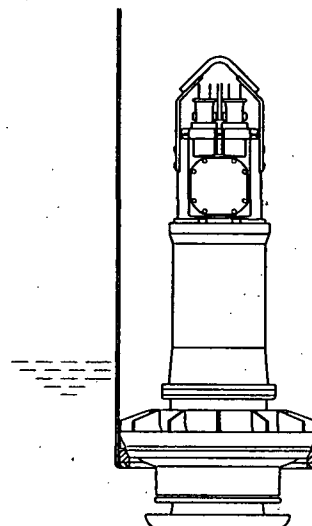
Submerged with stand for portable use in wet wells or for temporary use. The pump is equipped with a hose coupling for connection to delivery hose. Motor cooling is independent of submergence in the pumped liquid by means of motor internal heat conduits (pump of frame sizes 34 through 46) or a cooling jacket encasing the motor stator housing. Pump must be submerged sufficiently for the required suction head only.

**Version 6**

Horizontal dry installation with stand. Permanent installation in dry well with pump connected to suction line and rising main by bolted flange connections. Pump motor cooling is by means of motor internal heat conduits (pump of frame sizes 34 through 46) or a cooling jacket encasing the motor stator housing.

**Version 7**

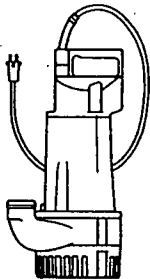
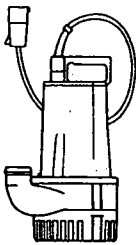
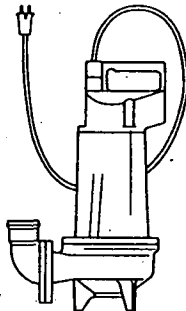
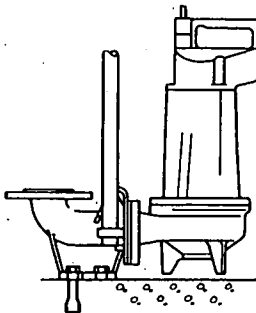
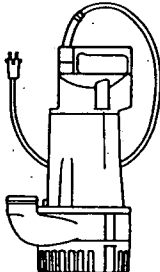
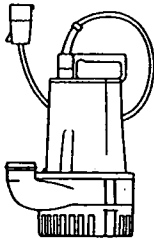
Vertical column installation. Permanent submersible installation in steel tube or concrete shaft. The circular pump casing fits onto a seat ring installed at the shaft or tube bottom opening and the pump stays in place by its own weight and from the reaction forces from the pumping action. The pump casing is special for the version and is open with trailing vanes. The version finds applications in low head installations for large pumped volumes.

**Using this manual**

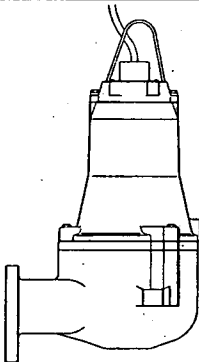
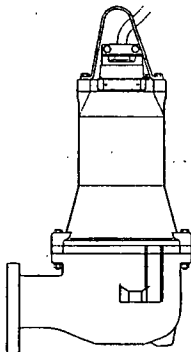
The pumps are grouped in **frame sizes**, each representing a physical motor size distinguished by common external and internal dimensions. Since most service and repair measures are related to frame size, the various service and repair operation descriptions in this manual are grouped according to frame size number. A guide to frame sizes is provided on the following pages for most pumps, for complete reference on frame sizes for all pumps please see Volume 3 B, Section 2.

Guide to frame sizes

Contractor pumps and drainage pumps

Frame size	Pump types			
26	ST 012 1 	ST 012 3 	SP1/SP3 012 vers. 5 	SP1/SP3 012 vers.2 
	ST 022 1 	ST 022 3 		

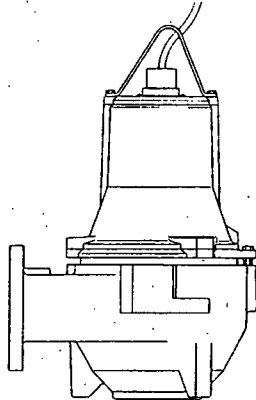
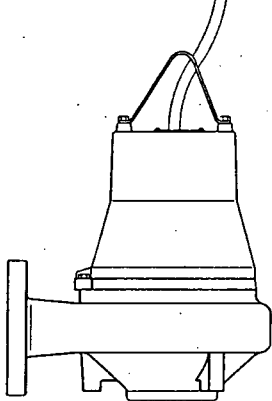
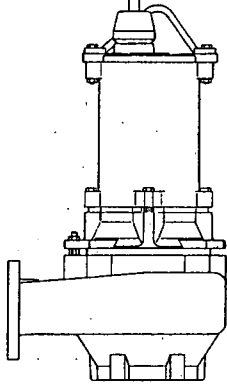
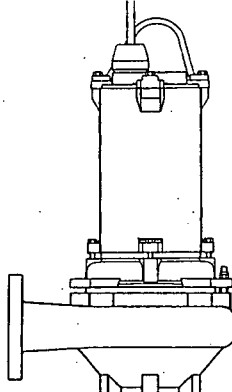
Sewage pumps and raw water pumps

Frame size	Pump outline	Pumps in this frame size
34		SV 014 BL SV 014 B SV 024 B SV 024 BH
38		SV 032 BL SV 032 BM SP 032 BL SP 032 BM

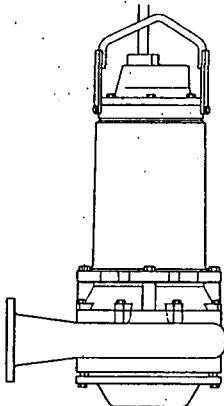
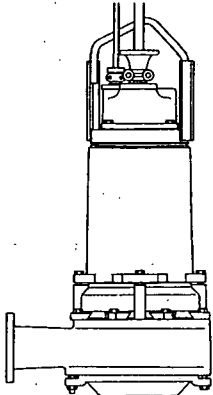
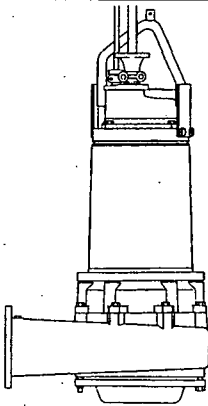
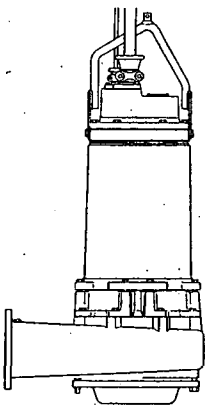
REPAIR MANUAL

SARLIN
Pumps

Section 1 Page 11

Frame size	Pump outline	Pumps in this frame size	
42		S1 024 B S1 024 C S1 034 B S1 044 B S1 044 C S1 026 SV 034 B SV 034 C SV 034 BH	SV 034 CH SV 042 B SV 042 C SV 044 B SV 044 C
46		S1 064 AH S1 064 AM S1 074 AH S1 074 AM S1 074 AS SV 064 B SV 074 B	
50		S1 054 S1 054 M S1 054 L S1 074 E S1 074 L S1 074 M S1 074 H S1 074 S S1 124 AE S1 124 AL S1 124 AM S1 124 AH	SV 054 H SV 074 H SV 124 AH SV 072 B SV 072 BH SV 092 BH SV 112 H SV 122 BH SS 038 SS 066
54		S1 104 L S1 104 M S1 104 H S1 134 L S1 134 M S1 134 H S2 134 L S1 174 L S1 174 M S1 174 H S2 174 L	S1 212 H S1 212 S



Frame size	Pump outline	Pumps in this frame size	
58		S1 184 L S1 184 M S1 184 H S1 224 L S1 224 M S1 224 H S2 224 L S1 264 L S1 264 M S1 264 H S2 264 L	SA 116 SA 264
62		S1 304 L S2 304 AL S1 304 M S2 304 M S1 304 H S1 404 L S2 404 AL S1 404 M S2 404 M S1 404 H	S2 1112 S2 158 S2 208
66		S2 278 L S2 278 M S2 278 H S2 358 M S2 508 L S2 554 M S2 654 AM S1 554 H S1 554 AH S1 654 H S1 654 AH	S3 2212 E S3 2210 L S3 3510 E S3 3510 L S3 508 M S2 508 H
70		S2 754 H S2 754 L S2 754 M S2 754 S S2 836 S2 1004 L S2 1004 M S2 1004 S S2 1304 L S2 1304 M S2 1604 M S2 576 S2 1604 L S2 806 H S2 1306 H S2 1154 H	S3 4510 E S2 658 E S3 808 E S3 658 L S3 806 L S3 1006 L S3 1306 L S3 658 M S3 806 M S3 1006 M S2 854 M S2 1154 M S2 658 H S2 1006 H S1 854 H S2 1604 H

REPAIR MANUAL

Section 1 Page 13

Frame size	Pump outline	Pumps in this frame size
01	<p>A technical line drawing of a pump assembly. It features a vertical cylindrical body with a flange at the bottom. Above the main body is a smaller, dome-shaped component with a central vertical pipe extending upwards. The entire assembly is mounted on a base.</p>	SV 014 SV 024 SV 034 SV 054 A S1 024 S1 034 S1 054 A

2. GENERAL NOTES FOR REPAIR WORK

- | | |
|---------------------------------------|-------------------------------------|
| 2.1 Tools and equipment | 2.6 Handling of stator |
| 2.2 Installing bearings | 2.7 Handling of machined parts |
| 2.3 Instruction for placing O-rings | 2.8 Using compressed air |
| 2.4 Lubricating parts during assembly | 2.9 Be systematic during the repair |
| 2.5 Tightening of screws | 2.10 Electricity |

2.1 TOOLS AND EQUIPMENT

For best results, always use the correct tools and equipment. Poor or incorrect tools must never be used as this will cause damage. See the list of the required tools in Volume 3 B.

2.2 INSTALLING BEARINGS

(see detailed instructions in section 11)

2.2.1 General advice

Before actually fitting a bearing, check the reference number and review the drawings, specifications and procedures.

Apply force only to the race you are fitting. Do not apply force to the rolling elements as this may cause damage.

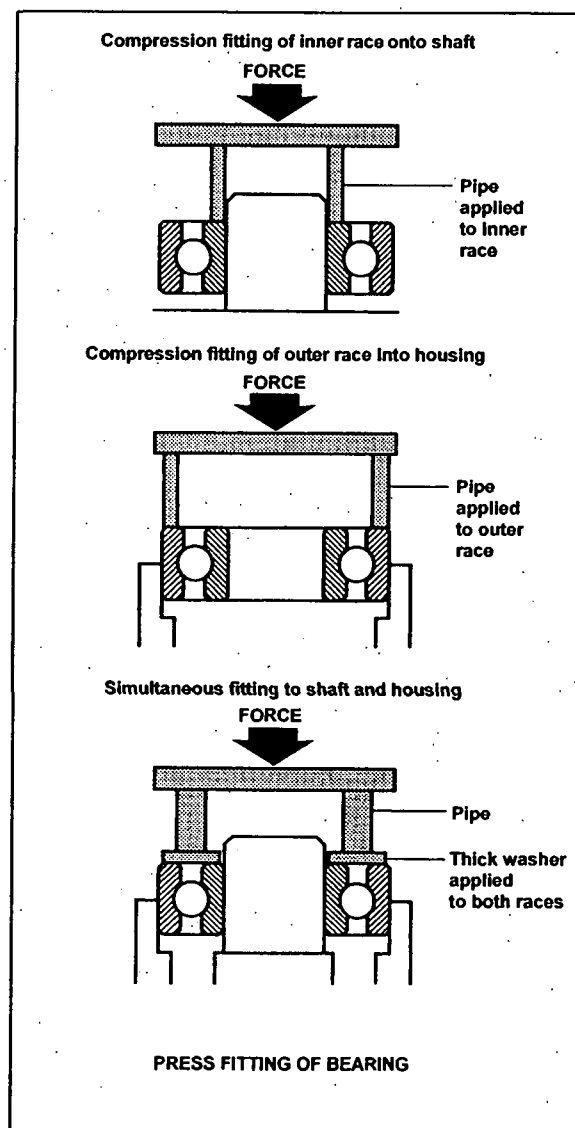
After fitting, and before actually running, check the assembly for possible defects (abnormal noise, vibrations, temperature, clearance, etc.)

Cleanliness

Ensure cleanliness at all times. Any contamination from foreign matter will result in rapid deterioration of the bearing.

Prepare all equipment, ensuring that it is clean. Carefully clean and check all parts and assemblies adjacent to the bearing.

Remove the bearing from its packing just before use, and place it on a perfectly clean workbench. Never wash the bearing. The bearing is protected against oxidation by means of a thin oil film that is compatible with all lubricants. Always use the greases for bearings recommended by Sarlin. If the bearing has to be stored for some time before fitting, protect it from workshop contamination.



REPAIR MANUAL

SARLIN
Pumps

Section 2 Page 2

2.2.2 Installing bearings using a press (or hammer)

It is recommended to use a pipe suited for the bearing to be press-fitted. If compression fitting is used on the shaft and in the housing, a washer that acts on the two rings simultaneously must be used. The two contacting surfaces must be in the same plane in order to position the bearing correctly. This method is particularly recommended for fitting self-aligning ball or roller bearings.

2.2.3 Heat assisted fitting

The temperature must not exceed 110 °C. On the other hand it must be high enough to cause the race to expand sufficiently to enable the bearing to be fitted.

Heating temperature depends partly on bearing dimension, and partly on the interference and material of the seating.

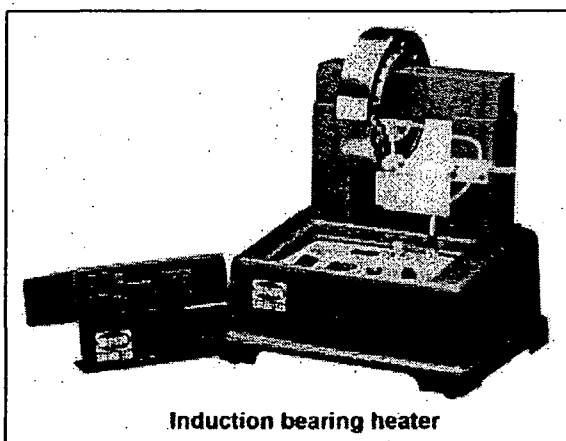
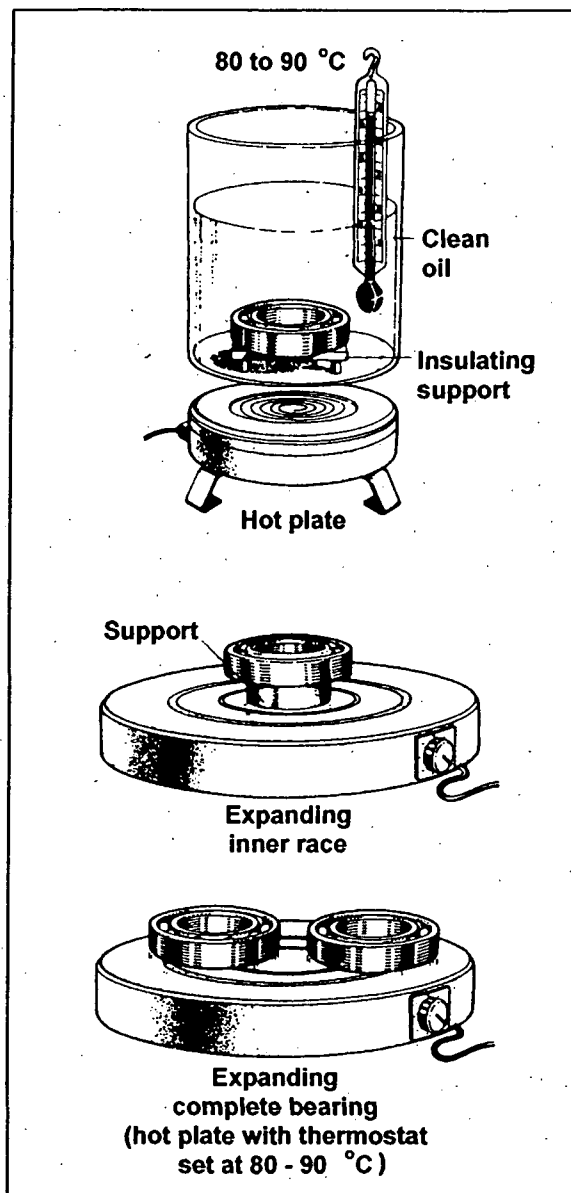
Note: Heating under flame is not recommended under any circumstances.

The various methods of heating are:

- Oil bath. The oil must be fluid and clean. The container must also be clean. Since a high temperature may damage the bearing, a heat insulating support should be placed between the bearing and the bottom of the container.

Note: Bearings greased for life cannot be heated in oil.

- Hot plate. Avoid direct contact between the bearings and plate using a support if no thermostat is provided.
- Oven.
- Induction heating. Induction heating is the best and most reliable method of heating. Only the metal parts are heated; the temperature is controlled by a sensor, and the method is very convenient. The original performance of the bearings will thus be completely preserved.



2.2.4 Disassembly

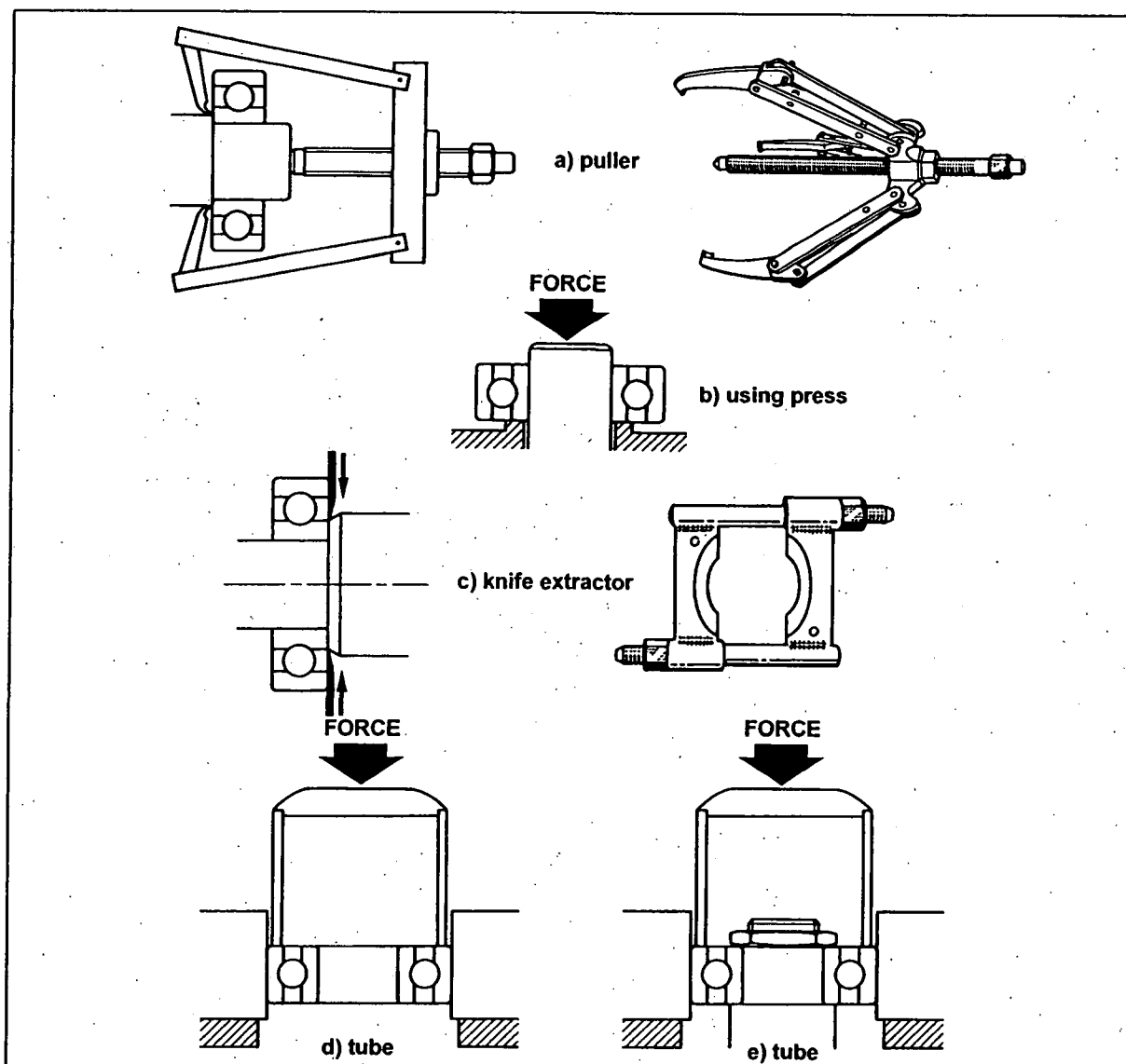
Using pullers or a press (See diagram on page 3.)

- a) Instructions for bearings that are press-fitted onto the shaft. The puller claws must be placed behind the inner race of the bearing when pulling the bearing off the shaft.
- b) If a puller is not available, a vise can be used, with the inner race resting on a support above the jaws, and the shaft hanging freely between them. The extraction force is exerted either by hammer or by press.

If the bearing sits against a shoulder higher than the thickness of the race it can be moved

using the device shown in figure c). This device can then be used for assisting the puller.

- Instructions for bearings press-fitted into the housing. The dismantling force is exerted on one side of the outer race using a pipe such as that shown in figure d).
- Instructions for bearings press-fitted onto the shaft and housing. The method required requires that the bearing is extraction complete with shaft from the housing. The force must be exerted on the outer race and not on the shaft. Figure e) illustrates this procedure which assumes that the housing is accessible from both sides. The bearing is then separated from the shaft.



REPAIR MANUAL**SARLIN**
Pumps

Section 2 Page 4

2.3 INSTRUCTIONS FOR ASSEMBLING O-RINGS

The complete system should be thoroughly cleaned before fitting the O-rings. O-rings should not be pulled over sharp edges, shafts with various diameters, threads, slots, and so on. In order to avoid damage, we recommend covering sharp edges with tape during placing of the O-rings.

The O-ring must not be left in the groove in a twisted position. O-rings should be stretched for a short period while carrying out the placing operation. It is necessary to allow the O-ring some time for reshaping after placing. Shaft seal O-rings with an outside diameter of less than 10 mm must be handled carefully during fitting because of the high expansion ratio they are subjected to.

It is recommended to use either a placing mandrel or a placing sleeve.

Stretching and Contraction

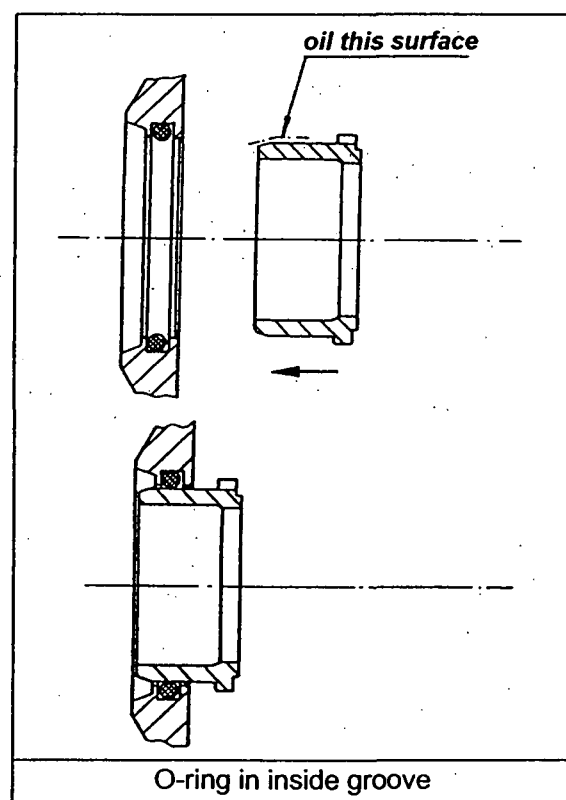
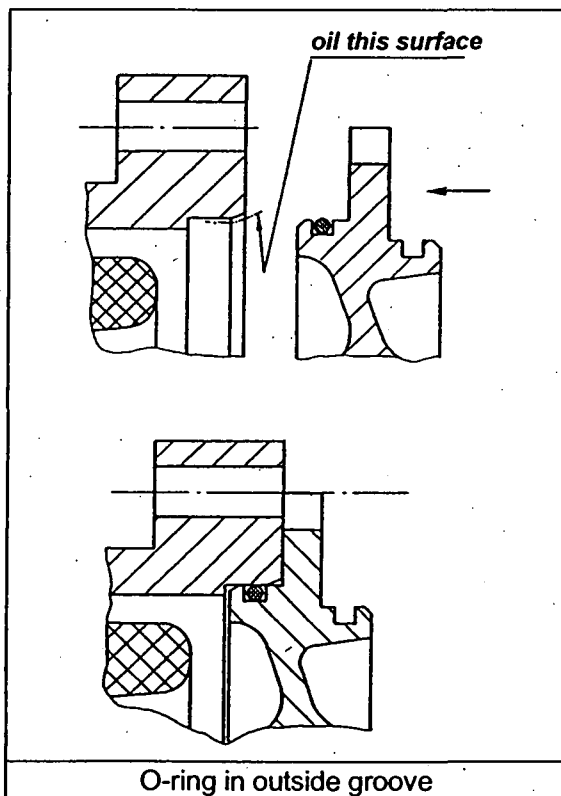
Continuous stretching should not be more than 6%. Otherwise there would be an excessive reduction of the cross-section and an excessive flattening at the inside case. Stretching of the inside diameter by 1 % of results in a reduction of the O-ring cross-section by 0,5% according to the following equation:

$$d_{2\text{after}} = d_{2\text{before}} \times \sqrt{\frac{d_{m\text{before}}}{d_{m\text{after}}}}$$

where d_m = medium O-ring diameter.

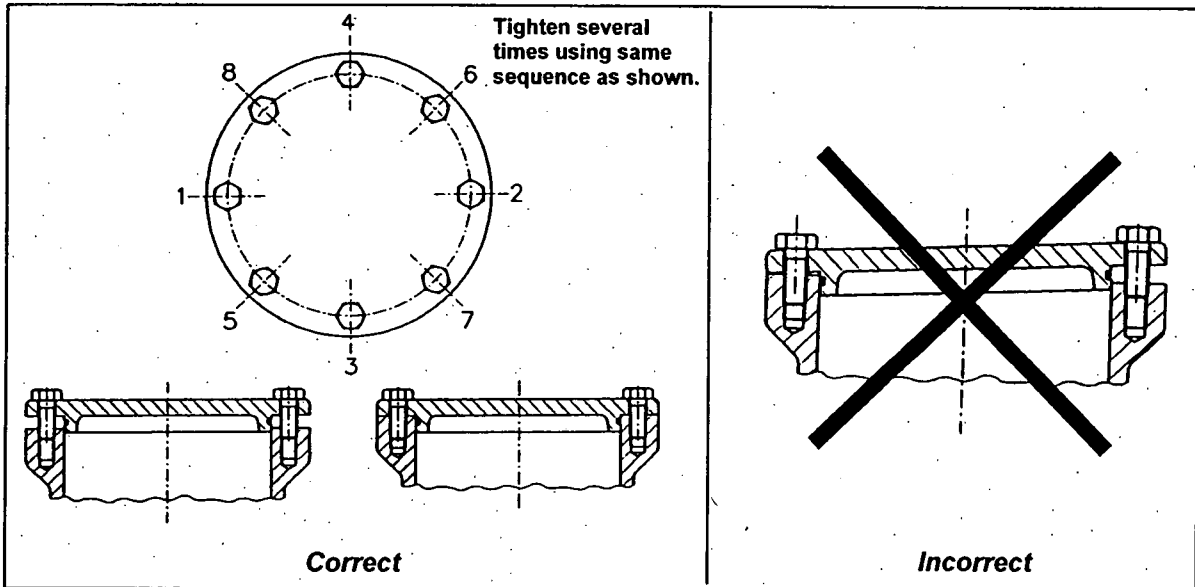
O-ring contraction should not be more than 3%, since otherwise there will be a danger of warping of the rings.

Ideally the O-rings should be not be stretched more than 6%, for contraction up to 3%. For O-rings with an inside diameter of up to 25 mm some overstretching is in practice unavoidable.

2.4 OILING PARTS DURING ASSEMBLY

2.5 TIGHTENING OF SCREWS

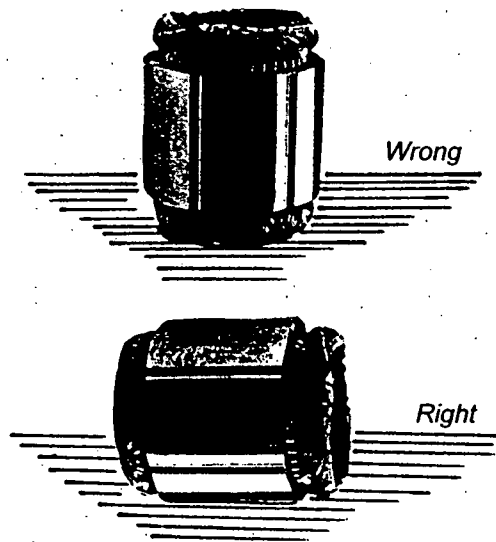
When assembling parts together tighten the screws gradually in a uniform way (sequence as shown below)



2.6 STATOR COIL PACKAGE

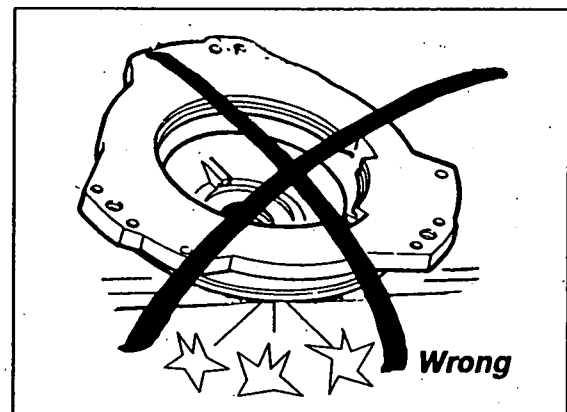
- Be very careful with the stator coil package. Coil ends can be damaged easily.
- Never place the stators vertically.
- Make sure that the coil ends are not dented during assembly or handling.

Make sure that no dust or foreign particles get into the coil windings. They may cause insulation failure and a short circuit.



2.7 MACHINED PARTS

Make sure that machined surfaces do not get dented. Scratches in machined surfaces can cause leakage and problems in the assembly.



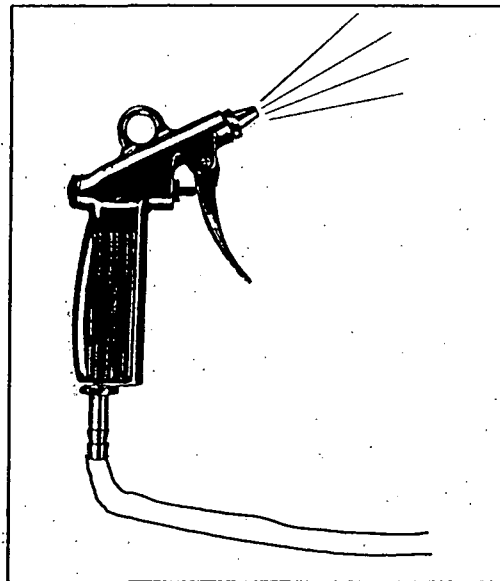
REPAIR MANUAL**SARLIN**
Pumps

Section 2 Page 6

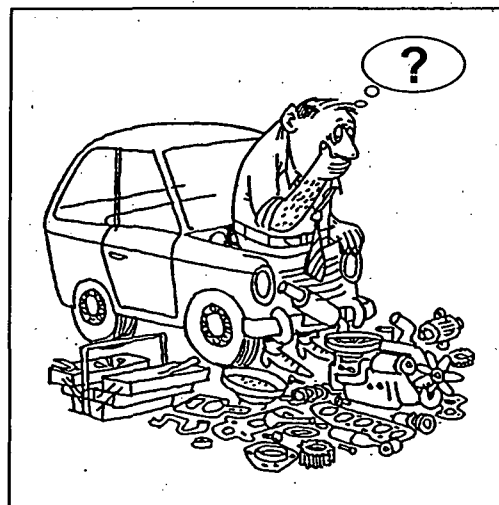
2.8 BLOWING WITH COMPRESSED AIR

- Be careful with compressed air when cleaning parts during assembly. Trash and chips must not be allowed to fly inside the motor; or get into the bearing brackets, oil housing or stator coils.

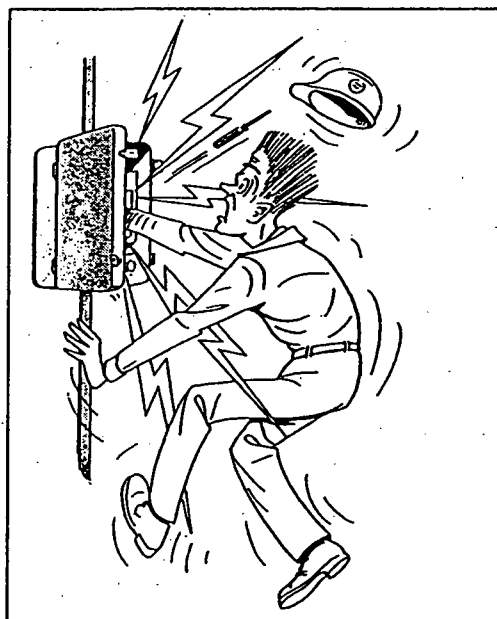
NOTE Always wear safety goggles when using compressed air.

**2.9 BE SYSTEMATIC WHEN MAKING REPAIRS**

- Do not work like the man at right with his car.
- Put the parts in order when dismantling the pump. This makes it much easier to carry out the assembly afterwards.

**2.10 ELECTRICITY!**

Remember safety regulations.



3. TROUBLESHOOTING AND TESTING

Troubleshooting should be performed at the installation or pump usage site. Motor repairs should always be referred to a repair shop.

Trouble	Possible cause	Check and remedy
Pump fails to start or stops without visible reason.	No power to motor.	Check power supply and fuses. Operate manual start and check contactor operation.
Pump fails to start or stops. Control panel indicates tripped overcurrent relay or protection devices	Loss of one phase of power supply.	Check power supply and fuses.
	Pump momentarily overloaded.	If condition not self-corrective, check for cause.
	Impeller jammed.	Check impeller and clear as necessary.
	Overcurrent relay incorrectly set.	Check and reset as necessary according to nominal current.
	Thermal switches tripped. Pump inadequately cooled.	Allow motor to cool. Ensure adequate cooling by immersion for pumps version 1 and 4.
	Moisture switch in motor tripped.	Check control circuit. If circuit remains open after motor has cooled bring pump to shop.
	Motor cable damaged.	Check for visual damages. Bring pump to shop if repair needed.
	Fluctuating voltage.	Check voltage. Allowable deviation is +/- 5%.
Pump runs but does not deliver rated volume flow.	Pump runs backwards.	Check direction of rotation and rectify as necessary.
	Impeller loose or worn.	Check impeller and replace as necessary.
	Pump or pipework clogged.	Check and clear as necessary.
	Pump head too high.	Check by pressure gauging and redesign rising main or install other pump.
	Valves closed or clogged. Check valve not operating.	Check valve position, clean as necessary. Relocate or replace check valve.
	Air accumulated in pump casing or suction pipeline.	Remove air. Raise wet well stop level or redesign suction pipeline.
	Pumped liquid too dense.	Dilute or redesign process.
	Pump not properly connected to submersible baseplate.	Pump down wet well level, lift pump and relocate onto baseplate.
	Leaking pipework.	Check pipework for leaks and fix as necessary.
	Pump wet well flushing system inadvertently activated.	Check for function and repair as necessary.

REPAIR MANUAL

Section 3 Page 2

Trouble	Possible cause	Check and remedy
Pump starts but shuts off.	Clogged pump causes overload to trip.	Check and clear pump as necessary.
	Motor overheated, tripping thermal switches.	Allow pump to cool; check for cause as above.
	Insufficient liquid in wet well.	Allow wet well to fill.
	Level control failure.	Clean or reset level control equipment or replace as necessary.
Pump vibrating or emitting excessive noise.	Pump partially clogged.	Check and clear pump as necessary.
	Pump runs backwards.	Check direction of rotation and rectify as necessary.
	Pump operates outside designed operation range.	Check pump head. Redesign rising main or select other pump.
	Pump mechanical failure.	Check pump for damages. Repair or bring to repair shop as necessary.
	Pump not correctly engaged to submersible baseplate.	Pump down wet well level, lift pump and relocate onto baseplate.
	Pump cavitates.	Check pump for partial suction blockage and clear as necessary. Check duty point and adjust as necessary.
	Pump stand, baseplate or guide rails not securely installed.	Check installation and tighten bolts where necessary.
Oil watery or emulsified.	Lower seal leakage.	Bring pump to workshop for repair.
Low oil level.	Upper seal leakage.	Bring pump to workshop for repair.

When doing electrical work, make absolutely sure that the pump is isolated from the power mains by removing fuses or cutting off at main switch. Observe all local regulations for electrical work and have an authorised electrician only perform all connecting and disconnecting work.

The pump motor may be dismantled and by authorised personnel only at an authorised repair workshop. After reassembly the pump motor must be subjected to tests for watertightness and electrical performance.

ELECTRICAL TESTING

Electrical measurements are made to determine if pump malfunctions are being caused by problems in the motor or in the motor cable.

CAUTION! When reconnecting any electrical leads refer to the wiring diagram(s) for the motor and the control panel. Connections to the wrong terminals may cause damage to the motor and/or control devices.

Voltage imbalance

Use a voltmeter to read each phase of the incoming 3-phase power. Each phase must be in balance with the other two as closely as can be measured with a commercial instrument. If the phases are out of balance, contact your power company. If the phases are in balance, check out the motor as described in the following steps:

- A) Use a voltmeter to read the voltage of incoming power lines 1 and 2, 2 and 3, and 1 and 3 at the control panel. The voltage must match as closely as can be measured. If possible, measure the voltage at the control panel with:
 1. pump off
 2. pump running in air
 3. pump submerged and running

The measured voltage under each condition should be the same.

- B) If the phases are in sequence when the pump is off but is out of sequence when the pump is running, check the power source, all interconnecting cables and the pump motor to locate the defect.
- C) Use an amprobe or equivalent instrument to measure the current (amperage) of each phase while the pump is running under full load, and with no load. In each condition, the amperage readings for all three phases must match as closely as

can be measured. Normal amperage values are listed in Volume 3B (Section 2).

Motor and power cable continuity

- A) Shut off incoming power to the control panel, and disconnect the motor power cable leads. Connect the ohmmeter test leads to any power cable leads (U1-U2, V1-V2, W1-W2 or U1-V1, U1-W1, V1-W1), and note the ohmmeter reading. A high resistance reading indicates an open or broken circuit in the power cable or motor windings, or a bad connection between the motor and cable.
- B) Repeat step A with each set of leads. The three readings must be as close as can be measured.
- C) If the readings indicate that continuity problems exist in the motor or motor cable, the motor must be returned to an approved repair shop.

Insulation resistance

- A) Disconnect the incoming power to the control panel, and disconnect the motor power cable leads. Connect one megohmmeter test lead to the motor cable green/yellow ground lead. Touch the other test lead to each of the motor cable leads in turn. Note the readings.
- B) The readings will indicate resistance values in both the power cable and motor windings. If the resistance reads infinity, the insulation is good. If the resistance reads between infinity and 100 megohms, the insulation is acceptable but should be rechecked regularly. If the resistance reads less than 100 megohms, the insulation should be checked more closely and frequently.
- C) If the readings indicate that a ground exists, test the stator and motor power cable separately. Replace as required.

REPAIR MANUAL



Section 3 Page 4

This page left intentionally blank.

4. PROCEDURES AND TESTING WHEN STARTING WORK ON PUMP

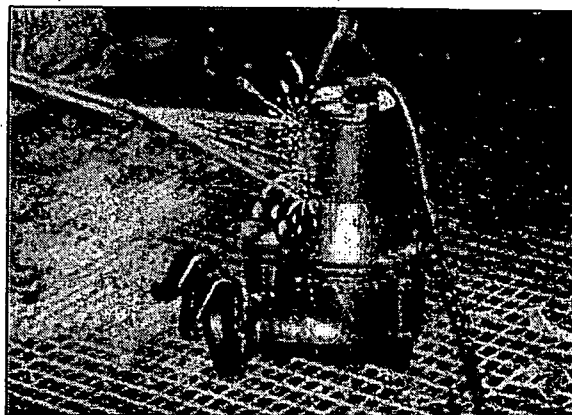
4.1 CLEANING

- Seal the loose cable end. A wet cable end may allow water to seep into the cable and into the motor.
- Wash the pump carefully.
- Remove caked dirt from the motor surface.

NOTE Dirt on the motor surface hampers cooling. Dirt not removed may get into sensitive parts e.g. the seals, during handling.

- Dry the pump after washing.
- For cleaning of a pump equipped with cooling jacket, please refer to Section 7.

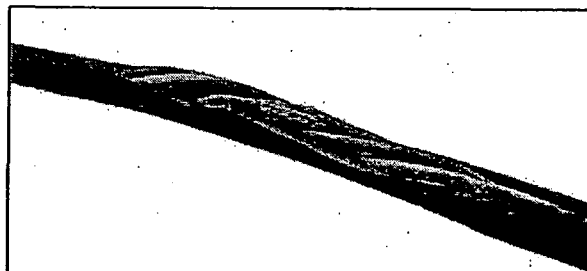
WARNING: When using cleaning solvents, remember that most of them are toxic and flammable. Use them only in a well ventilated area that is free from flame, sparks and excessive heat. Read and follow all precautions printed on the solvent container.



Washing dirty pump.

4.2 VISUAL INSPECTION

- Note possible external damage.
- Inspect the cable carefully. If the cable sheath is damaged, replace the cable.



Damaged cable sheath.

4.3 MOTOR SPACE INSPECTION.

- For pumps with cooling jacket, first remove the jacket. Please refer to Section 7.
- Open the inspection plug at the base of the stator and check whether there is any fluid (water, oil or a mixture of both) inside the motor. A small amount of clean oil does not require corrective procedures. If, however, water or a substantial amount of oil is found in the motor casing, both the bearings and the seals must be inspected (Section 10 and 11).

NOTE There can be a pressure build-up in the motor housing - open plug slowly.

- Measure the insulation resistance (Section 4.4.3) and, if necessary, dry out any wet parts See Section 12 and 13).



Motor casing inspection. Inspection plug removed.

REPAIR MANUAL**SARLIN**
Pumps

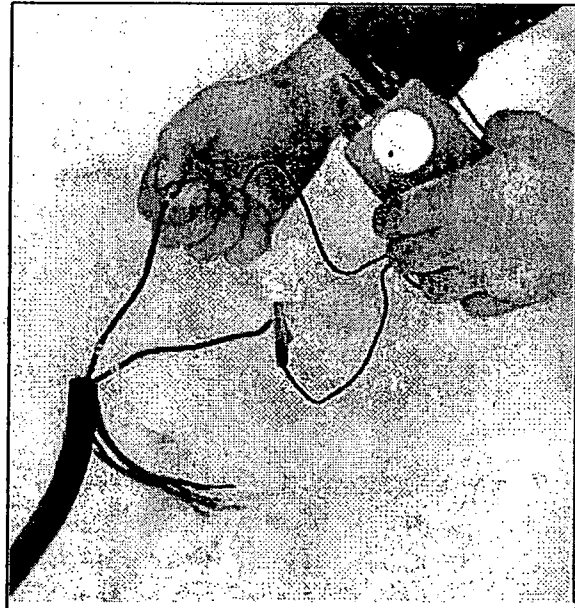
Section 4 Page 2

4.4 ELECTRICAL MEASUREMENTS

- If the cable is undamaged, make the measurements from the free cable end.
- If cable is damaged, measure from the cable terminal with cable disconnected. Connection terminals are accessible by hand once the motor cover has been removed. See Section 12.
- If you discover moisture in the motor, dismantle it and dry it out in an oven. See Section 13. Repeat all electrical measurements.

4.4.1 Testing internal motor control devices

- Connect tester (test bell, test lamp etc.) to leads P1 and P2 (on older pumps marked 1 and 2). If tester functions (bell rings, lights come on) the control circuit is closed and intact.

*Testing protective devices***4.4.2 Testing the earth connection**

- Connect one tester to the earth lead (yellow-green) and the second one to the pump body (an uninsulated point, not to the cooling jacket, if there is one). If tester functions, then the earth connection is in order.
- If tester doesn't function, the earth connection is faulty and must be repaired.

WARNING The pump should under no circumstances be connected to the mains voltage if the earth connection is not intact. Disregard of this precaution results in mortal danger.

*Testing earth connection.***4.4.3 Measuring insulation resistance**

- Use an insulation resistance tester, that can apply at least 500 volts DC.
- The insulation resistance must be greater than 100 megohms.
- Measure earth (body) to phases U1, V1 and W1
- Measure earth (body) to control circuit leads P1 and P2 (1 and 2)
- Measure control circuit leads P1 and P2 to phases U1, V1 and W1
- Measure between phases.

If any of the above-mentioned measurements are below 100 megohms, measure cable, windings and devices separately to find out where the insulation resistance has decreased.

Reduction of insulation resistance due to moisture requires drying of the relevant parts. See Section 12 cable drying and Section 13 stator and rotor drying.



4.4.4 Stator coil resistance

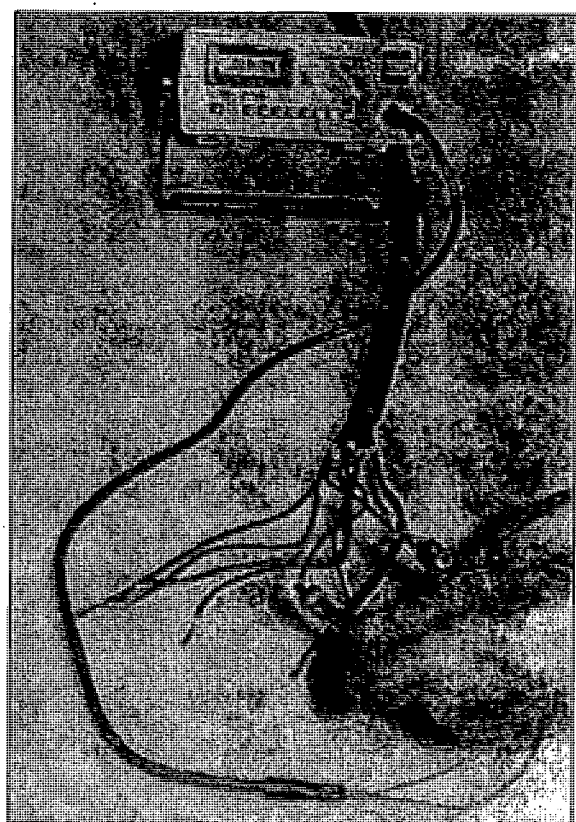
NOTE

Resistance values for motors are listed in the repair guide, part 3B.

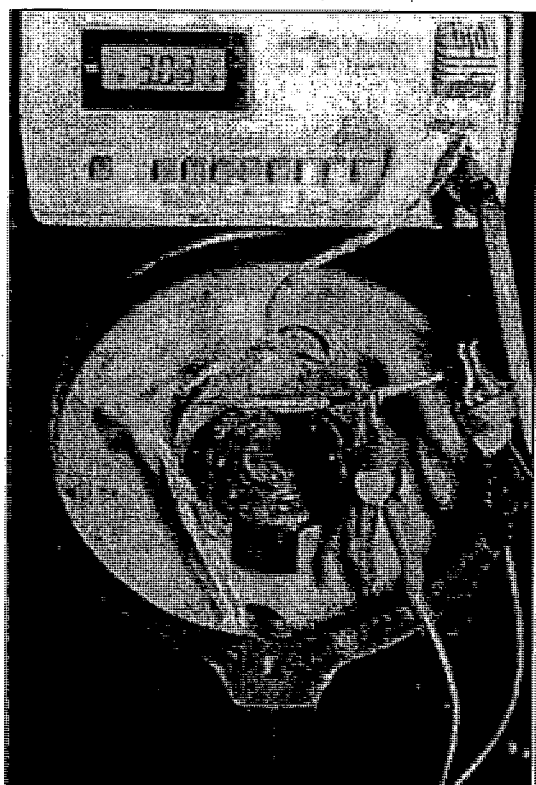
- The stator winding (coil) resistance is measured to find out the condition of the coils.
- If measurement from the free cable end indicates false readings, measure the resistance from the coil ends within the terminal space with cable disconnected.
- If zero readings or thereabouts are obtained, the stator must be dried before the stator resistance measurements are carried out. See Section 13.
- Verifying damage to the windings. Consistent readings for the resistance values of the different phases is sufficient evidence of winding damage. The measurements can be performed with a reliable multimeter with 3 digit accuracy. However, the maximum allowable difference between the phases is $\pm 10\%$.



Measuring insulation resistance.



Measuring stator winding resistance at cable free end.



Measuring stator coil resistance at terminal space.

REPAIR MANUAL



Section 4 Page 4

This page left intentionally blank.

5. DISMANTLING AND ASSEMBLING THE PUMP PARTS

5.1 SUCTION CLEARANCE INSPECTION AND ADJUSTMENT. VERSIONS 1,2,4,5 AND 7.

- All SI, S2, S3, S4, SN and SS pumps have an axial impeller clearance of $0,7 \pm 0,2$ mm.
- If the clearance has increased to 1,2 mm or more, readjust it to the specified value.

NOTE There is no clearance adjustment possibility on SV-pumps. You can check the impeller and volute casing for wear only.

Proceed as follows:

A. PUMPS FRAME SIZE 58 AND ABOVE

The adjusting screws are located in the suction cover at the bottom of the volute casing:

- Adjustment is made by tightening the adjusting screws.
- Measure the clearance several times when adjusting with a feeler gauge at different points by rotating the impeller by hand to different positions.

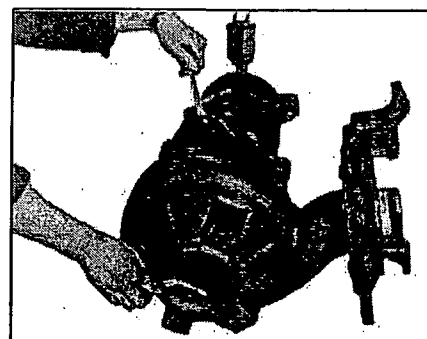


Suction clearance adjustment

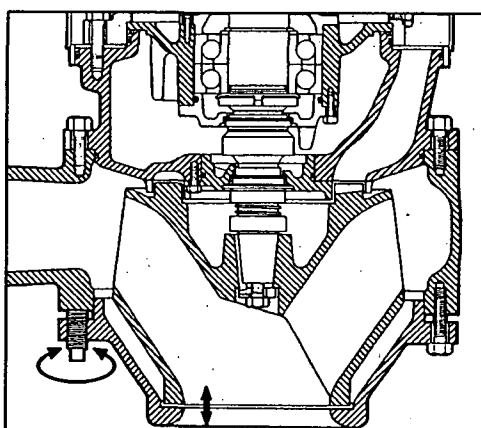
B. PUMPS FRAME SIZES 01... 54

The adjusting screws are located in the oil housing :

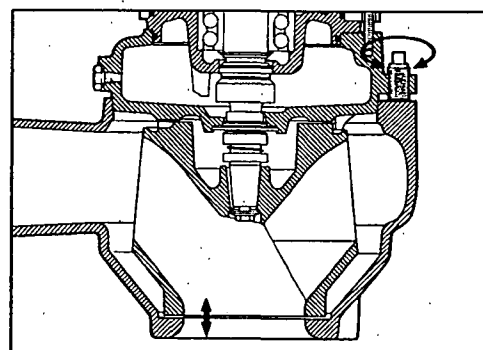
- Adjustment is made by tightening the adjusting screws.
- Measure the clearance several times when adjusting with a feeler gauge at different points and rotate the impeller by hand to different positions.



Suction clearance adjustment.



A. Adjusting screws located in suction cover. Frame size 58 and larger.



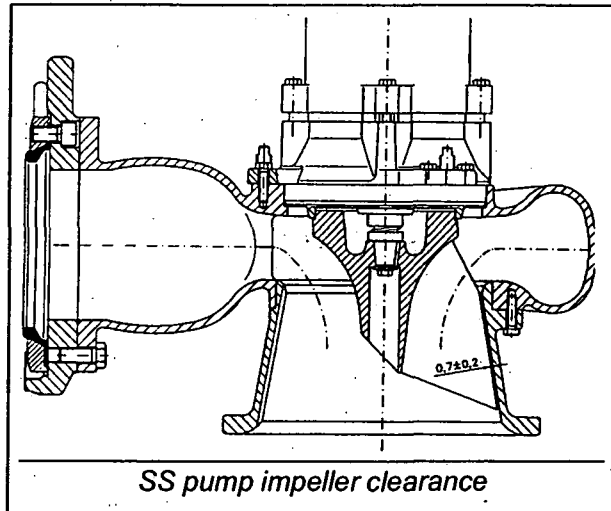
B. Adjusting screws located in oil housing. Frame sizes 01 through 54.

REPAIR MANUAL**SARLIN**
Pumps

Section 5 Page 2

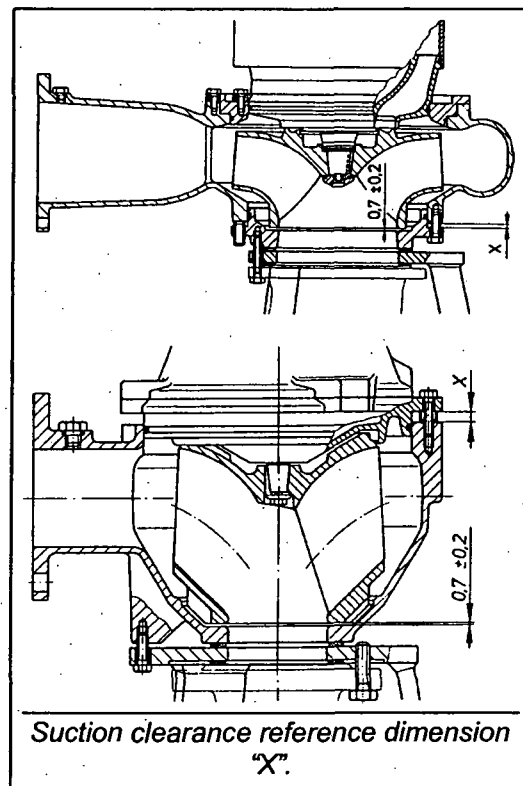
NOTE

In the SS pumps the adjustment is the same as in case B, but the adjusting screws work in the reverse direction.

**5.2 SUCTION CLEARANCE INSPECTION AND ADJUSTMENT. VERSIONS 3 AND 6.**

The following procedure should be followed in adjusting the suction clearance when the pumps are still connected to the suction and/or pressure piping.

- For pumps with separate suction cover, loosen the suction pipe flange
- Open the locking screws (item No. 028).
- Open the adjusting screws (item No. 074) until they clear the volute casing
- Tighten the locking screws until the clearance "s" closes.
- Measure and make a note of the reference gap "X" with feeler gauges.
- Tighten the adjusting screws until the reference gap has widened by 0.7 ± 0.2 mm.
- Retighten the locking screw. Confirm the gap "X".

**NOTE**

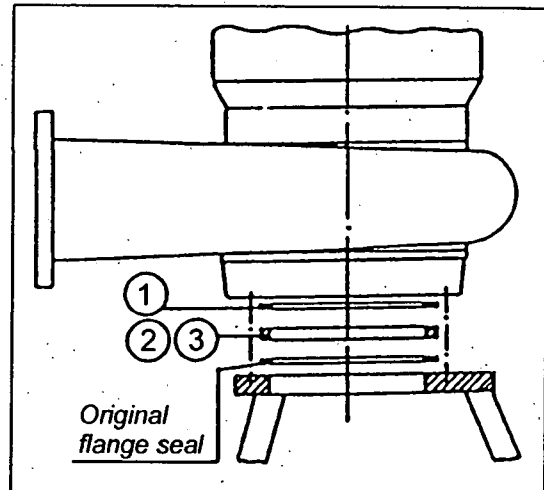
For pump units with a separate suction cover (frame size 58 and larger): If the impeller clearance is found to be worn excessively, spacers (adjusting shim item No. 083) should be used between the pump suction flange and pipework flange to relieve tension in the pipework.

Adjustment spacers:

- | | |
|----------------|----------------|
| 1. Flange seal | Thickness 3 mm |
| 2. Shim No.1 | Thickness 2 mm |
| 3. Shim No. 2 | Thickness 4 mm |

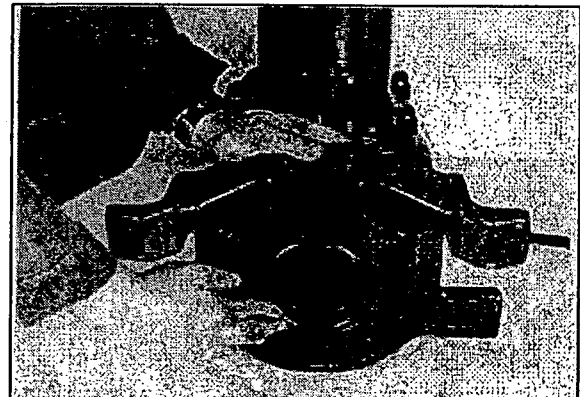
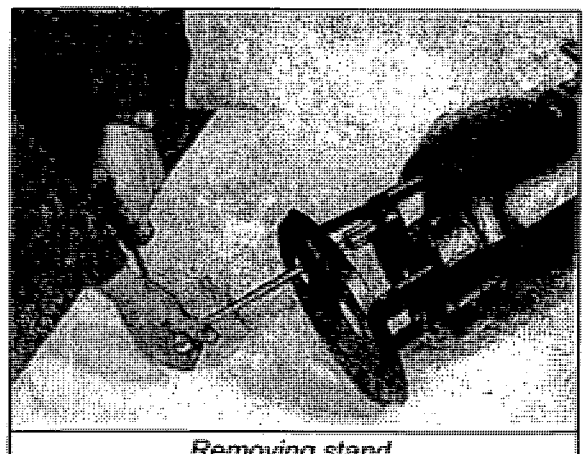
Adjustment spacer usage sequence

Set No.	Parts	Thickness
1	1	3 mm
2	1 + 2	5 mm
3	1 + 3	7 mm

**5.3 REMOVAL AND INSTALLATION OF STAND AND CONNECTING GUIDE SHOE**

Dismantling is necessary only if the parts are damaged or worn to the point of needing replacement.

- Check especially the rubber diaphragm. Replace it if there are any tears or if it shows significant wear.
- Dismantle the parts by loosening the fixing screws.
- Reinstallation is done by fixing the parts in position and tightening the screws.

*Inspecting rubber diaphragm.**Removing guide shoe.**Removing stand.*

REPAIR MANUAL**SARLIN**
Pumps

Section 5 Page 4

5.4 REMOVAL AND INSTALLATION OF SUCTION COVER.

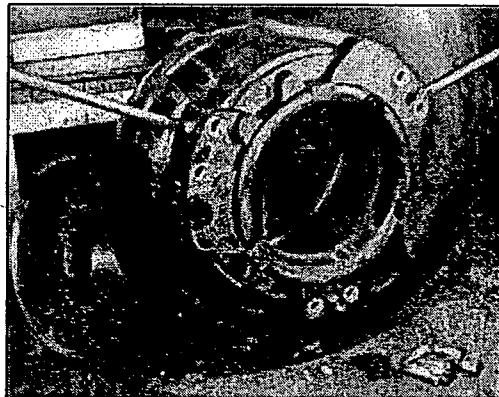
Frame size 58 and larger only.

It is necessary to remove the suction cover when checking the condition of the pump parts, or when the pump parts are worn.

- Unscrew the fixing screws.
- Pry the cover free by using levers. Assembly takes place in reverse order.

In version 3, note the correct position of the cover (flange bore in relation to pump discharge)

- Use a soft hammer to tap at the bottom to facilitate positioning.
- Screw the fixing screws in place.
- Check adjustment of the suction clearance.(see section 5.1)
- Tighten the screws.



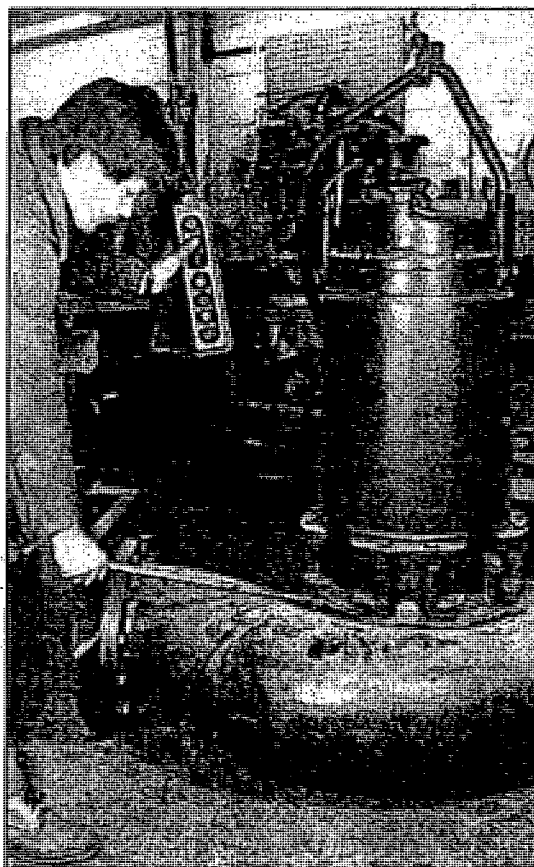
Removing suction cover using levers.

5.5 REMOVAL AND INSTALLATION OF VOLUTE CASING

- Hook the pump to a crane and lift it upright.
- Remove the volute casing fixing screws.
- Lift the motor from the casing.
- If needed, removal of the motor can be aided by tapping all around the casing with a soft hammer or by prying it loose with levers.



Removing volute casing using a soft hammer.



Removing volute casing using levers.

Assembly is done by lowering the motor with its impeller into the volute casing.

- Correct positioning of parts is assisted by light tapping with a soft hammer.
- Screw the locking screws and the adjusting screws in place. Adjust the suction clearance and tighten the locking screw.

WARNING The locking screws must not be tightened before the adjustment has been made. Otherwise the volute casing may press against the impeller which may cause damage to the bearings.

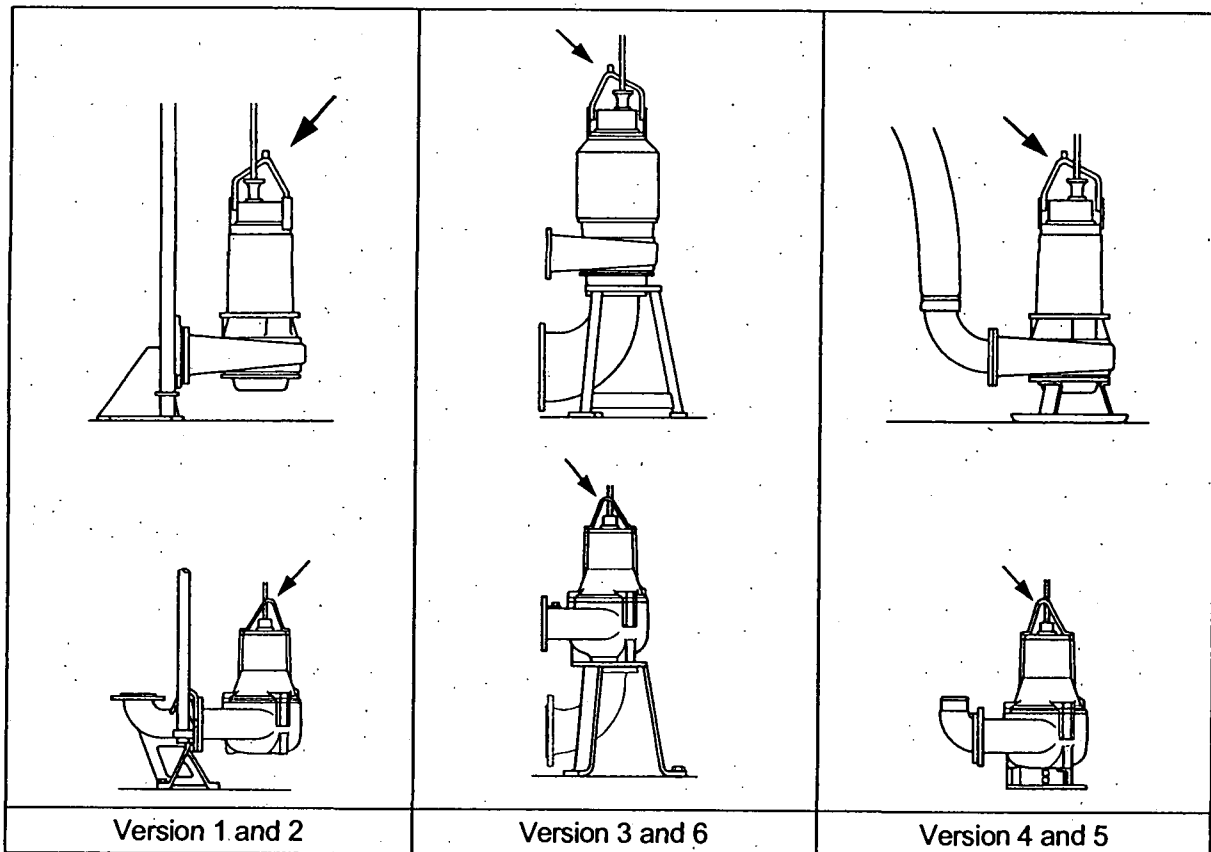
NOTE

SV-pumps have no adjustment facility.

Make sure that the lifting handle is positioned correctly:

- Version 1 and 2: The apex of the lifting handle is on the opposite side of the discharge opening.
- Version 3, 4 and 5: The apex of lifting handle is on the side of the discharge opening.

See the drawings below for reference on correct position of the lifting handle.



5.6 IMPELLER REMOVAL AND INSTALLATION

5.6.1 Removal of the impeller

Place the motor in a horizontal position on a firm workbench or trestle with the impeller facing outward.

- Remove the impeller screw.
- Remove the impeller preferably with a puller.

Removal is also possible with the aid of levers. Place the levers behind the impeller and opposite each other. Be careful. Never use just one lever, as this may cause damage to the shaft or bearings.

NOTE

Place levers under the impeller vane.

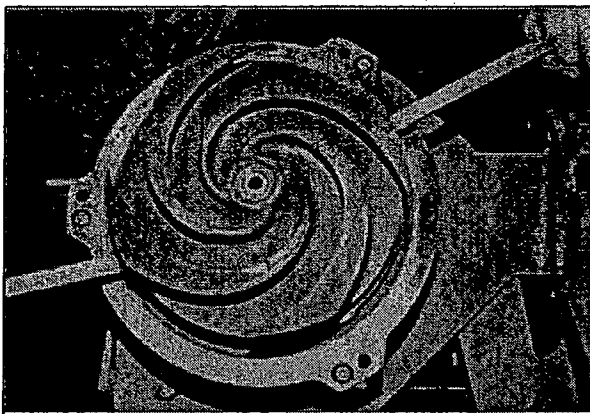
REPAIR MANUAL**SARLIN**
Pumps

Section 5 Page 6

5.6.2 Installation of the impeller

- Check the conical surfaces of the shaft and impeller. Clean them thoroughly.
- Oil the conical surfaces of shaft and impeller before mounting the impeller on the shaft.
- Place the impeller in position. Tighten the impeller screw by using a torque wrench.
- After initial tightening, tap the impeller lightly with a soft hammer in the axial direction.
- Complete the tightening process with the torque wrench. See section 5.1 0.

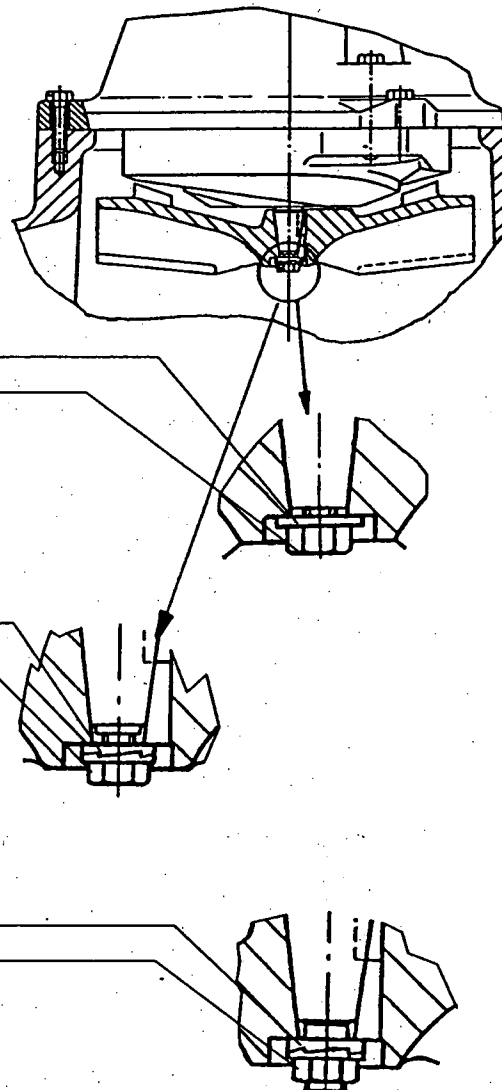
Details of removal and installation are given further on.

5.7 IMPELLER IN FRAME SIZES 26, 30 AND 38 AND 34 UP TO INTERCHANGEABILITY LETTER C*Removing impeller with levers.*

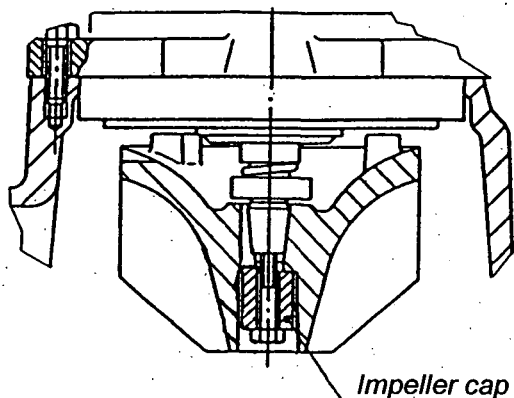
Item	Part	Part No	No. off
007	Washer	FGUB 067	1
010	Impeller screw	FMSR 06016	1
Used in frame size 26 and 30.			
Used in frame size 34 up to pump s/n 64604.			

Item	Part	Part No	No. off
007	Lock washer	FGUL 082	2
010	Impeller screw	FMSR 08020	1
Used in frame size 38.			
Used in frame size 34 from pump s/n 64604 to s/n 101393.			

Item	Part	Part No	No. off
007	Lock washer	FGUL 102	2
010	Impeller nut	FMHM 10	1
Used in frame size 34 from pump s/n 101394 to s/n xxxxxx.			



5.8 IMPELLER IN FRAME SIZES 01 AND FROM 42 TO 54 AND 34 FROM INTERCHANGEABILITY LETTER D ONWARDS

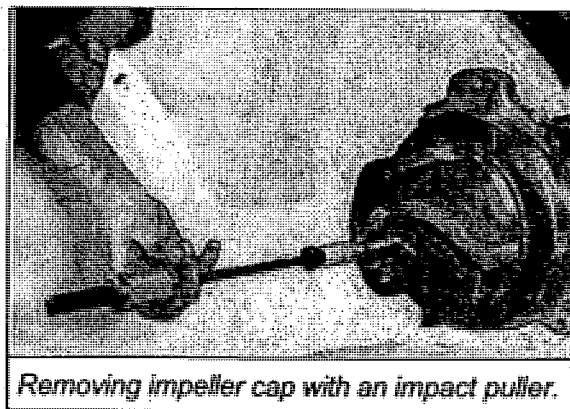
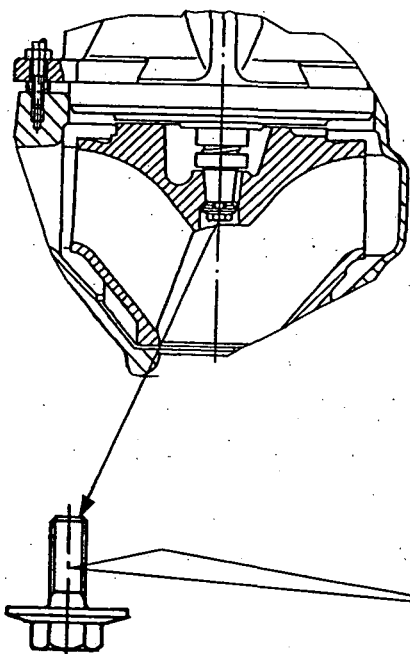


With the earlier, non-SuperVortex, types of SV pumps, in frame sizes 01 and 50 remove the impeller cap by using a special impact removal puller

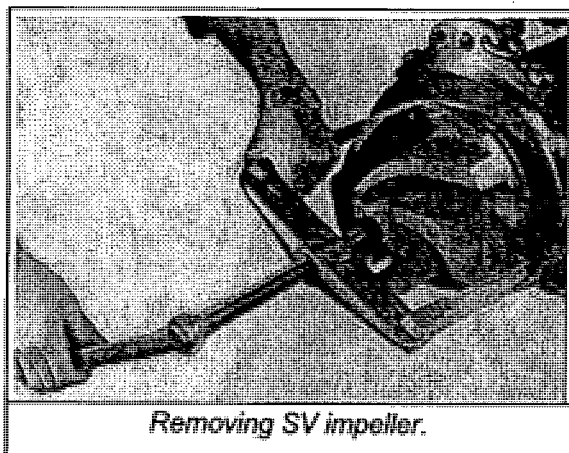
The old types are:

SV 014 - SV 034
SV 042
SV 054A
SV 054 - SV 074
SV 124A

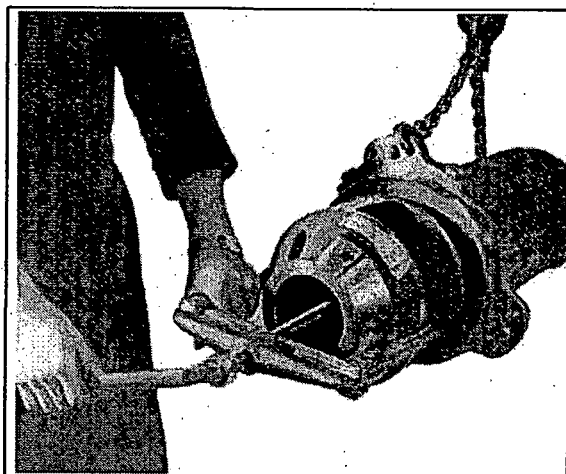
The other pump types in these frame sizes are constructed as shown below.



Removing impeller cap with an impact puller.



Removing SV impeller.

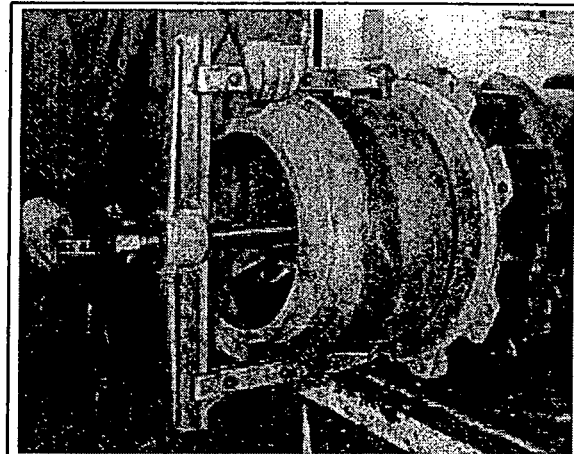
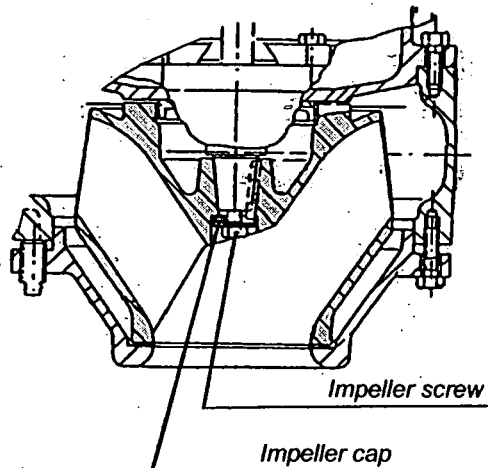
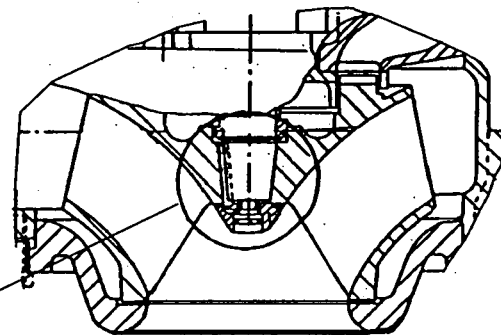
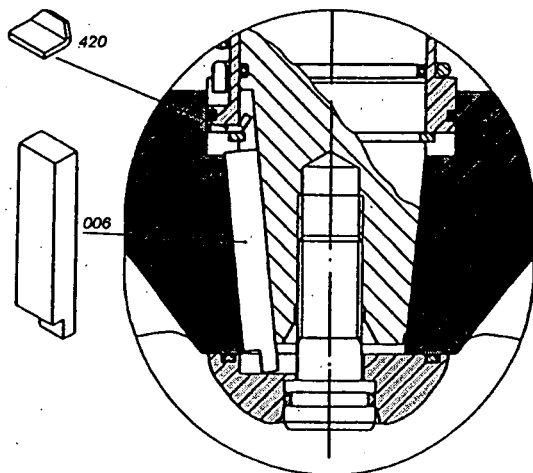


Removing S1, S2, S3, S4 and SN impeller.

Item	Part	Size	Used in frames
010	Imp. Screw 32432	M 8	42, (34)
	Imp. Screw 32437	M 10	46, 50
	Imp. Screw 32438	M 12	54

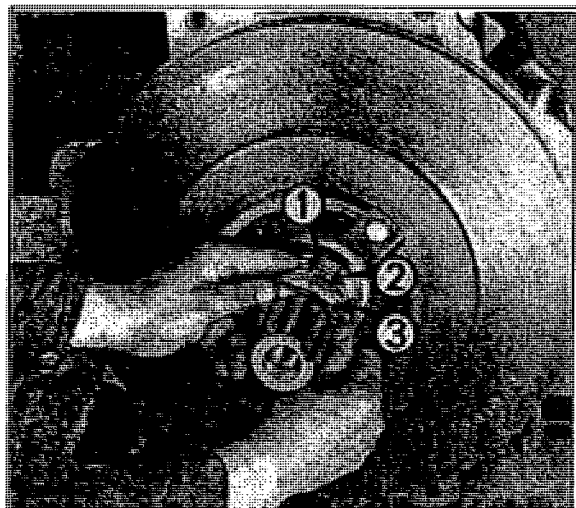
REPAIR MANUAL

Section 5 Page 8

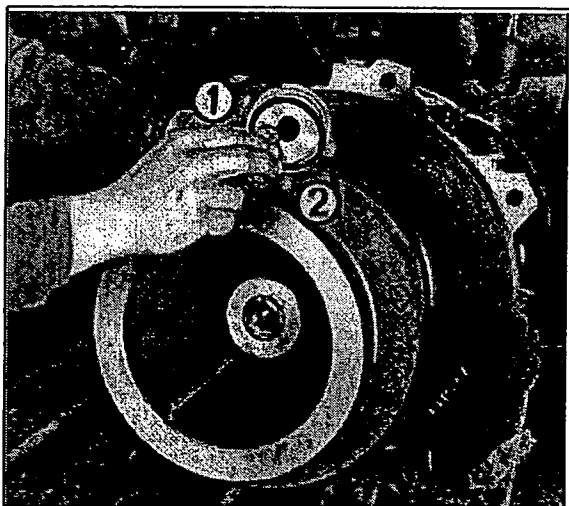
5.9 IMPELLER IN FRAME SIZES 58 TO 70**5.9.1 Impeller for frame sizes 58 and 62***Removing impeller.***5.9.2 Impeller for frame sizes 66 to 70***Item 420. Locking key for shaft sleeve**Item 006. Impeller key**Please note location of impeller key notch.*

In these pumps the shaft has been sealed from contact with the pumped liquid by means of O-rings. Always use good, preferably new O-rings, and lubricate them with oil.

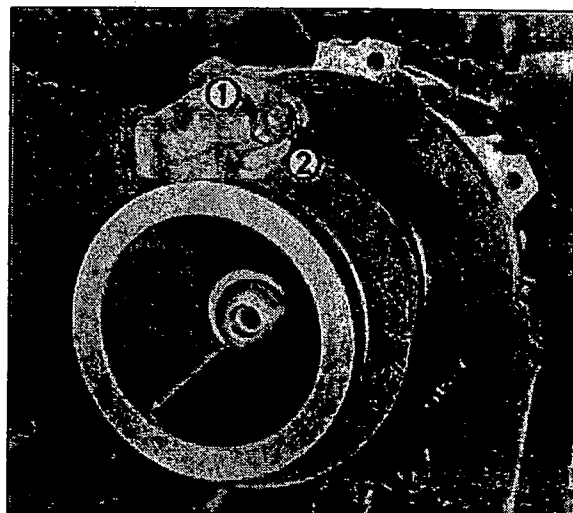
- Check the shaft and the impeller mating surfaces. Clean if necessary.
- Place an O-ring into the groove in the shaft sleeve.

*Fitting O-ring in the shaft protecting sleeve.*

① Retaining ring, ② O-ring groove, ③ O-ring



Fitting impeller cap O-ring.
① Impeller cap. ② O-ring.



Fitting impeller screw O-ring.
① Impeller screw. ② O-ring.

- Lubricate the conical surfaces on the shaft with oil.
- Lubricate the sealing surfaces on the impeller with oil.
- Place the impeller on the shaft.
- Place the O-ring on the impeller cap, then fit the cap in position.
- Place the O-ring into the groove on the head of the impeller screw.
- Tighten the impeller screw according to the instructions. See Section 5.10

5.10 TIGHTENING THE IMPELLER SCREW

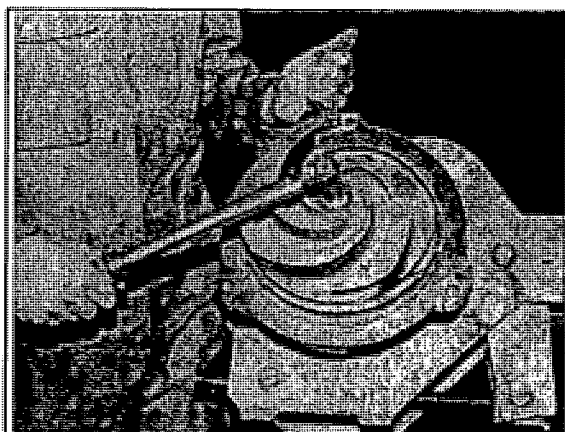
When assembling please note:

The threads of the impeller screw and its mating surfaces must be lubricated with oil to reduce friction and to prevent corrosion of the surfaces.

The fastening torques for different pumps are given in a table in Volume 3 B.

NOTE Using the right torque for-tightening the impeller screw is very important for the following reasons:

- If the torque is too low, the impeller may come loose.
- If the torque is too high, the screw will stretch and lose its tension and the impeller may come loose.

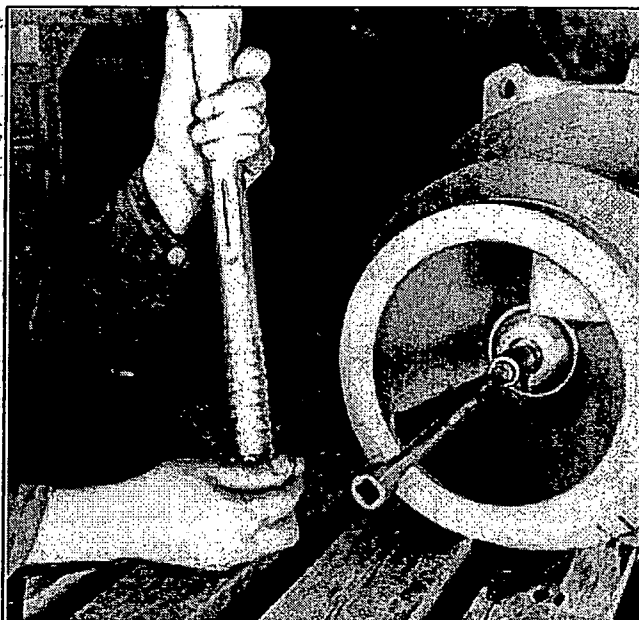


Tightening the impeller screw using a torque wrench (SV impeller).

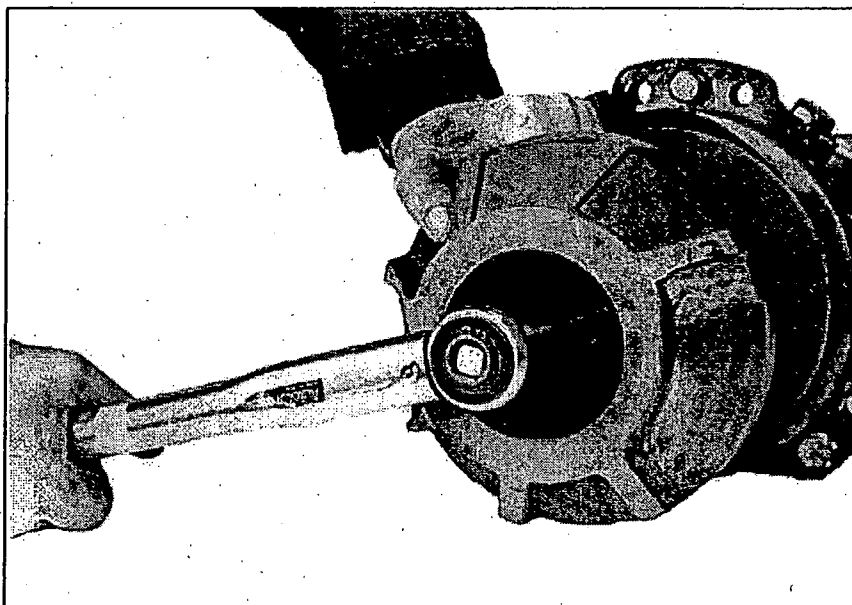
REPAIR MANUAL

Section 5 Page 10

SARLIN
Pumps



*Tightening the impeller screw using a torque wrench.
S2 impeller.*



Tightening the impeller screw using a torque wrench. S1 impeller.



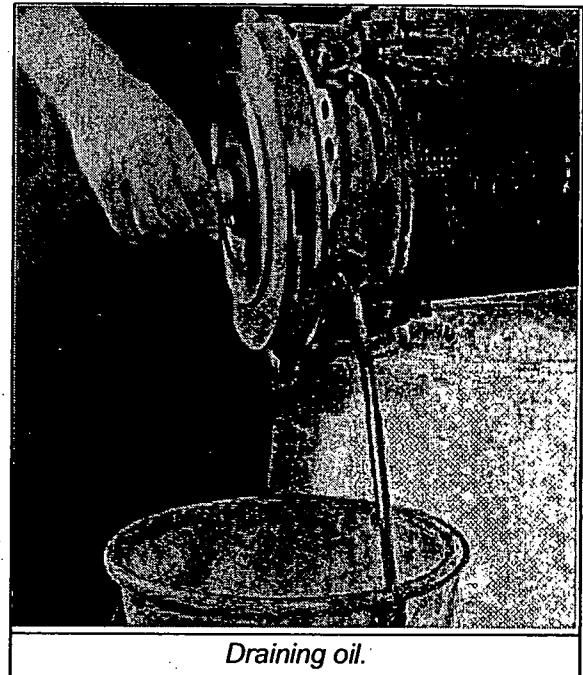
6. OIL DRAINING AND REFILLING

6.1 DRAINING

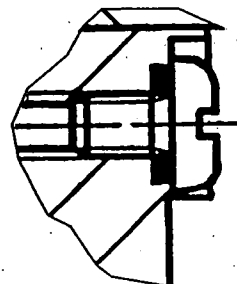
- Place the motor flat on a workbench with one oil plug facing upwards.
- Clean the area around the oil plugs.
- Place a container under the motor.
- Open the upper plug slowly so as to allow possible overpressure to escape.
- Open the plug to the side. Turn the motor and let the oil run out.
- Check the condition of the oil. Clear oil in good condition can be re-used. Emulsified or "milky" oil must be changed. If the oil contains much mixed water, the primary shaft seal must be checked and replaced if necessary.

NOTE Always make sure the oil plugs and the sealing surfaces are OK.

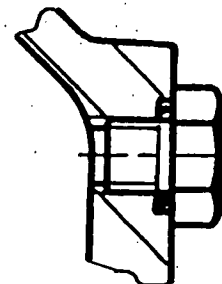
Always replace the O-rings after the oil plugs have been opened.



Draining oil.

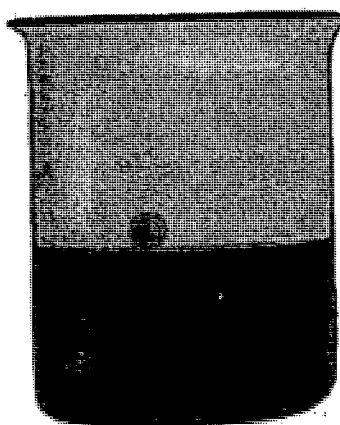


Oil plug for frame sizes 26 to 46. Part No. FMSL 0812 or FMSL 1012

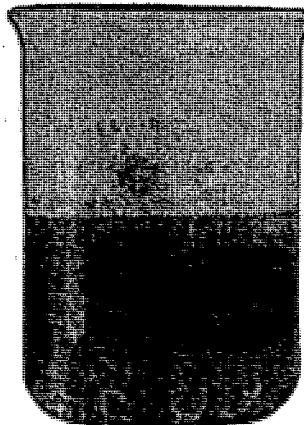


Oil plug for frame sizes 01, 50 and up. Part No. 34041

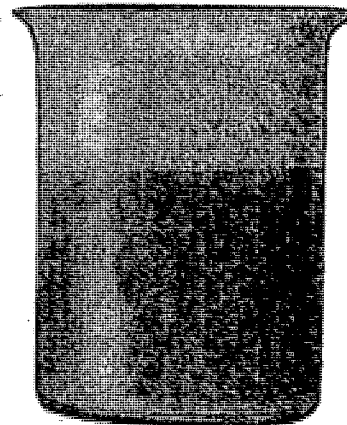
CONDITION OF OIL



A. Oil in good condition.



B. Oil emulsified. Change oil.



C. Excess water in oil. Change oil, check seal.

REPAIR MANUAL**SARLIN**
Pumps

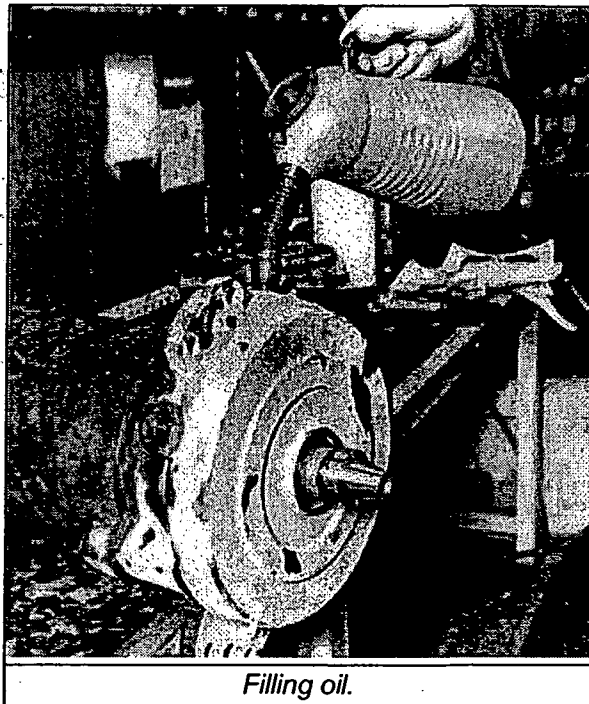
Section 6 Page 2

6.2 REFILLING

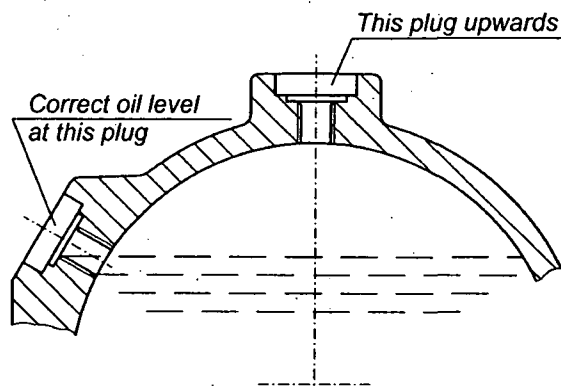
- Use grade SAE 10 W 30 motor oil.
- Fill the oil housing by pouring oil through the fill hole pointing upwards until the oil begins to flow out of the hole pointing to the side.
- Replace the O-rings and lubricate the m slightly with oil.
- Screw in the plugs and tighten up.

NOTE Do not use grease when lubricating O-rings.

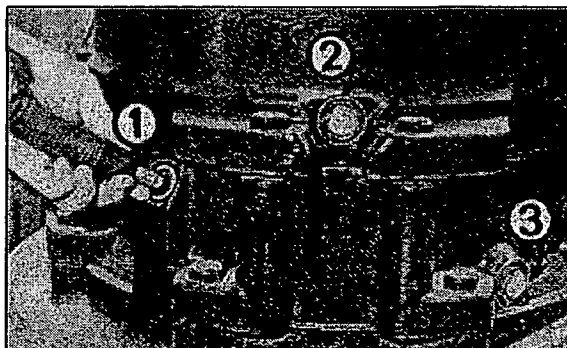
NOTE Correct oil quantities for all pumps are listed in Volume 3 B.



Filling oil.

**6.3 OIL DRAINING AND REFILLING PUMPS IN UPRIGHT POSITION**

- For pumps of frame size 66 and larger, the oil can be inspected and changed with the pumps in an upright position. Plug No. 1 indicates thus the correct quantity of oil. The oil is drained through the lower plug (3), using a vacuum pump for the residual oil.
- The condition of the oil is inspected as explained in Section 6.1 above.



Oil inspection and refilling when pump upright

- ① Oil plug for filling.
- ② Motor inspection plug.
- ③ Oil plug for draining.

7. REMOVING AND INSTALLING THE COOLING JACKET

The cooling jacket must always be removed when the motor has to be cleaned or opened.

7.1 PROCEDURE FOR REMOVING THE COOLING JACKET

- Remove the lifting handle.

7.1.1 Frame sizes 50 and 54

- Pry the cooling jacket loose with levers by using the adjusting screws for leverage support.

NOTE Light heating with liquid gas torches helps when removing cast-iron jackets.

7.1.2 Frame sizes 58 to 70

- Remove the jacket by using a crane or, for example, a bottle jack.

7.2 CLEANING

- Protect the free cable end. A wet cable end can allow moisture to penetrate the cable/motor.
- Carefully wash and clean the external surface of the motor and internal surface of the cooling jacket.
- Remove caked dirt from the motor surface.
- Dry the relevant parts after washing.
- Dirt on the motor surface reduces the cooling effect and can get into sensitive parts, e.g. the primary seal, while the pump is being handled.

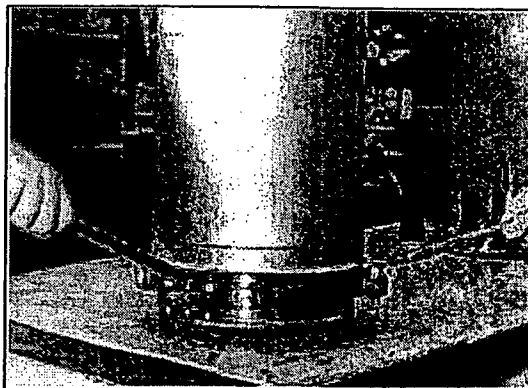
7.3 REINSTALLING THE COOLING JACKET

- Check the condition of the O-rings and their respective sealing surfaces.
- Lubricate the sealing surfaces of the cooling jacket.

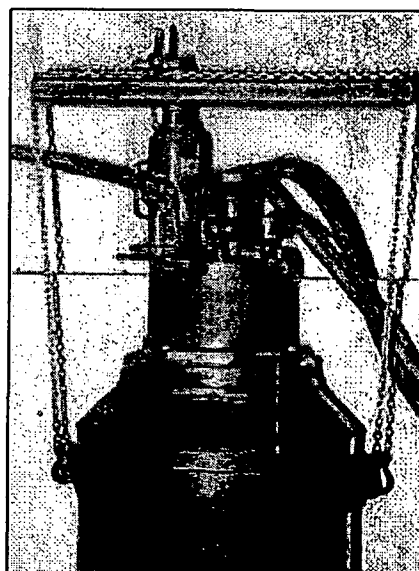
7.3.1 Frame sizes 50 and 54

- Place the cooling jacket onto the motor and, with the aid of the lifting handle and its screws, press the jacket into position. Make sure that the lifting handle is positioned correctly. (See Section 5.5)

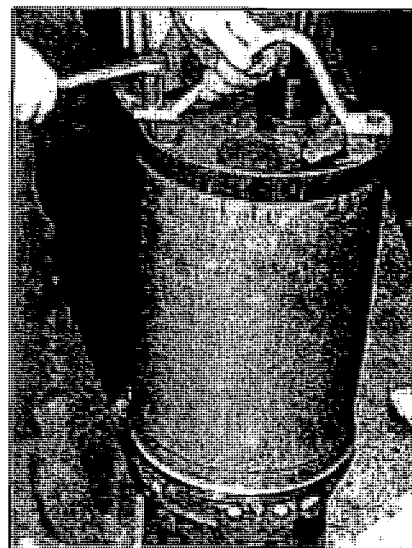
Installation of cooling jacket by using the lifting handle. Frame sizes 50 and 54. Z



Prying the cooling jacket loose.



Removing the cooling jacket using a bottle jack and a specially designed tool.



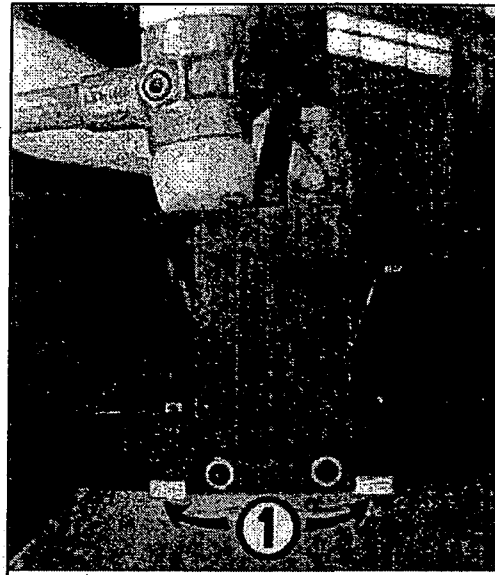
REPAIR MANUAL**SARLIN**
Pumps

Section 7 Page 2

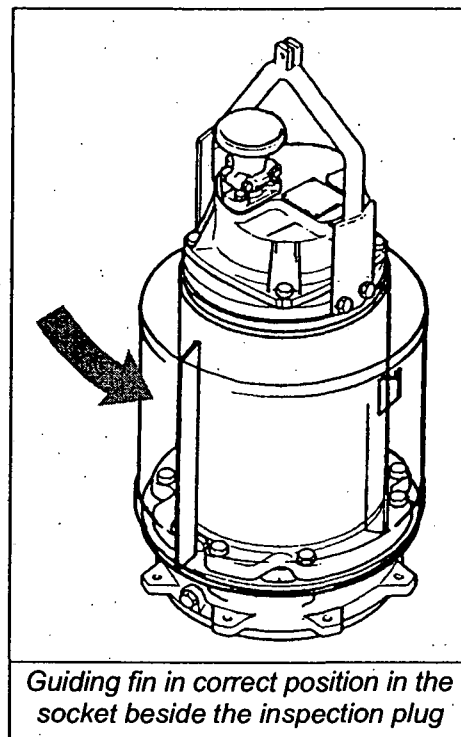
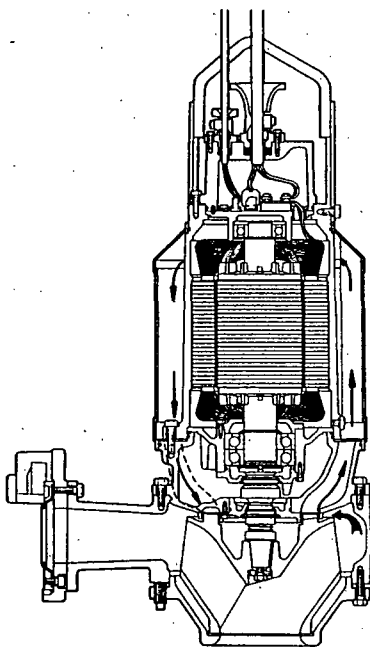
7.3.2 Frame sizes 58 and larger

NOTE The stator inspection plug must be closed before attempting to install the jacket.

- The correct position for the cooling jacket depends on the following:
- For pumps of frame sizes 58 and 62, it is determined by guide markers on the upper part of the jacket. The lifting handle must go between the markers.
- For pumps of frame sizes 66 and larger, it is determined by the longest guiding fin on the inside of the jacket. This fin must fit into the socket, which is beside the stator inspection plug.
- Place the jacket on the motor and press it down by hand. Check again that the O-rings are in place. Place the lifting handle on the upper edge of the jacket and work the jacket into the final position by tapping at the handle. Take care not to damage the upper rim of the jacket.
- Place the lifting handle in position and tighten the screws. Make sure that the lifting handle is positioned correctly according to installation version (please refer to section 5.5).



Guide markers. Frame sizes 58 and 62.

7.4 WORKING PRINCIPLE OF THE COOLING JACKET

Guiding fin in correct position in the socket beside the inspection plug

The pumped liquid is channeled through a rotating clearance into the cooling jacket. The cooling jacket automatically fills up with liquid. The cooling liquid is circulated throughout the system around the motor by the pumping action of the slots in the upper shroud of the impeller. The excess heat from the motor is dissipated into the liquid which in turn is cooled down when coming into contact with the impeller.

8. DISMANTLING AND ASSEMBLING AND INSPECTION OF SEALS

NOTE Handle seal parts with extreme care to prevent damage. Be very careful not to spoil the precision-finished seal faces; even fingerprints can shorten the seal life.

8.1 DISMANTLING THE SEAL UNITS (FRAME SIZES UP TO AND INCLUDING 46)

- Drain all oil from the oil housing before dismantling the seal.
- Remove the volute casing, impeller and the key.
- Unscrew the oil housing fixing screws. Pull the oil housing away from its place with, for example, a screwdriver. Lopsided pulling may damage the seal.

REMOVING THE LOWER STATIONARY SEAL

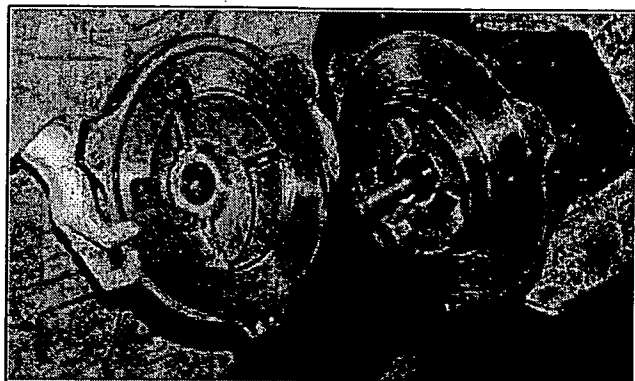
- Remove the counterdisc by pressing and turning simultaneously, thereby effecting its release.
- Remove the springs and press with fingers the lower stationary seal out of the oil housing. Check the condition of the oil housing O-ring. Replace if necessary.

REMOVAL OF SEAL RING

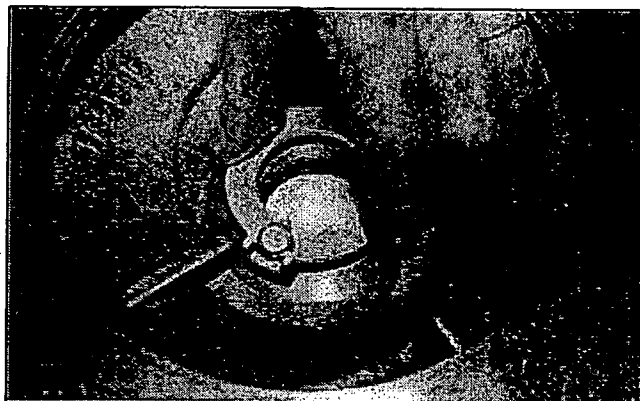
- Protect the conical shaft surfaces and key slot, e.g. by covering with tape.
- Remove the seal ring from the shaft by manually pulling at the seal ring.

REMOVAL OF SHAFT O-RING (old type)

- Remove the O-ring, taking care not to damage either the shaft or the O-ring (see picture below).



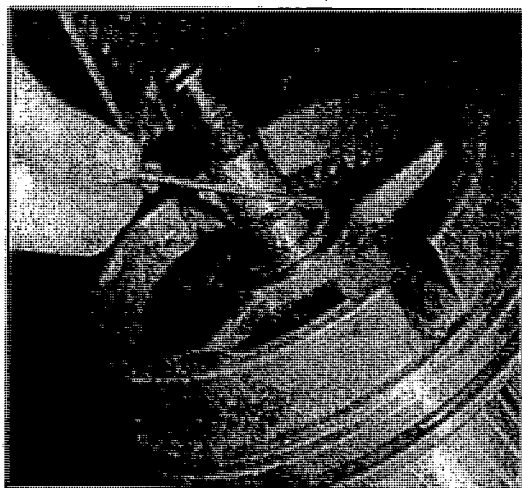
Removing oil housing.



Removing counterdisc.



Removal of seal ring.



<- Removing O-ring (old type).

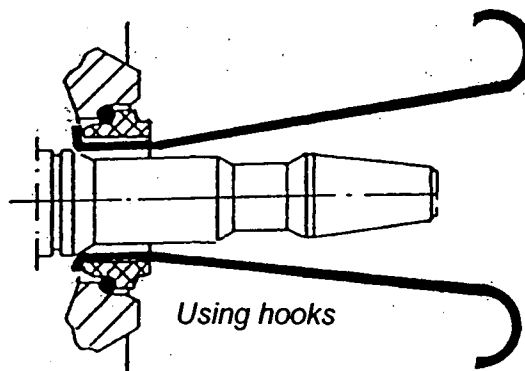
REPAIR MANUAL

SARLIN
Pumps

Section 8 Page 2

REMOVAL OF UPPER STATIONARY SEAL

- If there is no reason to remove the rotor, a stiff wire with a hooked end can be used to remove the upper stationary seal ring.
- If the lower bearing bracket must be removed, press the upper stationary seal away from its housing with your fingers.



VISUAL INSPECTION

(see also Section 8.8)

- After the seal has been dismantled, check its condition. Pay particular attention to the O-rings and their mating surfaces on the shaft and the oil housing. Replace damaged parts.
- If the seal surfaces are damaged, replace the entire seal unit.



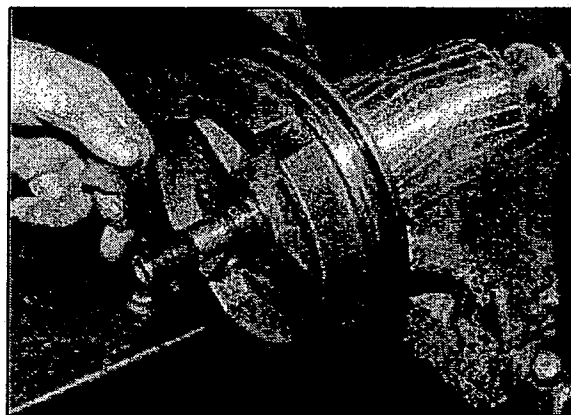
Pressing with thumbs.

DRIVING PIN

- Do not remove the seal driving pin from the shaft if it is not necessary.
- If it is necessary to remove the seal driving pin from the shaft and to replace it, use glue: Loctite "Super Fast" 601 or compatible.

NOTE

During dismantling and assembling the seal, the sharp edges of the keyway have to be covered, e.g. with tape.



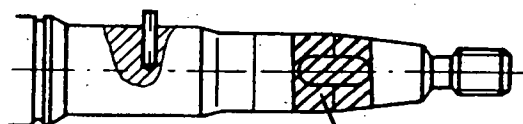
Using tape.

Shaft in frame sizes 26 to 38.

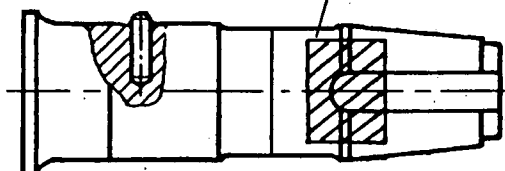
	Driving pin
Old type	FABN 02098
New type	FABN 03098

Shaft in frame size 42 and 34 from interch. letter D onwards.

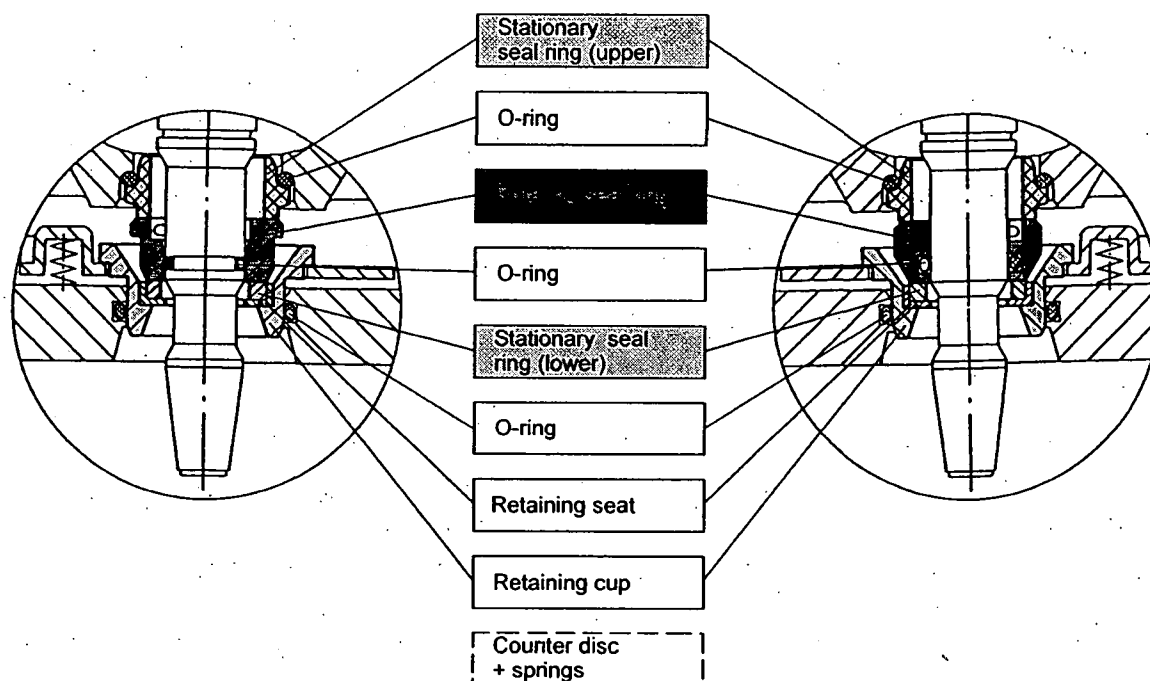
	Driving pin
Old type	FABN 03138
New type	FABN 04158



Tape to protect O-rings during assembly



8.2 ASSEMBLING SEAL UNITS FOR PUMPS OF FRAME SIZES 26, 38 AND 34 UP TO AND INCLUDING PUMPS WITH INTERCHANGEABILITY LETTER C.



Seal unit YJ 34452 (old type)

O-ring in the groove on the shaft
Used in pumps which do not have any interchangeability code, for example:

ST 022 H 1
SV 024 BH1

Seal unit YJ 34541 (new type)

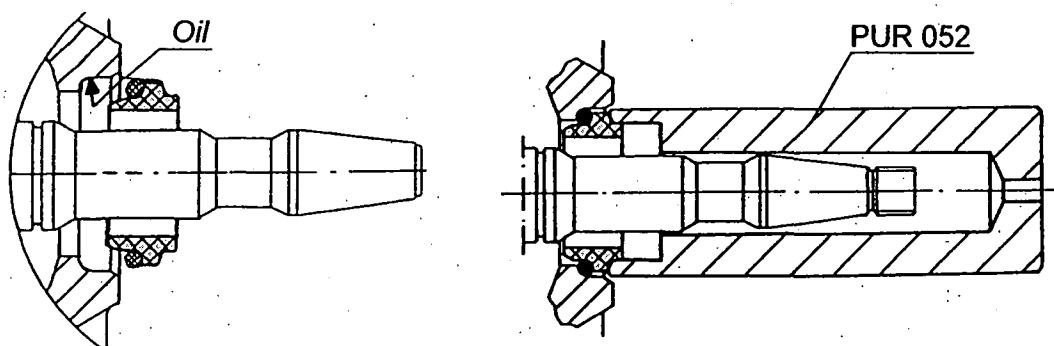
O-ring in groove in the rotating seal ring
Used in pumps which have an interchangeability code, for example:

ST 022 H 1 A
SV 024 BH1 A (or B..)

ASSEMBLING

NOTE Use clean tissue when handling the seal elements

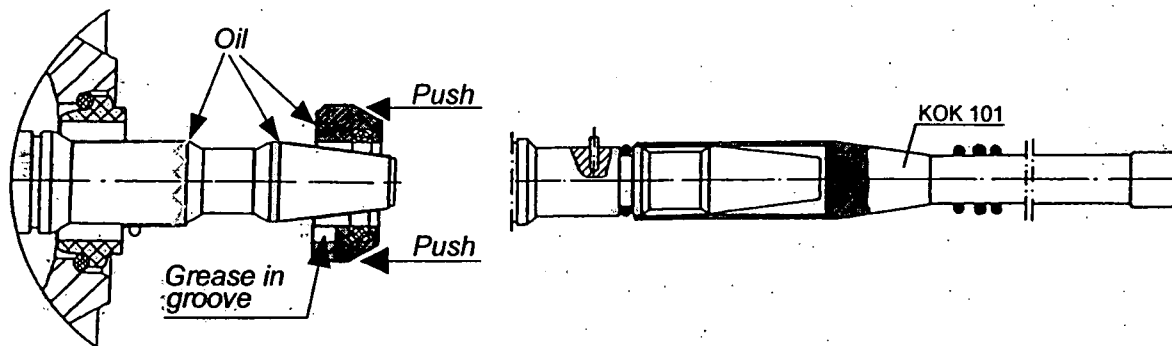
8.2.1 Upper stationary seal ring



- Lightly oil the stationary seal ring collar and place the O-ring on the stationary seal ring.
- Oil the seal cavity for the stationary seal ring and install the ring using the assembly tool.

REPAIR MANUAL**SARLIN**
Pumps

Section 8 Page 4

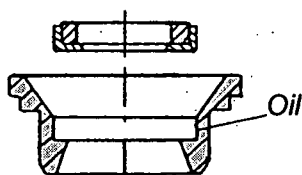
8.2.2 Rotating ring

When using seal unit YJ 34452, place the O-ring in the groove with a special tool.

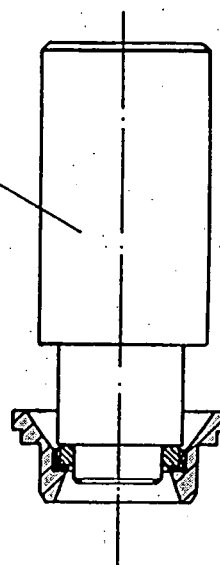
- Oil the O-ring lightly and install it in the groove in the seal ring or on the shaft.
- Lubricate the motor shaft and the upper face of the seal. Also put grease in the groove for the drive pin.
- Install the seal face on the shaft by hand so that the slot in the seal ring engages the drive pin and the seal ring is flush against the stationary seal ring.

8.2.3 Lower stationary seat unit

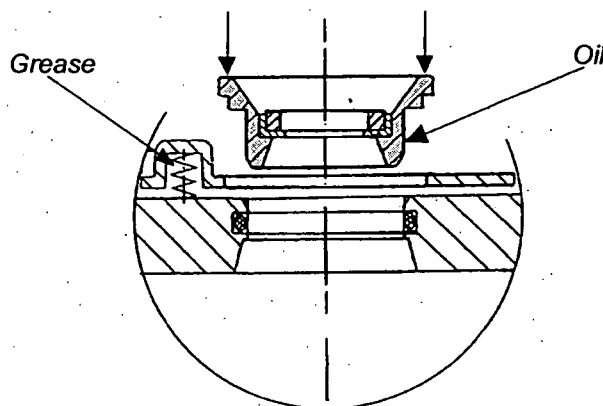
- Install the lower stationary seat in the retaining seat.
- Oil the retaining cup lightly inside and install the retaining seat in the retaining cup by using a special tool.



PUR 051

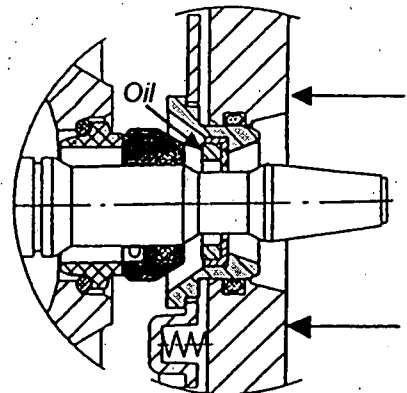
**8.2.4 Counterdisc, retaining cup and seal housing**

- Oil the O-ring lightly and install it in the seal housing
- Place a dab of grease in the cups of the spring locking disc to hold the three springs in place and install the springs in the cups.
- Install the counterdisc in the seal housing; rotate the spring locking disc so that it is locked in place by the gussets in the seal housing.
- Oil the retaining cup outside and place it through the spring locking disc so that the counterdisc seats against the flange of the retaining cup.

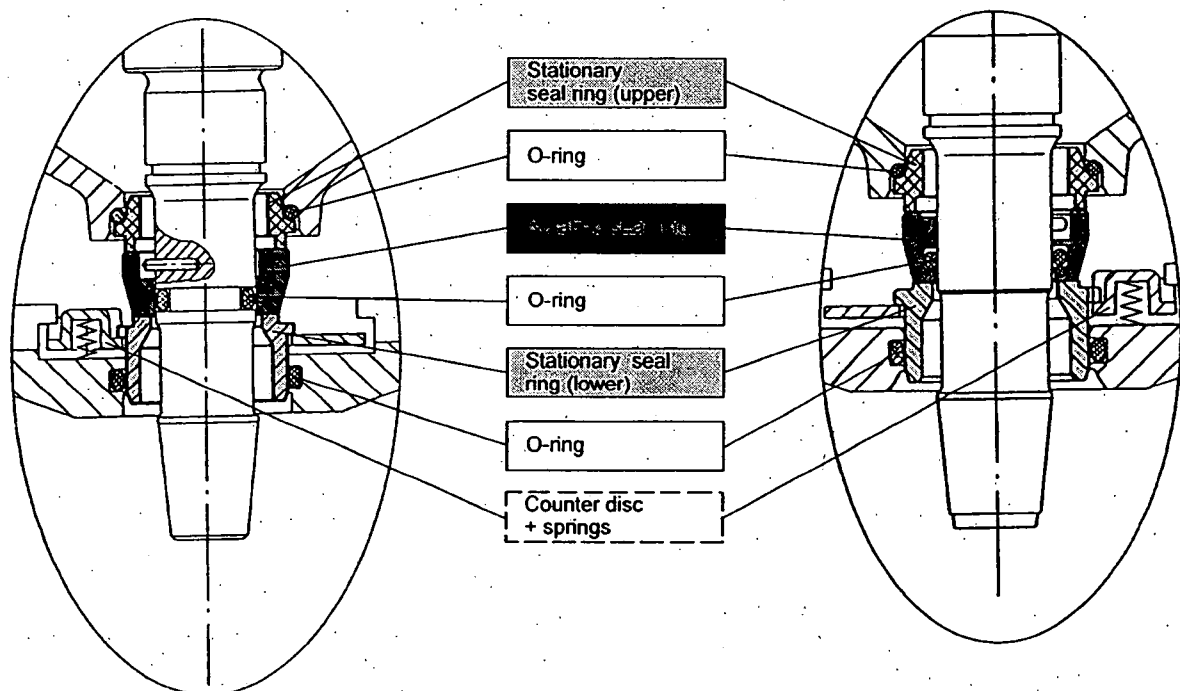


8.2.5 Seal housing

- Oil the seal faces lightly.
- Install the assembled seal housing in the stator/motor housing.
- Secure the seal housing to the motor housing with three screws.



8.3 ASSEMBLING THE SEAL UNIT FOR FRAME SIZE 42 and 34 FOR PUMPS WITH INTERCHANGEABILITY LETTER D AND ONWARDS.



Seal unit YJ 34499 (old type)
O-ring in groove on shaft

Used in pumps with generation marker A or B (or blank), for example:

SV 044 B 1

S1 044 A 1

Used in EX-pumps with blank interchangeability letter, for example:

SVX 044 B 1 _

Seal unit YJ 34538 (new type)
O-ring in groove in rotating ring

Used in pumps with generation marker C, for example:

SV 044 C 1

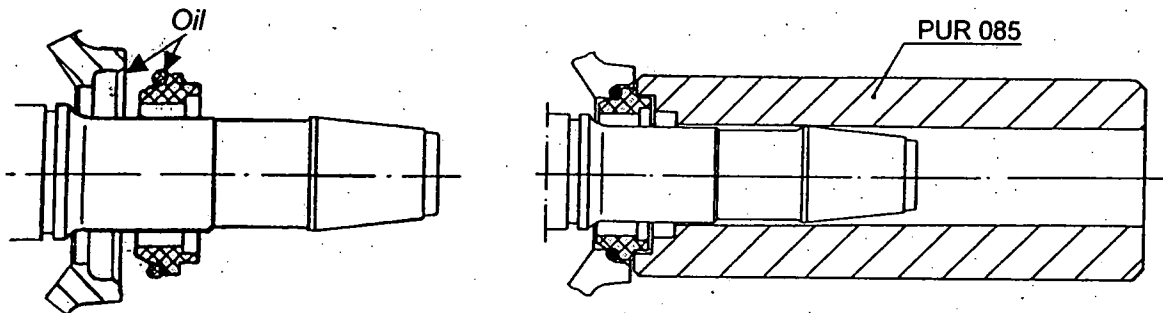
S1 044 C 1

Used in EX-pumps with generation marker A or B and interchangeability letter A, for example:

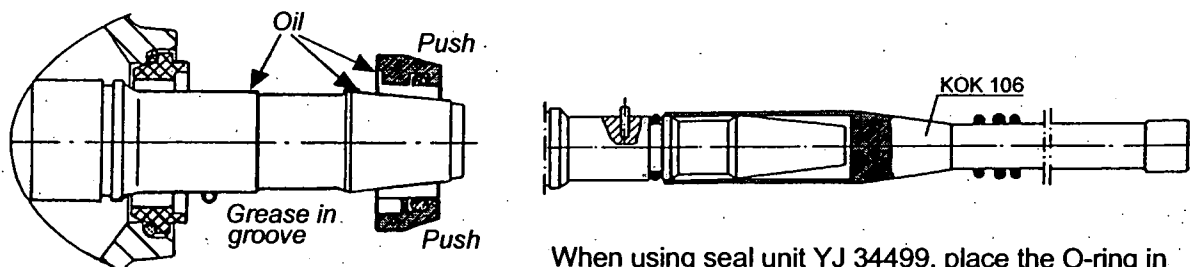
SVX 044 B 1 A

REPAIR MANUAL**SARLIN**
Pumps

Section 8 Page 6

ASSEMBLING**NOTE** Use clean tissue when handling the seal elements.**8.3.1 Upper stationary seal ring**

- Lightly oil the collar of the stationary seal and install the O-ring on the stationary seal.
- Oil the cavity for the stationary seal and install the seal with the tool in the seal housing.

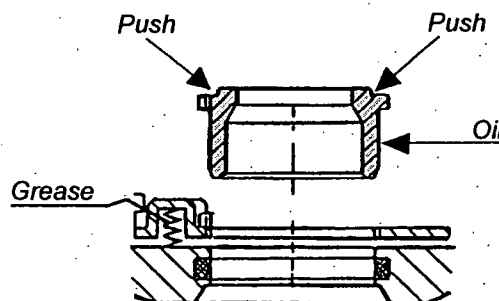
8.3.2 Seal face

When using seal unit YJ 34499, place the O-ring in the groove with a special tool.

- Lightly oil the rotating element O-ring and install in groove in seal ring or the shaft.
- Lubricate the motor shaft and the upper face of the seal. Also put grease in the groove of the drive pin.
- Install the rotating ring onto the shaft by hand so that the slot in the seal face engages the drive pin and the seal face is flush against the stationary seal.

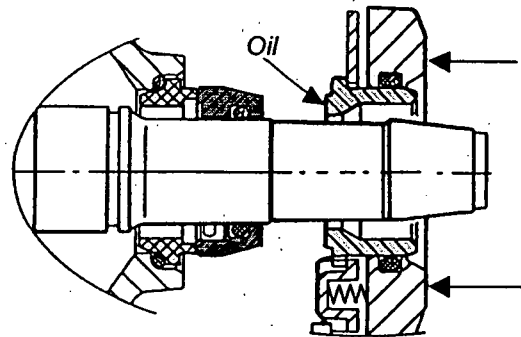
8.3.3 Lower stationary seal, counterdisc and seal housing

- Oil the O-ring lightly and install it in the seal housing
- Place a dab of grease in the cups of the counterdisc to hold the three springs in place and install the springs in the cups.
- Install the counterdisc in the seal housing; rotate the counterdisc so that it is locked in place by the brackets in the seal housing.
- Oil the stationary element outside surface and place it through the counterdisc so that the counterdisc sits against the flange of the stationary element.

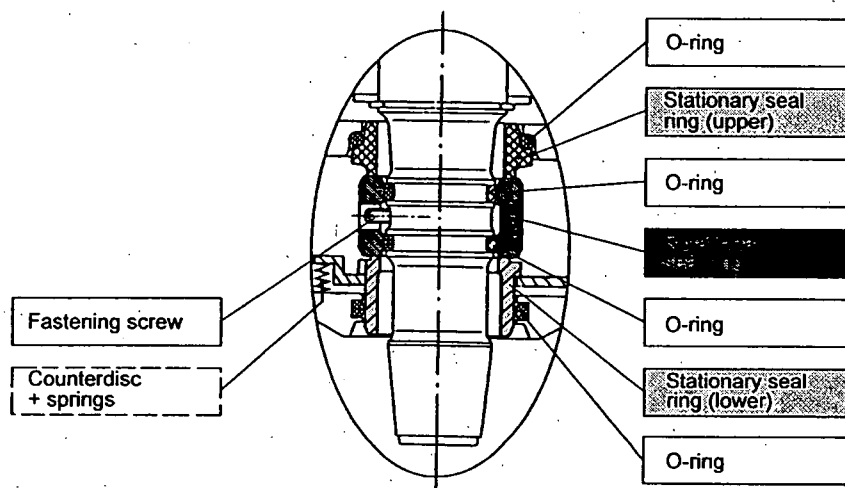


8.3.4 Seal housing

- Oil the seal faces lightly.
- Install the assembled seal housing in the stator/motor housing.
- Secure the seal housing to the motor housing with three screws.



8.4 ASSEMBLING THE SEAL UNIT FOR FRAME SIZE 46

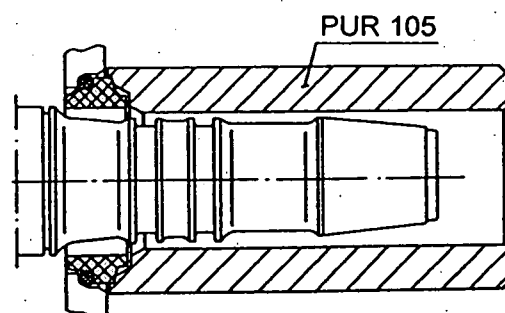
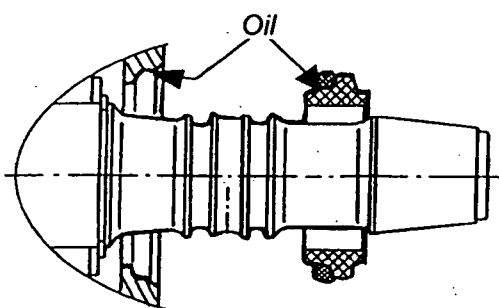


Seal unit YJ 34530

ASSEMBLING

NOTE Use clean tissue when handling the seal elements.

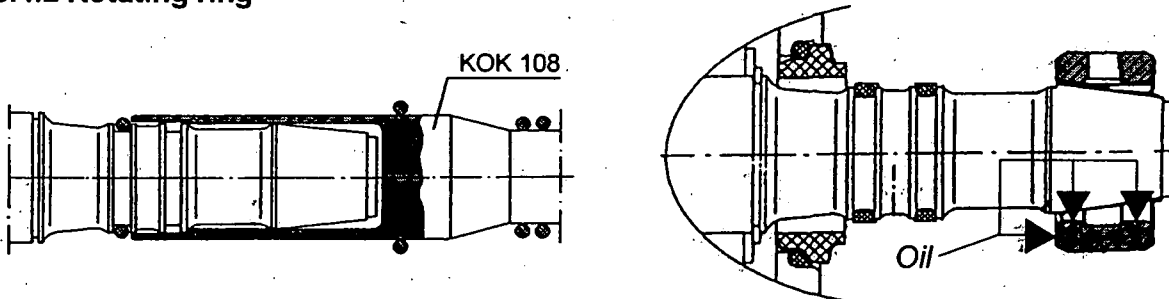
8.4.1 Upper stationary seal



- Oil the collar of the stationary seal lightly and install the O-ring on the stationary seal.
- Oil the cavity for the stationary seal and install the seal with the tool in the seal housing.

REPAIR MANUAL**SARLIN**
Pumps

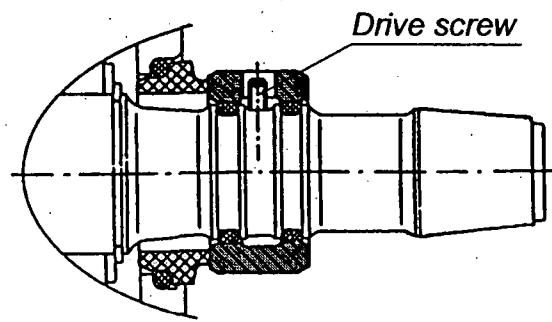
Section 8 Page 8

8.4.2 Rotating ring

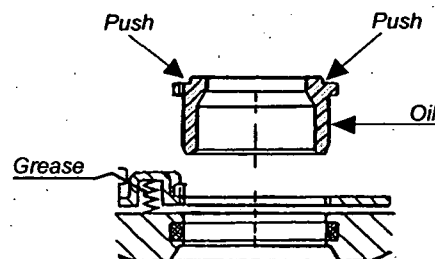
- Place the O-rings in the shaft grooves with the special tool.
- Lubricate the inside of the rotating ring and install it on the shaft by hand so that the hole in the ring is over the threaded hole for the drive screw.

8.4.3 Drive screw

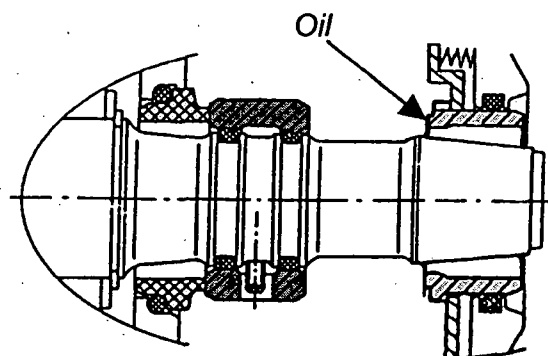
- Put the drive screw into the alien key and drive the screw into the thread, simultaneously pushing the rotating ring against the stationary seal. (Tool KOK 109)

**8.4.4 Lower stationary seal, counterdisc and seal housing**

- Oil the O-ring lightly and install in the seal housing
- Place a dab of grease in the cups of the counterdisc to hold the four springs in place and install the springs in the cups.
- Install the counterdisc in the seal housing; rotate the counterdisc so that it is locked in place by the brackets in the seal housing.
- Oil the stationary element outside and put it in place through the counterdisc so that the counterdisc seats against the flange of the stationary element.

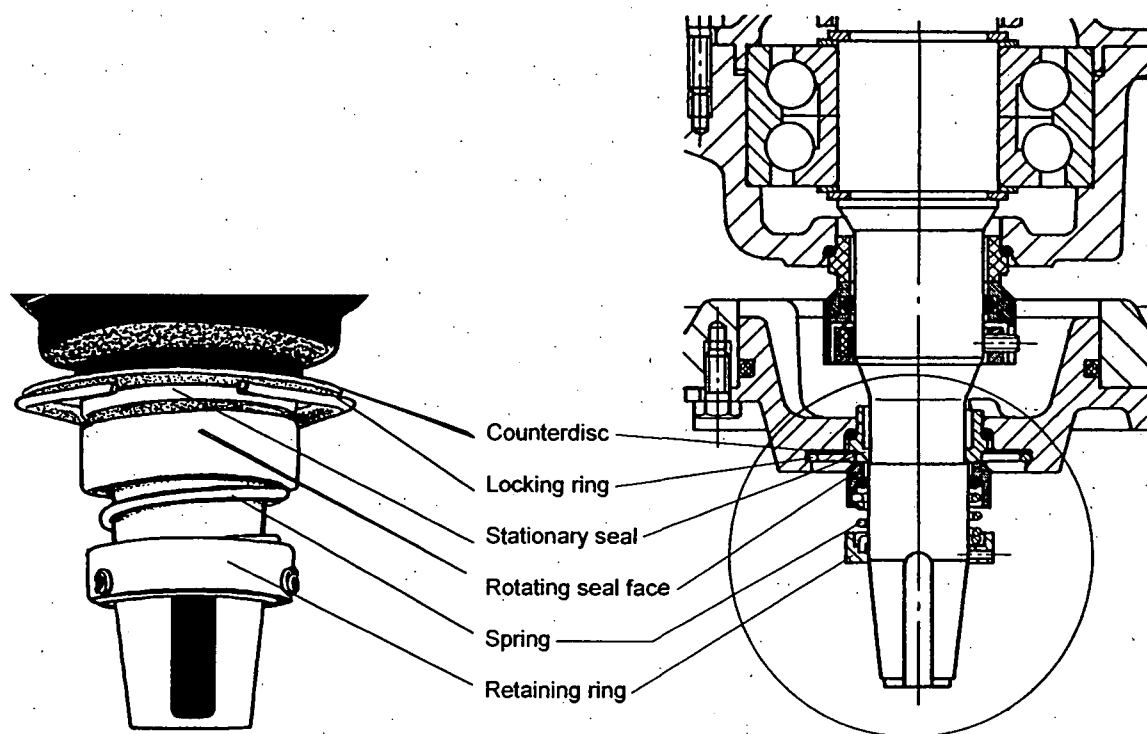
**8.4.5 Seal housing**

- Oil the seal faces lightly.
- Install the assembled seal housing in the stator/motor housing.
- Secure the seal housing to the motor housing with three screws.



DISMANTLING AND ASSEMBLING THE PRIMARY SEAL

8.5 DISMANTLING OF FRAME SIZES 01 AND FROM 50 TO 62, OLD MODEL



Primary seal ("old" design with retaining ring and central spring)

The primary shafts seals used in frame sizes 50 to 62 are either of the above pictured old model or of the new model presented in Section 8.8. On these pumps, the seals of old and new type are entirely interchangeable as units. Seal components are not interchangeable.

DISMANTLING

- Drain all oil from the oil housing before dismantling the seal.
- Remove the locking ring.

On frame sizes 58 and 62 the locking ring can be removed as shown in Section 8.7.



Removing locking ring.

REPAIR MANUAL

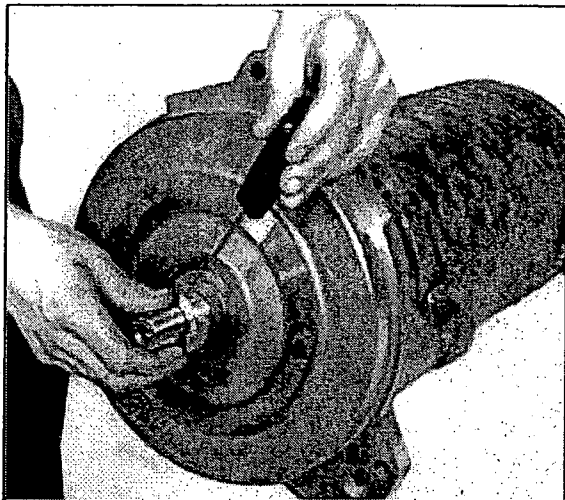
SARLIN
Pumps

Section 8 Page 10

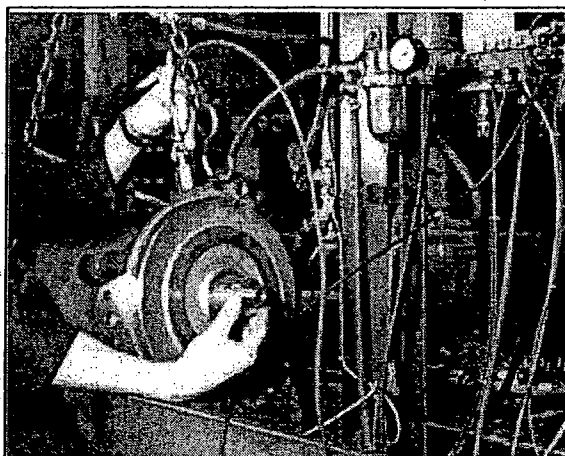
- Unscrew the retaining screw on the retaining ring.
- Blow compressed air carefully into the oil housing at a max. 1,5 bar pressure supporting the seal unit simultaneously by holding on to the retaining ring. The seal will come out as the pressure slowly rises.
- In field conditions you can use, for example, a car tyre pump or the equivalent.

If, however, you are dismantling the motor, you can proceed as follows:

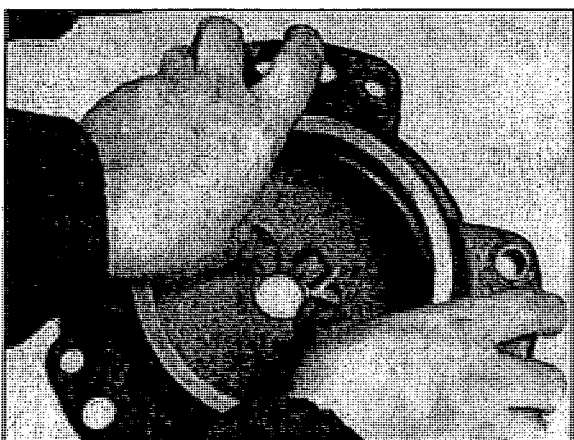
- After unscrewing the retaining ring screws, remove the retaining ring, seal spring and rotating seal face.
- Remove the counterdisc of the stationary seal.
- The stationary seal may now be removed. The best way is to dismantle the oil housing or the oil housing cover and press the ring out, using finger pressure, from the oil housing side.
- After disassembly, check the seal condition. Note the condition of sealing surfaces, O-rings and their contact surfaces on the shaft and in the oil housing. See Section 8.8.
- Replace the damaged parts. If sealing surfaces are damaged, replace both rotating seal ring and the stationary seal.



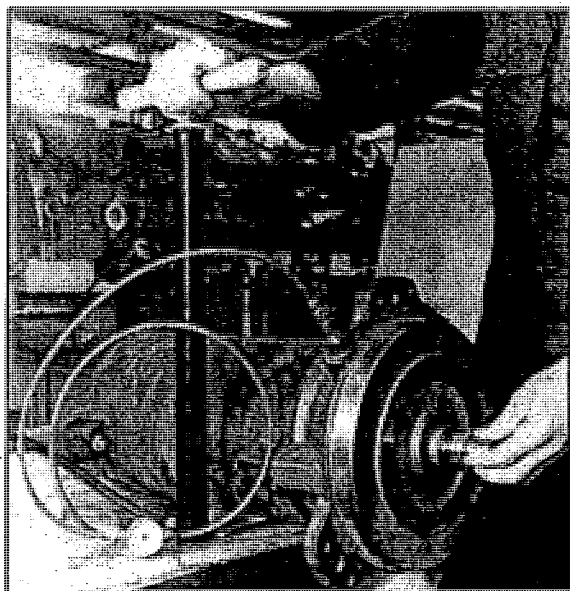
Unscrewing the retaining ring screw.



Removing the stationary seal using compressed air.



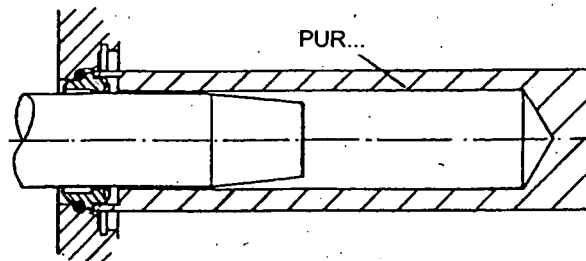
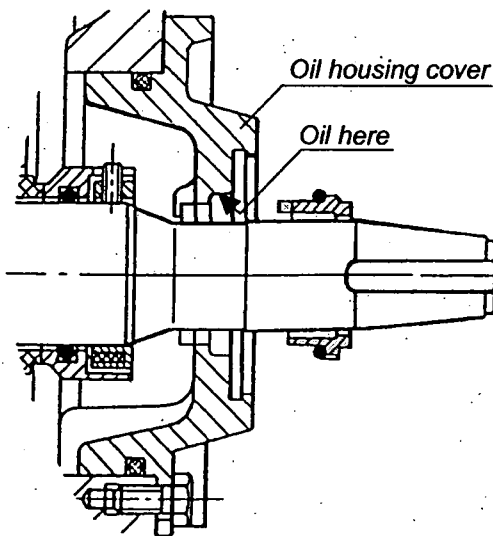
Removal of the stationary seal by hand from the oil housing side.



Removal of the stationary seal using a hand pump.

8.6 ASSEMBLING THE SEAL OF FRAME SIZES 01 AND FROM 50 TO 62, OLD MODEL

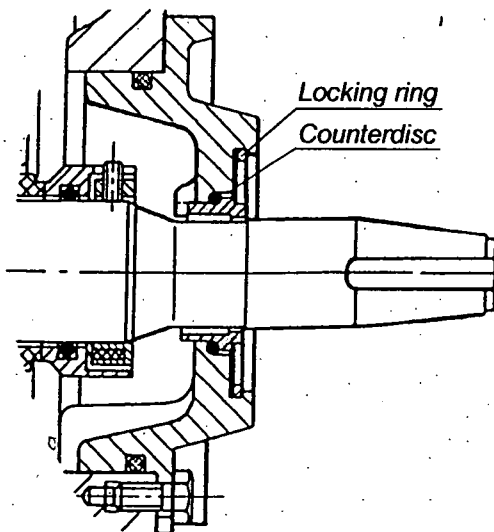
8.6.1 Stationary seal



Exercise care when handling the seal.
Be especially careful regarding cleanliness.

- Install the oil housing cover in position on the oil housing (frame sizes 58 to 62).
- Check that the O-ring that goes with the stationary seal is in position.
- Lubricate the seal cavity of the stationary seal.
- Check that the slot in the stationary seal engages with the lug in the casting that prevents rotation.
- Press the stationary seal into place in the oil housing using a special tool.

8.6.2 Counterdisc and locking ring



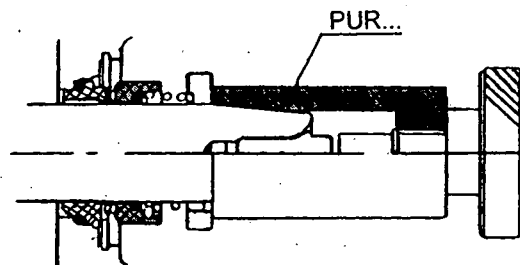
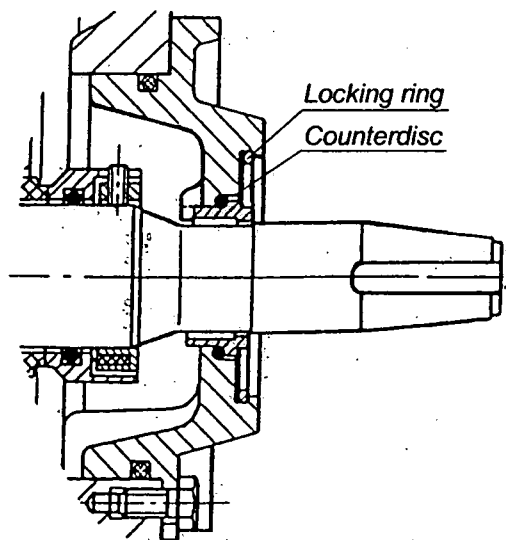
- Put the counterdisc into the seal housing. Install the locking ring of the counterdisc in position with a screwdriver. The locking ring can be installed before or after the retaining ring is assembled.

REPAIR MANUAL

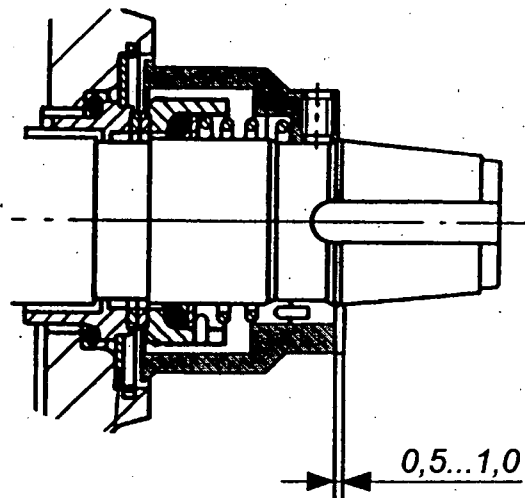


Section 8 Page 12

8.6.3 Rotating seal ring, spring and retaining ring



A special assembly tool guarantees correct positioning of the retaining ring.



Retaining ring in pumps type SV 072...SV 122 is shaped as a protective cup for the spring.

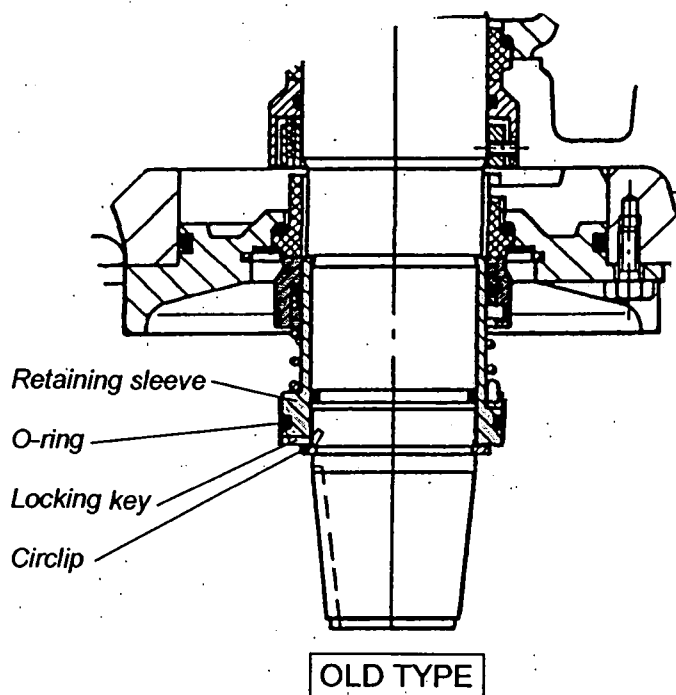
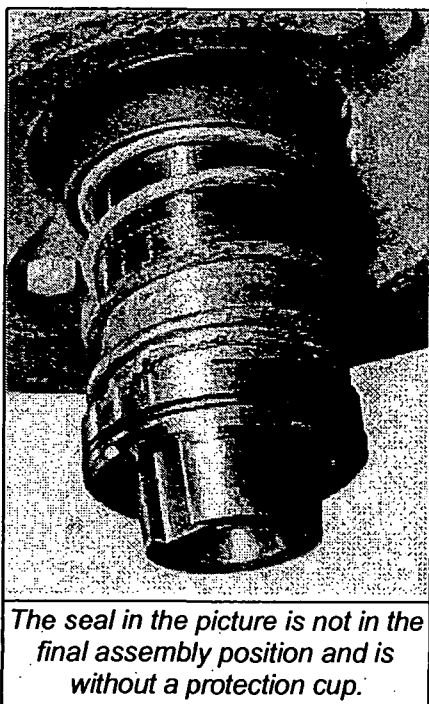


- Check that the O-ring is in position in the rotating element.
- Oil the shaft and the seal faces.
- Press rotating ring, O-ring, washer, spring and retaining ring as a unit onto the shaft by hand.
- Install the retaining ring to the correct position using a special tool.
- Tighten the retaining screw carefully.

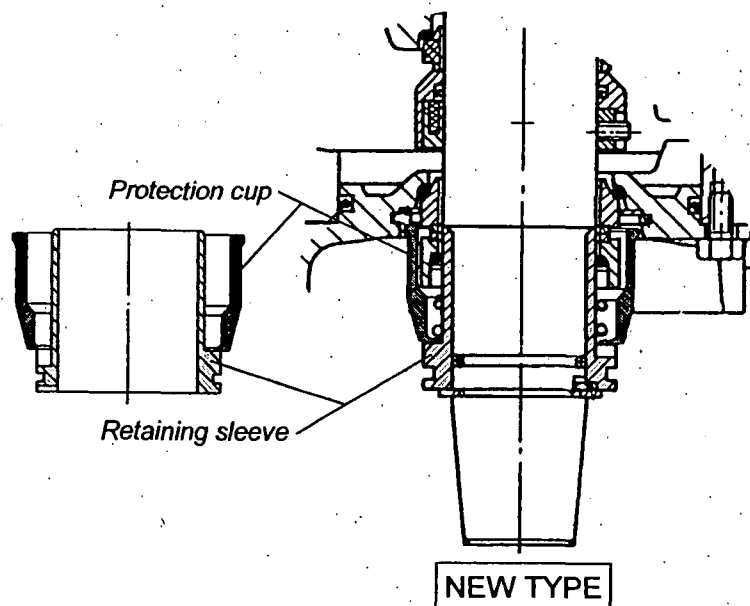
8.7 DISMANTLING THE SEAL OF FRAME SIZES 66 AND 70, PUMPS WITH RETAINING SLEEVE AT SHAFT END (NO INTERCHANGEABILITY LETTER).

(For pumps without retaining sleeve at shaft end, please refer to Section 8.8)

NOTE The seal is similar to the seal used in frame sizes from 50 to 62 (old type), except for the retaining ring, which is a combined shaft sleeve-retaining ring.



New type seals are equipped with a protection cup which covers the seal spring. The seals are interchangeable.

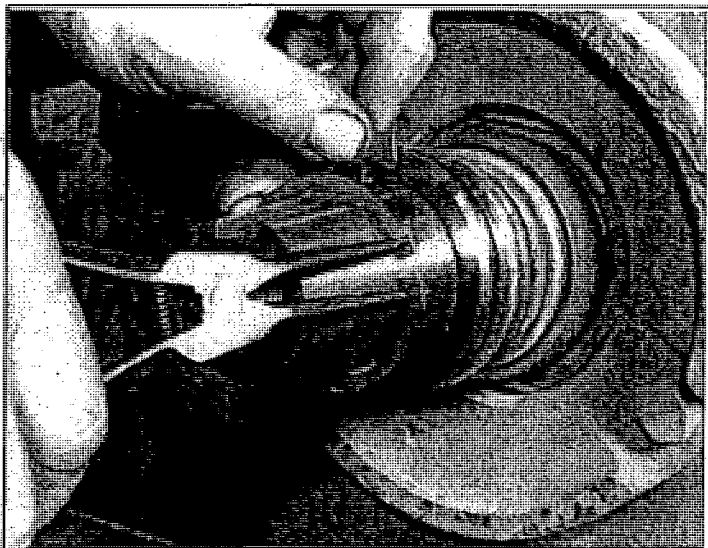
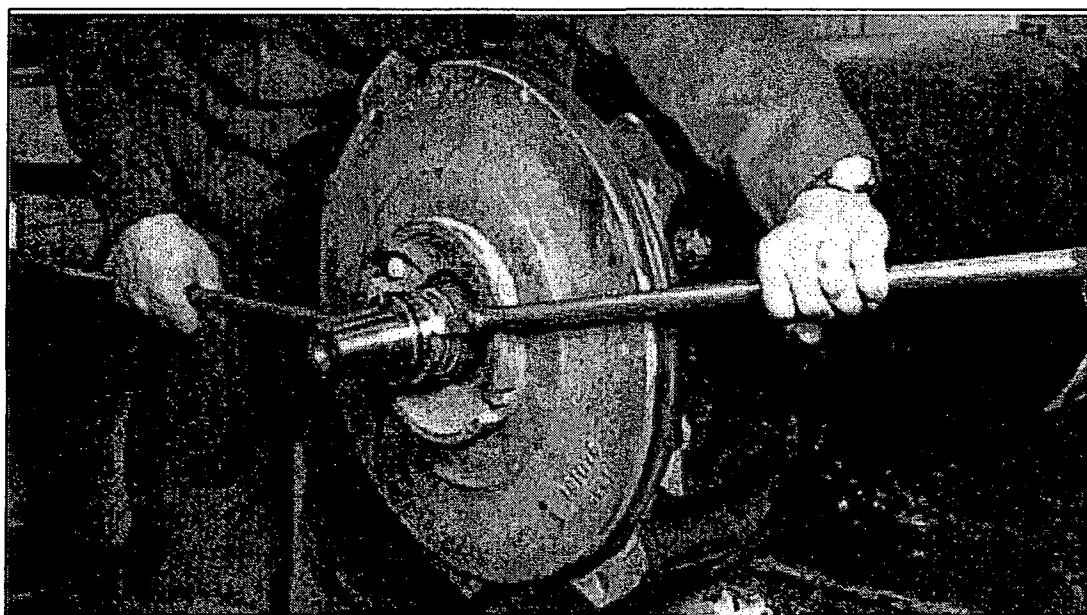


REPAIR MANUAL

Section 8 Page 14

DISMANTLING

- Drain all oil from the oil housing before dismantling the seal.
- Remove the circlip on the shaft and the locking key behind it.
- Pull the retaining sleeve (protection cup), seal spring and rotating the the seal face away from the shaft.
- Unscrew the fixing screws on the oil housing cover and pry the cover free.
- Remove the locking ring from the stationary seat.
- Remove the counterdisc from the stationary seat.
- Force the stationary seal out from inside the oil housing cover using finger pressure.

*Removing the circlip and locking key.**Application of leverage to remove the retaining sleeve.*

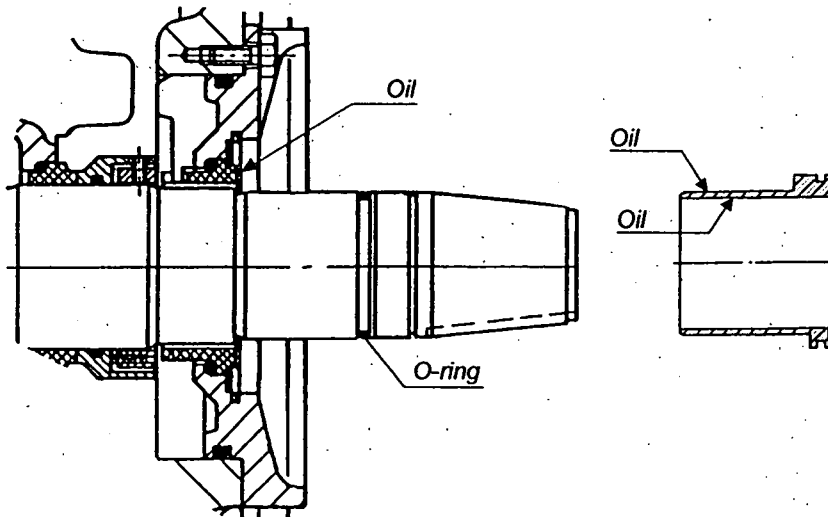
- After disassembly, check the seal condition. Note the condition of the sealing surfaces, O-rings and their contact surfaces on the shaft and in the oil housing. See Section 8.8.
- Replace damaged parts. If sealing surfaces are damaged, replace both the rotating seal ring and the stationary seal

8.8 ASSEMBLING THE SEAL OF FRAME SIZES 66 AND 70 IN PUMPS WITH RETAINING SLEEVE AT SHAFT END (NO INTERCHANGEABILITY LETTER).

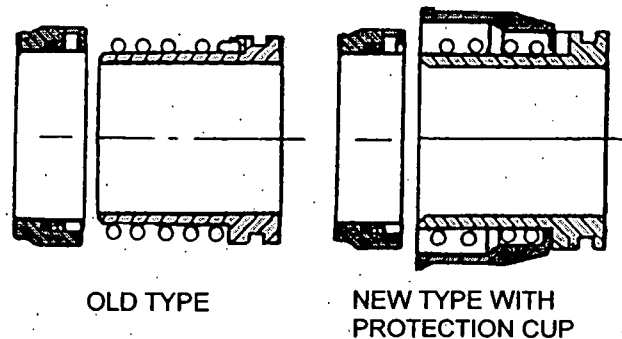
8.8.1 Stationary seal

- See instructions in Sections 8.6.1 and 8.6.2 when assembling the stationary seal, counterdisc and locking ring.

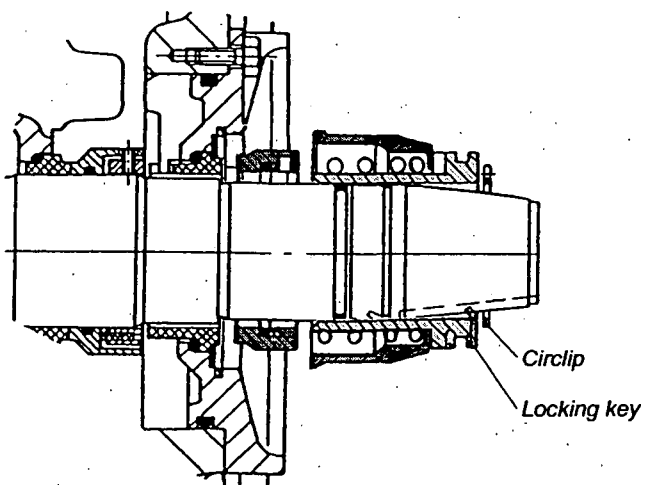
8.8.2 Rotating seal ring and shaft sleeve-retaining ring



- Place the relevant O-ring on the shaft.
- Oil the retaining ring inside and outside.
- Put the protection cup onto the retaining sleeve (new type).
- Press the seal spring, washer, O-ring and rotating seal ring into the retaining sleeve by hand, so that the spring rests against the shoulder of the sleeve.



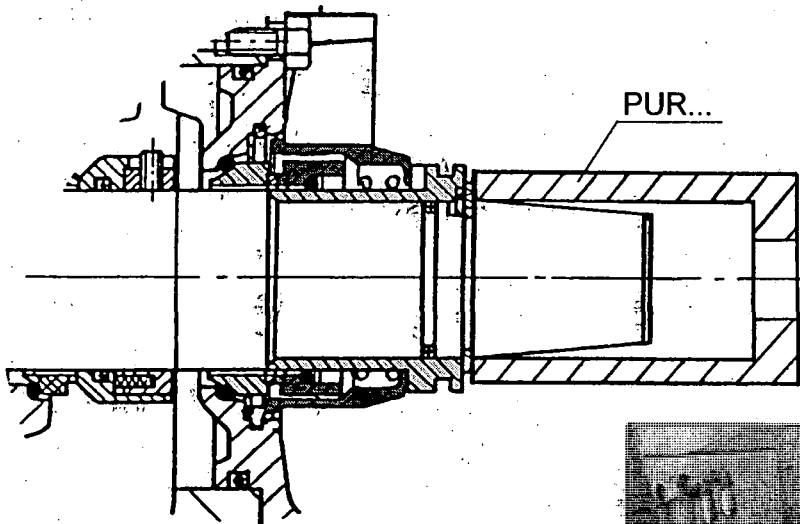
- Press the sleeve with its sealing parts onto the shaft by hand.
- Put the locking key in position with grease to hold it in place.
- Snap the circlip into the groove in the shaft.



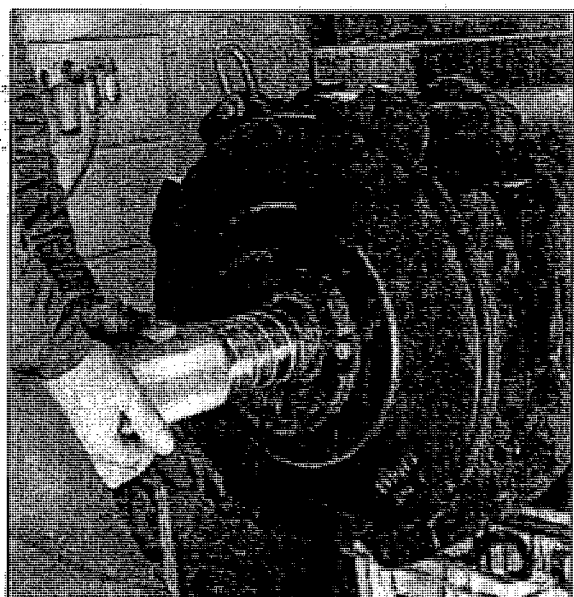
REPAIR MANUAL

SARLIN
Pumps

Section 8 Page 16



- Press the seal package onto the shaft with the required tool.
- The seal is in the right position when the circlip fits in its groove on the shaft.
- Ensure the position of the circlip by lightly tapping with a screwdriver and a soft hammer.

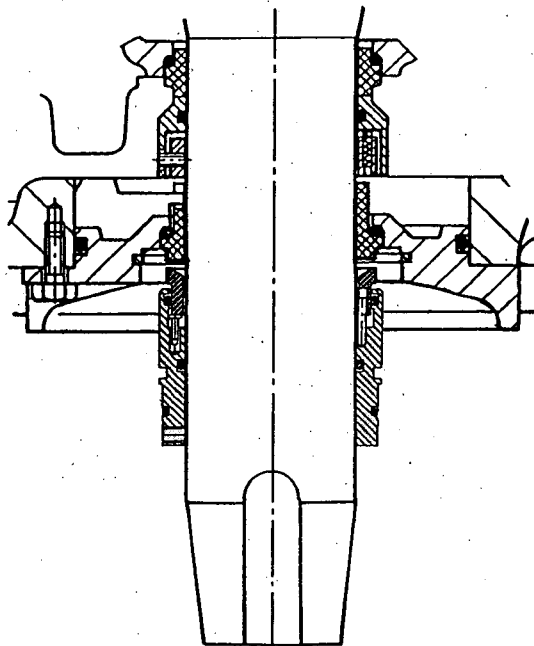


Mounting of the retaining sleeve with sealing parts onto the shaft.

8.9 DISMANTLING THE SEAL OF FRAME SIZES 50 TO 70 IN PUMPS WITH NEW SEAL MODEL. FRAME SIZE 66 AND 70 PUMPS WITH INTERCHANGEABILITY LETTER A AND ONWARDS.

DISMANTLING

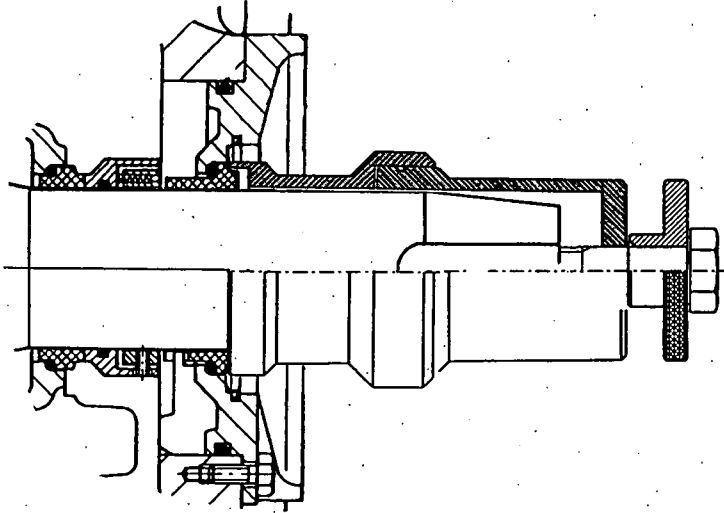
- Drain all oil from the oil housing before dismantling the seal.
- Open the retaining screws of the rotating seal member.
- Pull the rotating seal off the shaft by hand.
- Unscrew the oil housing cover retaining screws and pry the cover free.
- Remove the locking ring from the stationary seat.
- Remove the counterdisc from the stationary seat.
- Force the stationary seal out from inside the oil housing cover using finger pressure.



8.10 ASSEMBLING THE SEAL OF FRAME SIZES 50 TO 70 IN PUMPS WITH NEW SEAL MODEL. FRAME SIZE 66 AND 70 PUMPS WITH INTER-CHANGEABILITY LETTER A AND ONWARDS.

8.10.1 Stationary seal

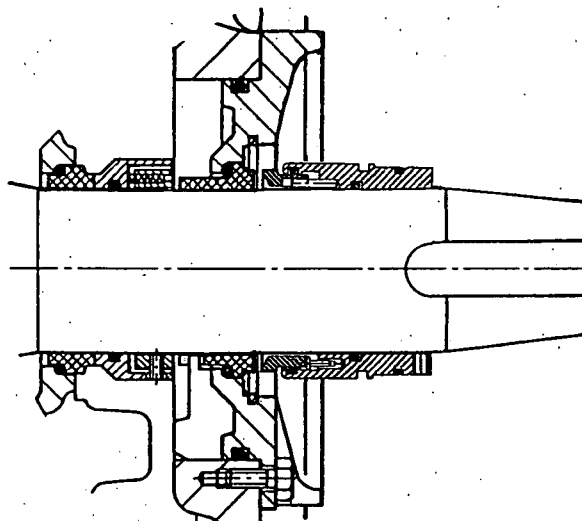
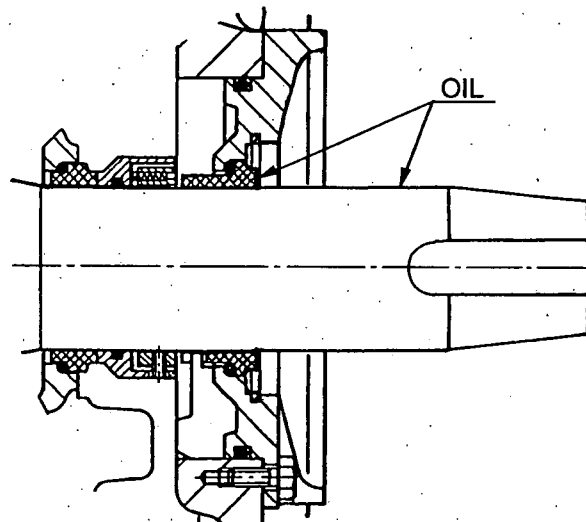
- Refer to instructions in Sections 8.6.1 and 8.6.2 when assembling the stationary seal, counterdisc and locking ring.



Press the stationary seal in its place with a special tool.

8.10.2 Rotating seal ring with retaining ring system

- Oil the shaft and the seal faces.
- Check that the O-ring is in position in the rotating ring seal system.
- Press the seal unit onto the shaft by hand.



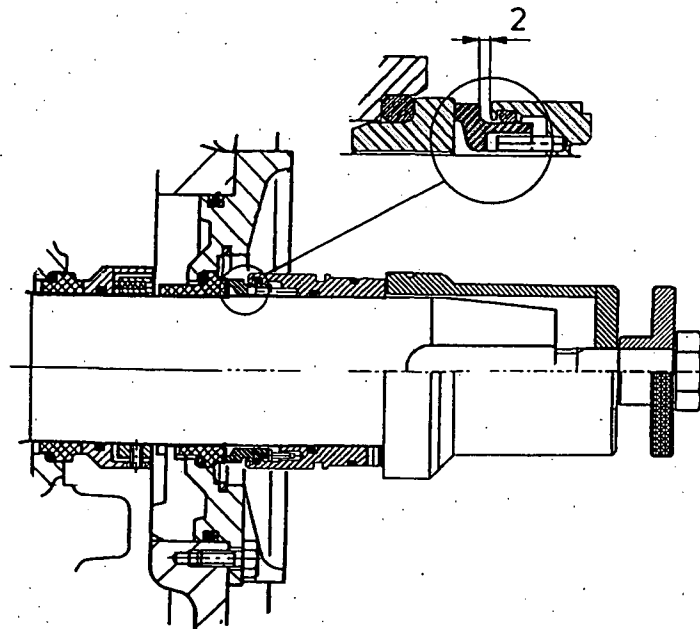
REPAIR MANUAL**SARLIN**
Pumps

Section 8 Page 18

- Install the rotating seal unit in its correct position using a special tool.
- Correct value for the gap between the rotating seal and the retaining ring is 2,0 mm +0,3/-0 mm.

NOTE Use the set up plastic tool delivered with the seal.

- Tighten the installation tool until the set-up tool becomes squeezed.
- Tighten the retaining screws.
- Remove the plastic set-up tool.

**8.11 INSPECTING AND CLEANING THE SEALS****8.11.1 Inspection of the seal faces of silicon carbide and carbon seals**

- Are the faces intact? (not broken, cracked, etc.).
- Are the faces worn too much? (deep scratches, oblique wearing).

CHECK Put the stationary seal and the rotation seal face together manually. Try to rotate them radially. If this is impossible, the seals have to be repaired or replaced.

- Leakage: If a greater leakage suddenly appears, the seal should be checked regarding seal faces, O-rings, etc.

NOTE A minimal leakage is acceptable since it improves the lubrication of the seal faces. A leakage of approximately 0,02..0,03 ml/hour is permissible.

8.11.2 Washing instructions for silicon carbide and carbon seals

The seals should be cleaned in the following way:

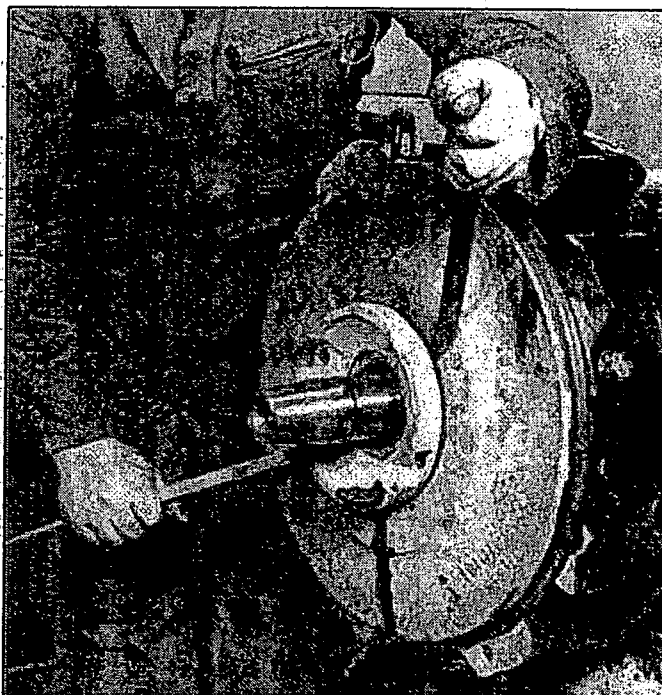
- Dismantle the seal and place the components in wide-meshed baskets with the faces upwards.
- Rinse carefully with warm water, max. 40 °C
- Dip the basket up and down in a bath of a degreasing agent.
- Rinse the components again with warm water, max. 40 °C
- Blow the components dry with compressed air and check that the components are thoroughly clean.
- Wipe the faces carefully with acetone.
- Inspect the surfaces according to the above instructions.
- Replace the O-rings with new ones and lubricate them properly.
- Assemble the clean seal and check the operation.

9. DISMANTLING AND ASSEMBLING THE OIL HOUSING

- Begin by removing the parts as shown in Sections 5 to 8..

9.1 DISMANTLING

- Remove oil housing cover (pumps of frame size 58 and larger).
 - Unscrew the retaining screws.
 - Remove the oil housing covers with the help of levers (please refer to Section 8.7).



Removing oil housing cover using levers.

- Remove the oil housing.
 - Unscrew the retaining screws.
 - Pry the oil housing free with levers. On large pumps, support the housing with a hoist.

NOTE

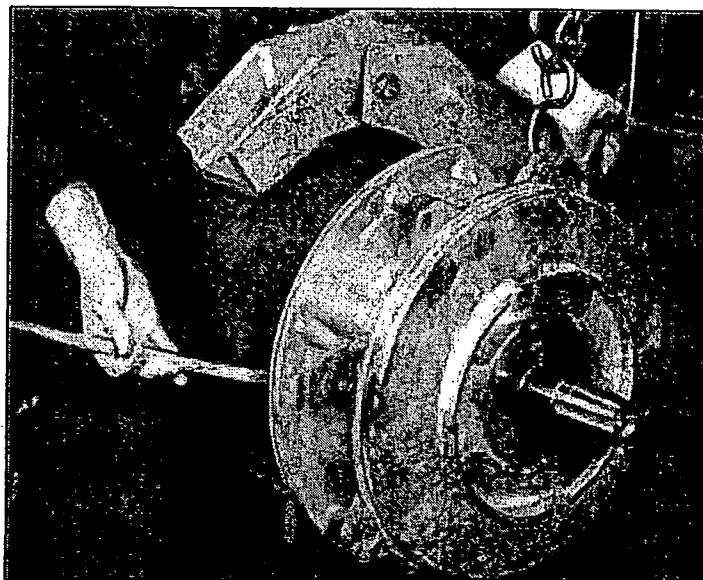
For instructions on removing the oil housing on frame sizes 26 to 46, please see Section 8.1.



Removing oil housing by applying leverage.

REPAIR MANUAL

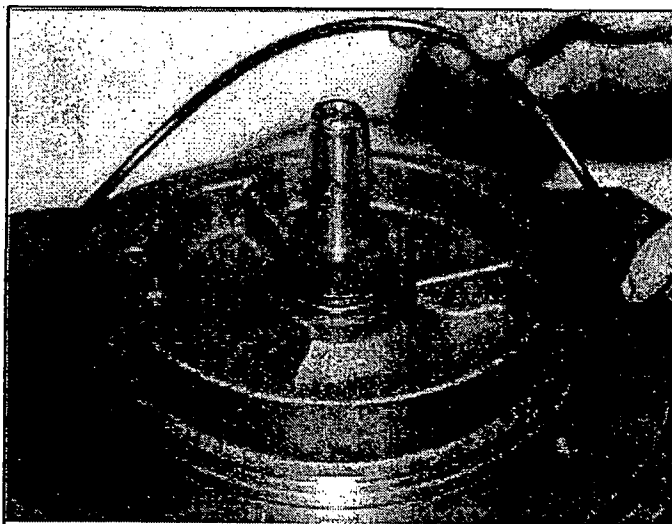
Section 9 Page 2

SARLIN
Pumps

Supported removal of oil housing using levers and lifting device.

9.2 ASSEMBLY

- Install the O-ring in its groove.

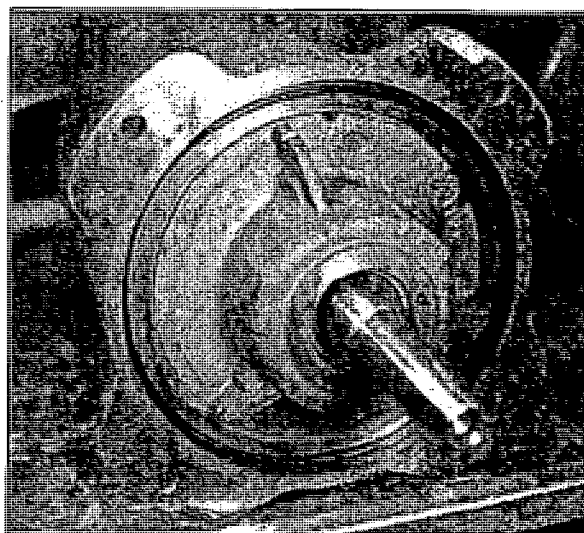


Installing O-ring in pump of frame size 42.

Frame size 58 and larger:

- Place the upper O-ring, which goes into the corner between the stator housing and the bearing bracket, in position. Use grease for temporary fixing of the O-ring.
- Place the other O-ring in the oil housing groove.

O-ring kept in place with grease.->

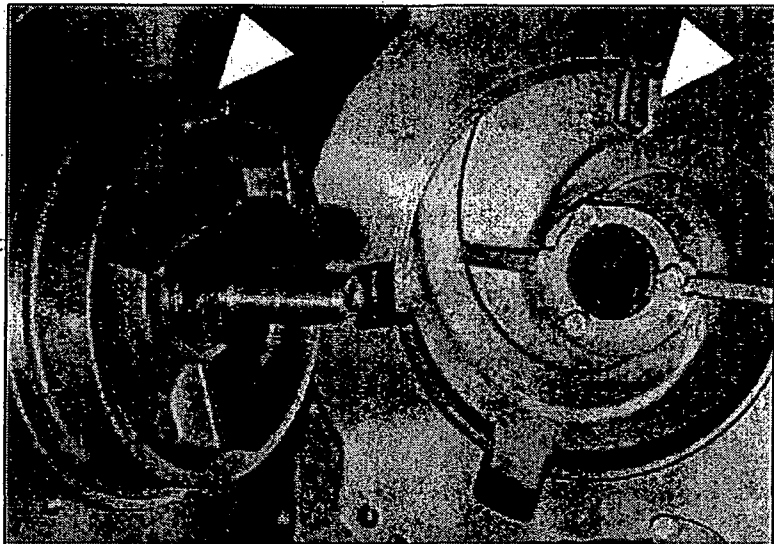




- Install the oil housing
 - Put the retaining screws in position
 - Tighten the screws gradually in sequence.

NOTE On pumps of frame size 42 and 46 the rotation guards must be in correct position before installation

NOTE On pumps of frame size 58 and larger the stator housing inspection plug and the oil housing plug must be positioned on the same side.



Rotation guards on pumps of frame size 42 and 46

REPAIR MANUAL



Section 9 Page 4

This page left intentionally blank.



10. DISMANTLING AND ASSEMBLING THE SECONDARY SEAL

FRAME SIZES 01 AND FROM 50 TO AND INCLUDING 70

NOTE

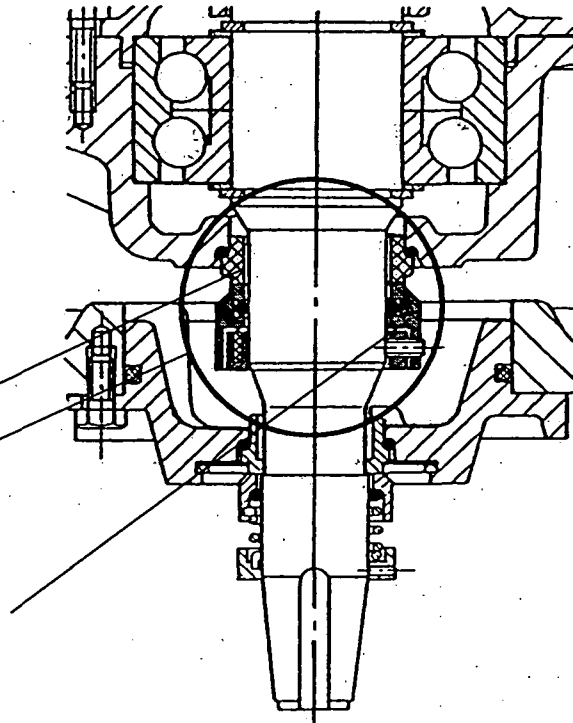
Seal construction is similar in all pumps of these frame sizes. Seal size only will change with the following seals used:

Frame size	Seal dia.
01	32 mm
50	38 mm
54, 58	50 mm
62, 66, 70	65 mm

Stationary seal ring

Secondary seal unit

Rotating seal ring with retaining system



10.1 DISMANTLING

- The primary seal and oil housing have to be removed. Please refer to Sections 8 and 9.
- Loosen the retaining screws of the rotating seal ring unit.
- Pull the rotating seal unit off the shaft by hand.
- Remove the stationary seal by applying finger pressure from the bearing bracket side. (For reference on removal of the bearing bracket, please see Section 11)



Removing stationary seal ring from the seal.



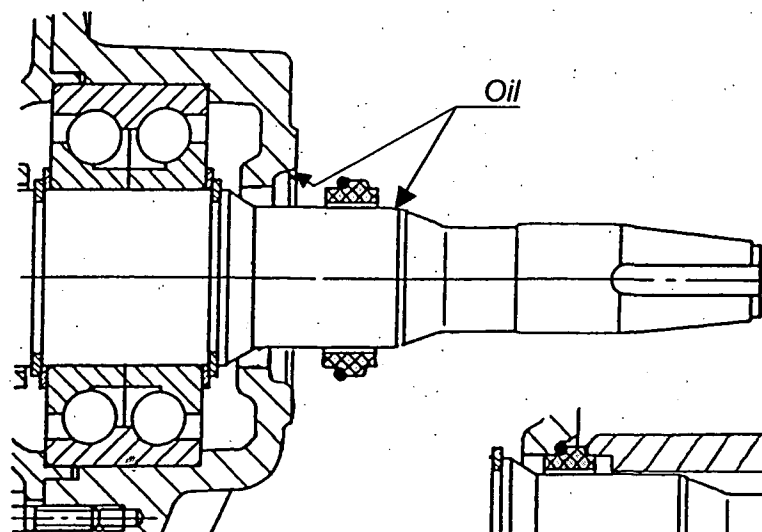
Loosening secondary seal retaining screws.

REPAIR MANUAL

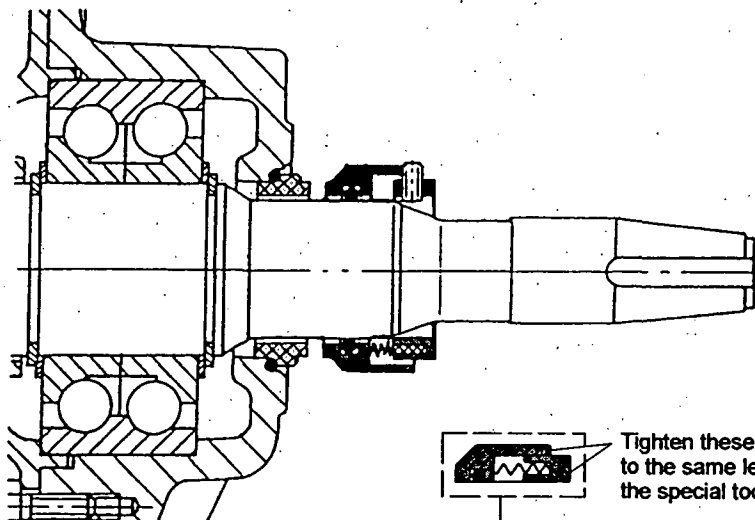
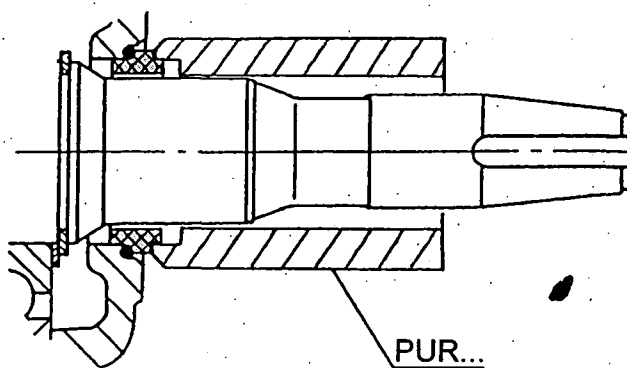
SARLIN
Pumps

Section 10 Page 2

10.2 ASSEMBLY. OLD MODEL



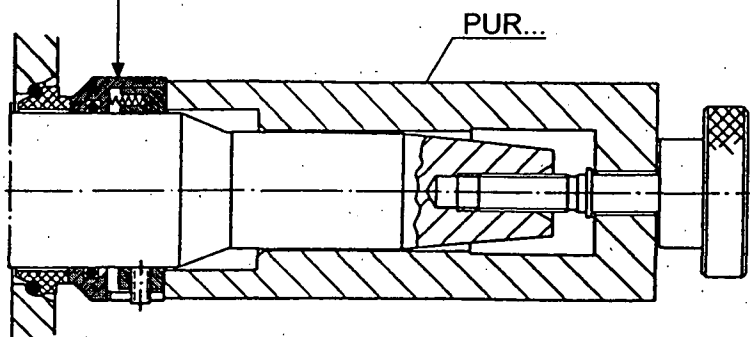
- Lightly oil the collar of the stationary seal and install the O-ring onto the stationary seal.
- Lubricate the seal cavity of the stationary seat and the shaft.
- Install the seal with the tool in the seal housing.



- Check that the O-ring is in position in the rotating ring.
- Press the seal unit onto the shaft by hand.
- Install the retaining ring in its correct position by using a special tool and tighten the retaining screws.

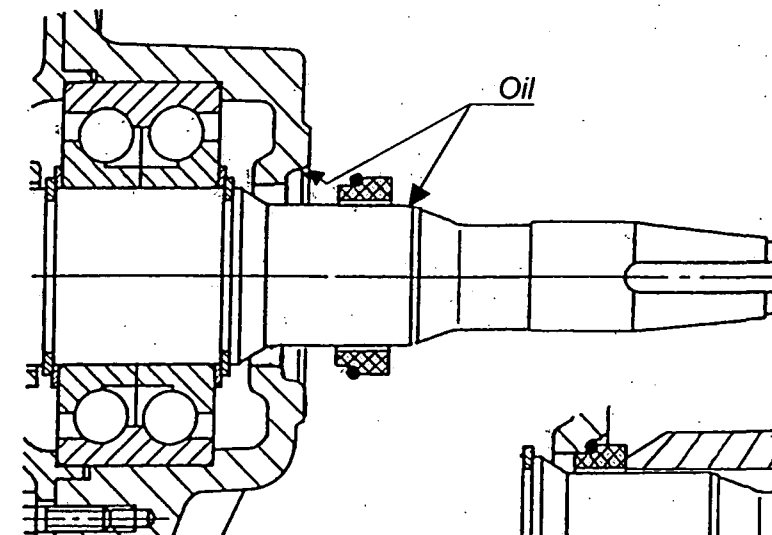


Tighten these surfaces to the same level with the special tool.

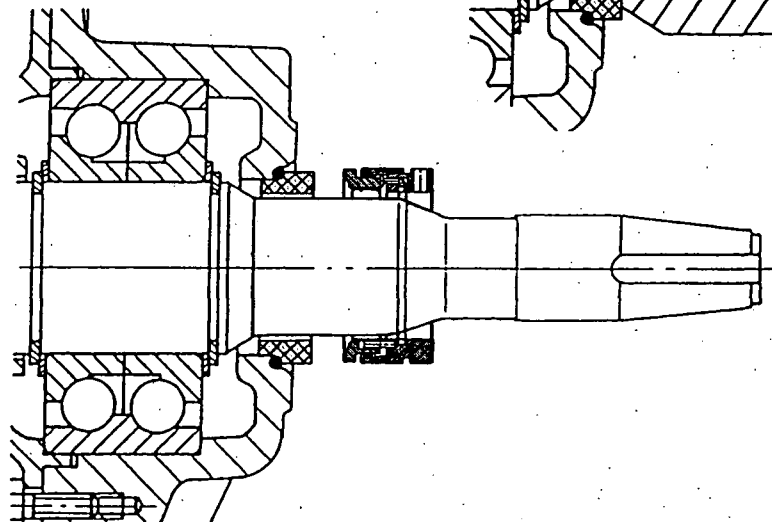
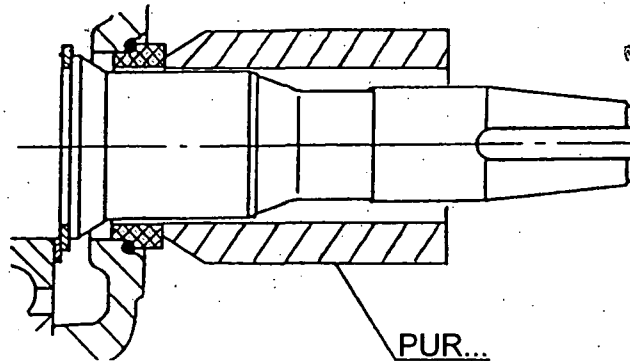


For checking the seal condition, please refer to Section 8.8.

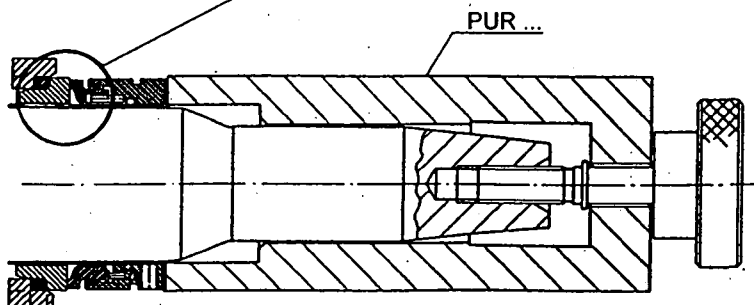
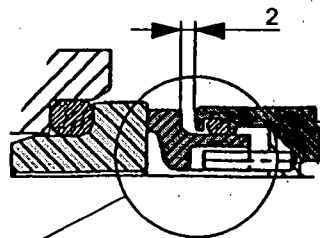
10.3 ASSEMBLY. NEW MODEL



- Lightly oil the collar of the stationary seal and install the O-ring onto the stationary seal.
- Lubricate the seal cavity of the stationary seat and the shaft.
- Install the seal with the tool in the seal housing.



- Check that the O-ring is in position in the rotating ring.
- Press the seal unit onto the shaft by hand.
- Install the retaining ring in its correct position by using a special tool.
- The gap between the rotating seal ring and the retaining ring must be $2,0 \text{ mm} +0,3/-0 \text{ mm}$.
- Using the plastic set-up tool provided with the unit, the installation tool is tightened until the plastic tool becomes lightly squeezed.
- Tighten the retaining screws.
- Remove the set-up plastic tool.



REPAIR MANUAL

SARLIN
Pumps

Section 10 Page 4

This page left intentionally blank.



11. DISMANTLING AND ASSEMBLING OF ROTOR AND BEARINGS

NOTE See also Section 2.2 General notes for dismantling and installation of bearings.

11.1 UPPER BEARING

The bearing can be replaced (except for pumps of frame size 46) without removing the rotor when the upper cover has been removed and the terminals are disconnected. For frame sizes 58 and larger, the upper bearing bracket has to be removed (using a removing thread facilitates removal).

- Remove the old bearing with an extraction tool.
- Install a new, heated bearing (80 °C... 90 °C).
- For bearing lubrication see Volume 3 B.

NOTE If for any reason the upper bearing has to be replaced, it is recommend that you also replace the lower bearing in the following way:

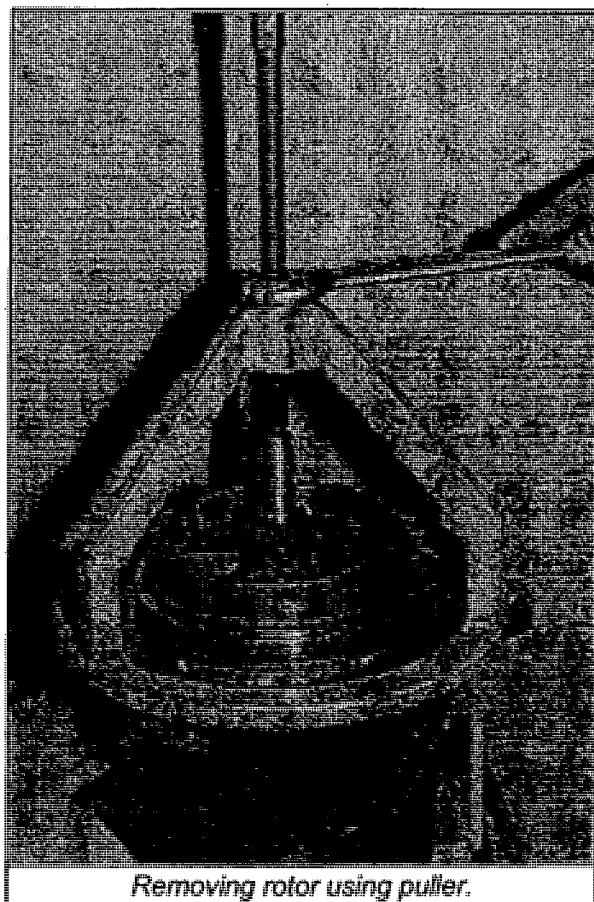
11.2 REMOVAL OF ROTOR

NOTE Always be careful that the ends of the coils do not get damaged.

- Put the motor in a horizontal position on a firm workbench or trestle with the shaft upwards.
- Remove the parts as shown in Sections 5 through 10.
- Remove the rotor in the following way:

11.2.1 Removal using puller

- Attach a puller to the motor shaft. Turn the screws on the puller so that the rotor and bearing shield are detached from their guard. See the number of the required puller from the tool list (a list of tools is given in Volume 3 B).



Removing rotor using puller.

REPAIR MANUAL

Section 11 Page 2

11.2.2 Removal with a hoist

The rotor can also be hoisted free by means of a hook attached in place of the impeller fixing screw.

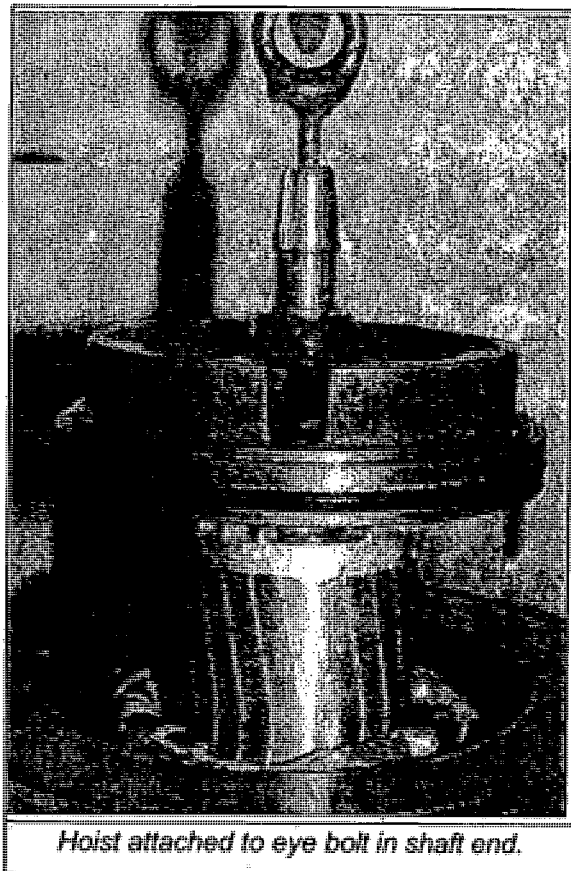
- Attach the hook in place of the impeller screw.
- Lift the rotor free with a hoist.

NOTE The methods above are suitable especially for motors of frame sizes 26 to 46.

11.2.3 Removal with levers

Turn the bearing bracket until you are able to pry the rotor away from the stator with the bearing bracket.

NOTE This method is suitable for motors of frame sizes 01, 50 and 54. If the rotor is too heavy to lift away by hand, see item 11.2.4.



Hoist attached to eye bolt in shaft end.



Prying the rotor from the bearing bracket with levers.

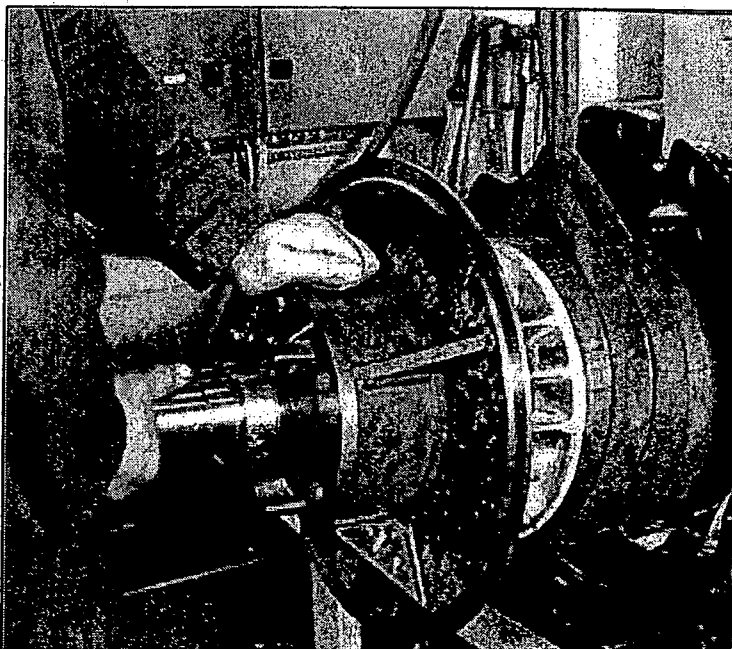


11.2.4 Removing using a lifting device

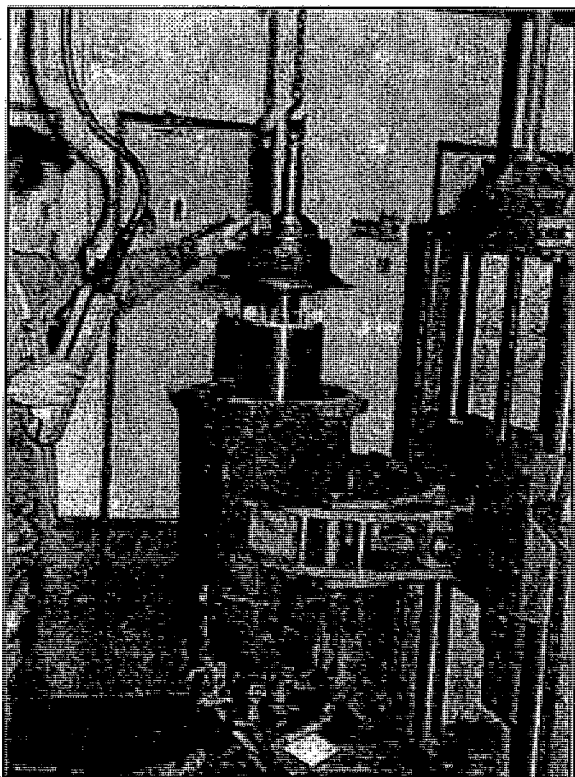
- Remove the rotor by tapping the upper end of the shaft with a soft hammer. (Or with levers, see item 11.2.3)
- When the rotor package is visible, support it with some lifting device, so that the rotor is easier to lift away without damaging the ends of the coils.

NOTE This method is suitable for motors of frame sizes 58 and larger.

- If a heavy motorised trestle is available remove the rotor as shown in item 11.2.2.



Supported removal of rotor.



Using motorised trestle.



Rotor in manual trestle.

REPAIR MANUAL**SARLIN**
Pumps

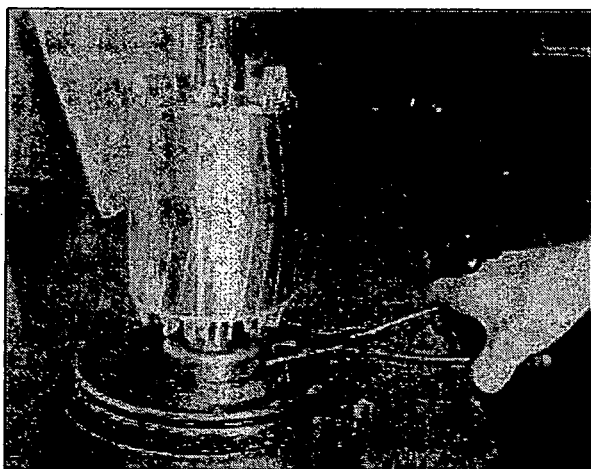
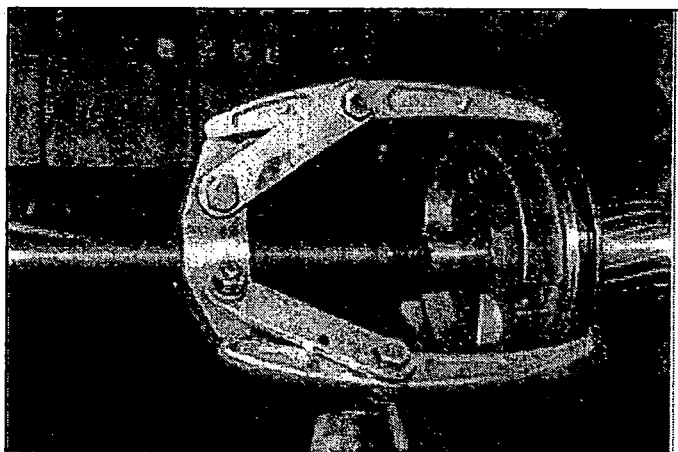
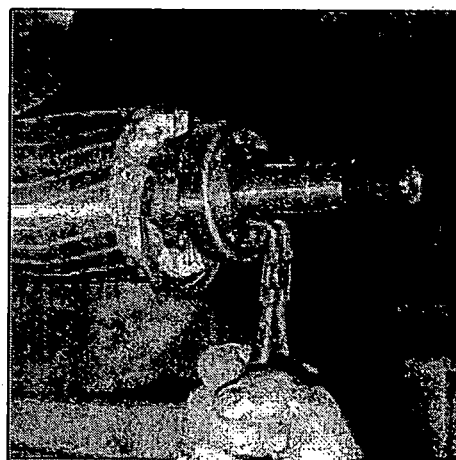
Section 11 Page 4

11.3 REMOVAL OF LOWER BEARING BRACKET

- Put the rotor on a workbench or in a trestle (or vise) for ease of handling. Depending of motor type proceed as follows:

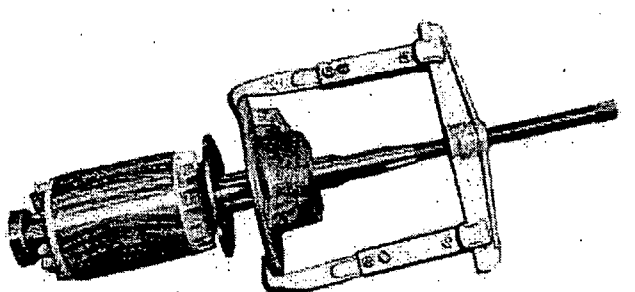
11.3.1 Frame sizes 01 and from 26 to 54

- Remove circlip from outer ring of lower bearing bracket.
- Remove the bearing bracket by using a suitable puller or press. Be careful of the shaft end and conical surfaces.
- Remove circlip at top of bearing.
- Remove washer and extract bearing with a puller.

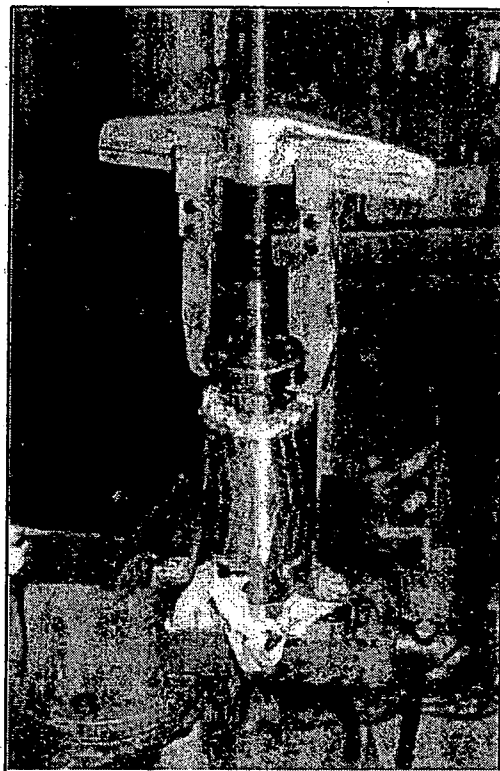
*Removing circlip.**Removing circlip.**Removing bearing bracket with puller.**Removing bearing circlip.*

11.3.2 Frame size 58

- Remove bearing housing cover

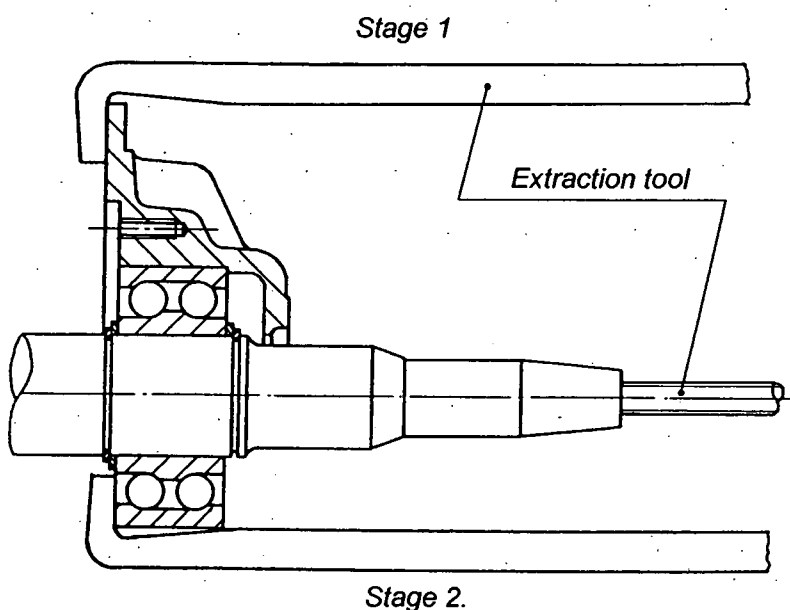


Pulling bearing housing cover



Pulling bearing.

- Pull out lower bearing bracket using an extraction tool. (Stage 1.)



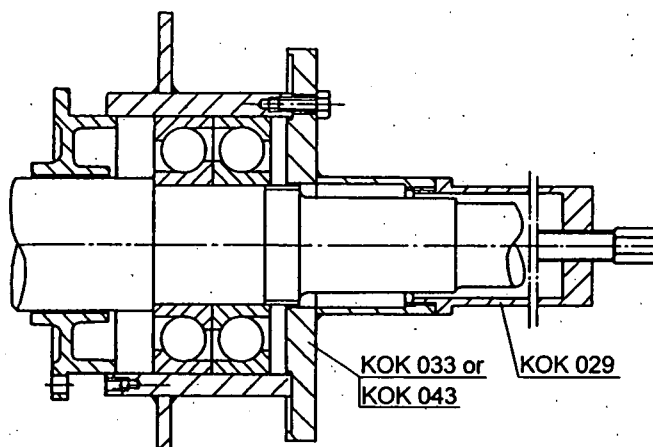
- Remove circlip and washer and pull the bearing away from the shaft using an extraction tool. (Stage 2.)

REPAIR MANUAL**SARLIN**
Pumps

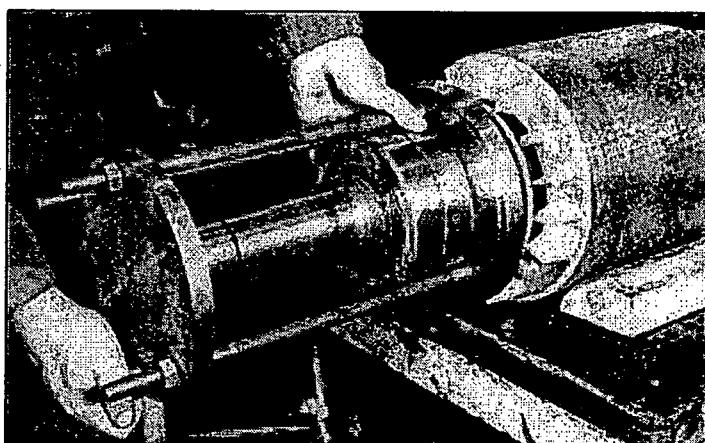
Section 11 Page 6

11.3.3 Frame sizes 62 and 66

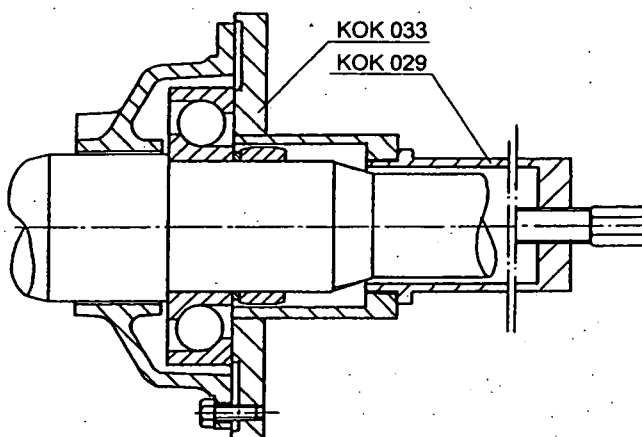
- Remove the lower bearing housing cover. (if necessary, remove the stationary seat of the secondary seal by pressing out from inside the bearing housing cover)
- Undo the upper bearing housing cover.
- Remove the bearing lock nut and lock washer.
- Remove the bearing bracket with a specially designed tool.

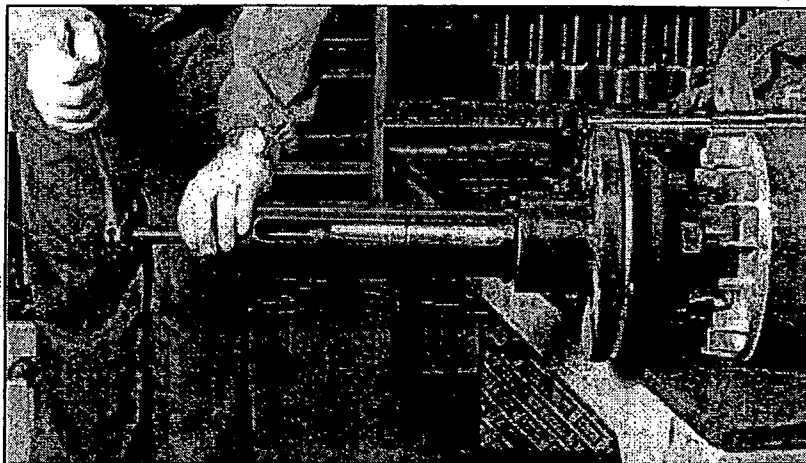
*Setting the special tool for removal of bearing bracket.*

- Remove the bearings from the shaft with a specially designed tool

*Removing bearings with special tool.***11.3.4 Frame size 70**

- Remove the lower bearing housing cover and O-ring.
- Undo the upper bearing housing cover.
- Remove the bearing lock nut, lock washer and roller bearing angle ring.
- Remove the lower bearing bracket, which will come off without using a tool.

*Setting the tool against the upper bearing housing cover.*



Removing bearings.

11.4 ASSEMBLING

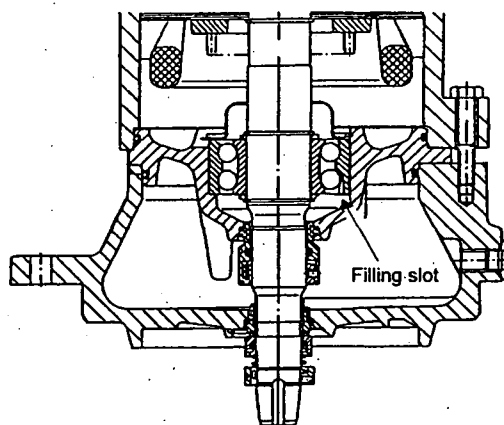
The procedure for assembling is the reverse of the dismantling process.

NOTE The lower bearings in frame sizes 26 and 30 and both bearings in frame sizes 34 to 46 are greased for life. If spare bearings are needed, always use original Sarlin high temperature greased bearings.

NOTE The lower bearings in frame sizes 50, 54 and 58 are of the double row angular contact ball type with filling slots. They must always be installed so that the filling slot is on the impeller side. Please refer to the drawing below.

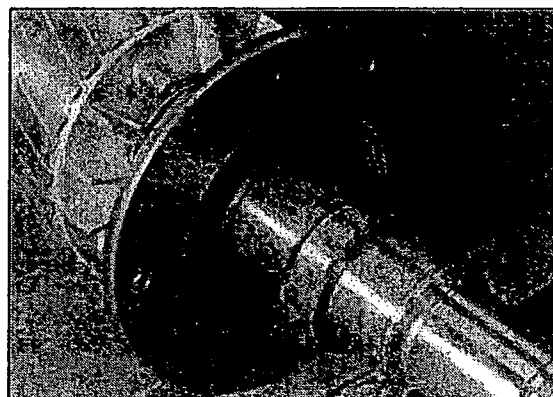
11.4.1 Frame sizes 01 and 26 to 54

- Make sure that the parts on the upper side of the bearing are installed first on the shaft (circlip, cover, washer, etc.)
- Heat the bearing before mounting on the shaft to 80 °C..90 °C.
- Put the lower washer and circlip in place.
- When the bearing is cooled, fit the bearing bracket after heating in an oven. Bearings which are not greased for life must be filled with grease (see lubrication of bearings in Volume 3 B). Place the circlip in the outer ring of lower bearing bracket.



11.4.2 Frame size 58

- Mount the bearing housing cover on the shaft.
- Put the upper circlip and washer in place.
- Mount a heated (80 °C.. 100 °C) bearing on the shaft. Put the lower washer and circlip in place.
- Lubricate the bearing.
- Fit the heated bearing bracket in its correct position.
- Attach the bearing housing cover.



Shaft circlip and washerZ

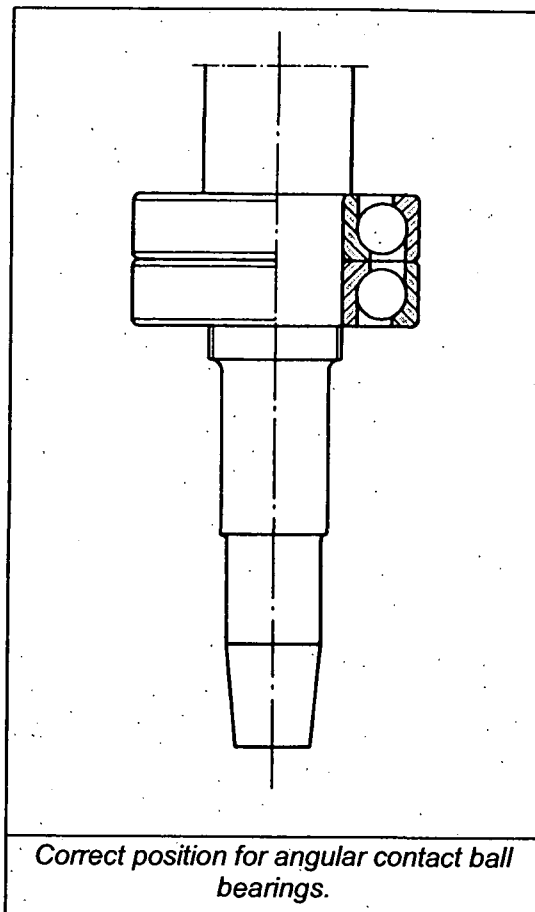
REPAIR MANUAL**SARLIN**
Pumps

Section 11 Page 8

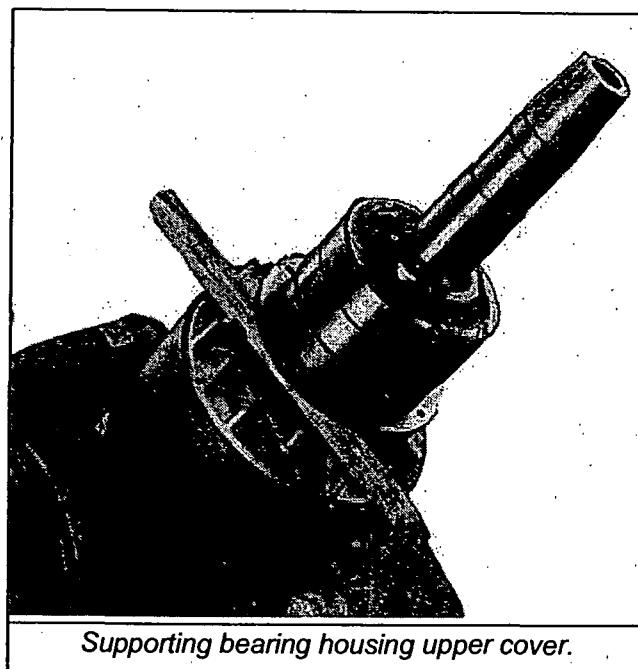
11.4.3 Frame sizes 62 and 66

- Mount the upper bearing housing cover on the shaft.
- Put upper circlip and washer into place (frame size 62 only).
- Fit the heated (80 °C..100 °C) bearings on the shaft. Note correct position for bearings (X-installation)
- Put the lock washer on the shaft.
- Screw in the lock nut, tighten and secure it.
- Attach the lower bearing housing cover to the lower bearing bracket.
- Heat the lower bearing bracket (70 °C..80 °C)
- Push the bracket onto the bearings while at the same time supporting the upper bearing housing cover against the bearings.

NOTE Without this support the outer ring of the upper bearing may move and be damaged.



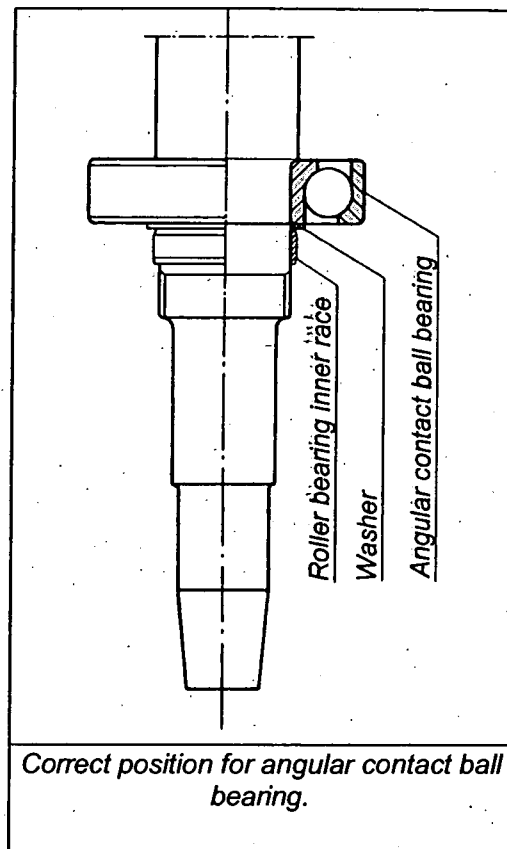
- Remove lower bearing housing cover.
- Lubricate the bearings.
- Put the O-ring in its groove in the lower bearing housing cover.
- Attach the upper and lower bearing housing covers.



11.4.4 Frame size 70

(Motor lower bearing arrangement with one angular contact ball bearing).

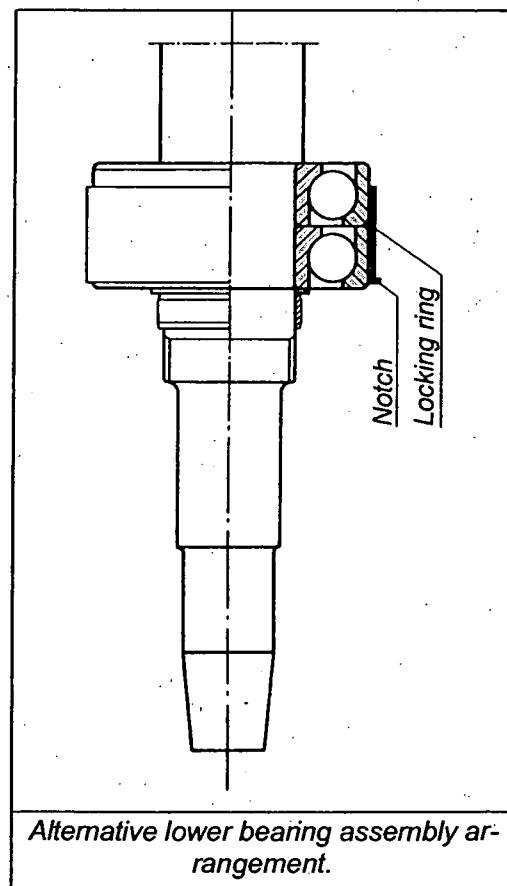
- Put the upper bearing housing cover on the shaft.
- Mount a heated (80 °C..100 °C) angular contact ball bearing (note the correct direction) washer and the heated inner ring of the roller bearing on the shaft.
- Force the roller bearing outer ring with rollers into the heated lower bearing bracket.
- Insert the springs (6 pcs.) in the lower bearing bracket. Ensure that the springs stay in position by filling their holes with bearing grease.
- Lubricate the bearings.
- Mount the lower bearing bracket.
- Attach the upper bearing housing cover.
- Put the roller bearing angle ring and lock washer in position.
- Screw in the bearing nut, tighten and secure it.
- Place the lower bearing bracket O-ring in its groove.
- Attach the lower bearing housing cover.



11.4.5 Frame size 70

(Motor lower bearing arrangement with two angular contact ball bearings)

- Put the upper bearing housing cover on the shaft.
- Put the angular contact ball bearings on your workbench on top of each others with crease in between (note the correct direction of the bearings)
- Mount the heated locking ring on the bearings (note the correct direction of the notch)
- Mount a heated (80 °C ... 100 °C) angular contact ball bearing set (note the correct direction) and the heated inner ring of the roller bearing on the shaft.



REPAIR MANUAL**Section 11 Page 10**

- Force the roller bearing outer ring with rollers into the heated lower bearing bracket.
- Insert the springs (6 pcs.) in the lower bearing bracket. Ensure that the springs stay in position by filling their holes with bearing grease.
- Lubricate the bearings.
- Mount the lower bearing bracket so that the slot in the bearing bracket engages the notch of the locking ring.
- Attach the upper bearing housing cover.
- Place the roller bearing angle ring and lock washer in position.
- Screw in the bearing lock nut and tighten and secure it.
- Place the lower bearing bracket O-ring in its groove.
- Attach the lower bearing housing cover.

11.5 ASSEMBLING ROTOR

The procedure for assembly is exactly the reverse of the dismantling process.

NOTE During assembly of the rotor, do not tap very hard at the rotor end. You may damage the bearings.

12. TOP COVER, CABLE INLET AND CONNECTION

12.1 MOTOR COVER REMOVAL

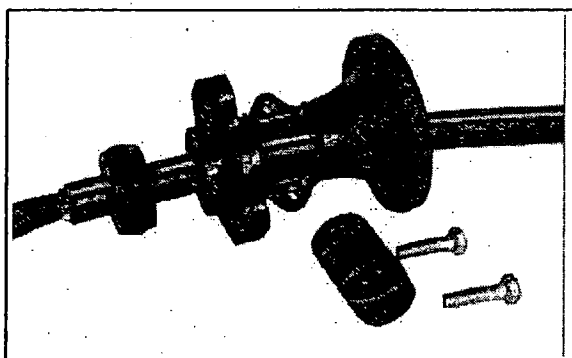
- Remove the lifting handle by unfastening the screws.
- Remove the motor cover by light tapping with a soft hammer or using levers.
- Be careful of the connecting leads.
- Disconnect the cable leads from the terminal board.



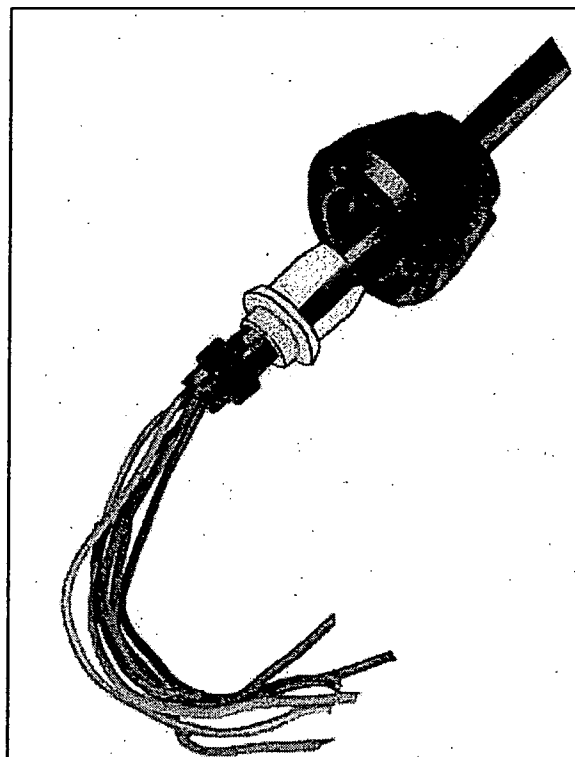
Removing top cover using levers.

12.2 DISMANTLING THE CABLE INLET

- Do not disconnect or remove the cable unless absolutely necessary.
- Loosen the inlet screws.
- Pull the cable and the cable inlet out.
- Disconnect the cable inlet by pulling it over the cable clamp.



Cable inlet assembly.



Cable inlet assembly.

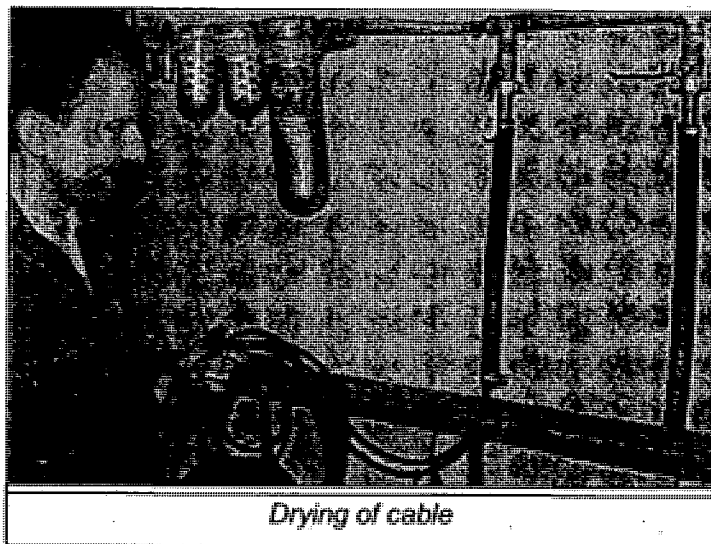
REPAIR MANUAL

Section 12 Page 2

SARLIN
Pumps**12.3 CABLE DRYING**

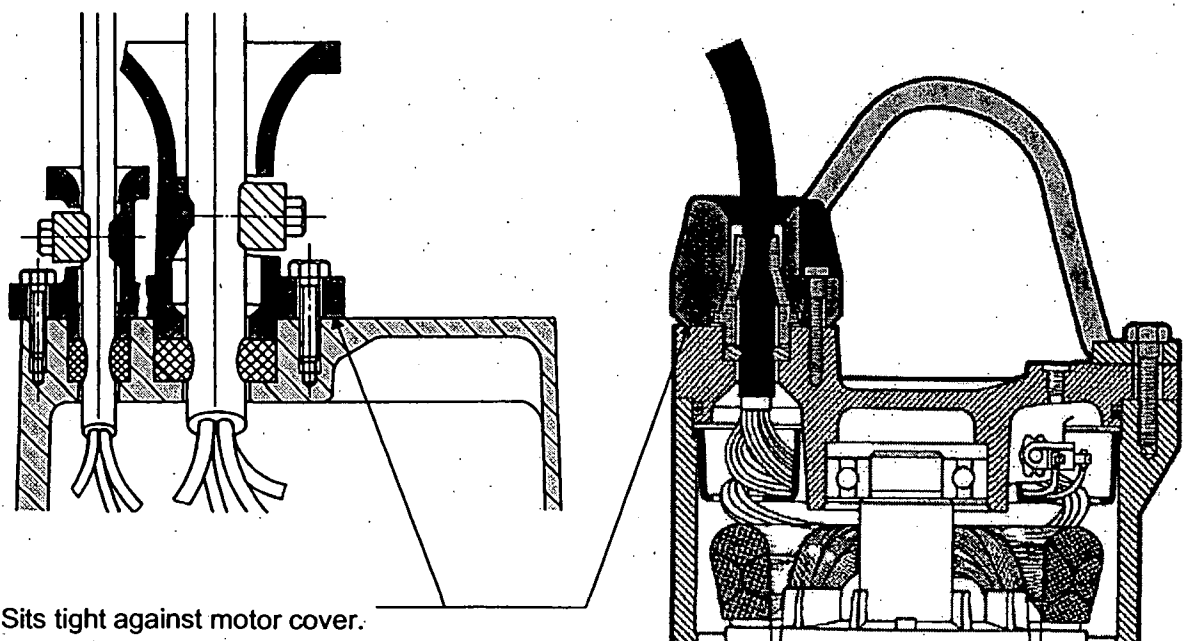
If the cable has become moist it can be dried as follows:

Blow clean dry air (max 0,8 bar) through the cable. Drying time is about 20 hours.

**12.4 INSTALLING THE CABLE INLET**

NOTE Do not reconnect the old cable in the same position at the cable inlet. Preferably use a new rubber seal.

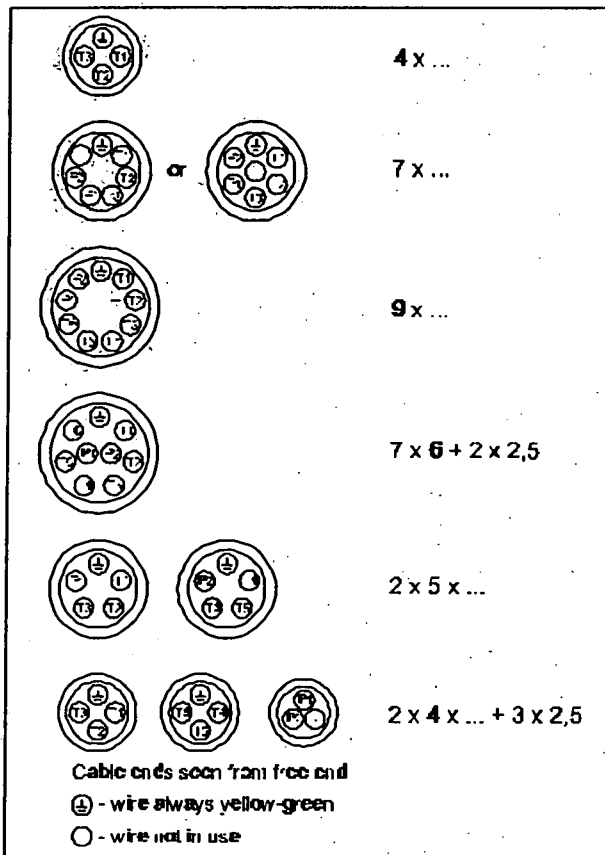
- Strip the cable end. Reserve enough length for connections. Also remember that the earth lead must be longer than the others. If same cable is to be used, it must be shortened so that the cable clamp and rubber seal seats in a new position.
- Push the cable inlet and rubber seal onto the cable.
- Attach the cable-inlet combination to the motor cover and tighten the screws so that the cable inlet presses against the motor cover.



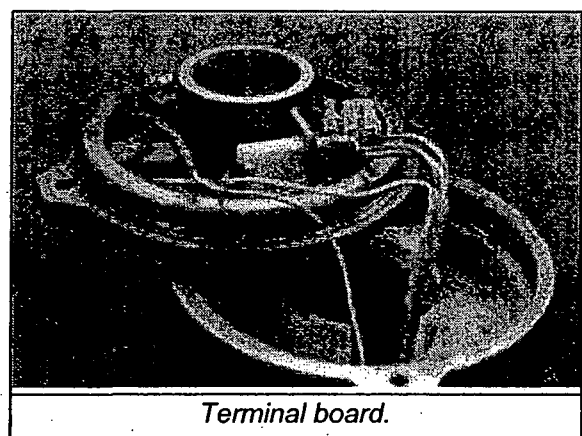
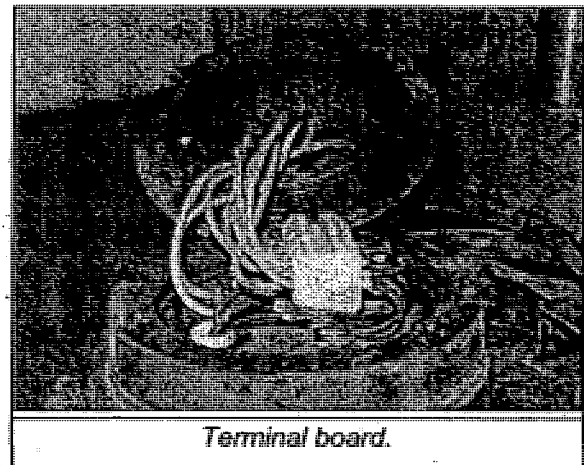
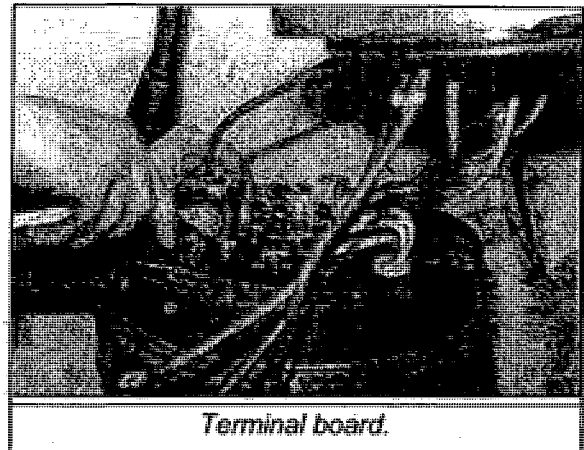
Sits tight against motor cover.

12.5 CONNECTING

- Remember to correctly mark the shortened cable leads.



- Lightly oil the O-ring and install in the top cover.
- Connect the cable and motor lead to the terminal board as shown in the circuit diagram (Connector sets are shown in Volume 3 B)



NOTE

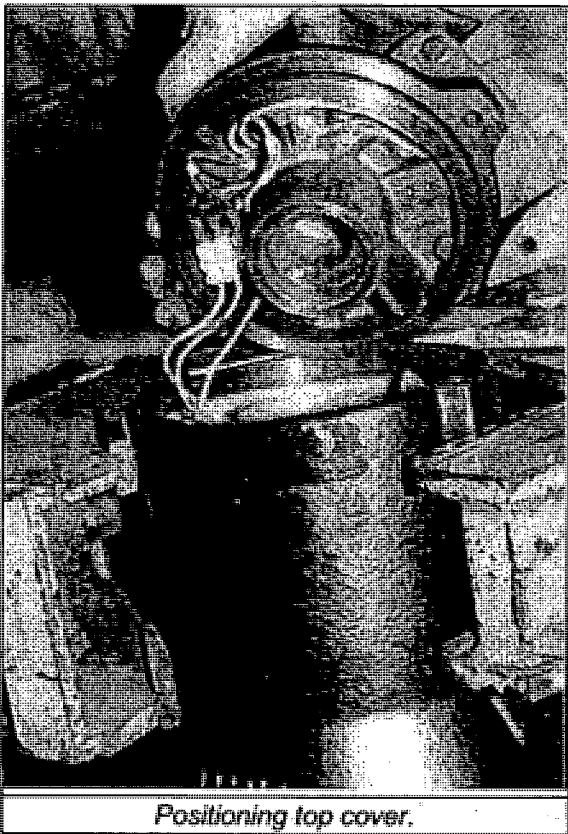
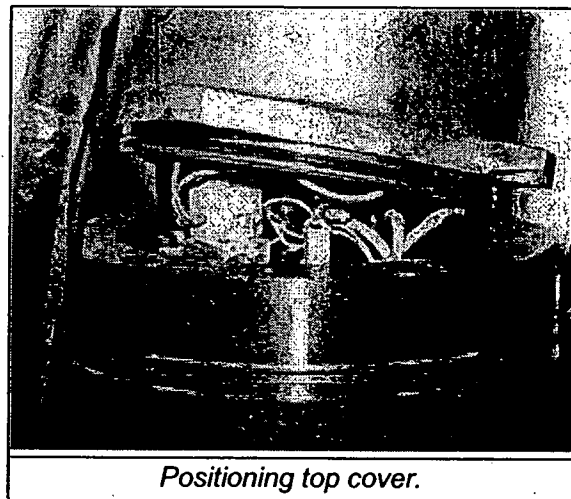
Fastening torque of the Allen screws in the connection plate (frame size 62 and larger) must be 1,3 kpm.

REPAIR MANUAL**SARLIN**
Pumps

Section 12 Page 4

12.6 INSTALLING THE TOP COVER

- Oil the collar of the stator housing lightly.

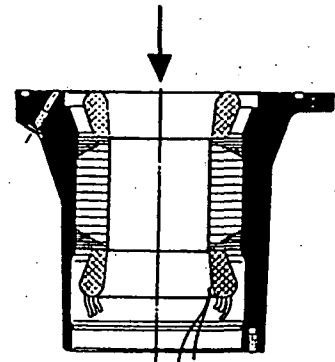
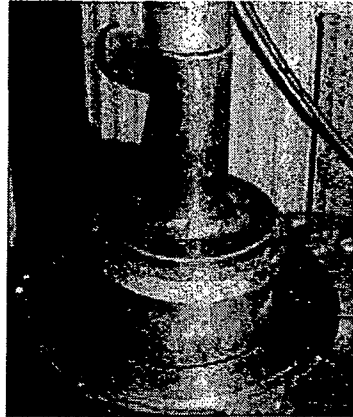
*Positioning top cover.**Oiling stator housing collar.**Positioning top cover.*

- Put the top cover carefully in position so that the leads will not become damaged.
- Tap the top cover lightly with a soft hammer in the right position and bolt the cover.
- Make the necessary measurements.

13 STATOR; REPLACEMENT AND DRYING

13.1 REPLACING STATOR, FRAME SIZE 42 PUMPS WITH CAST IRON HOUSING

NOTE For motors of frame sizes 26, 50, 54 and 58 stator housings and packages are not available as separate items, but as complete assemblies only.



Removing stator from housing.

Removing:

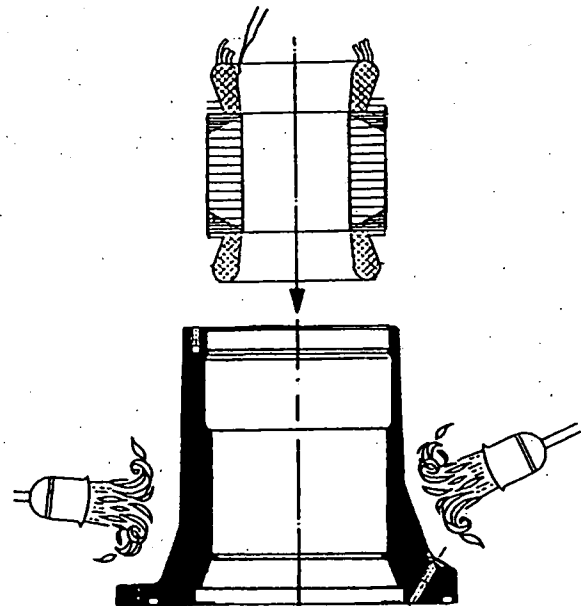
- Remove oil housing, rotor and motor cover.
- Note the position of the connecting leads coming from the stator housing in relation to the frame.
- Put the housing in a press in such a way that pressure can be applied on the stator from the pump side. An initial applied force of 15 tonnes is required to remove the stator.

NOTE: The stator can also be removed by applying heat to the housing. (Section 13.2)

Installing:

- To install a new stator, first heat the stator housing (200 °C to 250 °C), then, carefully noting the position of the leads, drop the stator onto the shoulder of the stator housing.

NOTE The heating can be done with liquid gas burners or in an oven.

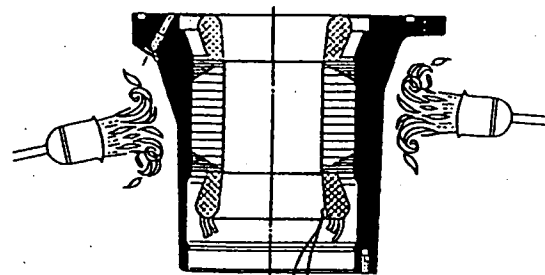


Installing stator.

13.2 REPLACING STATOR, FRAME SIZES 26, 30 AND 42 (VERSION 3 AND 6) PUMPS WITH ALUMINIUM HOUSING AND FRAME SIZE 46 (ALL MATERIALS)

Removal:

- Remove the oil housing, rotor and motor cover. Note the position of the connecting leads coming from the stator housing in relation to the frame.
- Put the stator housing in a press.
- Heat the stator housing with liquid gas torches at a temperature of 200 °C. Do this quickly so that the heat does not spread to the stator and press the package away from the stator housing.



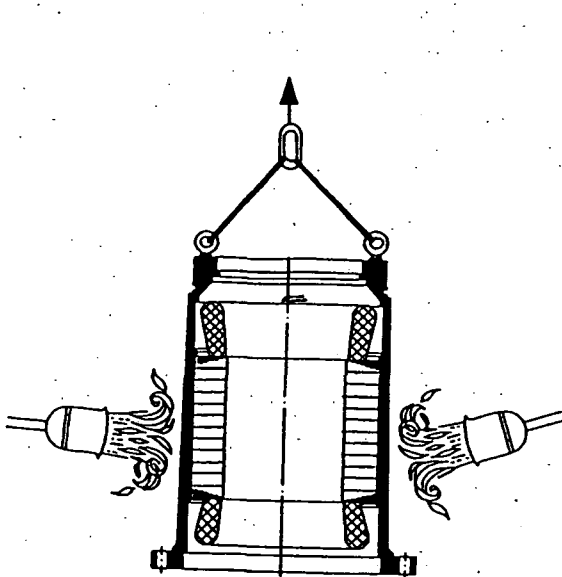
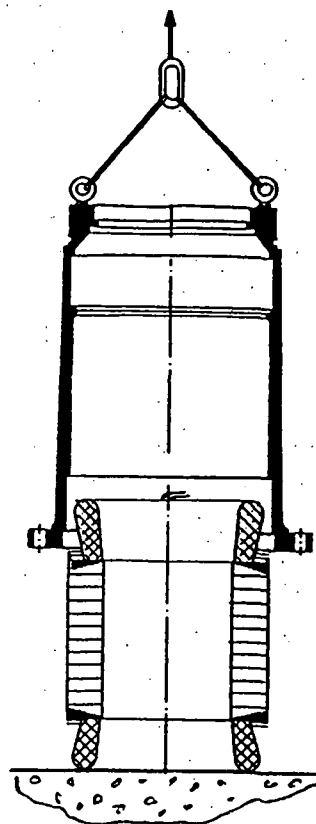
Removing stator.

REPAIR MANUAL**Section 13**Page 2**Installing:**

- To install a new stator, first heat the stator housing (150..200 °C), then, carefully noting the position of the leads, drop the stator onto the shoulder of the stator housing.

13.3 REPLACING STATOR, FRAME SIZES 34 AND 38

- These stators are replaced in the way similar to the described above, with the exception that the stator package will come out from the other end of the housing.

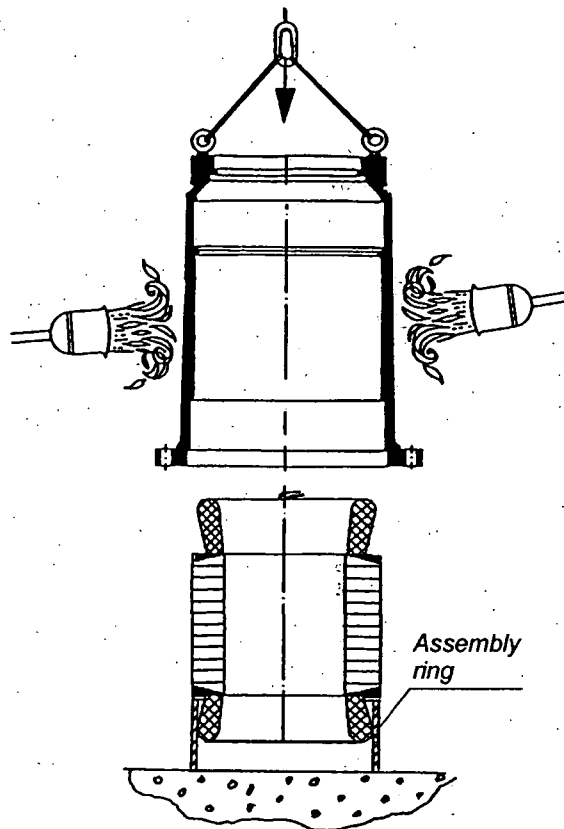
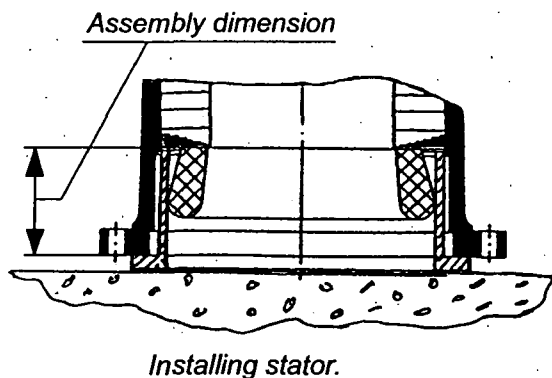
13.4 REPLACING STATOR, FRAME SIZES 01, 46 AND LARGER*Removing stator***Removal:**

- Lift the stator a bit off the floor.
- Heat the stator housing at the same time with 2 or 3 gas burners beginning from the bottom edge.
- Carry out the heating as quickly as possible. The stator package will drop to the floor after enough heat has been applied.

**Installing:**

- Put the stator package carefully in an assembly ring.
- Heat the stator housing to 200..250 °C with gas burners or in an oven.
- Lift the heated housing over the stator and lower it carefully onto the stator package.

NOTE The stators of frame sizes 01, 50 and 54 always need a special assembly tool for the correct positioning of the stator package, because the package will not go onto a shoulder in the stator housing. See the illustrations at right and below:

**13.5 DRYING STATOR**

- Place the stator in an oven at 100 to 110 °C. Drying time is 6...12 hours.

NOTE If the stator has become wet, the rotor must be dried as well. If this is not done, the stator may become moist again after re-assembly and trip the moisture switch.

- When the stator has cooled, carry out insulation resistance measurements to make sure it is dry.



REPAIR MANUAL

SARLIN
Pumps



Section 13Page 4

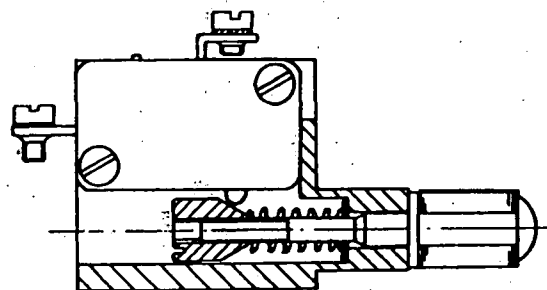
This page left intentionally blank.

14 MOISTURE SWITCH

14.1 DISMANTLING

- Remove leads from switch.
- Remove fixing screws and nut.
- Remove switch.

NOTE If the moisture switch has tripped, the whole unit must be replaced.

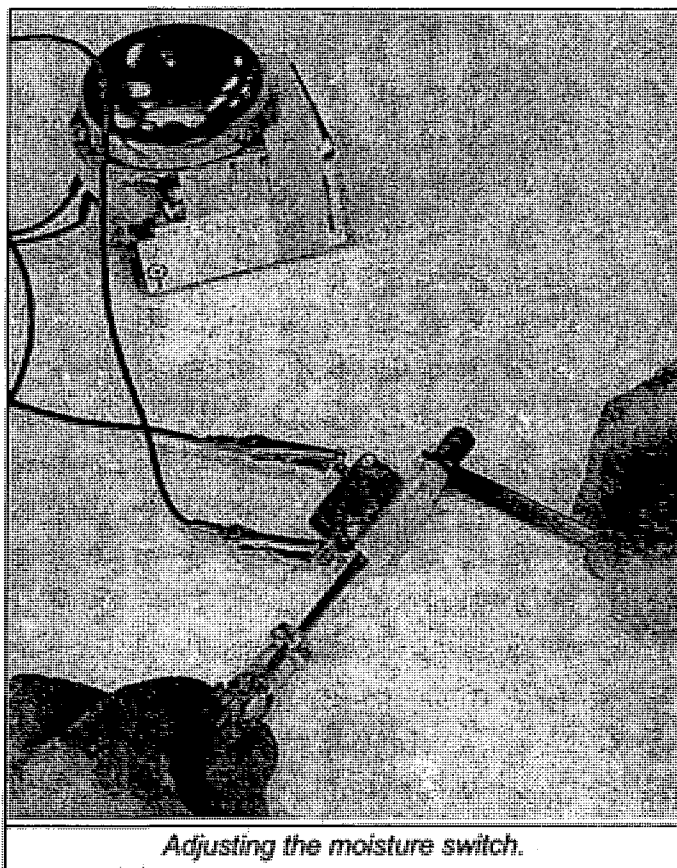


Moisture switch

14.2 INSPECTION AND ADJUSTMENT OF THE MOISTURE SWITCH

NOTE Do not touch the expander part of the switch with oily hands.

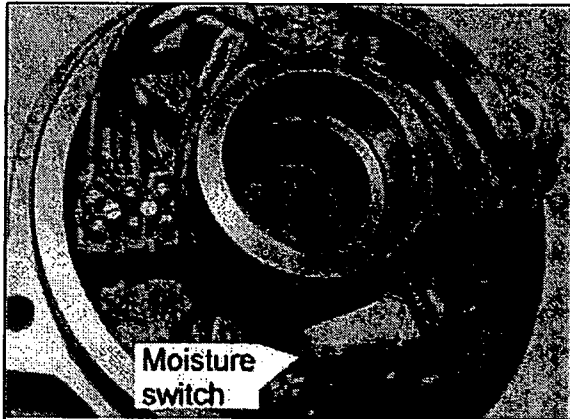
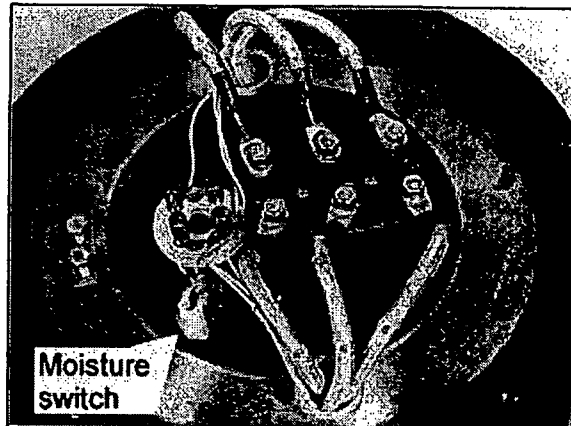
- The moisture switch must be stored in the sealed packing to protect the expander part from humidity. The relay is set at the factory and must be checked and re-set before it is installed in place. The moisture switch must be removed from its package one day prior to re-setting, to give sufficient time for the expander part to adjust itself to the local humidity level.
- Connect the switch to a simple bell circuit or other test circuit. Use the feeler gauge delivered with the Moisture Switch to adjust the clearance between the expander part and the switch body. The clearance should be 2,5 mm (0,1 inches).
- Check the microswitch
After connecting the test bell, pull the expander 2 or 3 times to make sure that the bell stops ringing (the electric circuit will be broken) when the expander is pulled outward and starts to ring when the expander is free.
- Adjusting the clearance
Place the feeler gauge between the body and the expander, pulling the expander outward. If the bell rings, turn the adjusting screw clockwise until the bell stops ringing. If again the bell is not ringing, turn the adjusting screw counterclockwise until the bell starts ringing.



Check the adjustment by removing the feeler gauge and re-installing it. The bell should connect on and off when you gently move the feeler gauge.

REPAIR MANUAL**SARLIN**
Pumps

Section 14 Page 2

*Moisture switch installed.**Moisture switch installed.***14.3 INSTALLING THE SWITCH**

- Install the tested switch in the motor in the reverse order of dismantling.
- Ensure that the leads do not get pinched between the insulation ring and the motor cover.



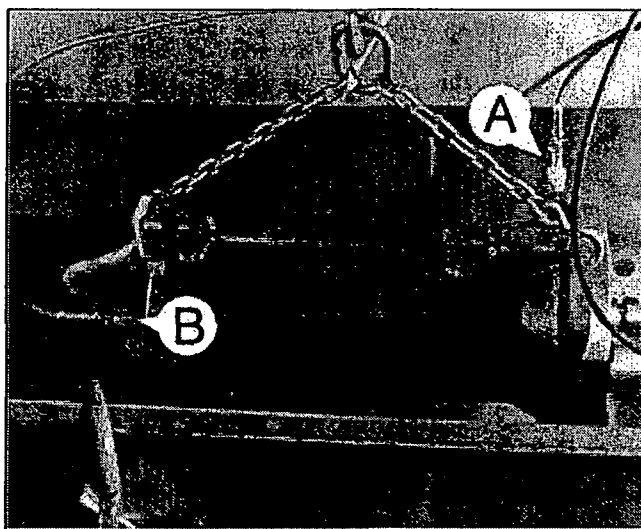
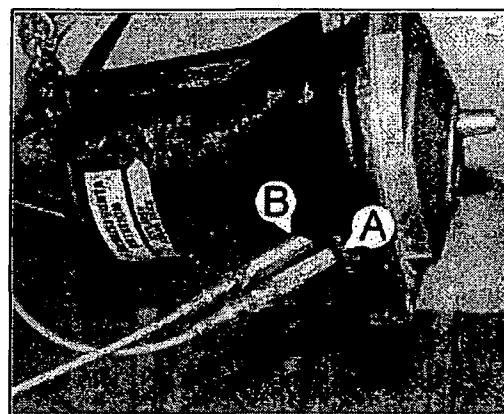
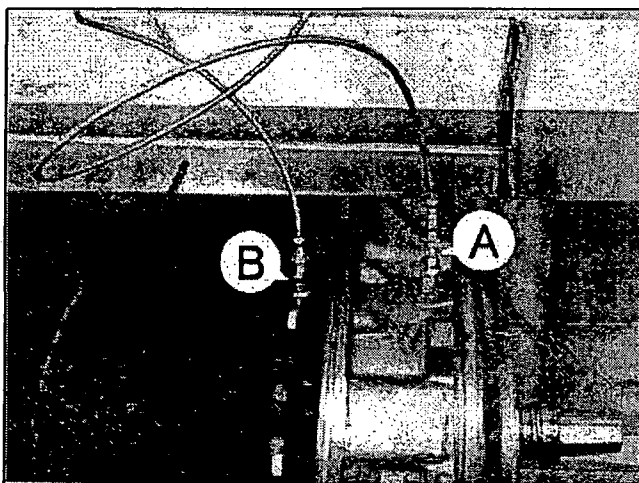
15 TIGHTNESS TESTING

- The tightness test always has to be carried out after the motor is opened.
- Use dry compressed air to perform the tightness test.
- Moisture admitted into stator chamber will cause the moisture switch to trip.
- Use nitrogen gas if available.

NOTE Make sure that the pressure never exceeds 1 bar. This could displace the seal.
Do not immerse the free end of the cable.

The test should be carried out as follows.

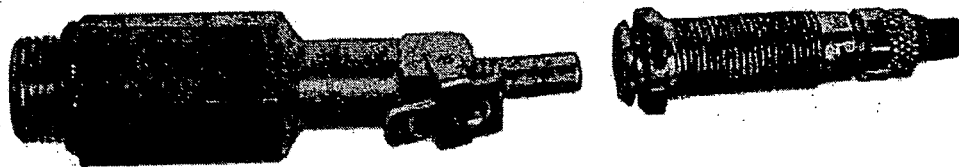
- Test repaired/overhauled pump before refilling with oil.
- Attach pressure hoses to oil housing (A) and stator inspection plug (B) with connectors.



Air pressure connectors attached.

REPAIR MANUAL

Section 15 Page 2

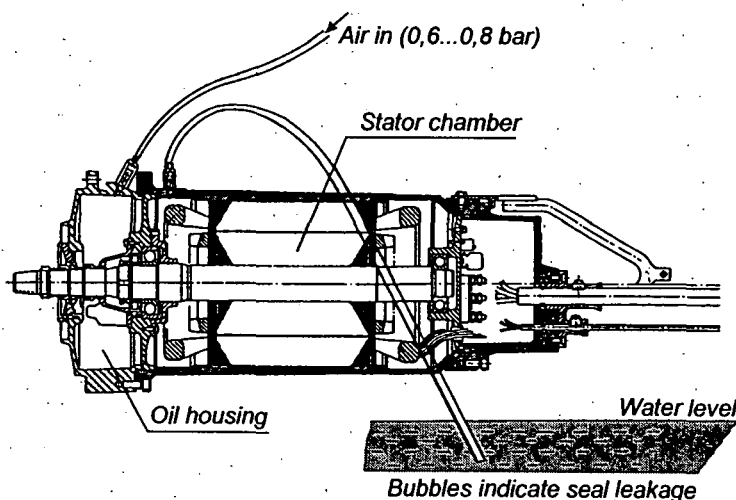
SARLIN
Pumps

Connector for tightness test.

NOTE

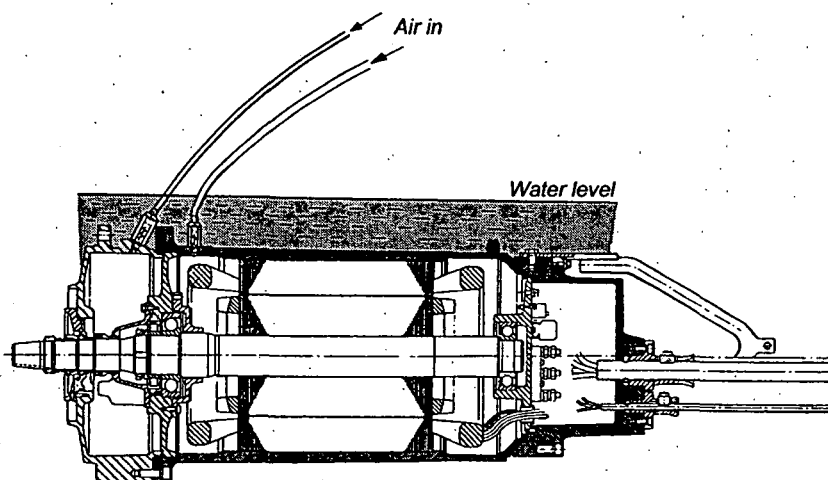
Consult the tool list in Book 3B for correct required test tools for your pump.

- Begin by making sure that there is a tight seal between the oil housing and the stator chamber. Apply compressed air at a pressure of about 0,6. 0,8 bar to the oil housing and submerge the end of the hose connected to the stator inspection plug in water. Make sure that no water gets into the stator chamber via this hose.
- If air emerges (water bubbles) from the end of the hose, the joint must be dismantled and the cause of the leak found and corrected.



Checking the secondary seal.

- Apply compressed air to motor through both hoses.
- Submerge motor in water and rotate motor a few times but no longer than 10 seconds so that the secondary seal does not burn. Carefully check that there are no air leaks.



Checking the motor.

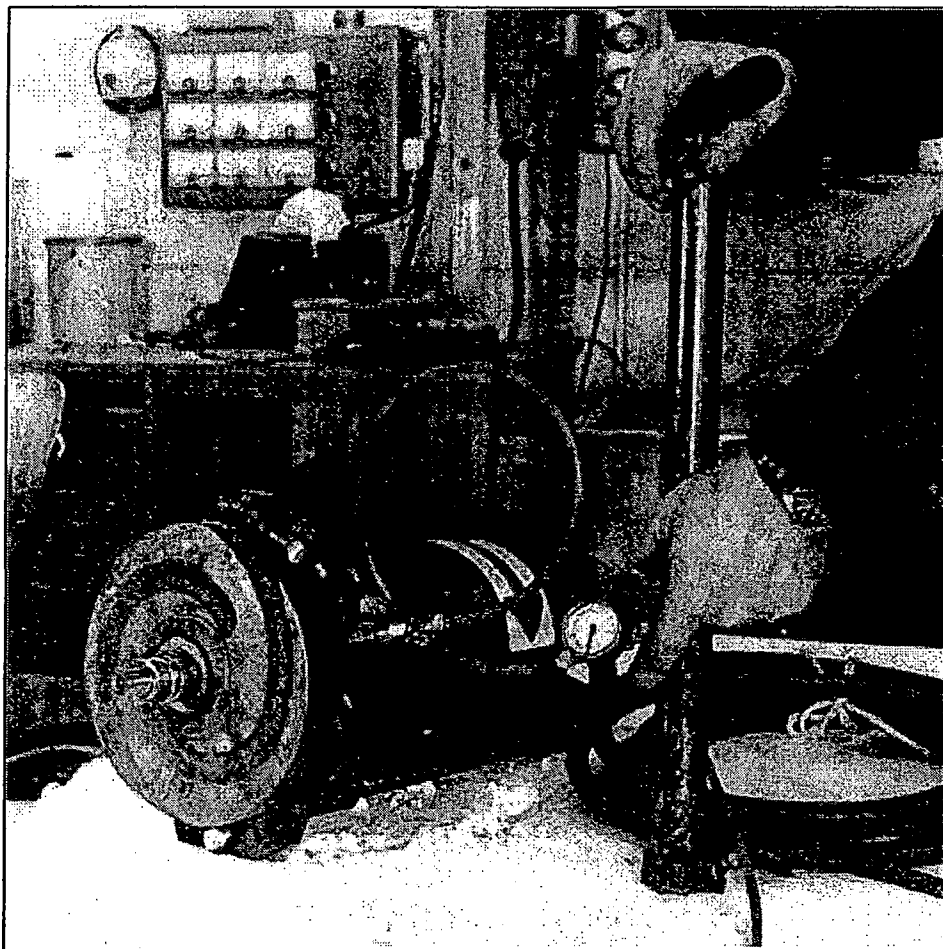


- If the primary seal leaks, revert to the procedure described in Section 8.
- When motor is proven to be watertight, check condition of plugs, their O-rings and mating surfaces. Replace parts where necessary.

NOTE As a precautionary measure, plug O-rings should always be replaced when the plugs have been opened.

- Refill with oil as shown in Section 6. and close the plugs carefully.

NOTE If compressed air is not available, you can use, for example, a car tyre pump. In that case both chambers have to be tested separately.



Tightness test with a car tyre pump.

REPAIR MANUAL



Section 15 Page 4

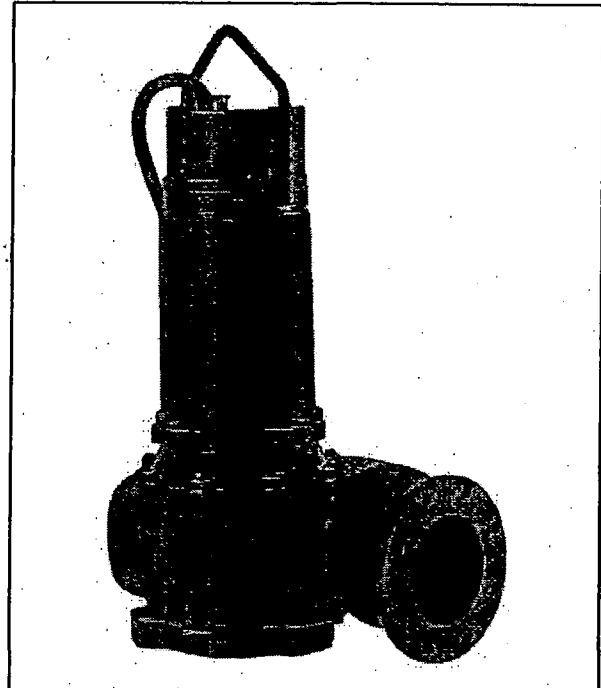
This page left intentionally blank.

16 INSPECTION OF OVERHAULED OR REPAIRED PUMP

Inspection procedures prior to delivery

- Using the tester at control leads P1 and P2 (1 and 2) and check that the protective devices are in order (see Section 4.4.1)
- Using the tester check that the earth lead (yellow-green) is connected to the body (see Section 4.4.2)
- Measure insulation resistance to check that it is over 100 megohms between:
 - phases (twisted together) to earth
 - phases (twisted together) to control leads P1 and P2 (1 and 2)
 - control leads P1 and P2 to earth
- Check the oil quantity in the oil housing (see Section 6.2)
- Check that surface dirt, which might have insulating qualities, is removed from the motor.
- Check that the rating plate is legible and that the ratings are still valid after the repair/adjustment work has been carried out.
- Check that the lead markings are indicated at the end of the cable
- Cover the end of the cable with a protective bag to protect it.

NOTE Always make sure that a tightness test has been carried out when any part of the motor has been opened.



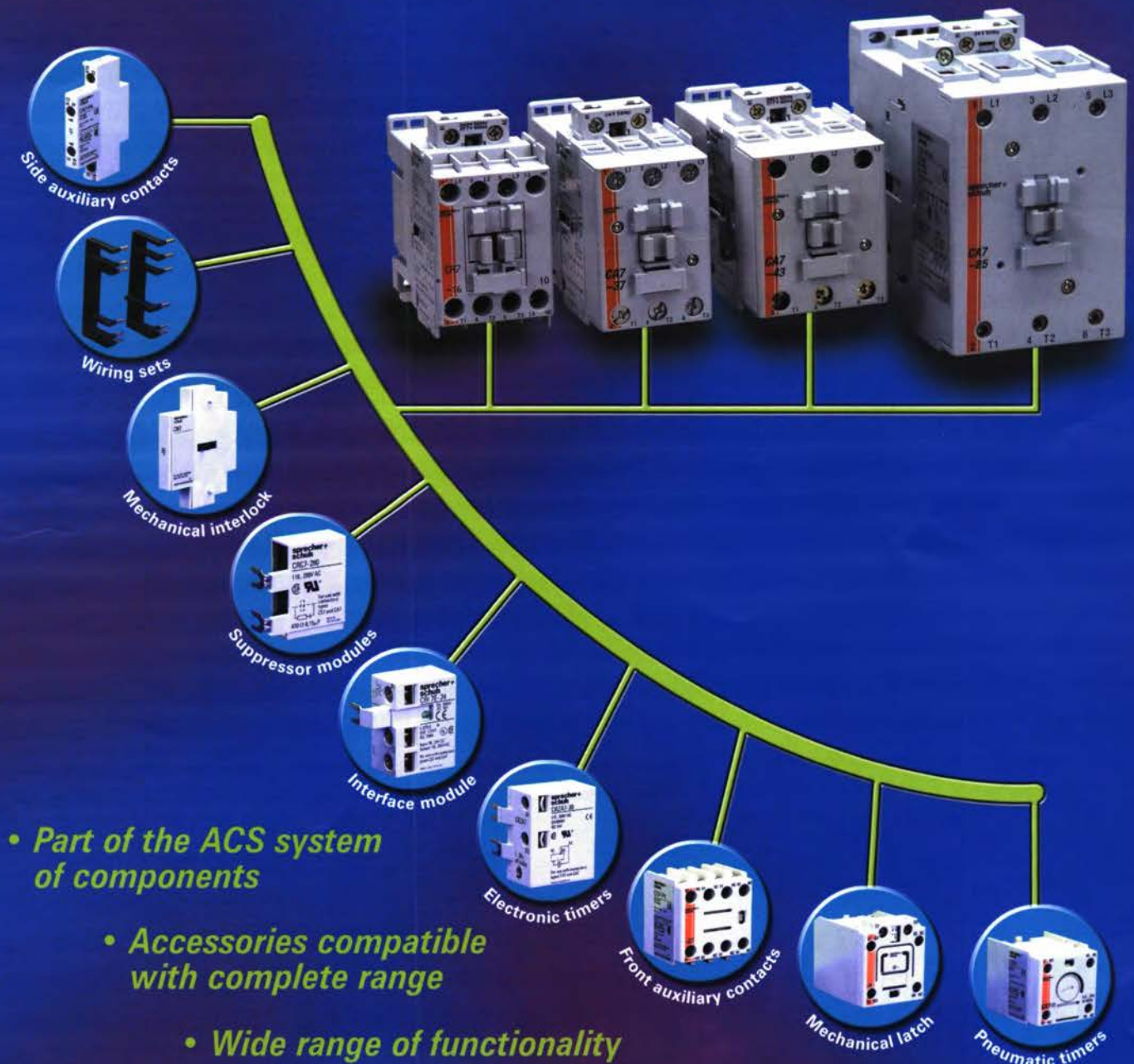
Well repaired or overhauled pumps keep the customer satisfied.

NOTE Fill out a service report for each overhauled pump and send one copy to:

Oy E. Sarlin Ab
Pumps Division
P.O. Box 750
FIN- 00101 HELSINKI
FINLAND

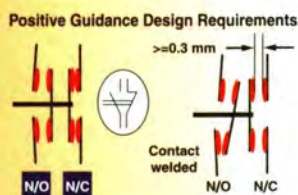
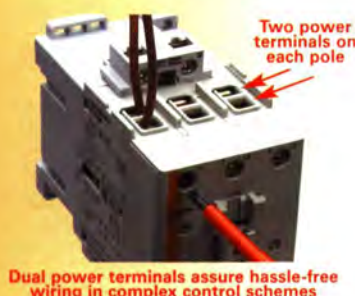
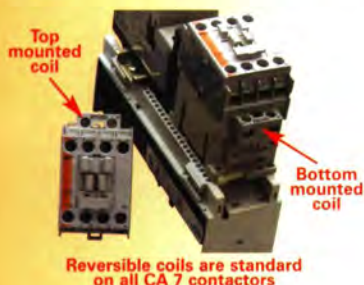
CA 7 Contactors

**More than just a contactor...
It's a contactor system.**



CA 7

Contactors ... features ahead of its time!



Reversible coils ... Total flexibility

Contactors usually have fixed coil connections. CA 7 contactors however, offer reversible coils giving the user the option of either top or bottom mounted coil terminals. This is particularly useful in providing more convenient access to coil connections.

The appropriate coil configuration can be ordered already fitted or simply modified on site.

Dual power terminals

CA 7-30 through to CA 7-85 are designed with two power terminals for each pole. This simplifies power wiring of interconnected contactors in reversing, reduced voltage and two speed applications. Simplified wiring results in less labour/downtime and reduced cost.

An extensive range of accessories common to all frame sizes is available: auxiliary contact blocks, timing elements, mechanical latch, interface module mechanical interlock and suppressor modules. A common mechanical interlock enables two CA 7 contactors of different physical size to be interlocked, making it ideal for applications such as multi-speed starters.

Sample of the Cat. No. when ordering:

CA 7 - 9 - 10...V

CA 7 series Refers to the AC 3 rating in amps Coil switching voltage

This is the auxiliary contact configuration 10 = 1 N/O, 01 = 1 N/C

	AC 3 kW	AC 3 Amps	AC 1 40 °C	AC 1 60 °C	Aux. Contacts N/O	N/C	Maximum Aux. Contacts	Cat. No. 1) 2) 3) 4)
CA 7-16 45 mm wide 16 A	4	9	32	32	1	0	9	CA 7-9-10...V
					0	1	9	CA 7-9-01...V
	5.5	12	32	32	1	0	9	CA 7-12-10...V
					0	1	9	CA 7-12-01...V
CA 7-37 45 mm wide 30 A, 37 A	7.5	16	32	32	1	0	9	CA 7-16-10...V
					0	1	9	CA 7-16-01...V
	11	23	32	32	1	0	9	CA 7-23-10...V
					0	1	9	CA 7-23-01...V
CA 7-43 54 mm wide 43 A	15	30	50	45	0	0	8	CA 7-30-00...V
	18.5	37	50	45	0	0	8	CA 7-37-00...V
	22	43	85	63	0	0	8	CA 7-43-00...V
CA 7-85 72 mm wide 60 A, 72 A, 85 A	30	60	100	100	0	0	8	CA 7-60-00...V
	37	72	100	100	0	0	8	CA 7-72-00...V
	45	85	100	100	0	0	8	CA 7-85-00...V

Note: 1) Add control voltage

2) Also available in DC control eg. (CA 7-9C-10...V)

3) Available in 4 pole version eg. (CA 7-9M40...V)

4) 4 pole DC version available on indent only

NHP
www.nhp.com.au
ELECTRICAL ENGINEERING PRODUCTS PTY LTD

A.B.N. 84 004 304 812

Melbourne Sydney Newcastle Brisbane Townsville Rockhampton Toowoomba Cairns Adelaide Perth Darwin Hobart

PH: +61 3 9429 2999 +61 2 9748 3444 +61 2 4960 2220 +61 7 3891 6008 +61 7 4779 0700 +61 7 4927 2277 +61 7 4634 4799 +61 7 4035 6888 +61 8 8297 9055 +61 8 9277 1777 +61 8 8947 2666 +61 3 6228 9575

FAX: +61 3 9429 1075 +61 2 9648 4353 +61 2 4960 2203 +61 7 3891 6139 +61 7 4775 1457 +61 7 4922 2947 +61 7 4633 1796 +61 7 4035 6999 +61 8 8371 0962 +61 8 9277 1700 +61 8 8947 2049 +61 3 6228 9757

FLYER CA7-F

Q-Pulse Id TMS738

Active 29/01/2014

CA7-F 10/01 14 M

Page 189 of 224

TemBreak

Total Protection, Complete Control



TERASAKI

TemBreak

Circuit Breaker

XS1600NE

690V AC

In **1600A**

Pole

Serial

TERASAKI ELECTRIC CO. LTD.

MADE IN JAPAN



BREAKING CAP.(sym)		
	WITH H.M.T.	WITHOUT H.M.T.
W I E C . D S . C E I M M		
690VAC	45kA	20kA
550VAC	85kA	20kA
440VAC	85kA	20kA
415VAC	85kA	20kA
380VAC	100kA	20kA
240VAC	150kA	20kA
W H E M A		
480VAC	85kA	20kA
240VAC	150kA	20kA
M A S		
440VAC	85kA	20kA
415VAC	100kA	20kA
SHORT-TIME		
WITHSTAND	CURRENT	
20kA	0.3SEC	



TemBreak

Total Protection, Complete Control

TemBreak incorporates a series of microprocessor based MCCBs that represents a major evolution in low-voltage distribution systems. They were engineered to meet the requirements of the fast developing information-oriented society. Each model is designed to serve a key point in the system. Providing refined characteristics, incorporating true r.m.s. detection and ensuring the reliability necessary for the efficient functioning of the system.

TemBreak's features are designed to match the needs of the 90's

- Meets Worldwide Users Requirements
- Electronic Type TemBreak
- Achieves a Higher Degree of Protection Co-ordination
- Adjustable Rated Current
- World Wide Standards
- Operation Unaffected by Harmonics
- Adjustable Long and Short Time-delay Trips
- Expanded Protective Functions
- Improved Breaking Performance
- Spacesaving
- Fast Break Mechanism
- Advanced Breaking Technology
- Highest Degree of Protection

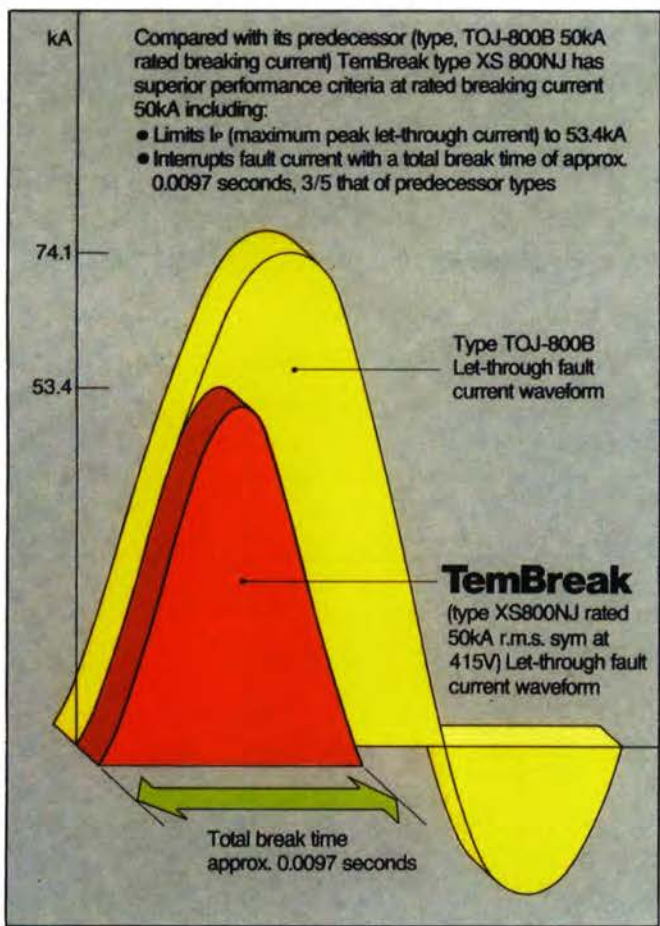
Contents:	Fast Break Mechanism	Page 2
	Advanced Technology	Page 4
	Correspondence TemBreak - Existing Breakers	Page 6
	Precise Protection Co-ordination	Page 8
	OCR Checker	Page 12

Fast Break Mechanism (FBM)

EXCEPTIONAL CURRENT LIMITING QUICK-BREAKING PERFORMANCE

TERASAKI's ingenuity on current breaking is reflected in the new Fast Break Mechanism (FBM) of the TemBreak series. Achieving high-speed, highly-efficient breaking. Its outstanding features include: U-shaped conductors, Dual Repulsive Contacts and Quick-break Arc Chutes (To quickly quench and extinguish ionized arcing gases). The Current Limiting, Quick-Breaking Performance of TemBreak provides exceptional current-limiting characteristics that have not been possible with existing moulded case circuit breakers. The current-limiting characteristics of TemBreak products, up to 800A frame, are outstanding.

REMARKABLE CURRENT — LIMITING FEATURE

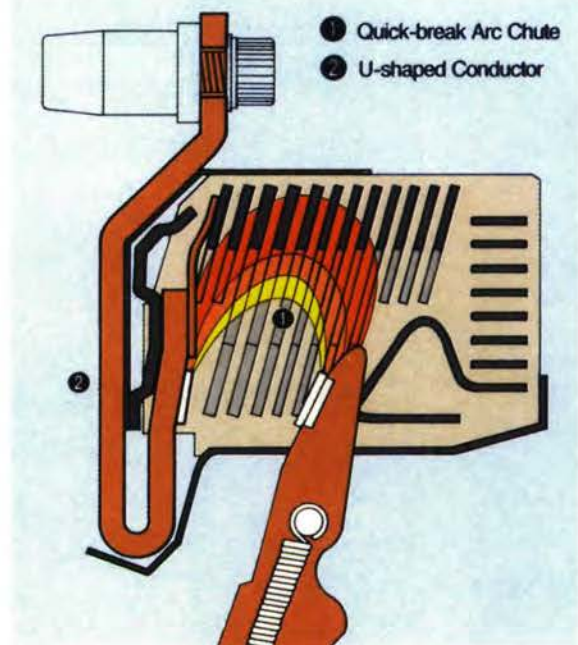


HIGH SPEED, HIGHLY-EFFICIENT BREAKING ACHIEVED!!

U-shaped Conductors

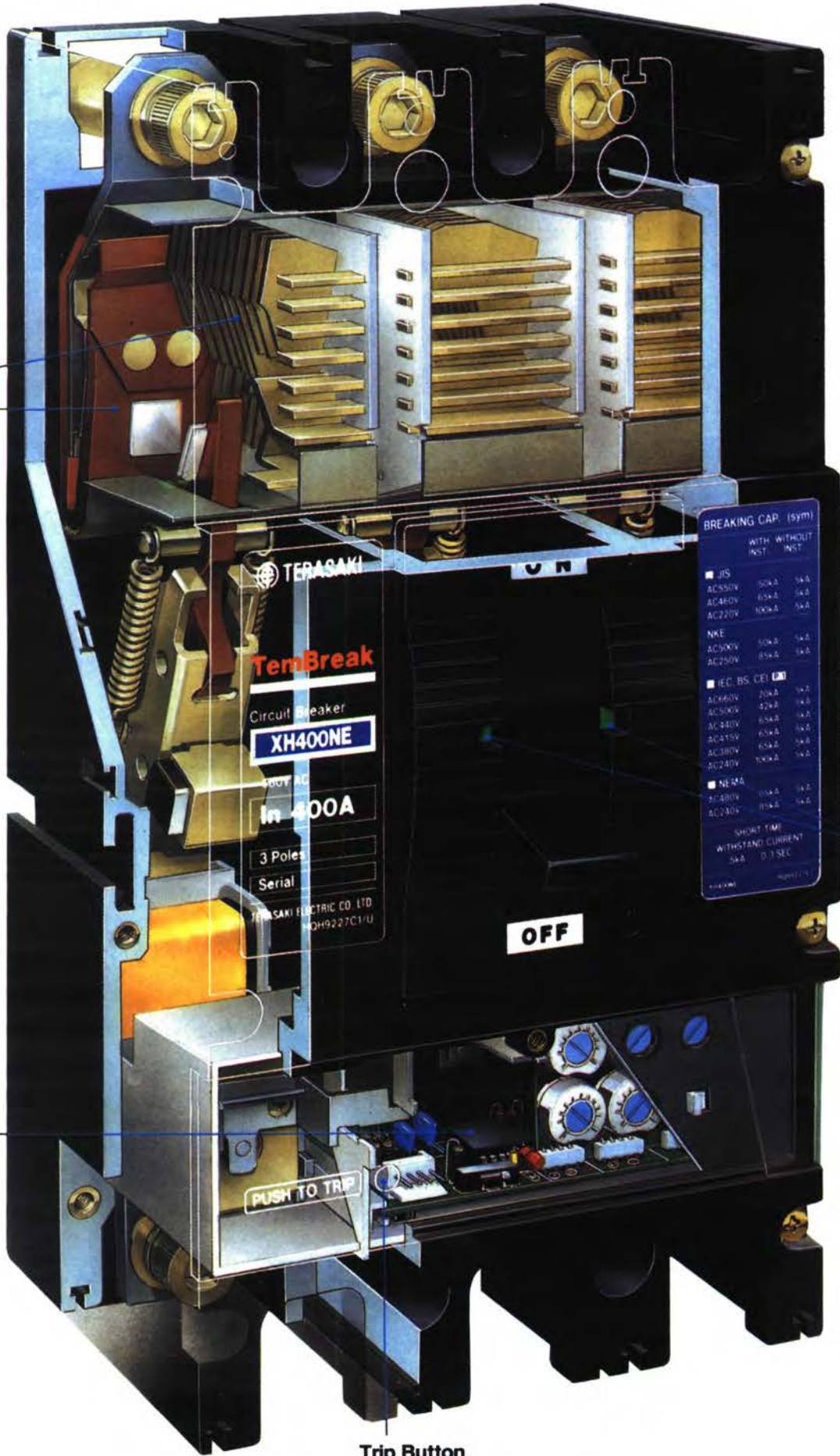
Dual Repulsive Contacts

Quick-break Arc Chutes



MULTI-PROTECTIVE FUNCTIONS!! By 8-Bit CPU

Terasaki's 28 years of achievements in the field of electronic technology is "second to none". In particular, its microcomputer application engineering has a "first class record" of supplying computer systems, of high, cost-performance to a variety of industrial plants over the past 10 years.



BREAKING CAP. (sym)

	WITH INST.	WITHOUT INST.
■ JIS		
AC550V	50kA	5kA
AC440V	65kA	6kA
AC220V	100kA	5kA
■ NKE		
AC500V	50kA	5kA
AC250V	85kA	5kA
■ IEC BS CEI		
AC660V	20kA	5kA
AC500V	42kA	5kA
AC440V	65kA	5kA
AC415V	65kA	5kA
AC380V	65kA	5kA
AC240V	100kA	5kA
■ NEMA		
AC480V	50kA	5kA
AC240V	85kA	5kA

SHORT TIME
WITHSTAND CURRENT
5kA 0.1 SEC

Contact
Status
Indicator

OFF

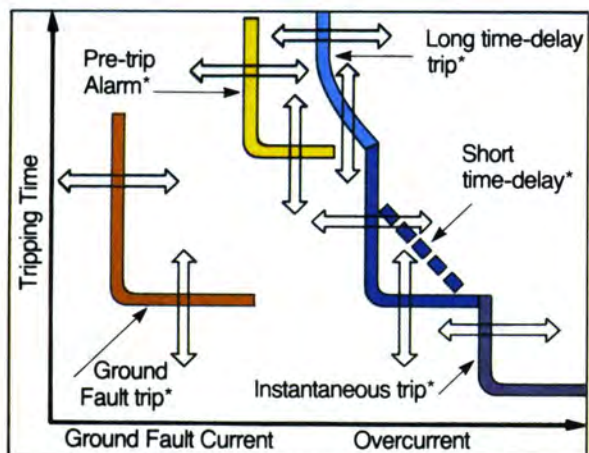
PUSH TO TRIP

Trip Button

XH400NE

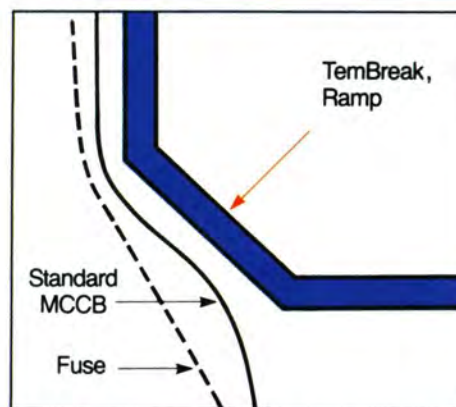
TemBreak contains advanced technology for precise protection co-ordination, anticipating the requirements of commercial buildings and automated factories.

Multiple Protective Functions Incorporating A Wide Range of Pick-Up Current and Time-delay Settings



* Adjustable

Protective Characteristics Are Readily Co-ordinated With Those of Thermal-Magnetic MCCBs and Fuses. (The adjustable short time-delay trip has a ramp in its characteristic curve)



TemBreak Meets All Major Standards

Based Standards

IEC PUB 157-1 Part 1/International Electrotechnical Commission

AS 2184/Australian Standard

BS 4752 Part 1/British Standard

VDE 0660/Verband Deutscher Elektrotechniker

CEI 17.5/Comitato Elettrotecnico Italiano

NEMA AB-1/National Electrical Manufacturers Association

JIS C8 370/Japanese Industrial Standards

TemBreak's Adjustable Rated Current Type (Meets IEC Standards) And Is Available In A Wide Range For Plant Applications

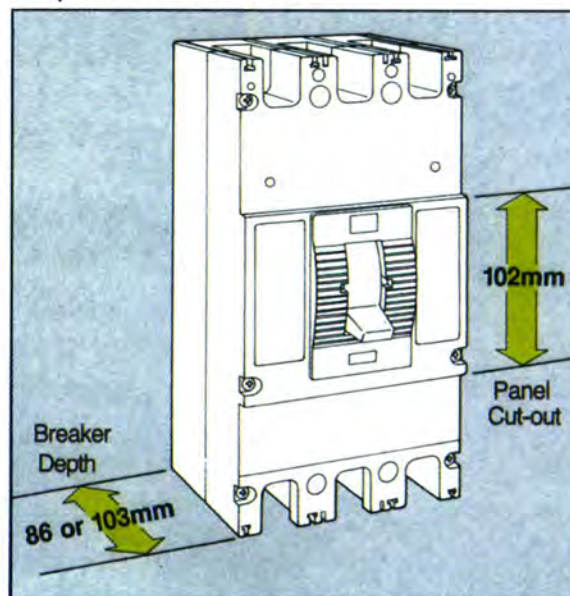
Plug in Mounting Blocks, for Switchboard Use

Note: The degree of protection provided by the mounting blocks for plug-in type TemBreak breakers (for Switchboard use) is IP-20, as defined in IEC Pub, 529.

Unified Dimensions Simplifies Distribution Board Design

TemBreak includes frame sizes up to 800A which are the most frequently used in distribution boards. Unified dimensions include:

Two depth sizes and one panel cut-out height
*Depth of XS100NS is 68mm

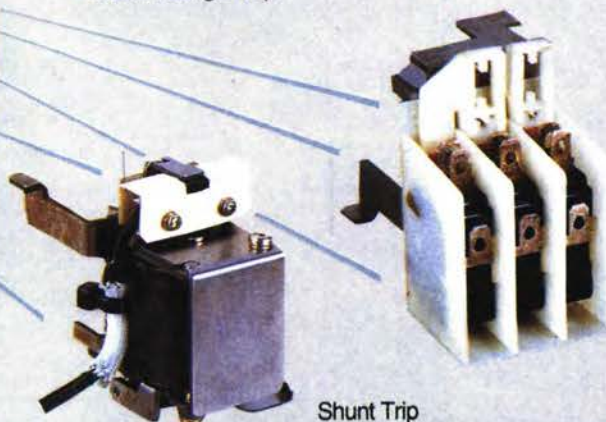


☆ **TemBreak is Available In 3-pole or 4-pole Construction**

☆ **Internal Accessories Are Common To All Types**

☆ **The Accessories Are Plug-in Type For Easy Exchange**

- Auxiliary Switches • Alarm Switches • Shunt Trip
- Undervoltage Trip



Shunt Trip

Auxiliary Switch

Contact Status Indication

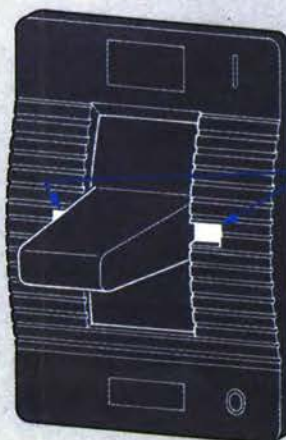
International symbols are used (colour coded) for status indication; I (ON) Red. TRIP, White. O (OFF) Green.

I(ON)



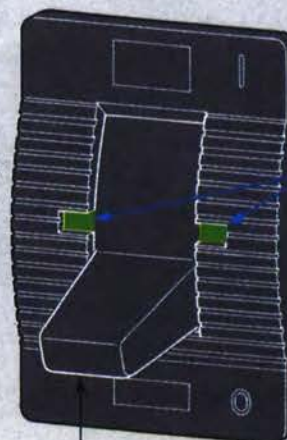
Red

TRIP



White

O(OFF)



Green

Handle

“Reliable Indication Mechanism,” for Safety

The operating handle indicates the O (OFF) position **ONLY** when the required isolating distance, between

the fixed and moving contact is achieved (No extra indication is necessary)

TemBreak

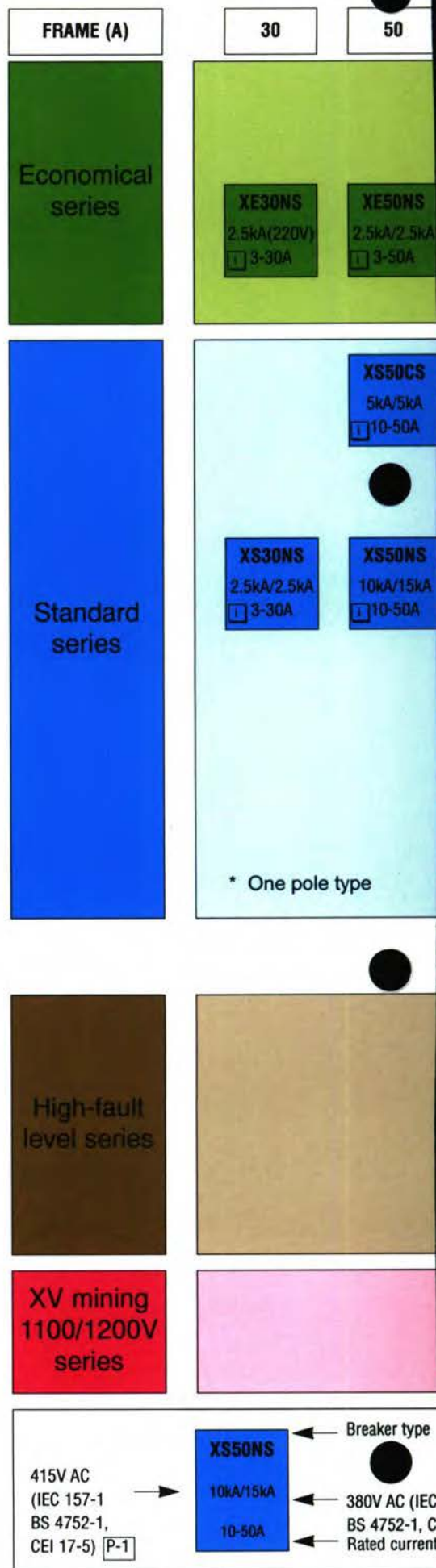
A new generation of MCCBs procuring a major evolution in low voltage distribution systems. Each model provides refined characteristics, incorporating true r.m.s. detection and ensuring the reliability necessary for the efficient functioning of a system.

- ☆ **UNAFFECTED BY HARMONICS**
- ☆ **UNIFIED DIMENSIONS**
- ☆ **3 and 4 POLE CONSTRUCTIONS**



TemBreak series

38 types



[illegible]

Precise Protection Co-ordination

TemBreak, Electronic Type

TemBreak Profile *(Electronic type)*

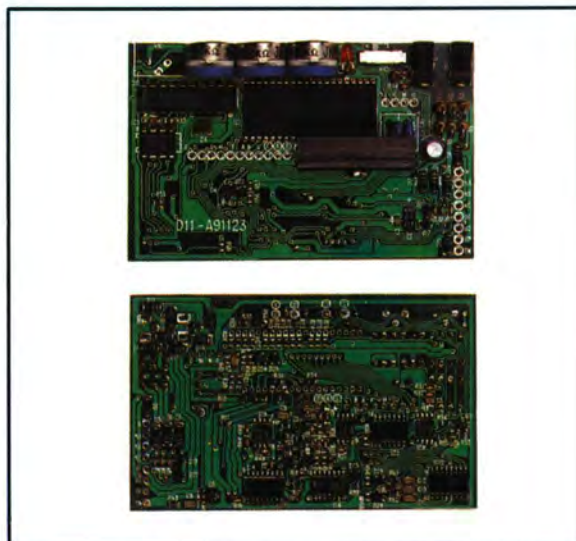
Each electronic type TemBreak product is fitted with an electronic protective device using an 8-bit microprocessor, to provide full protective functions necessary for upgrading low-voltage distribution systems and for achieving the highest reliability in operation.

Operation Unaffected By Harmonics

Semiconductor controlled power equipment in a distribution system can be a source of harmonic currents, which can cause malfunctioning in other equipment within the system.

The TemBreak's electronic protective device is designed to detect, true r.m.s. value of the load current. Therefore, remaining unaffected by harmonics.

TemBreak's electronic protective device consists of a number of flat-package ICs, which are compactly mounted, using high-density double-surface mounting, the most advanced surface mount technology.



Protective Characteristics of TemBreak *(Electronic type)*

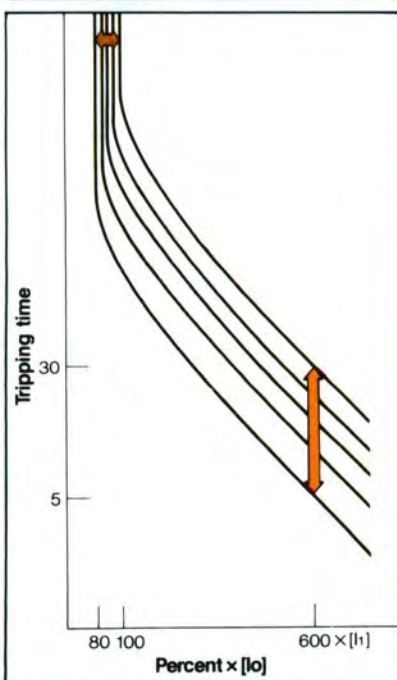
The protective characteristics include:

An adjustable long time-delay (For general industrial plants and for generator protection). An adjustable short time-delay trip (for co-ordination with existing solid-state trip and thermal magnetic trip breakers or fuses). An adjustable instantaneous

trip, an adjustable ground fault trip and an adjustable pre-trip alarm.

NOTE: The ground fault trip and pre-trip alarm can not be used simultaneously in a single breaker.

Adjustable long time-delay trip (LTD) For general industrial applications

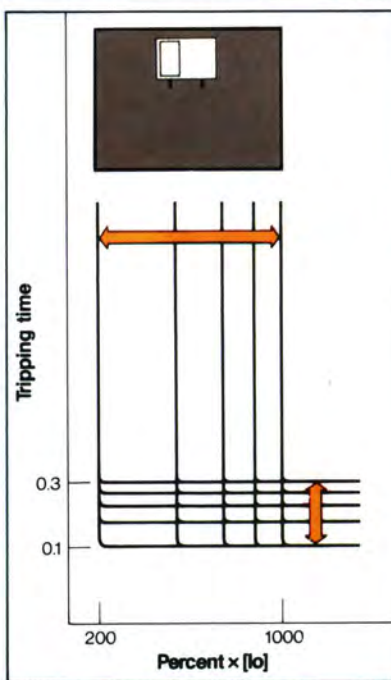


The pick-up current (I_1) of the LTD is adjustable from 80, 85, 90, 95 to 100% of the base current (I_0).



The LTD time delay at 600% of the rated current (I_1) is adjustable from; 5, 10, 15, 20 to 30 secs

Adjustable short time-delay trip (STD) For co-ordination with existing solid-state trip breakers

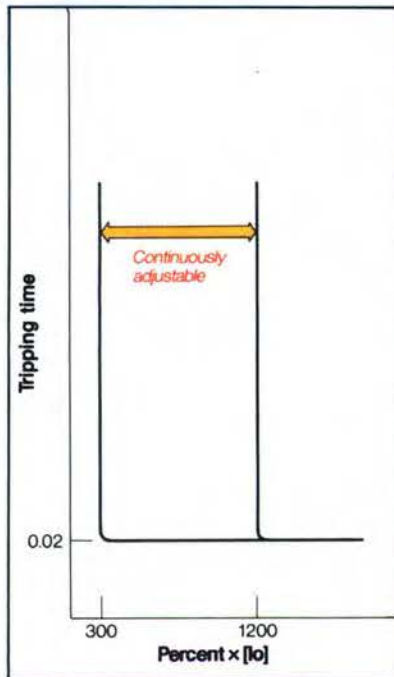


The STD pick-up current (I_2) is adjustable from; 200, 400, 600, 800 to 1000% of the rated current (I_0).



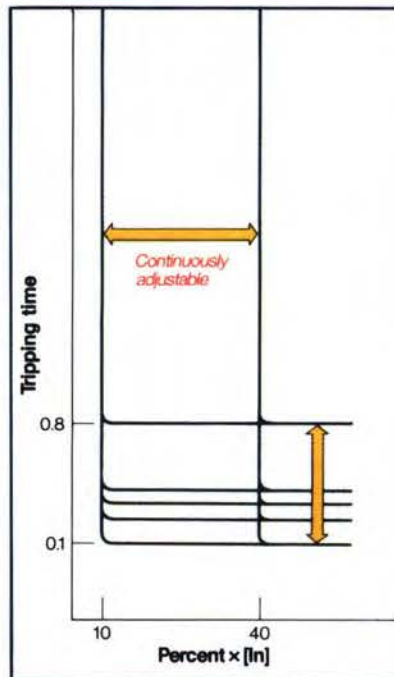
The STD has a definite time-delay characteristic. This opening time is adjustable from; 100, 150, 200, 250 to 300 ms

Adjustable instantaneous trip (INST)



The INST pick-up current [I_3] is continuously adjustable from 300% to 1200% of the rated current [I_o]

Adjustable ground fault trip (GFT)



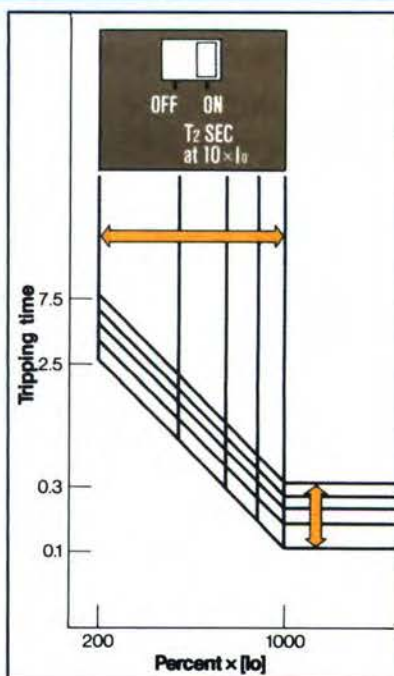
The GFT pick-up current [I_6] is continuously adjustable from 10% to 40% of the rated current [I_n]



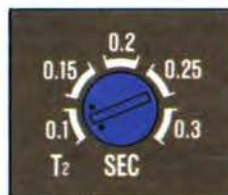
The GFT has a definite time-delay characteristic, its opening time is adjustable from; 100, 200, 300, 400 to 800ms

For co-ordination with thermal-magnetic trip breakers or fuses.

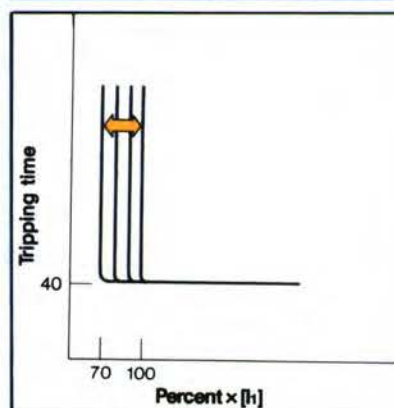
Adjustable pre-trip alarm (PTA)



The STD pick-up current [I_2] is adjustable from 200, 400, 600, 800 to 1000% of the rated current [I_o]



The STD has a time current characteristic of $FT = \text{constant}$ (ramp characteristic) for optimum co-ordination with conventional thermal-magnetic type moulded case circuit



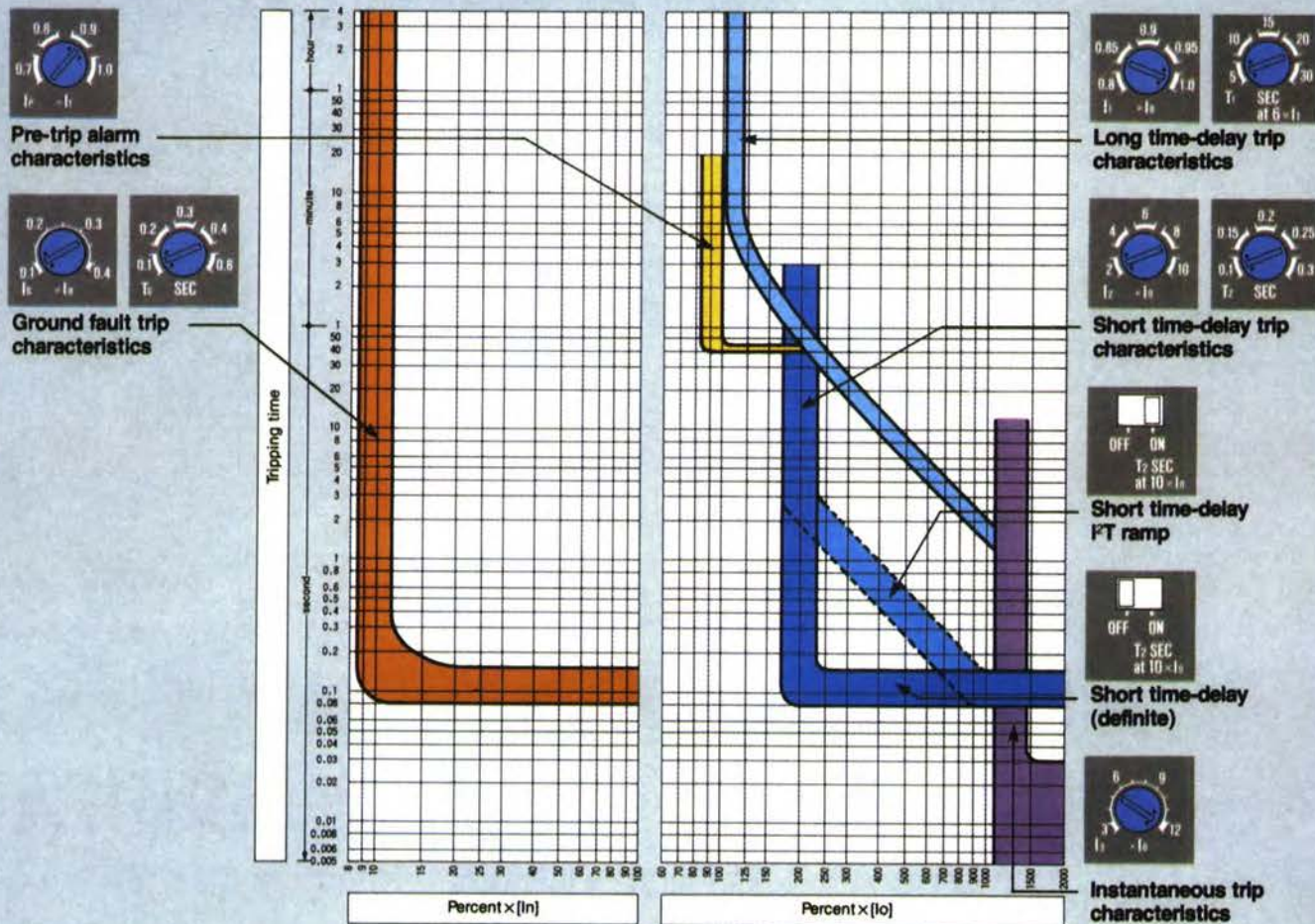
The PTA pick-up current [I_P] is adjustable from 70, 80, 90 to 100% of the rated current [I_i]. The time-delay is 40 seconds fixed. (A separate power source is required)

breakers or fuses. It has a definite time-delay characteristic at current levels above 1000% of the rated current [I_o]

Precise Protection Co-ordination

TemBreak, Electronic Type

Overcurrent tripping characteristics (Example)



Adjustable Rated Current

TemBreak (Electronic type)

The rated current of the electronic type TemBreak is adjustable in 15 steps from 50% to 100% of the nominal rated current, using the base current $[I_o]$ select switch and the rated current $[I_1]$ setting dial.

The rated current of a single breaker is adjustable in 15 steps from 50% to 100%. This is one of the essential features for precise protection co-ordination and for upgrading low-voltage distribution systems.

Base current	63	80	100
Current dial	80 85 90 95 100	80 85 90 95 100	80 85 90 95 100
Breaker rated current	50 54 57 60 63	64 68 72 76 80	80 85 90 95 100

Example: Base current 63, Current dial 72% (0.72), Breaker rated current 45.36 (rounded to 45).

Pick-up LED

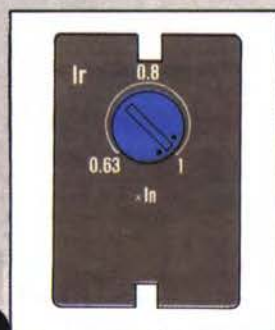
Note: If PTA is fitted, this LED flickers when PTA functions pick-up (separate control power required)

Trip Indicators (Optional)

One of the LEDs is lit to indicate which trip function tripped the breaker LTD, STD/INST or GFT (separate control power required)

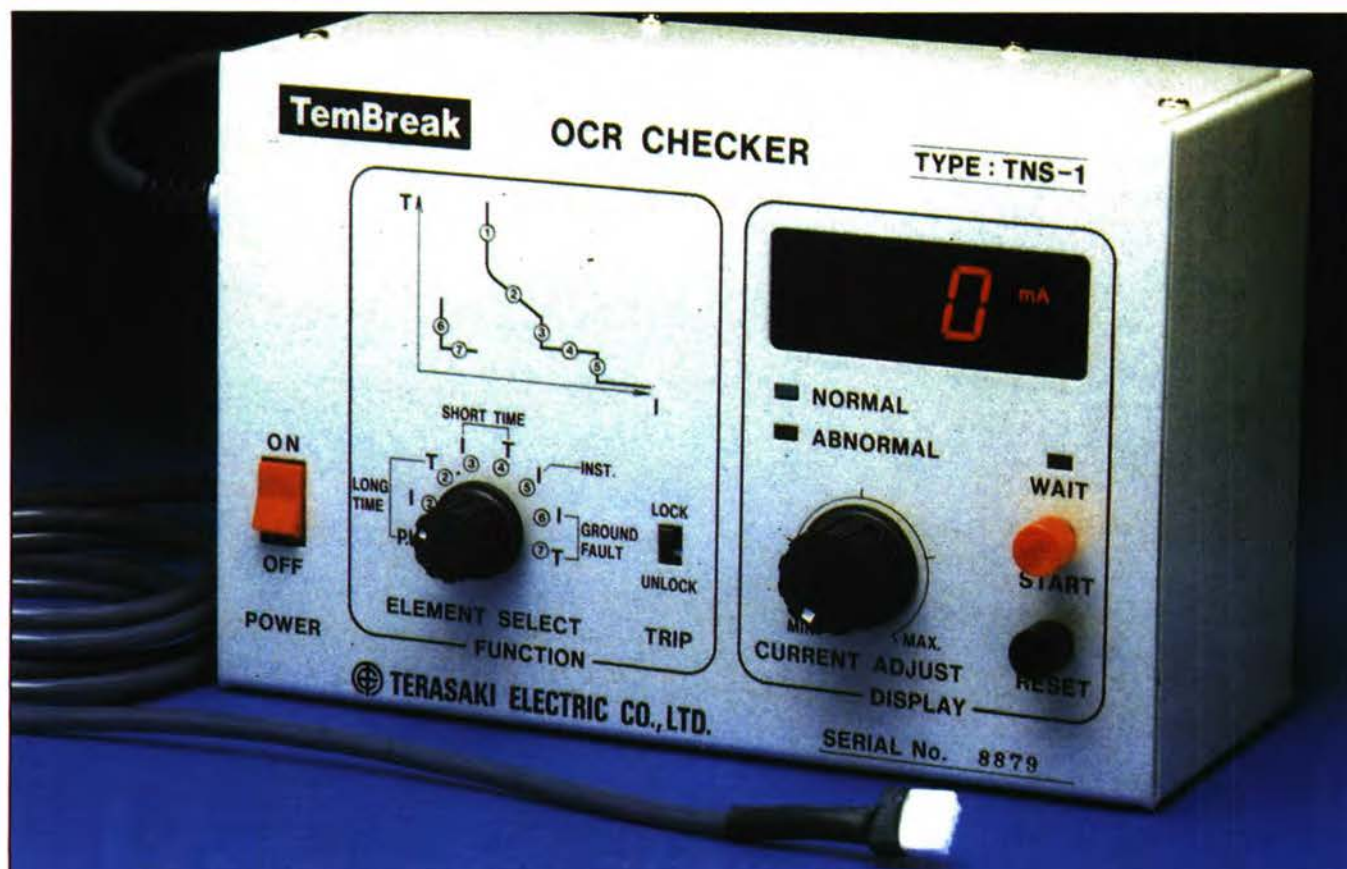
TemBreak *(Thermal-magnetic trip type)*

The rated current is continuously adjustable from 63% to 100% of the nominal rated current. The scale is marked at three positions; 63%, 80% and 100%



TemBreak

OCR Checker (Portable)



TemBreak OCR checker, type TNS-1, is an easy-to-use instrument for field testing the trip functions of the electronic type TemBreak circuit breakers.

It checks the pick-up current and tripping time values of the functions (LTD, STD, INST and GFT)

The values are indicated digitally on a 3-digit LED display

Power Source 100-110VAC or 220-240VAC,
single phase, 50/60Hz 30VA
Dimensions: 200mm(W) x 84mm (H) x 130mm (D)

NHP ELECTRICAL ENGINEERING PRODUCTS PTY LTD

A.C.N. 004 304 812

MELBOURNE:

43-67 River Street, Richmond, Victoria 3121. Telephone: (03) 429 2999
P.O. Box 199, Richmond, 3121
Fax (03) 429 1075

SYDNEY:

30-34 Day Street North, Silverwater, New South Wales 2141. Telephone: (02) 748 3444
P.O. Box 259 Ermington, 2115
Fax: (02) 648 4353

BRISBANE:

25 Turbo Drive, Coorparoo, Queensland 4151 Telephone: (07) 891 6008
P.O. Box 1127, Coorparoo DC, 4151
Fax: (07) 891 6139

ADELAIDE:

50 Croydon Road, Keswick, South Australia 5035 Telephone: (08) 297 9055
Fax: (08) 371 0962

PERTH:

38-42 Railway Pde., Bayswater, Western Australia 6053 Telephone: (09) 271 8666
Fax: (09) 272 3906

NEWCASTLE:

57 Crescent Road, Waratah, New South Wales 2298 Telephone: (049) 60 2220
P.O. Box 326, Mayfield 2304
Fax: (049) 60 2203

TOWNSVILLE:

62 Leyland Street, Garbutt, Queensland 4814 Telephone: (077) 79 0700
Fax: (077) 75 1457

ROCKHAMPTON:

208 Denison Street, Rockhampton, Queensland 4700 Telephone: (079) 27 2277
Fax: (079) 22 2947

TOOWOOMBA:

Cnr Carroll St. & Struan Crt., Toowoomba, Queensland 4350 Telephone: (076) 34 4799
Fax: (076) 33 1796

AGENTS:

HOBART:

H.M. Bamford (Hobart), 199 Harrington Street, Hobart, Tasmania 7000
Telephone: (002) 34 9299 Fax: (002) 31 1693

LAUNCESTON:

H.M. Bamford (Launceston), 59 Garfield Street, Launceston, Tasmania 7250
Telephone: (003) 44 8811 Fax: (003) 44 4069

DARWIN:

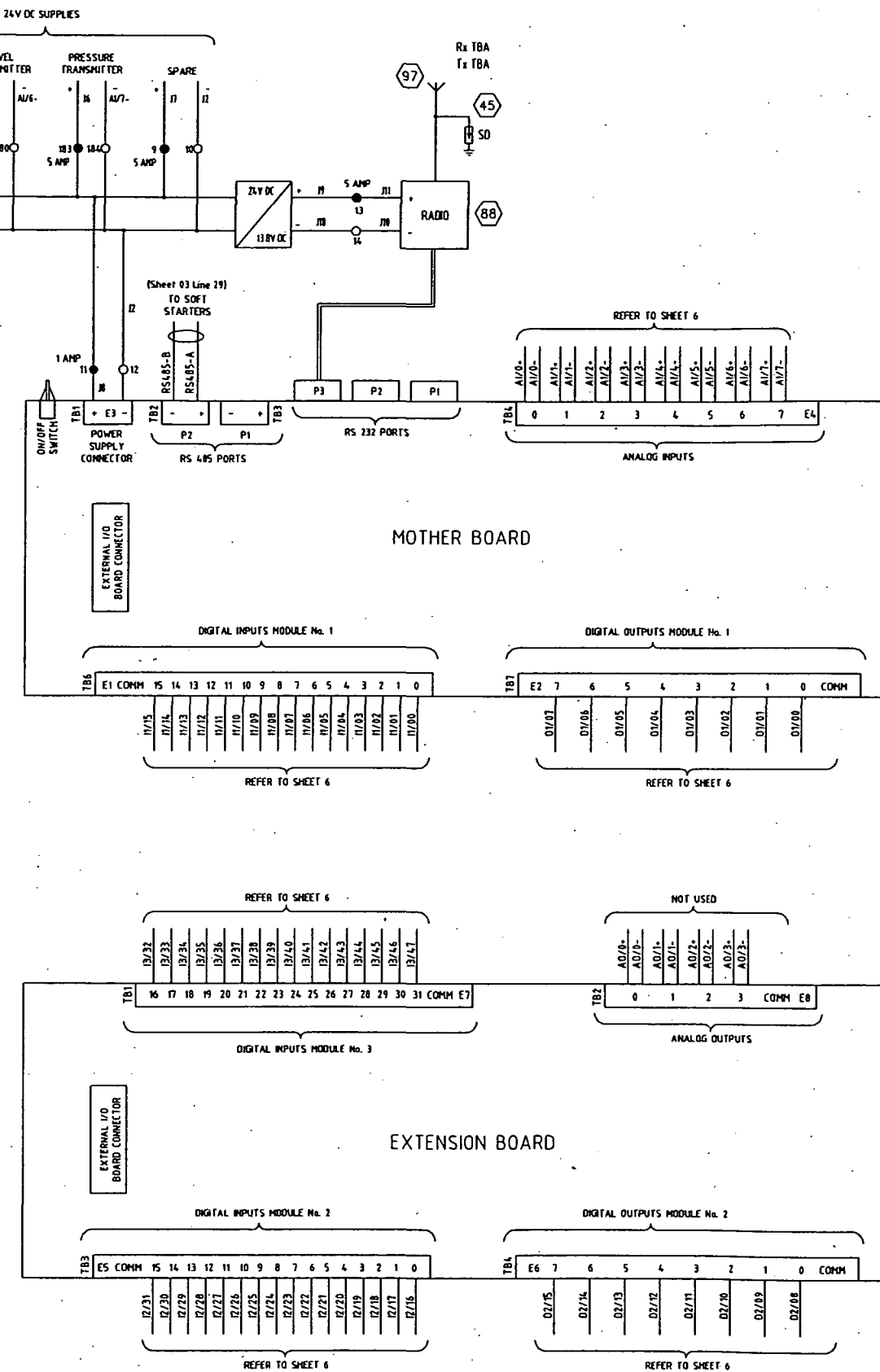
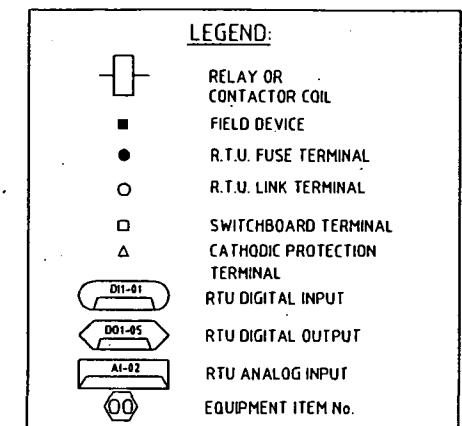
J. Blackwood & Son Ltd., Mataram Street, Winnellie, N.T. 0820
Telephone: (089) 84 4255 Fax: (089) 84 3945

NHP

Proudly Australian




NOTES

1. TERMINAL NUMBER SHOWN EITHER IMMEDIATELY BELOW, RIGHT OR LEFT OF TERMINAL.



Sheet 05

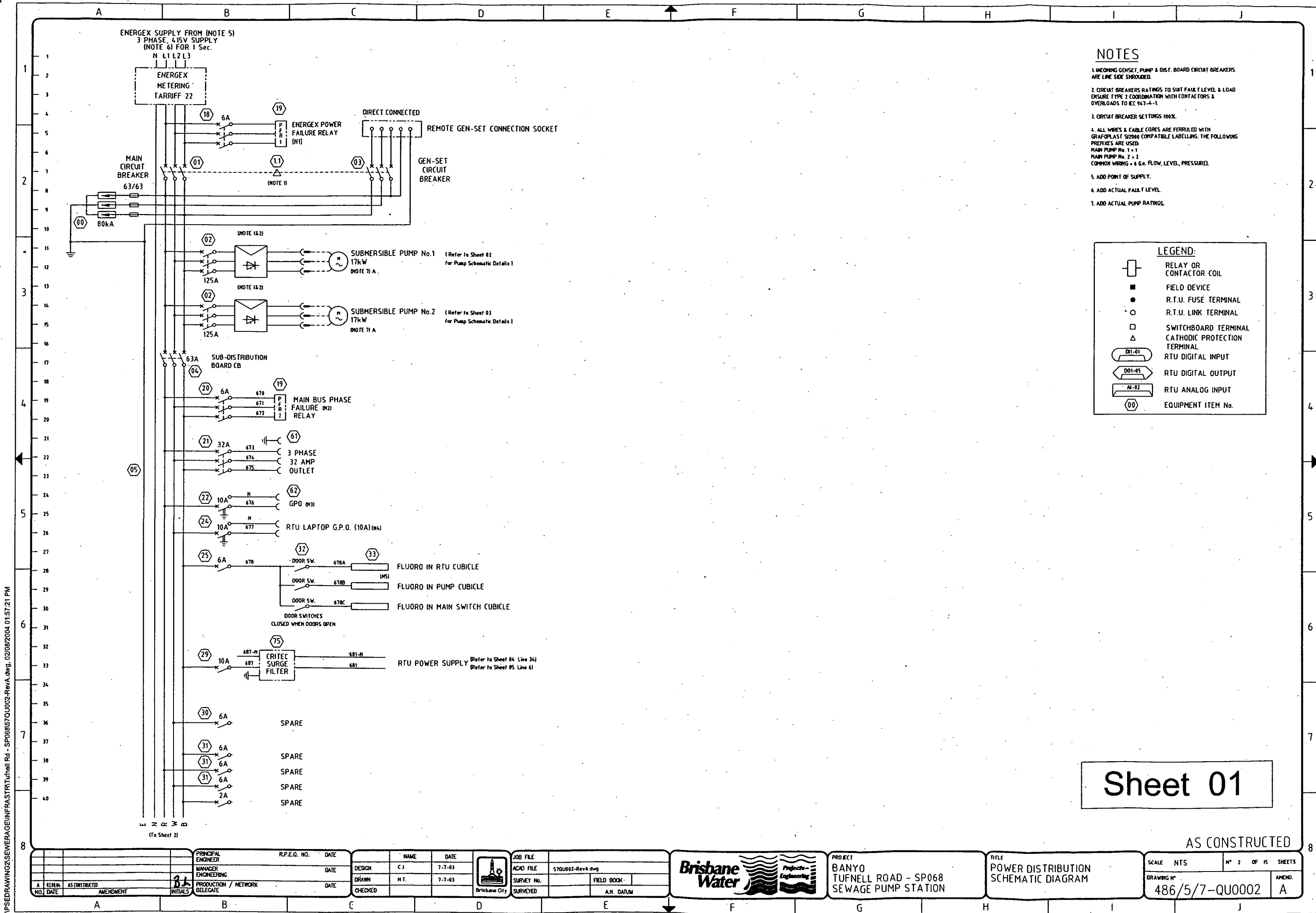
AS CONSTRUCTED

				PRINCIPAL ENGINEER		R.P.E.Q. NO.		DATE				NAME		DATE				JOB FILE								PROJECT		TITLE		SCALE		N° 6 OF 15 SHEETS		AS CONSTRUCTED	
				MANAGER ENGINEERING				DATE				DESIGN		C.I.		7-7-03		ACAD FILE		57GU006-RevA DWG				BANYO		PLC/RTU									
A				B.L.								DRAWN		H.T.		7-7-03		SURVEY No.				FIELD BOOK		TUFNELL ROAD - SP068		SCHEMATIC DIAGRAM				DRAWING N°		AMEND.			
NO.				DATE		AS CONSTRUCTED		AMENDMENT		INITIALS		CHECKED						SURVEYED				A.H. DATUM		SEWAGE PUMP STATION				486/5/7-QU006		A.					
A				B		C		D		E		F		G		H		I		J		K		L		M		N		O		P		Q	

TUFNELL ROAD - SP068 SUBMERSIBLE SEWAGE PUMP STATION ELECTRICAL DRAWINGS

ELECTRICAL DRAWING LIST			
Sheet No.	DRAWING NUMBER	REV.	TITLE
	486/5/7-QU001	A	DRAWING INDEX
01	486/5/7-QU002	A	POWER DISTRIBUTION SCHEMATIC DIAGRAM
02	486/5/7-QU003	A	PUMP 01 SCHEMATIC DIAGRAM
03	486/5/7-QU004	A	PUMP 02 SCHEMATIC DIAGRAM
04	486/5/7-QU005	A	COMMON CONTROL & ALARMS SCHEMATIC DIAGRAM
05	486/5/7-QU006	A	PLC/RTU SCHEMATIC DIAGRAM
06	486/5/7-QU007	A	PLC/RTU TERMINATION DIAGRAM
07	486/5/7-QU008	A	EQUIPMENT LIST
08	486/5/7-QU009	A	CABLE SCHEDULE
09	486/5/7-QU010	A	SWITCHBOARD LABEL SCHEDULE
10	486/5/7-QU011	A	SWITCHBOARD GENERAL ARRANGEMENT
11	486/5/7-QU012	A	SWITCHBOARD CONSTRUCTION NOTES
12	486/5/7-QU013	A	SWITCHBOARD CONSTRUCTION DETAILS
13	486/5/7-QU014	A	RAG REDUCTION TUBE FOR THE VEGA LEVEL PROBE
	1324-30	A	SITE LAYOUT

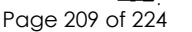
A		B		C		D		E		F		G		H		I		J																									
AS CONSTRUCTED		AMENDMENT		INITIALS		PRINCIPAL ENGINEER		R.P.E.Q. NO.		DATE		NAME		DATE		JOB FILE		ACAD FILE		570U001-RevA.dwg		PROJECT		BANYO TUFNELL ROAD - SP068 SEWAGE PUMP STATION		TITLE		ELECTRICAL DRAWINGS DRAWING LIST		SCALE		NTS		N° 1 OF 15 SHEETS		DRAWING NO.		486/5/7-QU001		AMEND.		A	
A		B		C		D		E		F		G		H		I		J																									



Sheet 01

AS CONSTRUCTED

			PRINCIPAL ENGINEER		R.P.E.O. NO.		DATE				NAME		DATE				JOB FILE						PROJECT BANYO TUFNELL ROAD - SP068 SEWAGE PUMP STATION		TITLE POWER DISTRIBUTION SCHEMATIC DIAGRAM		SCALE		NTS		N° 2 OF 15 SHEETS			
			MANAGER ENGINEERING				DATE		DESIGN		C.I.		7-7-03				ACAO FILE										570U002-Rev'd dwg		DRAWING N°		486/5/7-QU0002		AMEND. A	
			PRODUCTION / NETWORK DELEGATE				DATE		DRAWN		H.T.		7-7-03				SURVEY NO.										FIELD BOOK							
A					AS CONSTRUCTED				AMENDMENT		31		INITIALS														SURVEYED		A.H. DATUM					



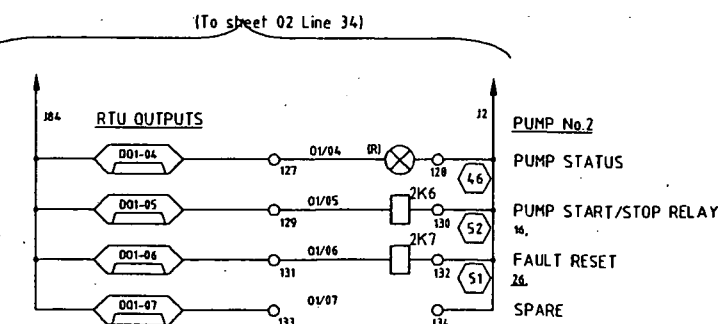
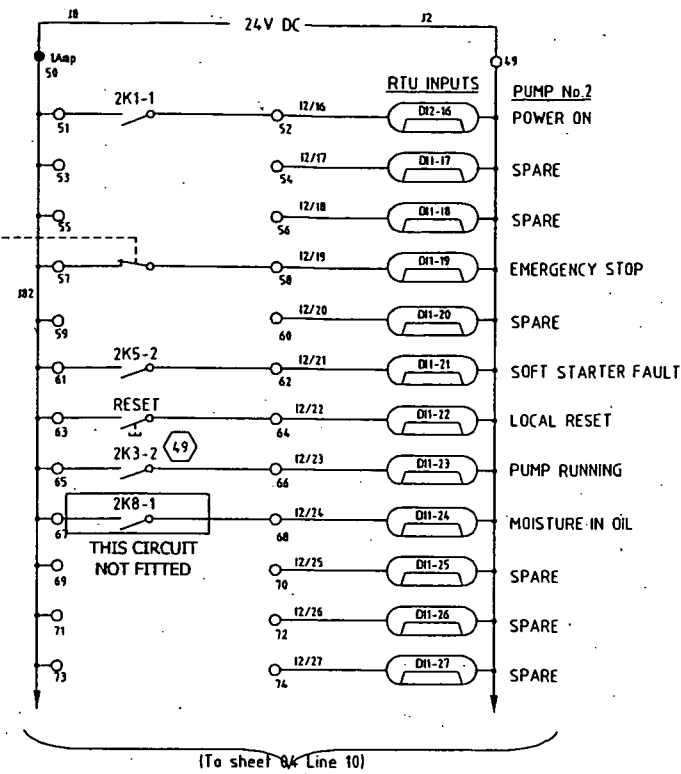
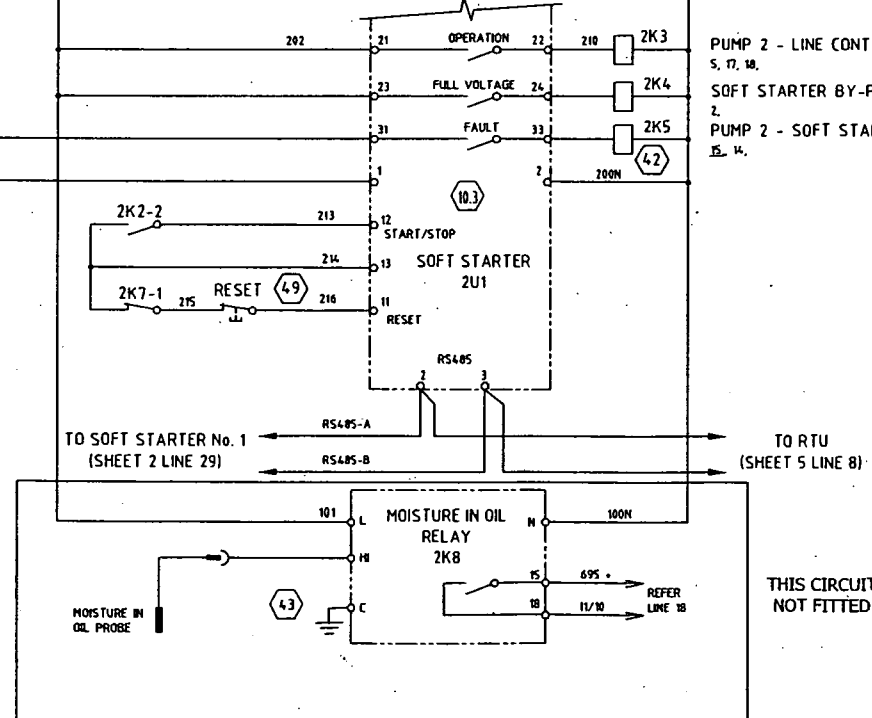
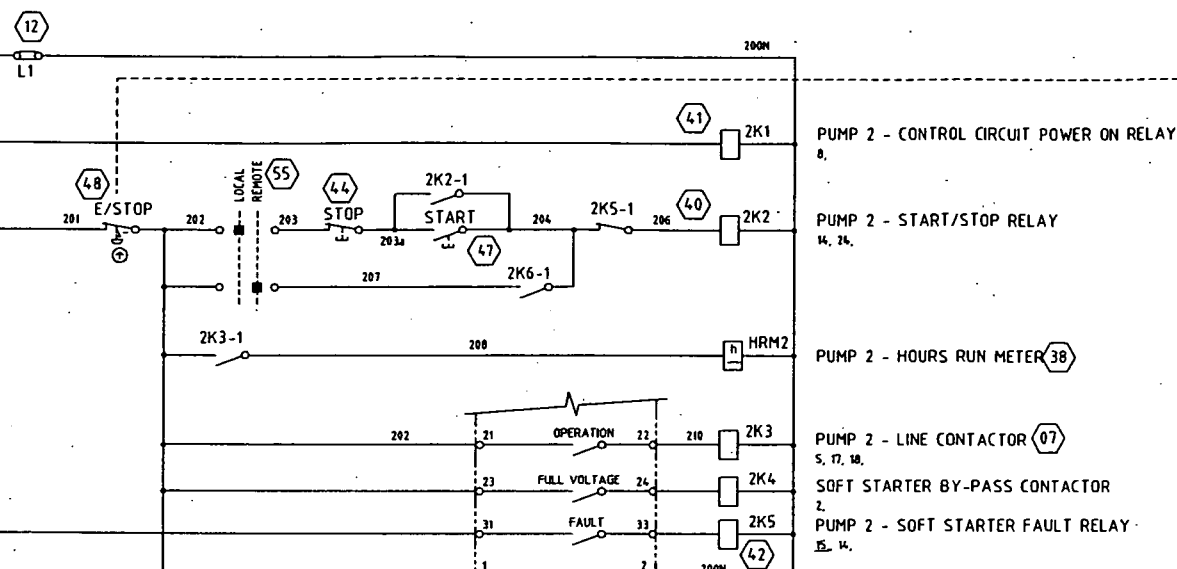
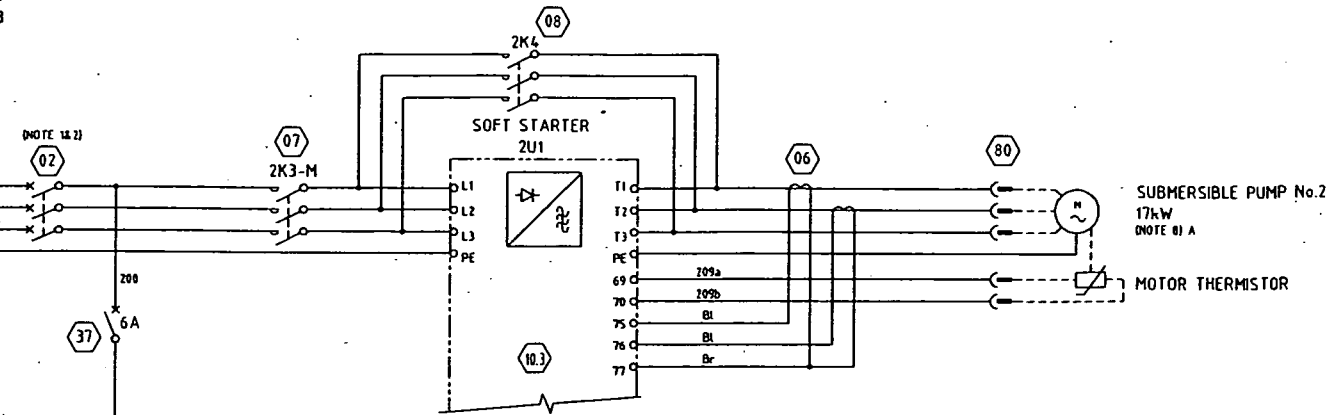
NOTES

1. INCOMING & PUMP CIRCUIT BREAKERS ARE LINE SIDE SHROUDED.
2. CIRCUIT BREAKERS RATINGS TO SUIT FAULT LEVEL & LOAD ENSURE TYPE 2 COORDINATION WITH CONTACTOR TO REC 94.7-4-1.
3. TERMINAL NUMBER SHOWN EITHER IMMEDIATELY BELOW, RIGHT OR LEFT OF TERMINAL.
4. FUSE TERMINALS ARE TO BE FITTED WITH 100mA FUSE-LINKS UNLESS OTHERWISE SHOWN.
5. CIRCUIT BREAKER SETTINGS 100%.
6. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST S12000 COMPATIBLE LABELLING.
7. THE FOLLOWING PREFIXES ARE USED:
MAIN PUMP No. 1 = 1
MAIN PUMP No. 2 = 2
COMMON WIRING = 6 (i.e. FLOW, LEVEL, PRESSURE).
8. ADD ACTUAL PUMP RATINGS.

LEGEND:

- RELAY OR CONTACTOR COIL
- FIELD DEVICE
- R.T.U. FUSE TERMINAL
- R.T.U. LINK TERMINAL
- SWITCHBOARD TERMINAL
- CATHODIC PROTECTION TERMINAL
- RTU DIGITAL INPUT
- RTU DIGITAL OUTPUT
- RTU ANALOG INPUT
- EQUIPMENT ITEM No.

(From SHEET 02)
415V SUPPLY
E N L1 L2 L3

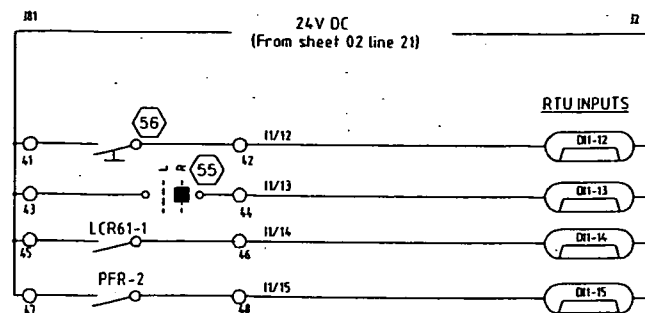


Sheet 03

AS CONSTRUCTED

DESIGN		NAME		DATE		JOB FILE		ACAD FILE		SURVEY No.		FIELD BOOK		A.H. DATUM		PROJECT		TITLE		SCALE		N° 2 OF 15 SHEETS		DRAWING No.		AMEND.	
C.I.		C.I.		7-7-03		570004-RevA.dwg		570004-RevA.dwg		7-7-03						BANYO TUFNELL ROAD - SP068 SEWAGE PUMP STATION		PUMP 02 SCHEMATIC DIAGRAM		NTS				486/5/7-QU004		A	
DRAWN		H.T.		7-7-03																							
CHECKED																											

ELV CONTROL

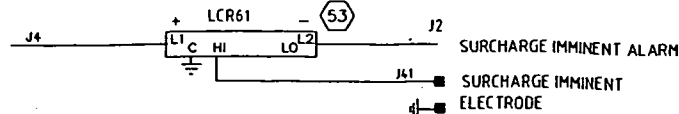
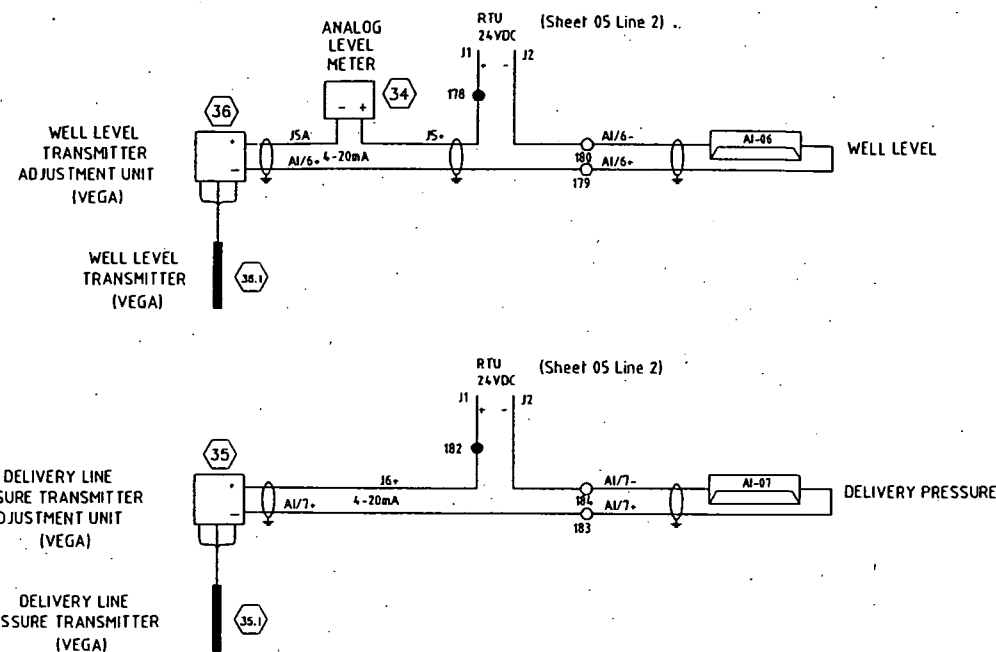
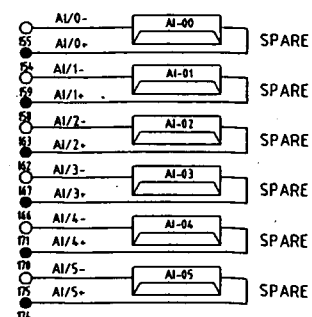


COMMON CONTROL

SITE ATTENTION ALARM
RESET PUSHBUTTON
LOCAL/REMOTE STATION
SURCHARGE IMMINENT ALARM
SITE POWER ON

24V DC CONTROL

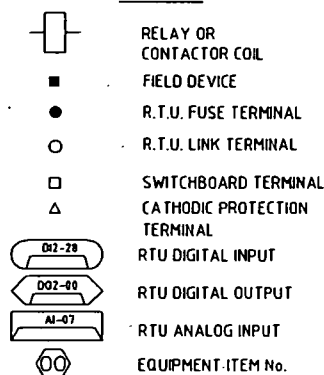
24V DC
(Sheet 05 Line 02)

RTU ANALOG INPUTS
FOR INSTRUMENTSRTU ANALOG INPUTS
(NOTE 2&3)

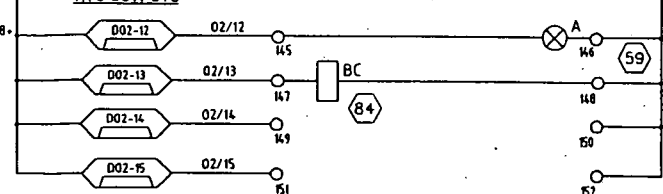
NOTES

- ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SIZ000 COMPATIBLE LABELLING. THE FOLLOWING PREFIXES ARE USED:
MAIN PUMP No. 1 = 1
MAIN PUMP No. 2 = 2
COMMON WIRING = 6 G = FLOW, LEVEL, PRESSURE
- TERMINAL NUMBER SHOWN EITHER IMMEDIATELY BELOW, RIGHT OR LEFT OF TERMINAL.
- FUSE TERMINALS ARE TO BE FITTED WITH 100mA FUSE TERMINALS UNLESS OTHERWISE SHOWN.
- DOOR SWITCHES TO BE INSTALLED ON ALL DOORS.

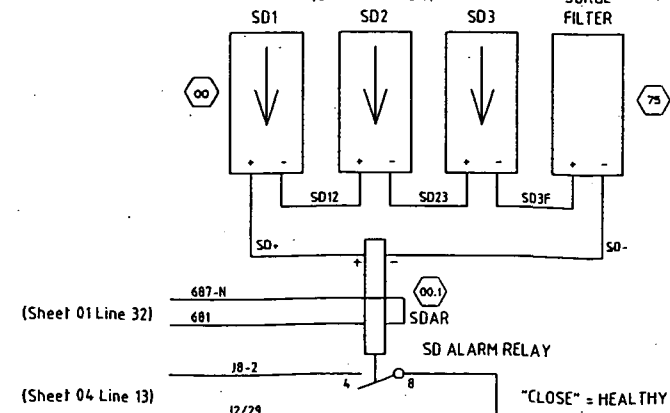
LEGEND:



RTU OUTPUTS



ATTENTION INDICATOR
(SWITCHBOARD)
BATTERY CHECK RELAY
(Sheet 05 Line 5)
SPARE
SPARE

SURGE DIVERSERS
(Sheet 01 Line 9)

Sheet 04

AS CONSTRUCTED

A		B		C		D		E		F		G		H		I		J	
NO. DATE		AMENDMENT		INITIALS		DATE		DATE		DATE		DATE		DATE		DATE		DATE	
AS CONSTRUCTED		AMENDMENT		INITIALS		DATE		DATE		DATE		DATE		DATE		DATE		DATE	
A		B		C		D		E		F		G		H		I		J	

PRINCIPAL ENGINEER
MANAGER ENGINEERING
PRODUCTION / NETWORK DELEGATE

R.P.E.Q. NO. DATE
DESIGN C.J. 7-7-03
DRAWN H.T. 7-7-03
CHECKED

NAME DATE
C.J. 7-7-03
H.T. 7-7-03

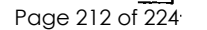
JOB FILE
ACAD FILE
SURVEY NO.
SURVEYED

5700095-RevA.DWG
FIELD BOOK
A.H. DATUM

PROJECT
BANYO
TUFNELL ROAD - SP068
SEWAGE PUMP STATION

TITLE
COMMON CONTROLS AND
ALARMS
SCHEMATIC DIAGRAM

SCALE NTS
M 5 OF 15 SHEETS
DRAWING NO. 486/5/7-QU005
AMEND. A



Q:\PSEDRAWING\2\SEWERAGE\INFRASTRUCTURE\Tufnell Rd - SP068\57QU008-RevA.dwg, 02/08/2004 01:59:36 PM

A		B		C		D		E		F		G		H		I		J	
ITEM No	QTY	DESCRIPTION	MANUFACTURER	CATALOGUE No	REMARKS			ITEM No	QTY	DESCRIPTION	MANUFACTURER	CATALOGUE No	REMARKS						
00	3	SURGE CONVERTER	CRITEC	IDS-480-4.5-277				51	2	PUMP FAULT RESET RELAY	IZUMI	RH2B-4J-24VDC							
00.1	1	SURGE CONVERTER ALARM RELAY	CRITEC	TSO-AR				52	2	PUMP START/STOP RELAY	IZUMI	RH2B-4J-24VDC							
01	1	MAIN CIRCUIT BREAKER - SHROUD	TERASAKI	XS250M/125 - UXL8007RE - UXL80091MD				53	1	SURCHARGE ALARM RELAY	MULITRODE	MTR-5		FREE ISSUE					
01.1	1	MAIN C.B. MECHANICAL INTERLOCK	TERASAKI/MIP	BASE PLATE - UXL8007MD				54	1	SURCHARGE PROBE	MULITRODE	0.2/1-H		FREE ISSUE					
02	2	PUMP CIRCUIT BREAKER - SHROUD	TERASAKI	XS250M/63 - XFLA22				55	1	STATION CONTROL SELECTOR SW.	KRASUS & HAMMER	CAD01-A361-440							
03	1	GEN SET CB	TERASAKI	XS250M/125 - UXL8007RE - UXL80091MD				56	1	SITE ATTENTION RESET	SPRECHER & SCHUH	DSP-F63LX11							
04	1	SUB-DISTRIBUTION BOARD CBs	TERASAKI	DTC6363C				57		NOT USED									
05	1	SUB-DISTRIBUTION BOARD CHASSIS	TERASAKI	CD-2-10/11-3				58		NOT USED									
06	4	CURRENT TRANSFORMERS INCLUDING CABLE KIT 01-207-00	ENDOTRON	TO SUIT MSF-445				59	1	SITE ATTENTION ALARM INDICATOR	SPRECHER & SCHUH	DSP-PLS - 05-30LA LAMBER, 24V							
07	2	PUMP CONTACTORS	SPRECHER & SCHUH	CA7-43, 1 SEE NOTE 2, SHT 21				60		NOT USED									
08	2	PUMP SOFT STARTER BY-PASS CONTACTOR	SPRECHER & SCHUH	CA7-43				61	1	3 PHASE OUTLET	CLIPSAL	5650510LE							
09		NOT USED						62	1	1 PHASE OUTLET	CLIPSAL	15V - 980 (SHROUD)							
10.1	2	EXTERNAL KEYPAD KIT	ENDOTRON	01-2130-00				63	1	DIS. BD. NEUTRAL LINK	CLIPSAL	BP165018							
10.2	2	CT CABLE KIT	ENDOTRON	01-2020-00				64	1	DIS. BD. EARTH LINK	CLIPSAL	BP165018							
10.3	2	PUMP SOFT STARTER X	ENDOTRON	MSF-445 - MODBUS RTU SERIAL COMMS CARD				65		SWITCHBOARD TERMINALS	PHOENIX								
12	2	PUMP NEUTRAL CABLE	ALSTOM	BS2001 (WHITE)				65.1	16	ANALOGUE DISCONNECT	PHOENIX	UK-5							
12A	2	PUMP NEUTRAL LINK	ALSTOM	COPPER LINK				65.2	16	END PLATE	PHOENIX	TO SUIT UK-5							
13	3	SURGE CONVERTER FUSES	MIP	63AMP 63MS MOTOR START				65.3	20	FUSE TERMINAL	PHOENIX	UK-5 HES1							
14		NOT USED						65.4	20	END PLATE	PHOENIX	TO SUIT UK-5 HES1							
14.1		NOT USED						65.5	20	FUSE CARTRIDGE	PHOENIX	FUSE 20 1005mm							
15		NOT USED						65.6	141	DISCONNECT TERMINAL	PHOENIX	UK-5							
15.1		NOT USED						65.7	5	END PLATE	PHOENIX	TO SUIT UK-5							
15.2		NOT USED						65.8	9	END STOP	PHOENIX	TO SUIT UK-5							
15.3		NOT USED						66	1	MAIN NEUTRAL LINK	CLIPSAL	20LA63							
15.4		NOT USED						67	1	MAIN EARTH LINK	CLIPSAL	20LA63							
16		NOT USED						68	1	INSTRUMENTATION EARTH LINK	CLIPSAL	BP165018							
17		NOT USED						69		NOT USED									
18	1	PHASE FAILURE CIRCUIT BREAKER	TERASAKI	DTC6363MC	MINIMUM 1A			70	4	CORROSION INHIBITOR	CORTEC	VPO-110 OR 111		FROM AP CONTROLS					
19	2	PHASE FAILURE RELAY	CHROMPTON INSTRUMENTS	252-PSGV				71		NOT USED									
20	1	PHASE FAILURE CIRCUIT BREAKER	TERASAKI	DTC6363MC				72		NOT USED									
21	1	3 PHASE OUTLET CIRCUIT BREAKER	TERASAKI	DTC63632C				73		NOT USED									
22	1	1 PHASE OUTLET CIRCUIT BREAKER	TERASAKI	DSRCHM30A				74		NOT USED									
23		NOT USED						75	1	RTU SURGE REDUCTION FILTER	CRITEC	TDF-11A-240V							
24	1	RTU LAP-TOP GPO CIRCUIT BREAKER	TERASAKI	DSRCHM30A				76	1	GENERATOR CONNECTION SOCKET	MONROES	143P - 125 AMP 5 PIN WALL SOCKET		FROM AFLEX					
25	1	SW/BO FLURO CIRCUIT BREAKER	TERASAKI	DTC6363MC				77	1	BATTERY ENCLOSURE	NETWORK	ENWG 101-23 DETAIL 1							
26		NOT USED						78	1	BATTERY VENT	FIBOX	MB10564							
27		NOT USED						79	1	RTU LAP TOP G.P.O.	CLIPSAL	PS / 449 / 449A							
28		NOT USED						80	2	DECONTACTOR	MARECHAL	DS6 (316A13 - 316A131)							
29	1	RTU CIRCUIT BREAKER	TERASAKI	DTC6363MC				81	2	ANGLE ADAPTOR	MARECHAL	DS6 (316A13 - 316A131)							
30	1	WELL CLEANING CIRCUIT BREAKER	TERASAKI	DTC6363MC				82	2	PLUG TOP	MARECHAL	DS6 (316A13 - 316A131)							
31	3	SPARE CIRCUIT BREAKERS	TERASAKI	DTC6363MC				83		NOT USED									
32	7	SW/BO DOOR MICRO SWITCHES	CANSCO	SH292	4 OFF BLV 3 OFF BRV & BLV			84	1	RTU BATTERY CHECK RELAY	IZUMI	RH2B-4J-24VDC							
33	3	SW/BO 0W INTERNAL FLURO LIGHTS	PHORN	BD0100				85	1	RTU POWER SUPPLY 24VDC	INNOVATIVE ENERGIES	SR254-24C		FREE ISSUE					
34	1	WELL LEVEL INDICATOR	CHROMPTON INSTRUMENTS	244-01KG-HG-IP-SR 4-20mA, 0-100%, AD1 RED POINTER				86	1	RTU 24V/120VDC CONVERTER	INNOVATIVE ENERGIES	EX24VW-12		FREE ISSUE					
35	1	PRESSURE ADJUSTMENT UNIT	VEGA	VEGA DIS12				87	2	BATTERY	YUASA	NP7-12		FREE ISSUE					
35.1	1	PRESSURE TRANSDUCER	VEGA	DB4				88	1	RADIO	TRD	OR 10007A0200		FREE ISSUE					
36	1	WELL LEVEL ADJUSTMENT UNIT	VEGA	VEGA DIS12				89		NOT USED									
36.1	1	WELL LEVEL TRANSDUCER	VEGA	VEGA WELL 72				90	1	TELEMETRY UNIT	MITS	MD3311EA/2710-377		FREE ISSUE					
36.2	1	RAG REDUCTION TUBE						91		NOT USED									
37	2	PUMP CONTROL CIRCUIT BREAKER	TERASAKI	DTC6363MC				92		NOT USED									
38	2	PUMP HOURS RUN METER	NATIONAL	TN639				93		NOT USED									
39		NOT USED						94		NOT USED									
40	2	PUMP START/STOP RELAY	IZUMI	RH2B-4J-240VAC				95		NOT USED									
41	2	CONTROL CIRCUIT ON RELAY	IZUMI	RH2B-4J-240VAC				96		NOT USED									
42	2	PUMP FAULT RELAY	IZUMI	RH2B-4J-240VAC				97	1	ANTENNA	TRD	ANTISAL YAGI 13dB 15 ELEMENT		FREE ISSUE					
43	1	MOISTURE IN OIL RELAY						97.1	1	ANTENNA MAST	SWBO BUILDER								
44	2	PUMP STOP PUSH BUTTON	SPRECHER & SCHUH	DSP-F63LX01				97.2	1	COAX CABLE (INTERNAL)	R.F. INDUSTRIES	RG58		FREE ISSUE					
45	1	RADIO COAX SURGE PROTECTION	POLYPHASE CORPORATION	IS-50MX-C2				97.3	1	COAX CABLE (EXTERNAL)	R.F. INDUSTRIES	RG213		FREE ISSUE					
46	2	PUMP STATUS INDICATOR	SPRECHER & SCHUH	DSP-PLS - 05-30LA 3R (RED, 24V)				97.4	1	COAX PLUG	R.F. INDUSTRIES	SPA		FREE ISSUE					
47	2	PUMP START PUSH BUTTON	SPRECHER & SCHUH	DSP-F63LX11				97.5	1	COAX PLUG	R.F. INDUSTRIES	N89 (MALE)		FREE ISSUE					
48	2	PUMP EMERG STOP PUSH BUTTON	SPRECHER & SCHUH	DSP-HYS14 ILX01/01				97.6	2	COAX PLUG	R.F. INDUSTRIES	N07 (MALE)		FREE ISSUE					
49	2	PUMP RESET PUSH BUTTON	SPRECHER & SCHUH	DSP-F63LX11				97.7	1	U CLAMPS	R.F. INDUSTRIES	UNV		FREE ISSUE					
50		NOT USED																	

NOTES
 1. CATALOG No. TO SUIT RATING OF PUMP STATION.
 2. CATALOG No. TO SUIT RATING OF PUMP FOR NORMAL SOFT STARTED DUTY.

Sheet 07

AS CONSTRUCTED

A		B		C		D		E		F		G		H		I		J	
A		B		C		D		E		F		G		H		I		J	

PRINCIPAL ENGINEER		R.P.E.Q. NO.		DATE		NAME		DATE		JOB FILE		ACAD FILE		PROJECT		TITLE		SCALE		N° 8 OF 15 SHEETS	
MANAGER		DATE		DATE		DESIGN		7-7-03		SURVEY NO.		57QU008.DWG		BANYO TUFNELL ROAD - SP068 SEWAGE PUMP STATION		EQUIPMENT LIST		DRAWING N°		486/5/7-QU008	
PRODUCTION / NETWORK DELEGATE		DATE		CHECKED		H.T.		7-7-03		SURVEYED		FIELD BOOK		A.H. DATUM				AMEND.		A	

Q-Pulse Id TMS738

ITEM No.	DESCRIPTION	LABEL 1	LABEL 2 (IF NECESSARY)	TEXT HEIGHT	MATERIAL / COLOUR	CORRECTLY INSTALLED	ITEM No.	DESCRIPTION	LABEL 1	LABEL 2 (IF NECESSARY)	TEXT HEIGHT	MATERIAL / COLOUR	CORRECTLY INSTALLED
00	SURGE DIVERTER	LIGHTNING ARRESTORS		4mm	TRAFFOLYTE W/B/M		48	PUMP STOP PUSH BUTTON	PUMP EMERGENCY STOP	PUMP EMERGENCY STOP	4mm	TRAFFOLYTE W/B/M	
01	MAIN CIRCUIT BREAKER	MAIN SWITCH		3mm	TRAFFOLYTE W/B/M		49	PUMP RESET PUSH BUTTON	FAULT RESET	FAULT RESET	4mm	TRAFFOLYTE W/B/M	
02	PUMP CIRCUIT BREAKER	PUMP No 1	PUMP No 2	4mm	TRAFFOLYTE W/B/M		50						
03	PUMP SOFT STARTER	PUMP No 1	PUMP No 2	4mm	TRAFFOLYTE W/B/M		51						
04	SUB-DISTRIBUTION BOARD (SDB)	SUB-DISTRIBUTION BOARD		4mm	TRAFFOLYTE W/B/M		52	PUMP START/STOP RELAY	NO	NO	4mm	TRAFFOLYTE W/B/M	
04.1				4mm			53	SURCHARGE ALARM	LEAK SURCHARGE ALARM		4mm	TRAFFOLYTE W/B/M	
04.2							54						
05							55	PUMP CONTROL SELECTOR SW.	STATION CONTROL LOCAL REVERSE		4mm	TRAFFOLYTE W/B/M	
06	CURRENT TRANSFORMER	CURRENT TRANSFORMER	CURRENT TRANSFORMER	4mm	TRAFFOLYTE W/B/M		56	SITE ATTENTION RESET	SITE ATTENTION ALARM RESET		4mm	TRAFFOLYTE W/B/M	
06.1							57						
07	PUMP CONTACTOR	NO CONTACTOR	NO CONTACTOR	4mm	TRAFFOLYTE W/B/M		58						
07.1							59	SITE ATTENTION ALARM	ATTENTION IF ALARM ACTIVE CONTACT CONTROL ROOM		4mm	TRAFFOLYTE W/B/M	
07.2							60						
07.3							61	3 PHASE OUTLET	3 Ø OUTLET		4mm	TRAFFOLYTE W/B/M	
08	BY-PASS CONTACTOR	NO BY-PASS CONTACTOR	NO BY-PASS CONTACTOR	4mm	TRAFFOLYTE W/B/M		62	1 PHASE OUTLET	1 Ø OUTLET		4mm	TRAFFOLYTE W/B/M	
09							63	NEUTRAL LINK	NEUTRAL		4mm	TRAFFOLYTE W/B/M	
10	SOFT STARTER	SOFT STARTER	SOFT STARTER No. 2	4mm	TRAFFOLYTE W/B/M		64	EARTH LINK	EARTH		4mm	TRAFFOLYTE W/B/M	
11							65						
12	PUMP M/LINK	PUMP No 1 M/LINK	PUMP No 2 M/LINK	4mm	TRAFFOLYTE W/B/M		65.1						
12A							65.2						
13							65.3						
14	INSTRUMENT FUSES	F1 2/20A	F1 2/20A	4mm	TRAFFOLYTE W/B/M		65.4						
14.1							65.5						
15	CT TEST LINK	TL1	TL2	4mm	TRAFFOLYTE W/B/M		65.6						
15.1							65.7						
15.2							65.8						
15.3							66	MAIN NEUTRAL LINK	MAIN NEUTRAL		4mm	TRAFFOLYTE W/B/M	
15.4							67	MAIN EARTH LINK	MAIN EARTH		4mm	TRAFFOLYTE W/B/M	
16							68	INSTRUMENTATION EARTH LINK	INSTRUMENTATION EARTH		4mm	TRAFFOLYTE W/B/M	
17							69						
18	EMERGENCY PHASE FAILURE RELAY	PER EMERGENCY PHASE FAILURE RELAY		4mm	TRAFFOLYTE W/B/M		70						
19	PHASE FAILURE RELAY	PER PHASE FAILURE RELAY		4mm	TRAFFOLYTE W/B/M		71						
20	PHASE FAILURE CIRCUIT BREAKER	PER PHASE FAILURE RELAY		4mm	TRAFFOLYTE W/B/M		72						
21	3 PHASE OUTLET CIRCUIT BREAKER	3 PHASE OUTLET		4mm	TRAFFOLYTE W/B/M		73	24VDC 3A LINEAR POWER SUPPLY	24VDC POWER SUPPLY		4mm	TRAFFOLYTE W/B/M	
22	1 PHASE OUTLET CIRCUIT BREAKER	1 PHASE OUTLET		4mm	TRAFFOLYTE W/B/M		74	24VDC CIRCUIT BREAKER	1 Ø SUPPLY 25VDC		4mm	TRAFFOLYTE W/B/M	
23							75						
24	RTU LAP TOP GPO CIRCUIT BKR	RTU LAP TOP GPO		4mm	TRAFFOLYTE W/B/M		76						
25	SW/NO FLUORO CIRCUIT BREAKER	SWITCHBOARD LIGHTS		4mm	TRAFFOLYTE W/B/M		77	BATTERY ENCLOSURE	RTU BATTERIES		4mm	TRAFFOLYTE W/B/M	
26							78						
27	24VDC POWER SUPPLY CIRCUIT BKR	24VDC POWER SUPPLY		4mm	TRAFFOLYTE W/B/M		79	RTU LAP TOP GPO	RTU LAP TOP GPO		4mm	TRAFFOLYTE W/B/M	
28	TRANSFORMERS CIRCUIT BREAKER	TRANSFORMERS SUPPLY		4mm	TRAFFOLYTE W/B/M		80	DECONTACTOR	PUMP No 1	PUMP No 2	4mm	TRAFFOLYTE W/B/M	
29	RTU CIRCUIT BREAKER	RTU SUPPLY		4mm	TRAFFOLYTE W/B/M		81						
30							82						
31							83						
32							84	RTU BATTERY DISCHARGE RELAY	DO		4mm	TRAFFOLYTE W/B/M	
33							85	RTU POWER SUPPLY	RTU POWER SUPPLY		4mm	TRAFFOLYTE W/B/M	
34	WELL LEVEL INDICATOR	WELL LEVEL		4mm	TRAFFOLYTE W/B/M		86						
35	PRESSURE TRANSMITTER RELAY	PRESSURE TRANSMITTER		4mm	TRAFFOLYTE W/B/M								
36	WELL LEVEL TRANSMITTER	WELL LEVEL TRANSMITTER		4mm	TRAFFOLYTE W/B/M								
37	PUMP CONTROL CIRCUIT BKR	PUMP No 1 CONTROL	PUMP No 2 CONTROL	4mm	TRAFFOLYTE W/B/M								
38	PUMP HOURS RUN METER	PUMP No 1 HOURS RUN	PUMP No 2 HOURS RUN	4mm	TRAFFOLYTE W/B/M								
39													
40													
41	CONTROL CIRCUIT ON RELAY	PH1 CCT ON	PH2 CCT ON	4mm	TRAFFOLYTE W/B/M								
42	PUMP FAULT RELAY	PH1	PH2	4mm	TRAFFOLYTE W/B/M								
43	MOISTURE IN OIL RELAY			4mm	TRAFFOLYTE W/B/M								
44													
45													
46													
47	PUMP START PUSH BUTTON	PUMP START	PUMP START	4mm	TRAFFOLYTE W/B/M								

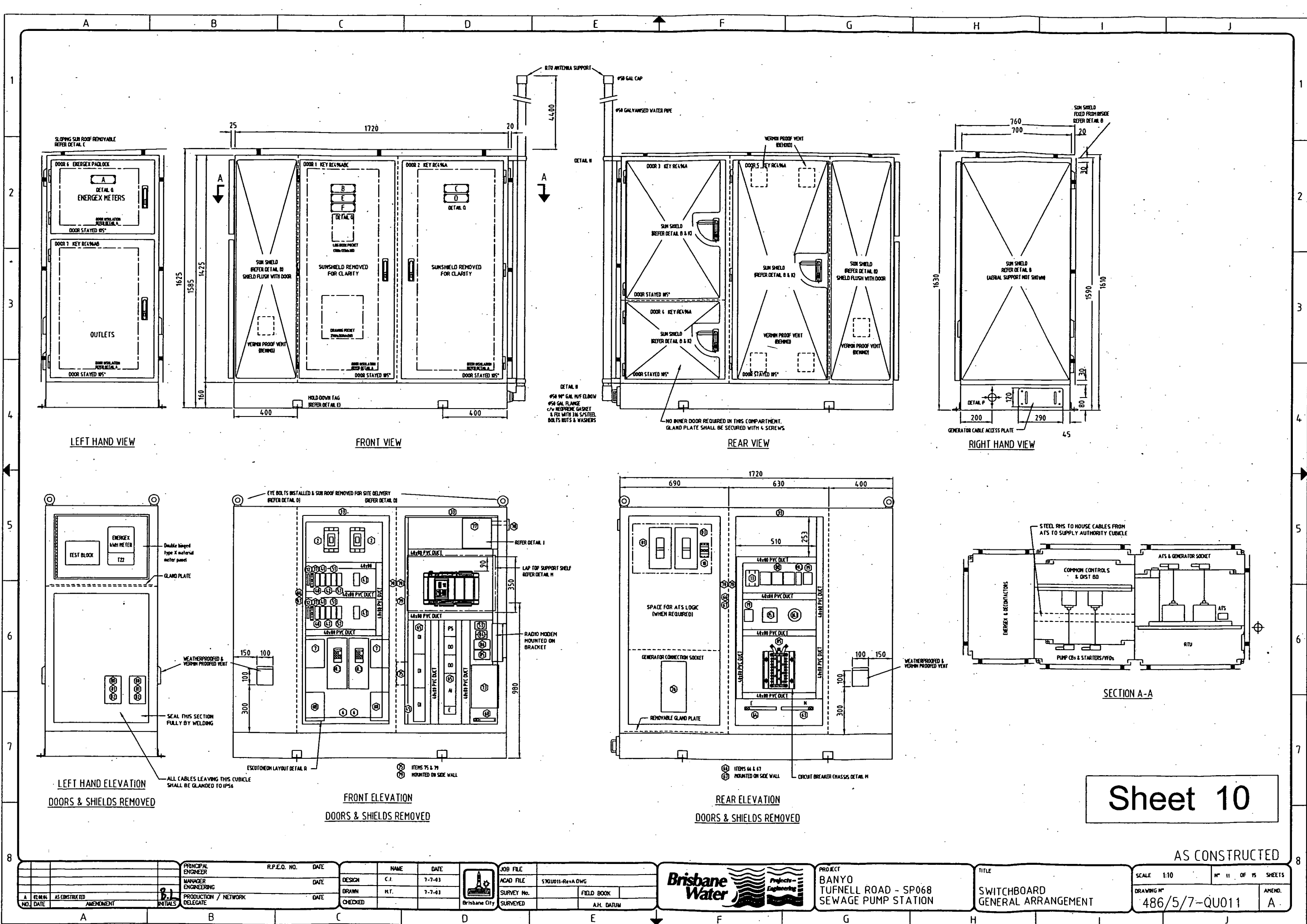
- NOTES
1. MAIN SWITCH SIZE TO SUIT RATING OF PUMP STATION.
 2. SOFT STARTER CURRENT RATING FOR NORMAL DUTY.
 3. LABELS FITTED ADJACENT ASSOCIATED EQUIPMENT LABELS OBSTRUCTED BY SWITCHBOARD WIRING ARE RELOCATED TO ADJACENT DUCT LID. DUCT LID SECURED BY SINGLE CABLE TIE AT ONE CORNER.

Sheet 09

AS CONSTRUCTED

A		B		C		D		E		F		G		H		I		J	
NO. DATE AS CONSTRUCTED AMENDMENT		PRINCIPAL ENGINEER MANAGER ENGINEERING PRODUCTION / NETWORK DELEGATE		R.P.E.Q. NO. DATE DATE		NAME DATE C.J. 7-7-03 H.T. 7-7-03		JOB FILE ACAD FILE SURVEY No.		570U010-RevA.DWG FIELD BOOK A.M. DATUM		PROJECT BANYO TUFNELL ROAD - SP0668 SEWAGE PUMP STATION		TITLE SWITCHBOARD LABEL SCHEDULE		SCALE NTS 486/5/7-QU010		NO. 10 OF 15 SHEETS AMEND. A	

Q:\PSEDRAWING\SEWERAGE\INFRASTRUCTure\Tufnell Rd - SP068\57QU011-RevA.dwg, 02/08/2004 02:00:36 PM



CONSTRUCTION

Cubicle construction 3mm Marine grade Aluminium (5251).
Plinth construction 160x60 channel 6061 T6 Grade Aluminium.
Folded, "Pulse MIG" & "TIG" welded with all visible seams and joints fully welded, free from splatter and ground smooth where needed.
External doors and covers fitted with Emka 1011-207 self grip seal.
"D" Handles fitted where indicated on the drawings.
M6 Earth studs fixed to the interior of all doors and hinged escutcheons and on adjacent cubicle interior surfaces.
Door stiffeners, door stays, cable straps, and document holders etc fitted where shown on the drawings.
Lift-off covers and mounting panels fixed with M8 studs & chrome acorn nuts.
Gland plates manufactured from 6mm Bakelite.
Gland plate openings reinforced with 25x6mm flat aluminium bar.
Gland plate seals attached to cubicle not gland plate.
Gland plate fixings are NOT more than 150 mm apart (refer Detail F)
Hinges Selectrix HI-B650.
Star washers fitted under all hinge screws.
Locks Doors 1-5, 7
Selectrix 1107 - PSCU1 handle
Selectrix 1107-UI23 3pt cam
Lockwood 71 Barrel Lock
Emka 1049-U3 roller rod
Key Codes RC496A, RC496AB, RC496ABC refer to each door for clarification.

Lock Door 6

Selectrix 1107-PSC01 handle
Selectrix 1107-UI23 3pt cam
Emka 1049-U3 roller rod
ENERGEX Lockwood No234B brass pin tumbler padlock.
Hinged escutcheons fixed with Emka 1/4 turn 1000-UI42

OPERATING PARAMETERS

Standard	AS 3439.1
Current & Frequency	AC 50Hz
Rated Operational Voltage Ue	415 VAC
Rated Insulation Voltage Ui	660 V
Rated Auxiliary Voltage	24 VDC / 240 VAC
Rated Current (Main Bus)	400 AMPS
Short Circuit Current Isc	35 kA
Duration of Isc	1 sec
Degree of Protection	IP 55 to AS 1939
Measure of Protection by barriers and enclosures	
Service Conditions	Outdoors
Mass	Not exceeding 2000kg
Forms of Segregation	Form 1
Earthing System	TN-S

PAINTING

Aluminium Surface Preparation.
Finish smooth all exposed welds, clean, descale, and degrease all surfaces.
Surfaces pretreatment in accordance with AS 1580 & AS 3715 using Novox LF acid etch cleaner, Novacoat 12 conversion coating, & clean water rinses.
Apply DULUX ALPHATECH 3000 powder coat to manufacturer's recommendations.
CUBICLE & EXTERNAL COMPONENTS :- DULUX Mist Green (36648) matt finish.
INTERIOR ITEMS (mounting panels, escutcheons, etc.) :- DULUX Bright White (32366)
Minimum Dry Film Thickness all surfaces 50 microns.

WIRING

All wiring to be PVC V90 HT 0.6/1kV Grade with tinned conductor.
Control and instrumentation wiring has flexible copper conductors, and is colour coded as detailed below, numbered each end, and terminated by the use of appropriate pre-insulated crimp lugs.
Power wiring to be minimum 2.5sqmm stranded copper conductors, phase colour coded as detailed below.
Low level instrumentation signals & 4-20mA signals wired in shielded pair minimum size 0.5sqmm. Earthed at one end only.
Earth cables minimum 2.5sqmm flexible.
Doors and hinged escutcheons bonded with 4sqmm flexible earth strap.
Wire numbering will be equal to Grafoplast SI2000 system.
Wire numbers are readable left to right, bottom to top as shown.

COLOUR CODE

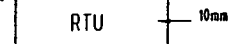
Phase wiring (A,B & C)	Red, White, Blue	2.5sqmm (min)
Potential Metering (240/415 VAC)	Red, White, Blue, Black	1.5sqmm
Current Metering (Secondary)	Red, White, Blue, Grey	2.5sqmm
240 VAC Control Active	Red	1.5sqmm
240 VAC Neutral	Black	1.5sqmm
24 V ELV Positive	Orange	1.5sqmm
24 V ELV Negative	Violet	1.5sqmm
24 V RTU Positive	Orange	0.5sqmm
24 V RTU Negative	Violet	0.5sqmm
RTU Wiring	Grey	0.5sqmm
Intrinsically safe wiring	Blue	1.5sqmm
Earth	Green/Yellow	2.5sqmm (min)
Door & Escutcheon Earth Bonds	Green/Yellow	4 sqmm

LABELS

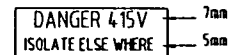
Internal labels W/B/W engraved Traffolyte to label schedule.
Warning labels R/W/R engraved Traffolyte.

Main switch labels

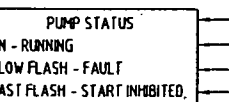
Material B/W/B

Compartment labels

Material W/B/W

Warning labels

Material R/W/R

Other labels

Material W/B/W

Internal labels secured by M3 chrome plated metal threads.

Labels obstructed by switchboard wiring are relocated to adjacent duct lid. The duct lid is secured by a single cable tie at one corner.

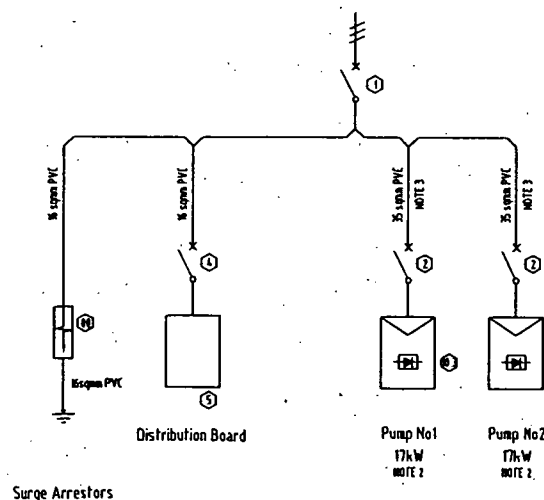
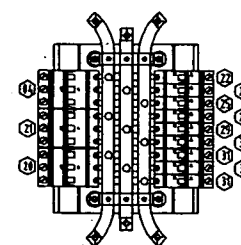
External labels secured by M3 316 stainless steel metal threads.

LABEL	TEXT	TEXT HEIGHT	PARTIAL LETTERING	DIMENSIONS	QUANTITY
A	SUPPLY AUTHORITY METER PANEL	10mm	Black	300x20	1
B	SPINNET	20mm	Black	150x15	1
C	WARNING THIS SITE IS MONITORED BY NETWORK CONTROL. PLEASE INFORM THE OPERATOR BEFORE ISOLATING PUMPS OR STATION	10mm	Black	250x100	1
D	PLEASE CHECK THAT THE PUMPS ARE IN PROPER MODE BEFORE LEAVING SITE	10mm	Black	270x60	1
E	DANGER KEY	10mm	Red	120x15	1
F	ELECTRONIC SOFT STARTERS No 1 & No 2	10mm	Black	300x25	1

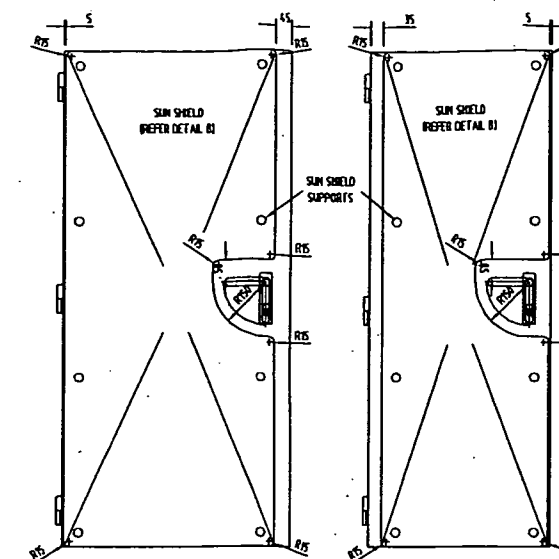
External labels 10mm 316 316 grade stainless steel, fixed with M3 316 stainless steel metal threads.

DETAIL Q

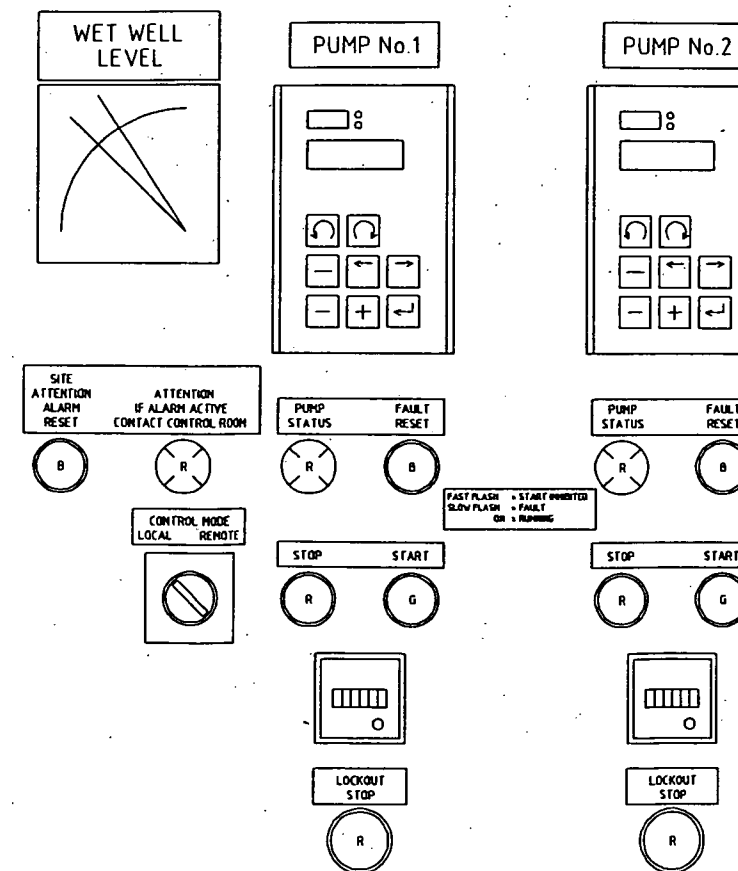
(EXTERNAL STAINLESS STEEL LABEL DETAIL)

**POWER WIRING DETAIL****DETAIL M**
SUB-DISTRIBUTION BOARD ARRANGEMENT**NOTES**

1. ADD CORRECT PUMP No.
2. ADD CORRECT PUMP RATINGS.
3. ADD CORRECT WIRE SIZE.

**DETAIL K**

(DOOR SUN SHIELD DETAIL)

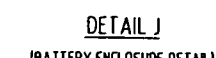
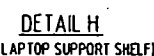
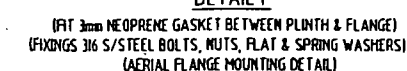
**TYPICAL ESCUTCHEON LAYOUT****PUMPS INTERLOCKED**

TUFNELL ROAD	
ACTUAL SURCHARGE	77%
SURCHARGE IMMINENT	77%
START DUTY PUMP	77%
STOP DUTY PUMP	77%
LEVEL PROBE LENGTH	77%
LEVEL PROBE RANGE	77%

Sheet 11

AS CONSTRUCTED

PRINCIPAL ENGINEER	ORIGINAL SIGNED BY	R.P.E.O. NO.	DATE	DESIGN	NAME	DATE	JOB FILE	ACAD FILE	S70U012-Rev A.DWG	SURVEYED	FIELD BOOK	A.H. DATUM	PROJECT	BANYO TUFNELL ROAD - SP068 SEWAGE PUMP STATION	TITLE	SWITCHBOARD CONSTRUCTION NOTES	SCALE	NTS	N° 12 OF 15 SHEETS	DRAWING N°	486/5/7-QU012	AMEND.	A
MANAGER ENGINEERING				DRAWN	H.T.	7-7-43																	
PRODUCTION / NETWORK DELEGATE				CHECKED																			



Sheet 12

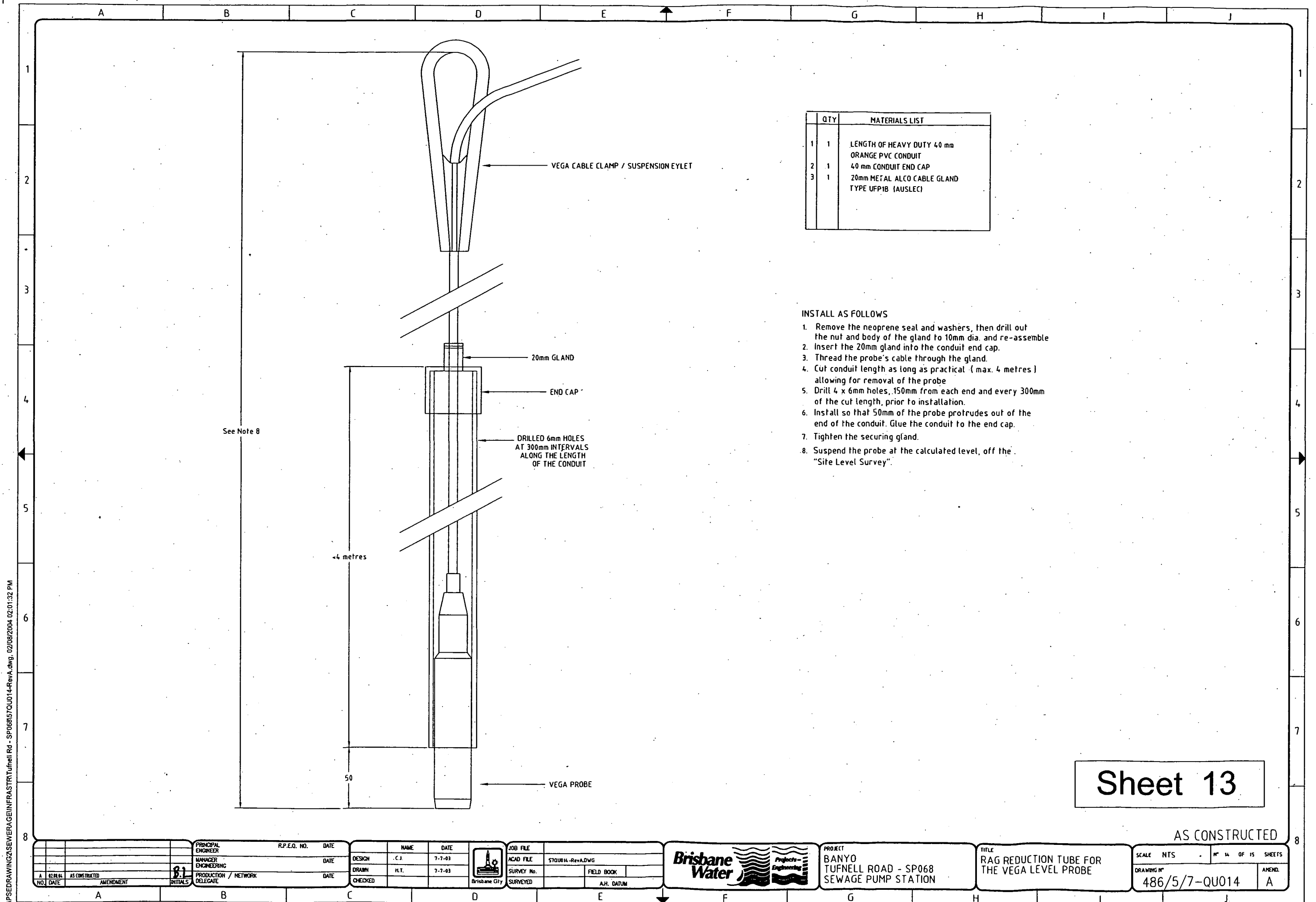
AS CONSTRUCTED

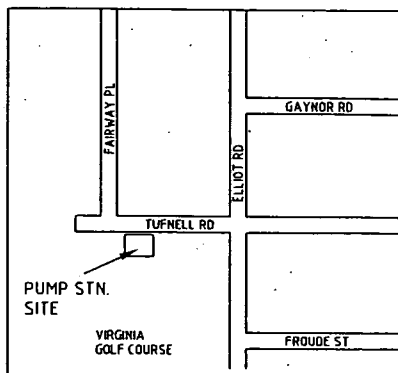
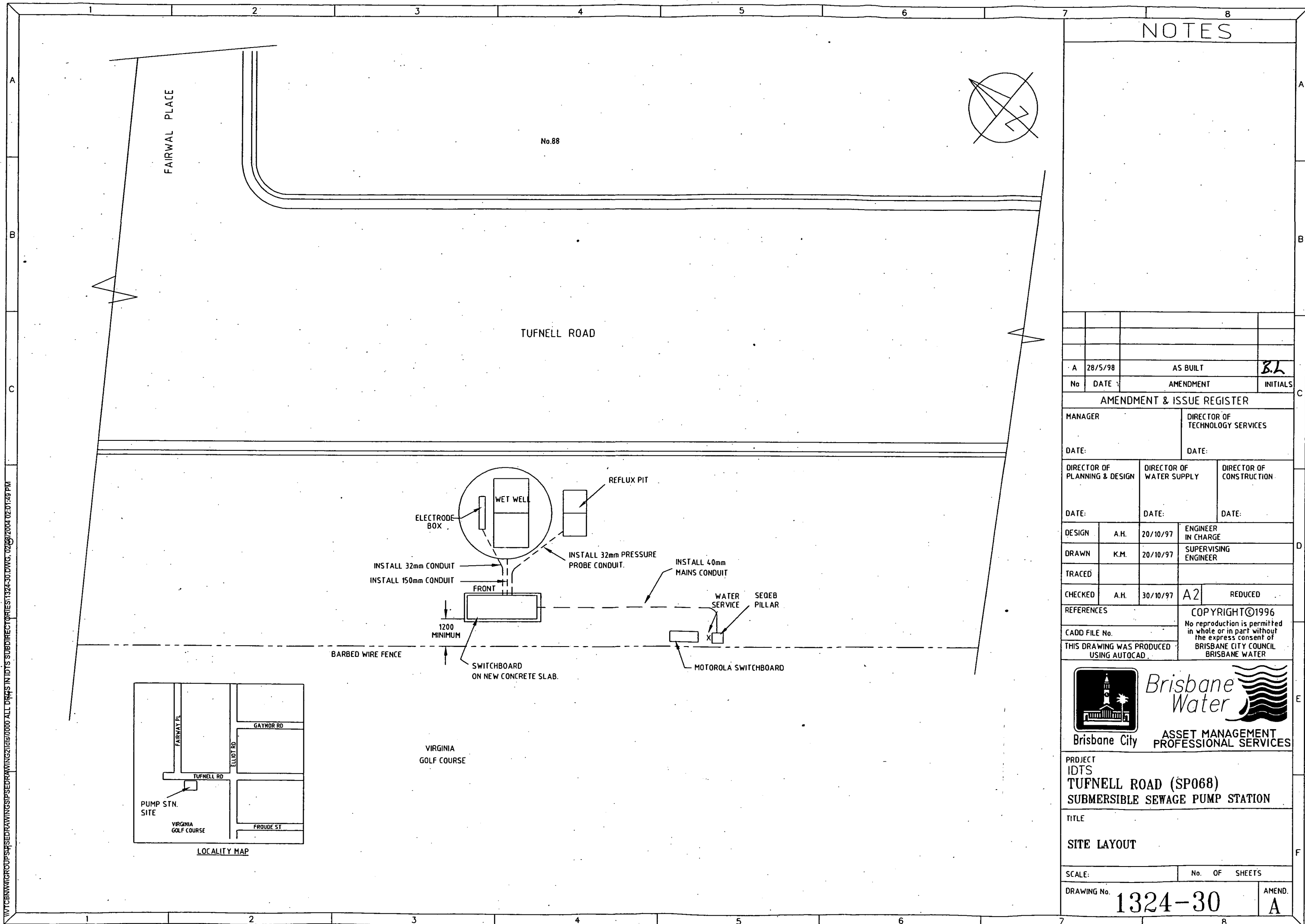
		PRINCIPAL ENGINEER		R.P.E.Q. NO.		DATE				NAME		DATE		JOB FILE				PROJECT		TITLE		SCALE		NTS		M ^o 13 OF 15 SHEET			
		MANAGER ENGINEERING				DATE				DESIGN		C.J.		7-7-03		ACAD FILE		S7QU013-Rev A DWG		BANYO TUFNELL ROAD - SP068 SEWAGE PUMP STATION		SWITCHBOARD CONSTRUCTION DETAILS		DRAWING M ^o		486/5/7-QU013		AMEND	
A 02/04/04		AS CONSTRUCTED		B.L.		INITIALS		PRODUCTION / NETWORK DELEGATE		DATE		DRAWN		M.T.		7-7-03		SURVEY No.		FIELD BOOK									
NO. DATE		AMENDMENT						CHECKED										SURVEYED		A.H. DATUM									



Brisbane Water
Projects - Engineering

PROJECT		BANYO TUFNELL ROAD - SP068 SEWAGE PUMP STATION	
TITLE		SWITCHBOARD CONSTRUCTION DETAILS	
SCALE		NTS	
DRAWING M ^o		486/5/7-QU013	
AMEND		A	





NOTES

A	28/5/98	AS BUILT	B.L.
No	DATE	AMENDMENT	INITIALS

AMENDMENT & ISSUE REGISTER

MANAGER		DIRECTOR OF TECHNOLOGY SERVICES	
DATE:		DATE:	
DIRECTOR OF PLANNING & DESIGN	DIRECTOR OF WATER SUPPLY	DIRECTOR OF CONSTRUCTION	
DATE:	DATE:	DATE:	
DESIGN	A.H.	20/10/97	ENGINEER IN CHARGE
DRAWN	K.M.	20/10/97	SUPERVISING ENGINEER
TRACED			
CHECKED	A.H.	30/10/97	A2 REDUCED

REFERENCES	COPYRIGHT©1996 No reproduction is permitted in whole or in part without the express consent of BRISBANE CITY COUNCIL BRISBANE WATER
CADD FILE No.	
THIS DRAWING WAS PRODUCED USING AUTOCAD	



Brisbane Water

Brisbane City

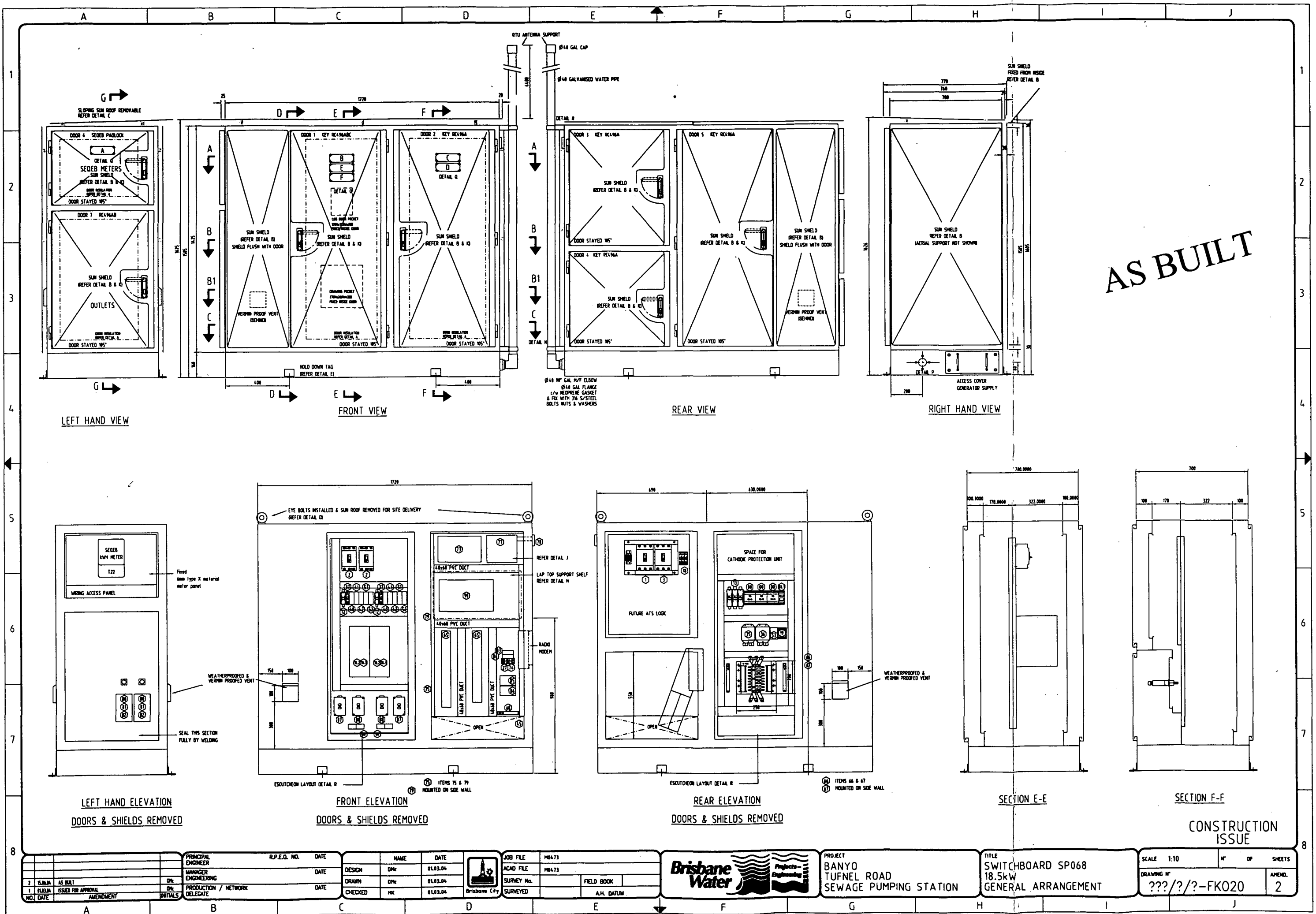


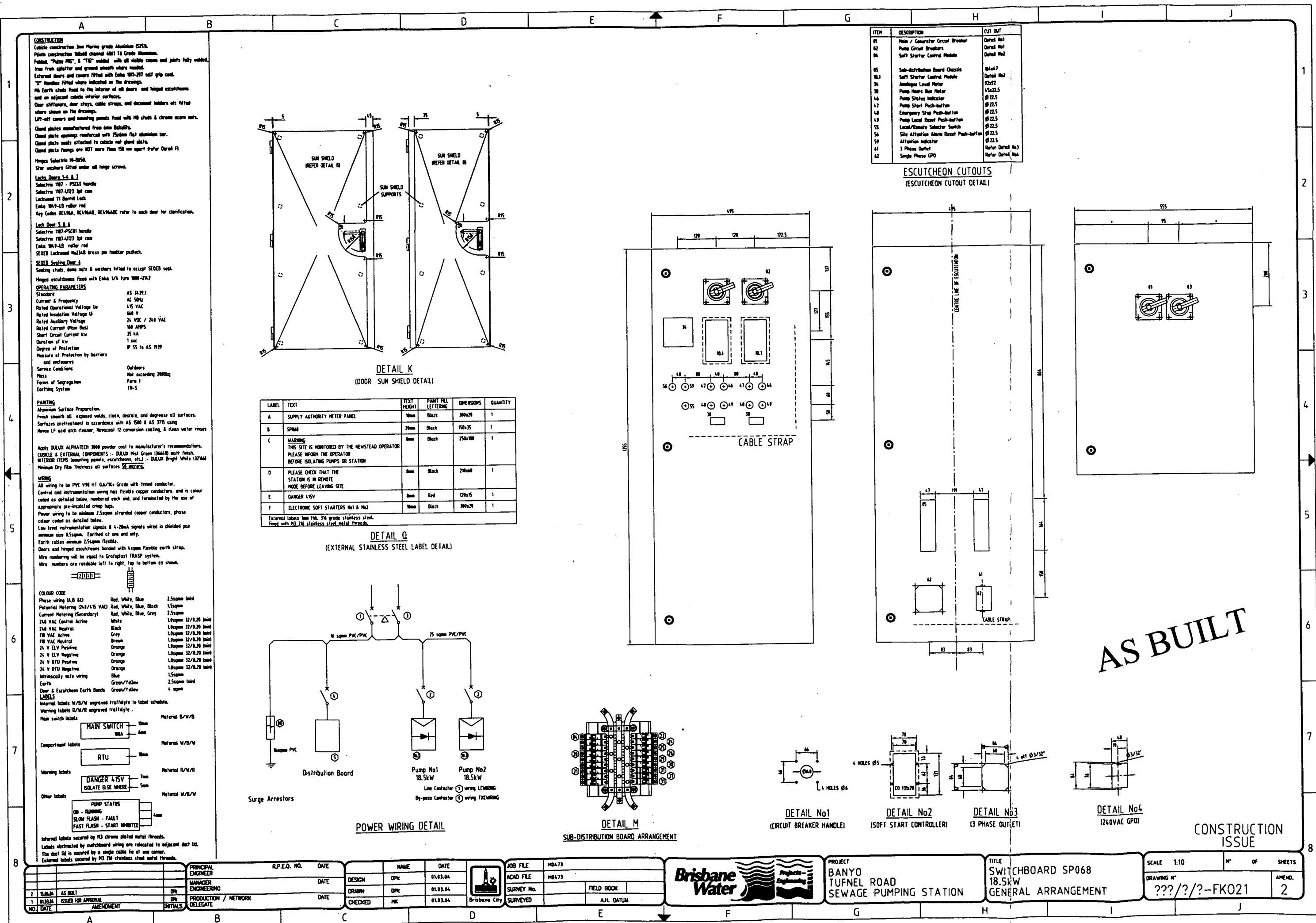
ASSET MANAGEMENT PROFESSIONAL SERVICES

PROJECT
IDTS
TUFNELL ROAD (SP068)
SUBMERSIBLE SEWAGE PUMP STATION

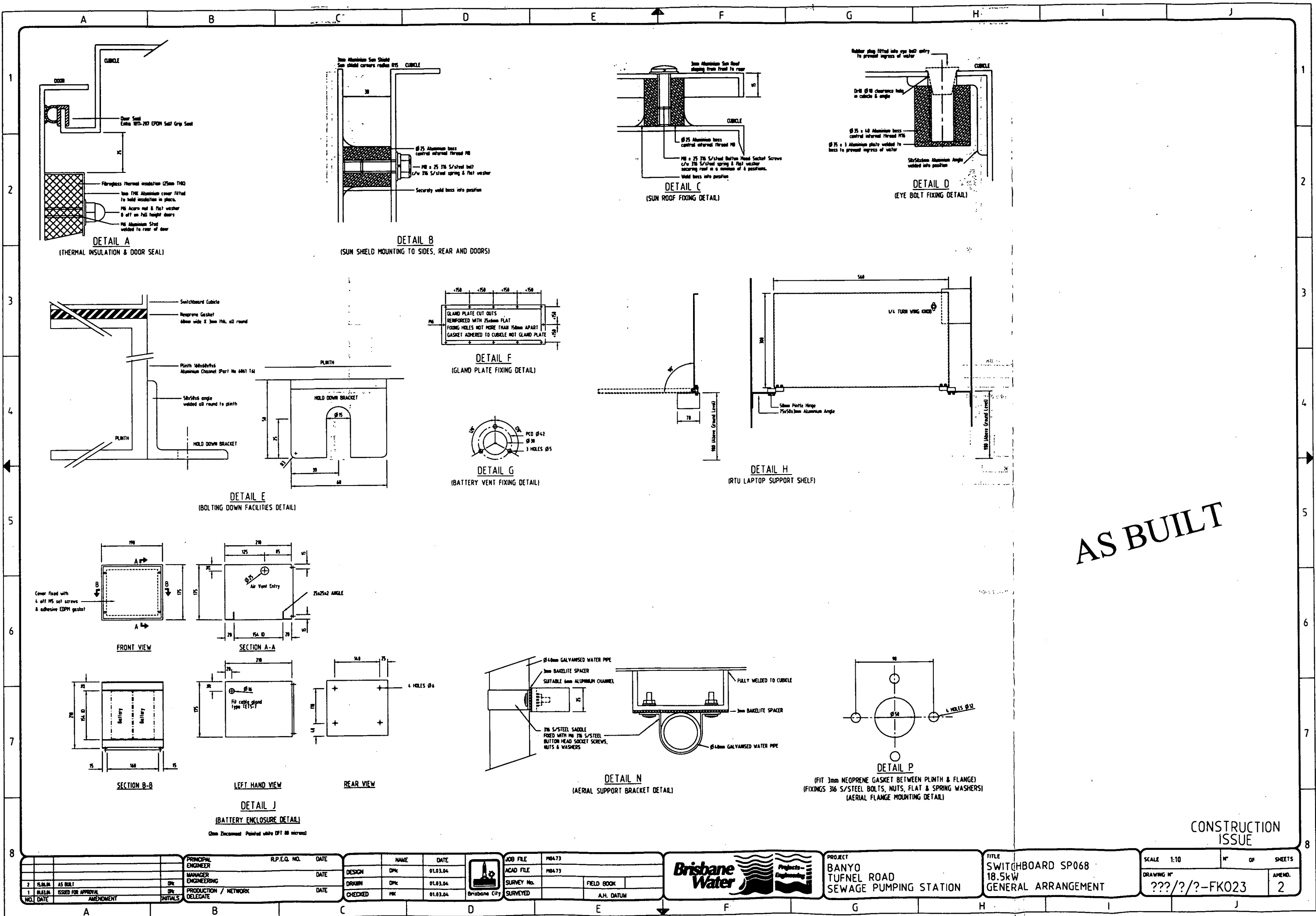
TITLE
SITE LAYOUT

SCALE:	No. OF SHEETS
DRAWING No. 1324-30	AMEND. A







CONSTRUCTION
ISSUE

NO.	DATE	ISSUED FOR APPROVAL	AMENDMENT	INITIALS	PRINCIPAL ENGINEER	R.P.E.Q. NO.	DATE	NAME	DATE	JOB FILE	PROJECT	TITLE	SCALE	1:10	N°	OF	SHEETS	AMEND.
1	01.03.04	AS BUILT			MANAGER ENGINEERING			DESIGN	DPK	01.03.04	BANYO TUFNELL ROAD SEWAGE PUMPING STATION	SWITCHBOARD SP068 18.5kW GENERAL ARRANGEMENT						2
2	01.03.04	ISSUED FOR APPROVAL			PRODUCTION DELEGATE			DRAWING	DPK	01.03.04								
3	01.03.04							CHECKED	PK	01.03.04								