



**BRISBANE CITY COUNCIL**

**RAUBERS ROAD**

**BANYO**

**VACUUM SEWERAGE SYSTEM**

**OPERATIONS & MAINTENANCE MANUAL**

**JULY 1997**

**Edwards Environmental Enterprises Pty Ltd**

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**BRISBANE CITY COUNCIL**

**RAUBERS ROAD**  
**BANYO**  
**VACUUM SEWERAGE SYSTEM**

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**BRISBANE CITY COUNCIL**  
**RAUBERS ROAD**  
**BANYO**  
**VACUUM SEWERAGE SYSTEM**  
**OPERATIONS AND MAINTENANCE MANUAL**

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**VACUUM SEWERAGE SYSTEM**

**SECTION 1 VACUUM SEWERAGE TRANSPORT SYSTEM**

- 1.1 System Details
- 1.2 Scheme Details
- 1.3 Basis of Design
- 1.4 Component Sizing



# **BRISBANE CITY COUNCIL**

## **RAUBERS ROAD BANYO VACUUM SEWERAGE SYSTEM**

### **1. VACUUM SEWERAGE TRANSPORT SYSTEMS**

#### **1.1 System Details**

A vacuum sewerage system comprises numerous components that are combined to form a system. The sewage is produced and flows by gravity to a collection sump similar in size to a manhole. In this sump is installed the automatic pneumatic interface valve. This valve is the interface between the gravity flows under normal atmospheric conditions and the vacuum within the sewerage system.

The interface valve opens for about 4 to 6 seconds to admit the sewage and some air from the sump, (about 40 litres of sewage), then closes. This is achieved by pneumatic pressure; no electrical supply is required. The valve may operate for only 3 or 4 times per hour, (but more frequently if required), and for the rest of the time it is closed.

The next component is the vacuum sewer network. These pipes are laid to a sawtooth profile approximately 1.0 to 1.5 metres cover. Polyethylene pipe has proven most effective and robust, particularly when used in conjunction with electrofusion fittings. The diameters of a vacuum sewer are generally smaller than for a conventional sewer due to the much higher velocities achieved; up to 6 metres per second. In this scheme 110, 140 and 180 mm O.D. are used.

The next set of components are those forming the collection station. Firstly, the vacuum collection vessel. This tank separates the sewage from the air admitted to the system to provide the motive force for the transportation of the sewage. The sewage falls to the bottom of the vessel and is pumped out by the sewage pumps. The air in the upper part of the vessel is evacuated by the vacuum pumps. The active volume of the vessel is determined by the total number of stops and starts to be made by the sewage pumps. The vessel material is mild steel.

Sewage pumps are of a conventional type but are carefully checked to ensure the NPSH available and NPSH required is satisfactory to ensure efficient operation. Two pumps are provided each sized to pump at the design peak flow, with one pump operational and the other as standby.

Vacuum pumps are of the liquid ring type. The capacity of the vacuum pump is determined by the peak sewage flow into the system, ie a small system will require small vacuum pumps, a larger system with many more people being served will require larger pumps.

Isolation valves in the collection station and in the sewer network are provided to allow isolation of particular mains or branches in the event of a problem somewhere in the system with a damaged pipe or valve.

It should be noted that vacuum sewers perform two distinct functions; firstly and most obviously they are the conduit through which the collected sewage is transported from the collection sump to the collection vessel in the vacuum station. However, a second vital function for which the vacuum mains must be designed is the efficient and rapid transfer of vacuum back to the extremities of the network of mains after a valve has fired and admitted sewage and air into the system.

At the end of sewer lines, the functions described above become of particular importance. The interface valve's ability to adjust and increase the volume of air entering the system behind the sewage means that it is possible to ensure the velocity of the sewage is kept high and therefore efficiently transported within the mains.

If the pipes are undersized or insufficient air is admitted to the system via the interface valves, then the performance of the vacuum system as a whole will suffer. In particular the collection sumps at the extremities of the network must have sufficient vacuum after firing at times of peak flow conditions.

As a result of balancing the above requirements for vacuum sewer mains, each system is individually designed for optimum performance

## **1.2 Scheme Details**

The scheme is to service 42 lots varying in size between 7750m<sup>2</sup> and 1292m<sup>2</sup>. The area of land zoned Light Industrial is 3.712ha and 9.248ha is zoned General Industrial. The Total Area is 12.96 ha. An extension to service the Mitchells Food area of 3.42ha has been provided.

The system has been designed in accordance with Brisbane City Council's detailed Specification for Vacuum Sewer Systems and Vacuum Pumping Stations - July 1996.

Drawings of the Scheme are attached.

### 1.3 Basis of Design

The hydraulic loading applicable to the development has been assessed as follows:

Loading Rate - mixed light industry	=	30.0 EP/Gross Ha
Equivalent Person (EP)	=	250L/day
Contributing population equivalent	=	490 EP

Ref: Water Resources: Guidelines for Planning & Design of Sewerage Systems - Volume 1, Table 2.1 Equivalent Persons & Flows

ADWF	=	Area x Loading Rate x Equivalent Persons
	=	(12.96+3.42) x 30.0 x 250 L/day
	=	122 850 L/day
	=	1.42 L/s

Peak Flow given by Drawing NoA3-99 480

Maximum Flow (Domestic)	=	4 x ADWF
	=	5.68 L/s

### I/I Allowance

Allow 42 lots with 40m of gravity line at infiltration rate of 20m<sup>3</sup>/kmd  
ie 1680m @ 20m<sup>3</sup>/kmd

I/I Allowance	=	0.4 L/s
Total Flow	=	6.08L/s

### 1.4 Component Sizing

#### 1.4.1 Vacuum Main

The hydraulic head in the system is the summation of

- friction losses along the pipeline
- static losses at the "jump-ups" along the pipeline
- static lift losses at the pumping station

The layout has the following friction losses:

110 dia pipe 400m at 1.18L/s	0.34m
140 dia pipe 539m at 4.0L/s	0.68m
180 dia pipe 645m at 6.08L/s	0.97m
Sub Total	1.99
Static Losses at Jump Ups	<u>3.09</u>
Total	5.08m



Minimum vacuum required to operate valve	15Kpa
Vacuum losses available	51Kpa
System operating vacuum range	65 to 80Kpa

The system will therefore work satisfactorily in the range of 65Kpa to 80Kpa.

#### 1.4.2 Sewage Pumps

Select a sewage pump able to pump at a flow rate of 6.0L/s at a head of 22.2m.

Calculations of head at duty point:

Vacuum Head	7.0m
Friction losses in pump station	1.0m
Static lift at pump*	<u>14.2m</u>
Total Head	22.2m

\* BCC advise HGL @ pump station is 16.2m AHD

Select Hidrostral pump Model CO8O-LH

Estimated 24m @ 6.0L/s

NPSHR	2.75m
Sphere size	60mm
Suction dia	100mm
Outlet dia	80mm

#### 1.4.3 Vacuum Pumps

Two vacuum pumps required on a duty and standby basis (Clause 10.1 of Detail Specification)

Vacuum pump capacity is determined by air/liquid ratio. Select A/L ratio of 8.

Vacuum pump capacity	=	141m <sup>3</sup> /hr minimum
Operating vacuum range (design)	=	65 to 80Kpa

Provide Siemens ELMO-F 2BV 5111 rated at 230m<sup>3</sup>/hr assuming saturated air @ 20°C with operating liquid @ 15°C at discharge pressure of 1013mbar.

To reduce service liquid requirements add a partial recirculation discharge separator.

#### 1.4.4 Vacuum Vessel Capacity

Assume 10 starts per hour for sewage pupmps (CL11.1 of Detail Specification)

$$\begin{aligned}\text{Volume of Vacuum Vessel} &= V_t \\ \text{Volume of Active Part of Vessel} &= V_a\end{aligned}$$

Maximum number of starts occurs when the inflow is half of the sewage pump capacity.

$$\begin{aligned}\text{Time to fill} + \text{Time to empty} &= \frac{60}{10} \\ &= 6 \text{ minutes}\end{aligned}$$

$$\frac{V_a}{3.00} + \frac{V_a}{6.00-3.00} = 360 \text{ seconds}$$

$$\begin{aligned}\frac{2V_a}{V_a} &= 360 \times 3.0 = 1080L \\ &= 502L\end{aligned}$$

$$\begin{aligned}V_t &= 2.75 \times V_a \text{ (min)} \\ &= 1380L \text{ (min)}\end{aligned}$$

$$\text{Adopt Collection Tank Volume} = 1500L$$

Assume diameter . 900mm therefore length 2.36m  
1200mm therefore length 1.32m

Adopt a tank of 900mm dia approximately.

# RAUBERS ROAD BANYO VACUUM SEWERAGE SYSTEM FOR BRISBANE CITY COUNCIL

## ENVIRONMENTAL CONDITIONS

### VEGETATION PROTECTION

- TREES WITHIN 4m OF GENERAL MACHINE OPERATION SHOULD BE PROTECTED WITH TREE GUARDS. THESE COMPRISE RUBBER OR HARDWOOD CIRCLES CONSTRUCTED WITH 1.8m BATTENS CLOSELY SPACED AND ARRANGED VERTICALLY FROM GROUND LEVEL. CIRCLES SHOULD BE STRAPPED TO THE TREE PRIOR TO CONSTRUCTION AND REMAIN UNTIL COMPLETION.
- CONSTRUCTION VEHICLE ACTIVITY SHOULD BE LIMITED BY FENCING OF UNDISTURBED AREAS.
- WHERE POSSIBLE TREE ROOTS SHOULD BE TUNNELLED UNDER RATHER THAN SEVERED. IN THE EVENT OF ROOT DAMAGE, MAKE A CLEAN CUT ABOVE THE SEVERED ROOT AND TREAT THE ROOT WITH A SUITABLE FUNGICIDE.

### SOIL MANAGEMENT

- TOPSOIL AND SUBSOIL SHOULD BE STOCKPILED SEPARATELY.
- NO NET LOSS OF SEDIMENT SHOULD OCCUR FROM THE WORK SITE. THIS WILL NECESSITATE THE USE OF APPROPRIATE EROSION AND SEDIMENT CONTROLS. THESE SHOULD BE IMPLEMENTED AT THE SITE ESTABLISHMENT PHASE AND MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD.
- NO SOIL SHOULD BE STOCKPILED WITHIN 5m OF THE CREEK BANK OR WITHIN THE CREEK CHANNEL.
- CARE SHOULD BE TAKEN TO PREVENT SEDIMENT FROM ENTERING THE STORMWATER SYSTEM. THIS MAY INVOLVE PLACING APPROPRIATE SEDIMENT CONTROLS AROUND STOCKPILES AND/OR SILT TRAPS AROUND GULLIES.

### REHABILITATION

- PRE-DISTURBANCE SOIL PROFILES AND COMPACTION LEVELS ARE TO BE REINSTITATED.
- THE TRENCH AREA IS TO BE TOPSOILED AND SEEDED OR TURFED UPON COMPLETION OF WORKS.
- ALL DISTURBED AREAS ARE TO BE LEFT IN A STABLE CONDITION.
- ALL PLANTINGS WILL NEED TO BE MAINTAINED THROUGHOUT THE ESTABLISHMENT PHASE.

PLEASE NOTE THAT ALL ENVIRONMENT PROTECTION MEASURES SHOULD BE IMPLEMENTED PRIOR TO ANY CONSTRUCTION WORK, INCLUDING CLEARING, COMMENCING.  
FOR FURTHER INFORMATION PLEASE CONTACT BILL MANNERS OR SUSAN STEWART ON 3403 9585.

NAME OF ESTATE	-
SUB PLAN No.	-
No. OF ALLOTMENTS	-
AREA IN Ha.	-
TOTAL LENGTH OF SEWERS	Ø100mm -
	Ø150mm -
	Ø225mm -
	Ø300mm -
RETICULATION No.	-
BCC DELEGATES APPROVAL DATE	
BCC SEWER LIVE WORKS ORDER No.	

VACUUM PUMPING STATION SEE DRG. 233-CB

DETAIL PLAN SHEET 1 3016/33189-85

DETAIL PLAN SHEET 2 3016/33189-86

DETAIL PLAN SHEET 3 3016/33189-87

COMPOSITE PLAN  
1:2500

## DRAWING LIST

3016/33189-84	TITLE SHEET, COMPOSITE PLAN AND DRAWING LIST
3016/33189-85	DETAIL PLAN SHEET 1 OF 3
3016/33189-86	DETAIL PLAN SHEET 2 OF 3
3016/33189-87	DETAIL PLAN SHEET 3 OF 3
3016/33189-88	VACUUM MAINS LONGITUDINAL SECTIONS SHEET 1 OF 3
3016/33189-89	VACUUM MAINS LONGITUDINAL SECTIONS SHEET 2 OF 3
3016/33189-90	VACUUM MAINS LONGITUDINAL SECTIONS SHEET 3 OF 3
3016/33189-91	PUMPING STATION ARRANGEMENT
3016/33189-92	PUMPING STATION STRUCTURAL DETAILS (NOT INCLUDED IN THIS APPROVAL)
3016/33189-93	BRANCH LAYOUT AND DETAILS
3016/33189-94	COLLECTION CHAMBER AND DETAILS

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D	COUNCIL'S COMMENTS INCORPORATED	BE 09/12/96
C	GENERAL AMENDMENTS	BE 13/11/96
B	CLIENTS COMMENTS INCORPORATED	BE 31/10/96
A	ISSUED FOR APPROVAL	BE 19/9/96
Mk	Details of Amendment	Approved

COUNCIL DELEGATE (BRISBANE WATERS)

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P O Box 82  
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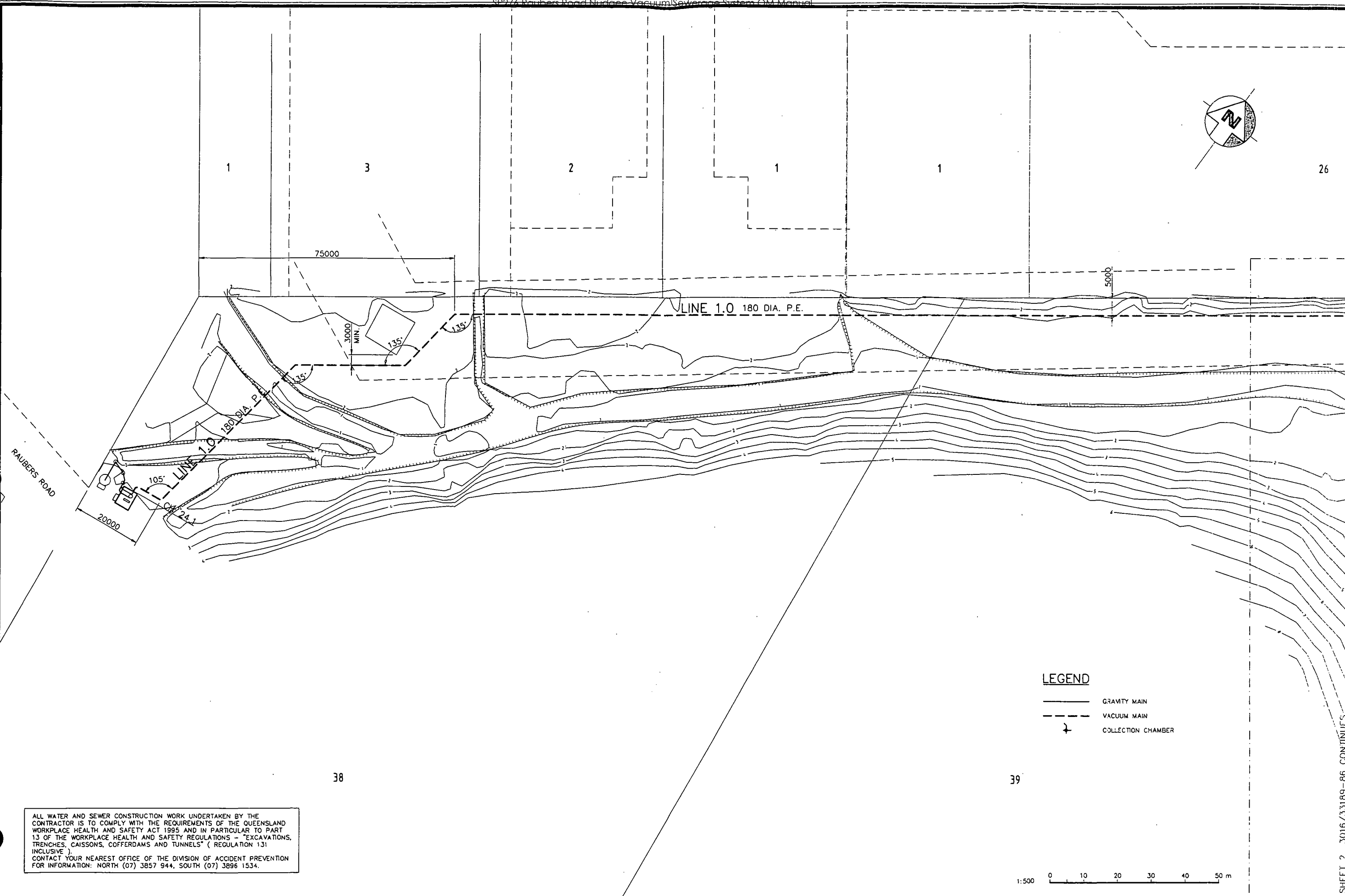
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Project: RAUBERS ROAD BANYO  
VACUUM SEWERAGE SYSTEM

Designed: BE Drawn: SAC Checked: [Drill] [Eng] Approved:

TITLE SHEET  
COMPOSITE PLAN  
AND DRAWING LIST

Drawing No.  
3016/33189-84  
Amendment  
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Cdd File No.  
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Page 11 of 136



# LEGEND

- GRAVITY MAIN
- - - VACUUM MAIN
- + COLLECTION CHAMBER

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ALL WATER AND SEWER CONSTRUCTION WORK UNDERTAKEN BY THE CONTRACTOR IS TO COMPLY WITH THE REQUIREMENTS OF THE QUEENSLAND WORKPLACE HEALTH AND SAFETY ACT 1995 AND IN PARTICULAR TO PART 13 OF THE WORKPLACE HEALTH AND SAFETY REGULATIONS - "EXCAVATIONS, TRENCHES, CAISSONS, COFFERDAMS AND TUNNELS" (REGULATION 131 INCLUSIVE).  
CONTACT YOUR NEAREST OFFICE OF THE DIVISION OF ACCIDENT PREVENTION FOR INFORMATION: NORTH (07) 3857 944, SOUTH (07) 3896 1534.

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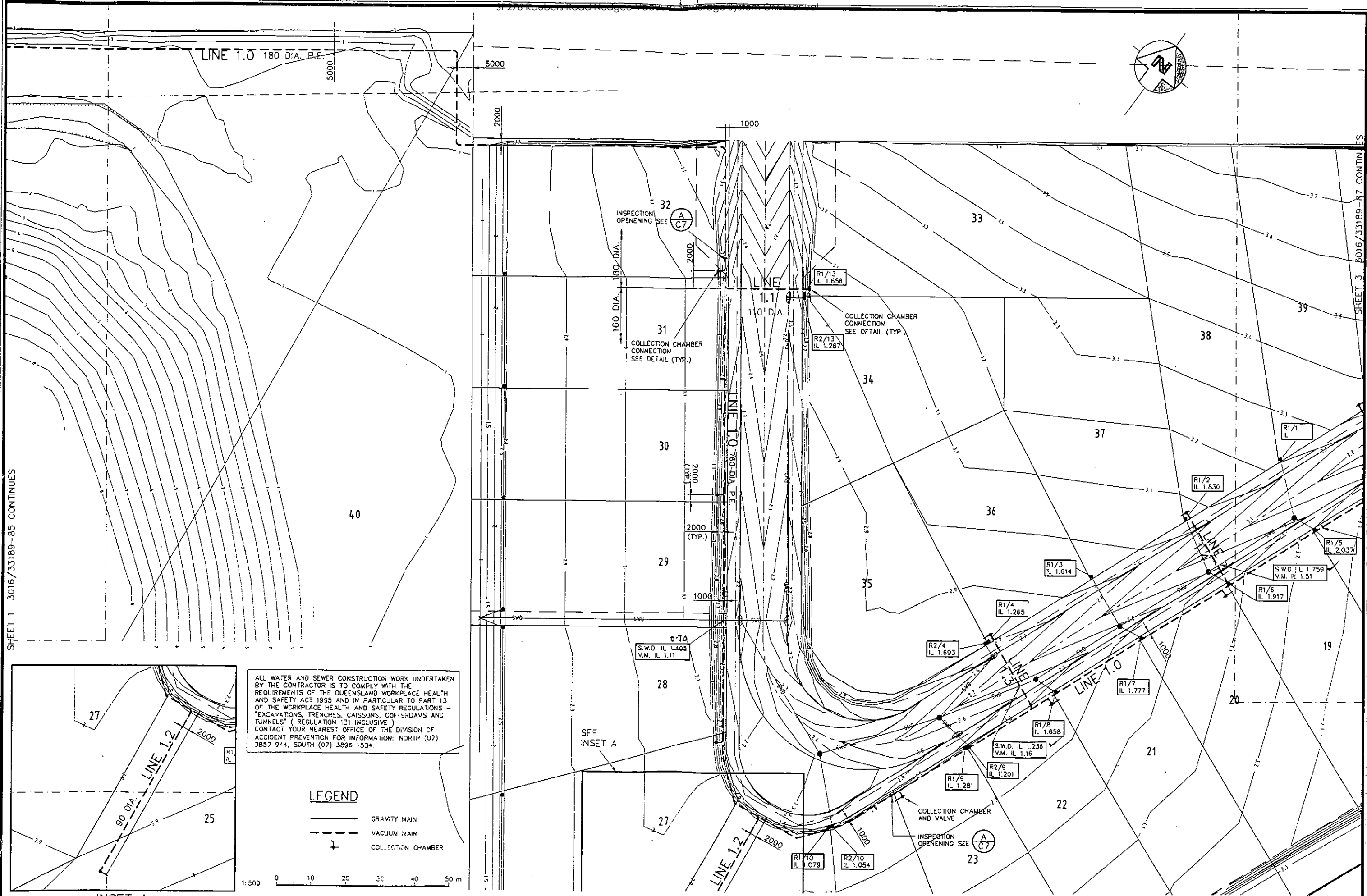
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ACN 003 215 692 NSW Australia Fax: (612) 8956 7258  
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Drawn	SAC
Checked (DRAFT)	
Eng	
Approved	

DETAIL PLAN  
SHEET 1 OF 3

Drawing No.	3016/33189-85
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Cad File No.	12/01/96

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SHEET 1 3016/33189-85 CONTINUES

SHEET 3 3016/33189-87 CONTINUES

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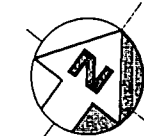
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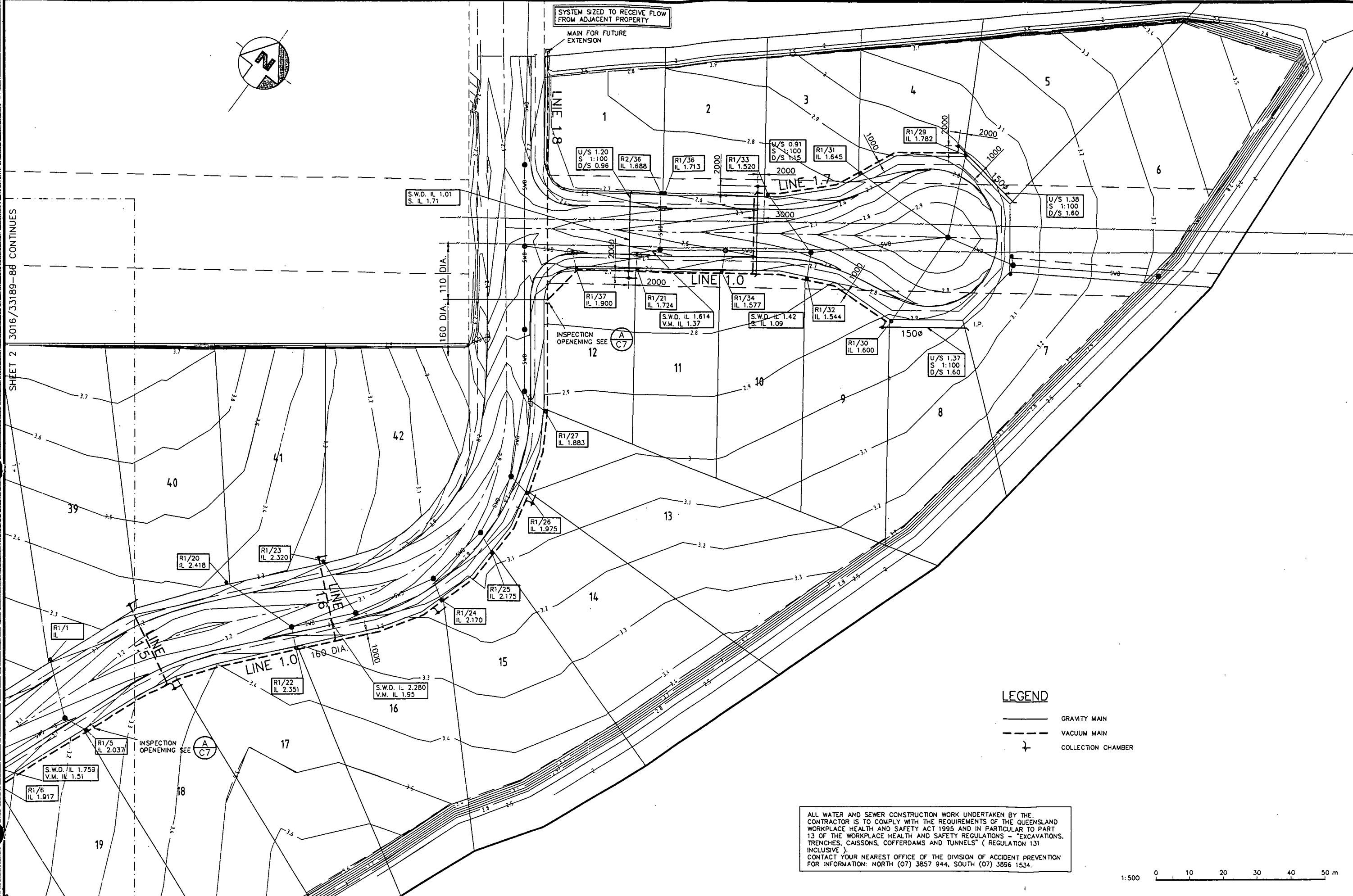
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DETAIL PLAN  
SHEET 2 OF 3

Drawing No. 3016/33189-86  
Amendment D  
Page 88 of 128



SHEET 2 3016/33189-88 CONTINUES



## LEGEND

- GRAVITY MAIN  
 --- VACUUM MAIN  
 ⊕ COLLECTION CHAMBER

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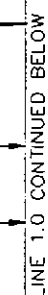
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VACUUM SEWERAGE SYSTEM

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DETAIL PLAN  
SHEET 3 OF 3

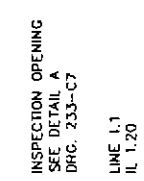
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Page 19 of 136



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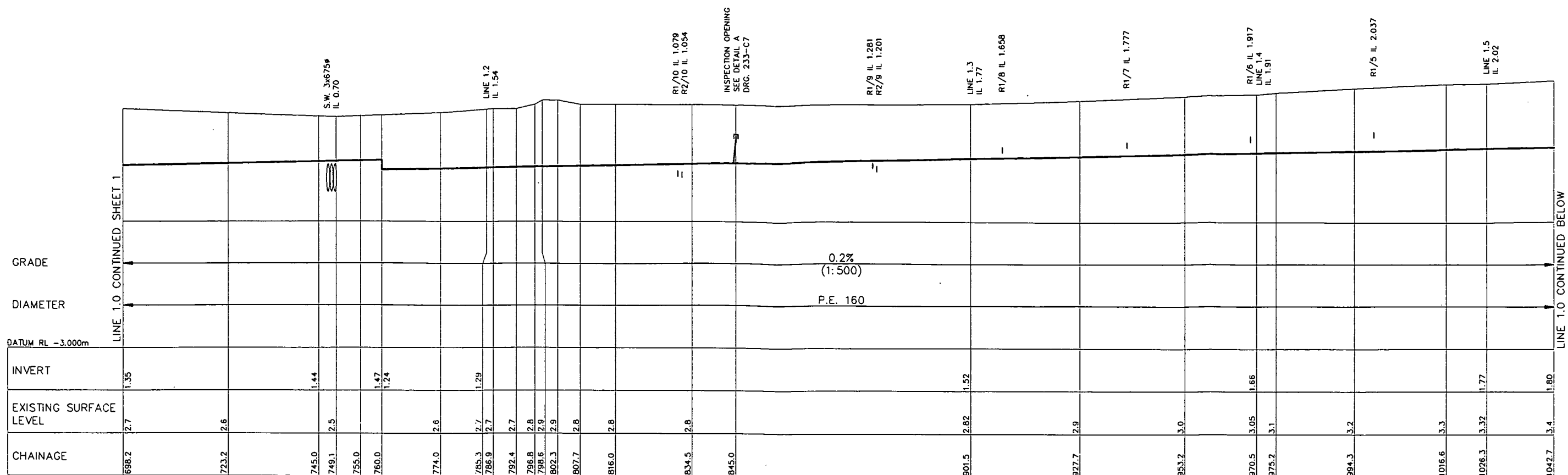
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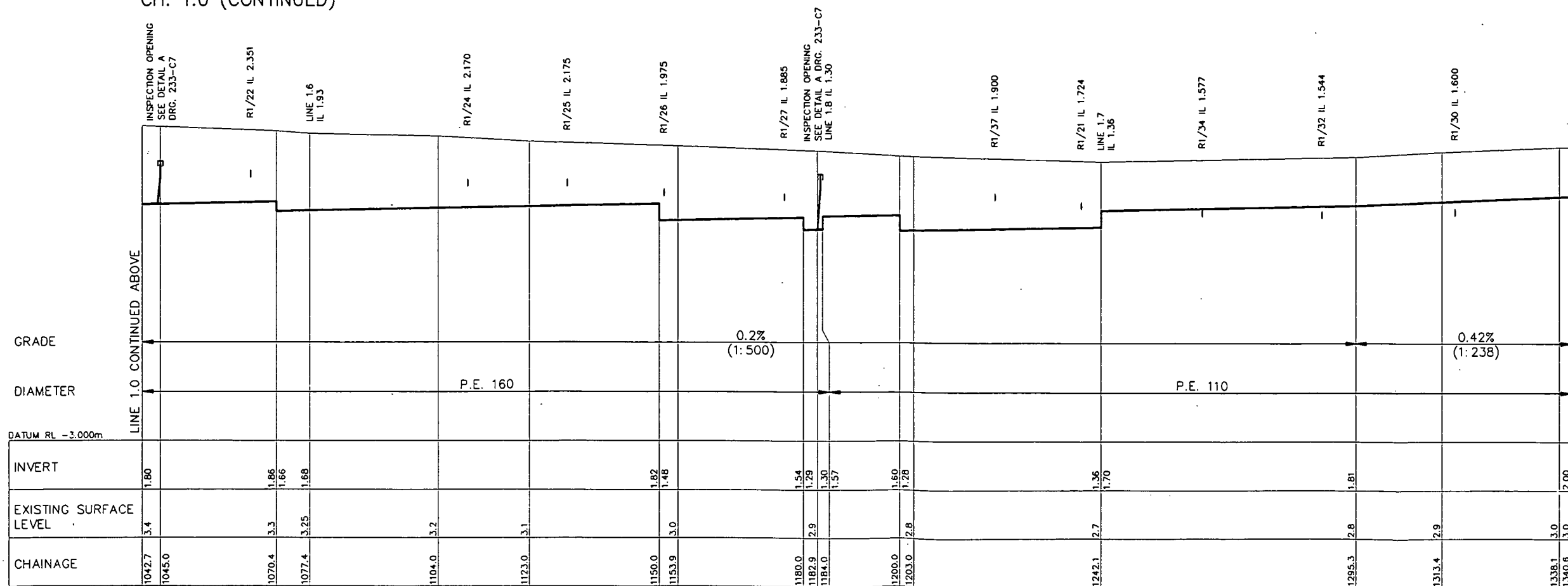
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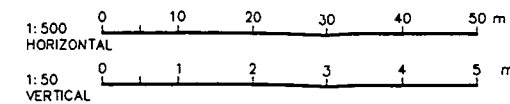




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CH. 1.0 (CONTINUED)



## NOTES:

- MINIMUM COVER ON VACUUM MAIN:  
900mm IN FOOTWAY/PRIVATE PROPERTY.  
1000mm IN ROADWAY.

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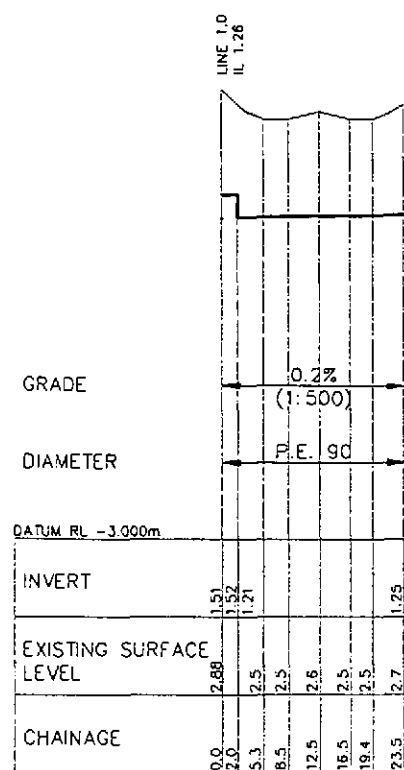
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VACUUM SEWERAGE SYSTEMDesigned: BE Drawn: SAC Checked (Drill): (Eng): Approved: *[Signature]*

VACUUM MAINS  
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SHEET 2 OF 3

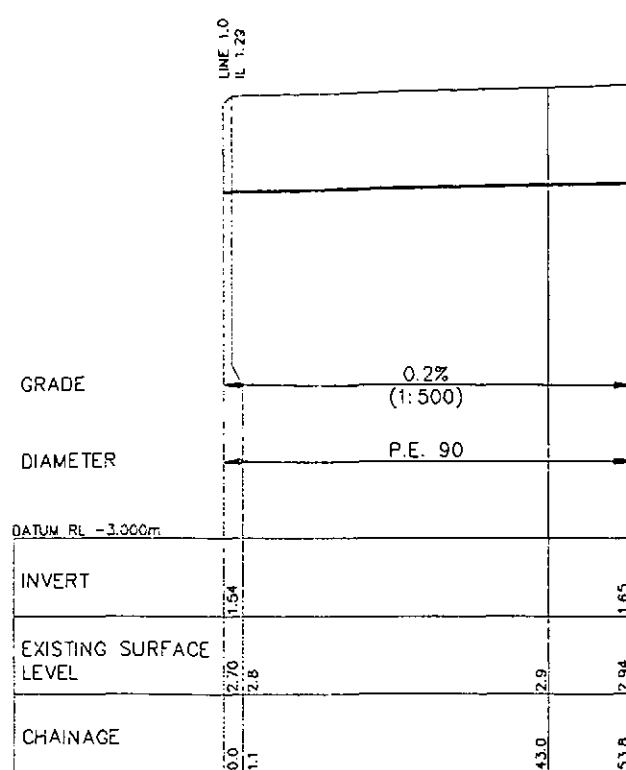
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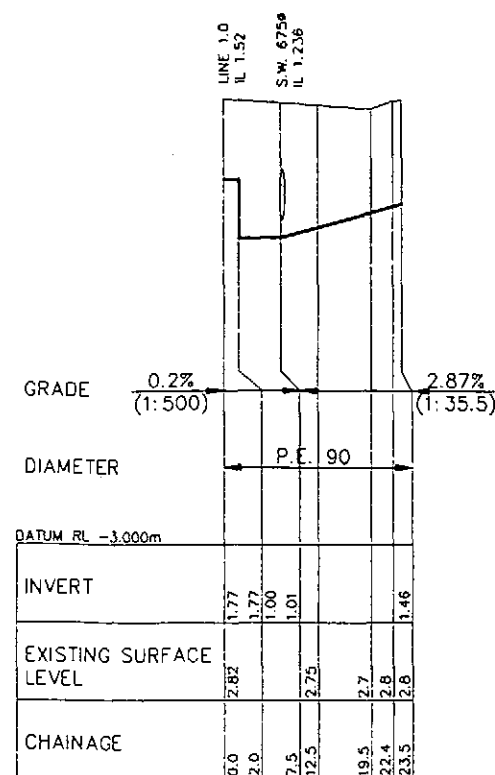
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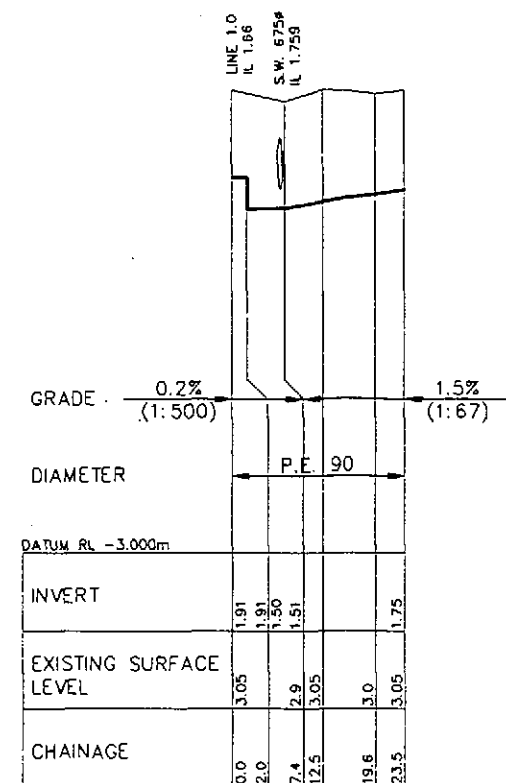
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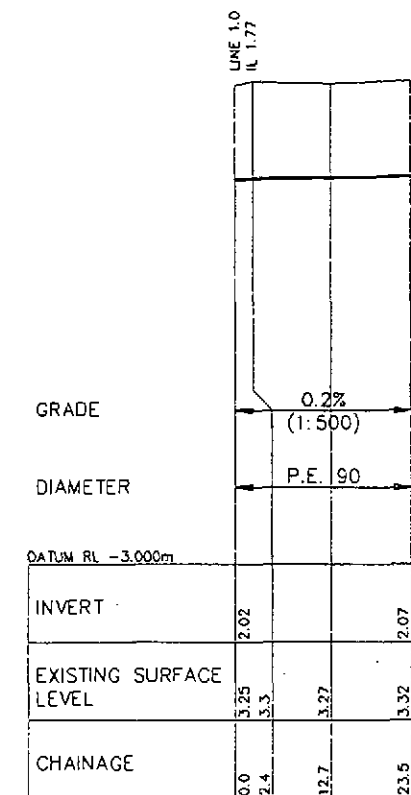
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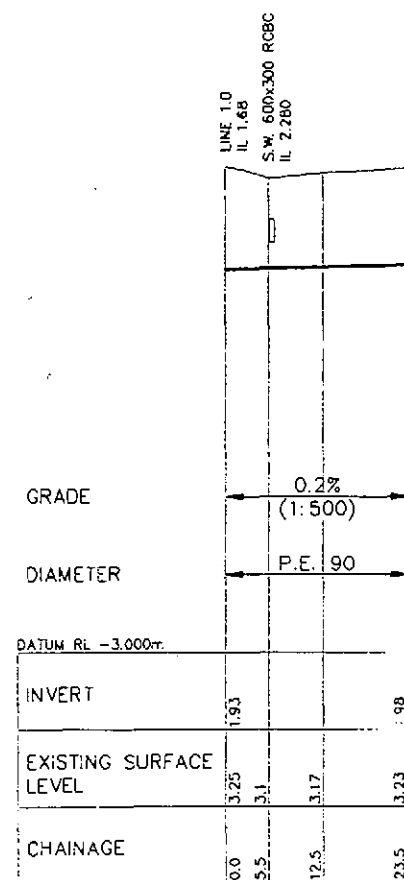
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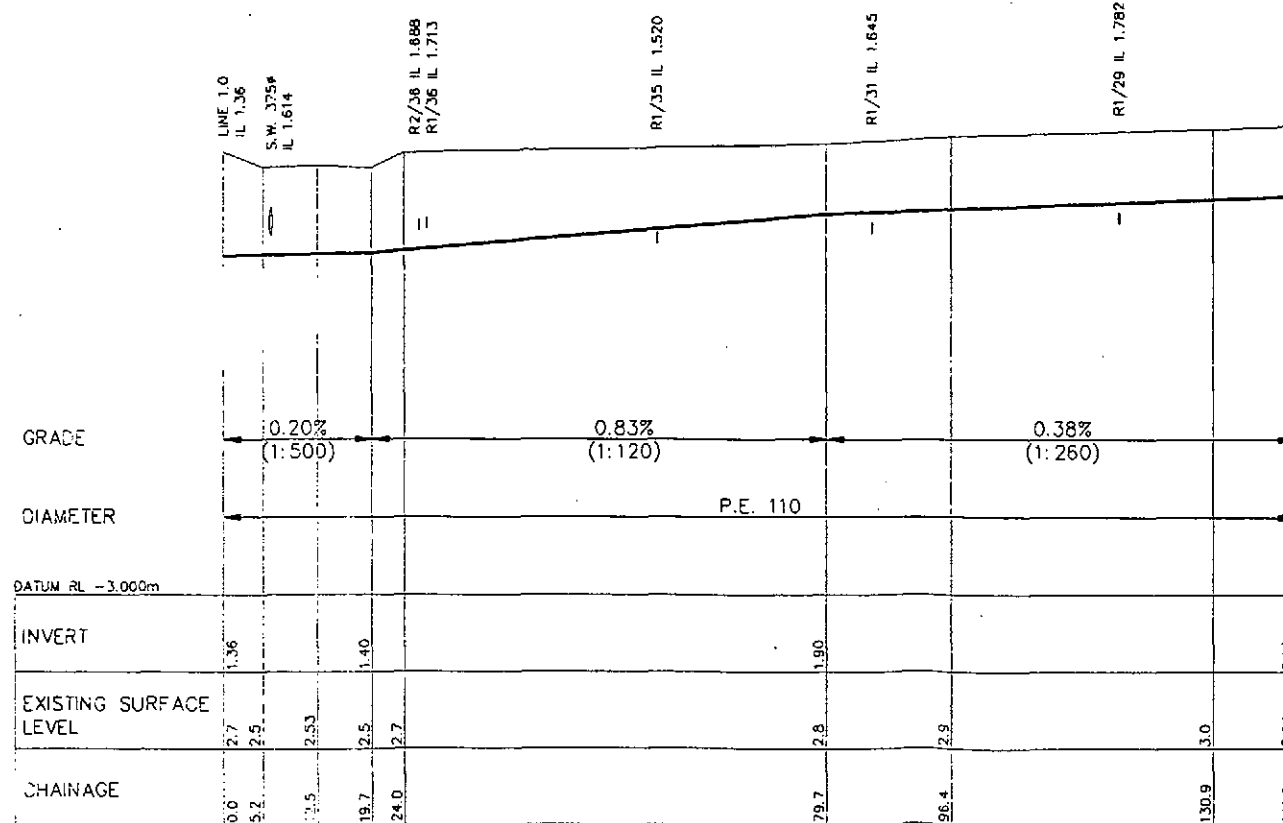
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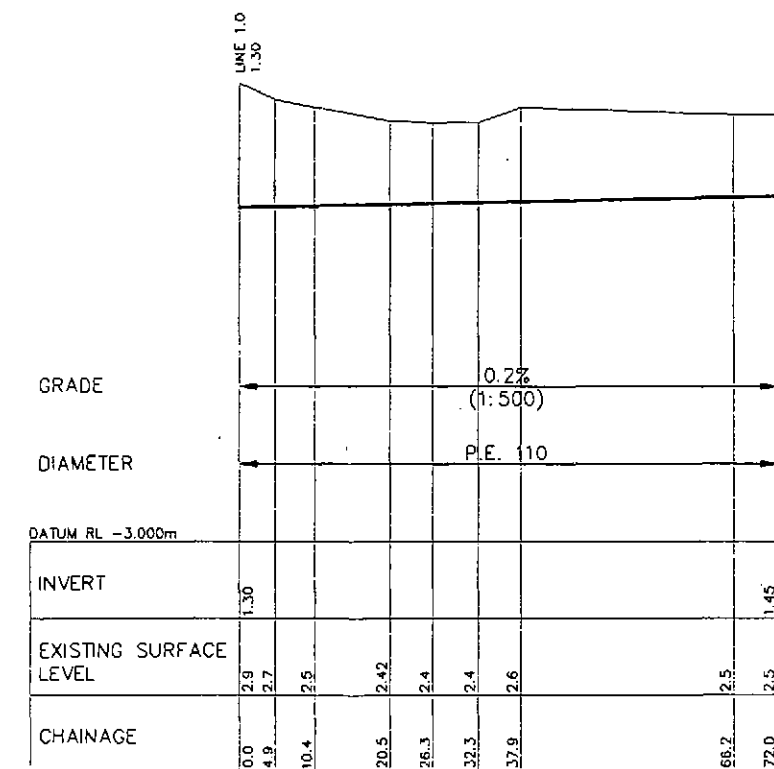
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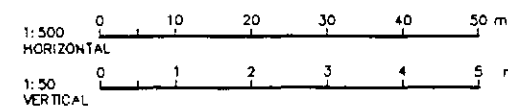
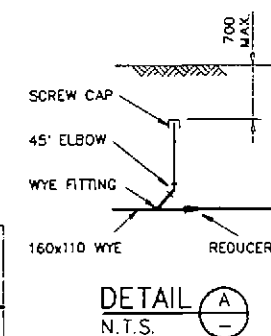
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CH. 1.7



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VACUUM SEWERAGE SYSTEM

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VACUUM MAINS  
LONGITUDINAL SECTIONS  
SHEET 3 OF 3

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3018/33189-90

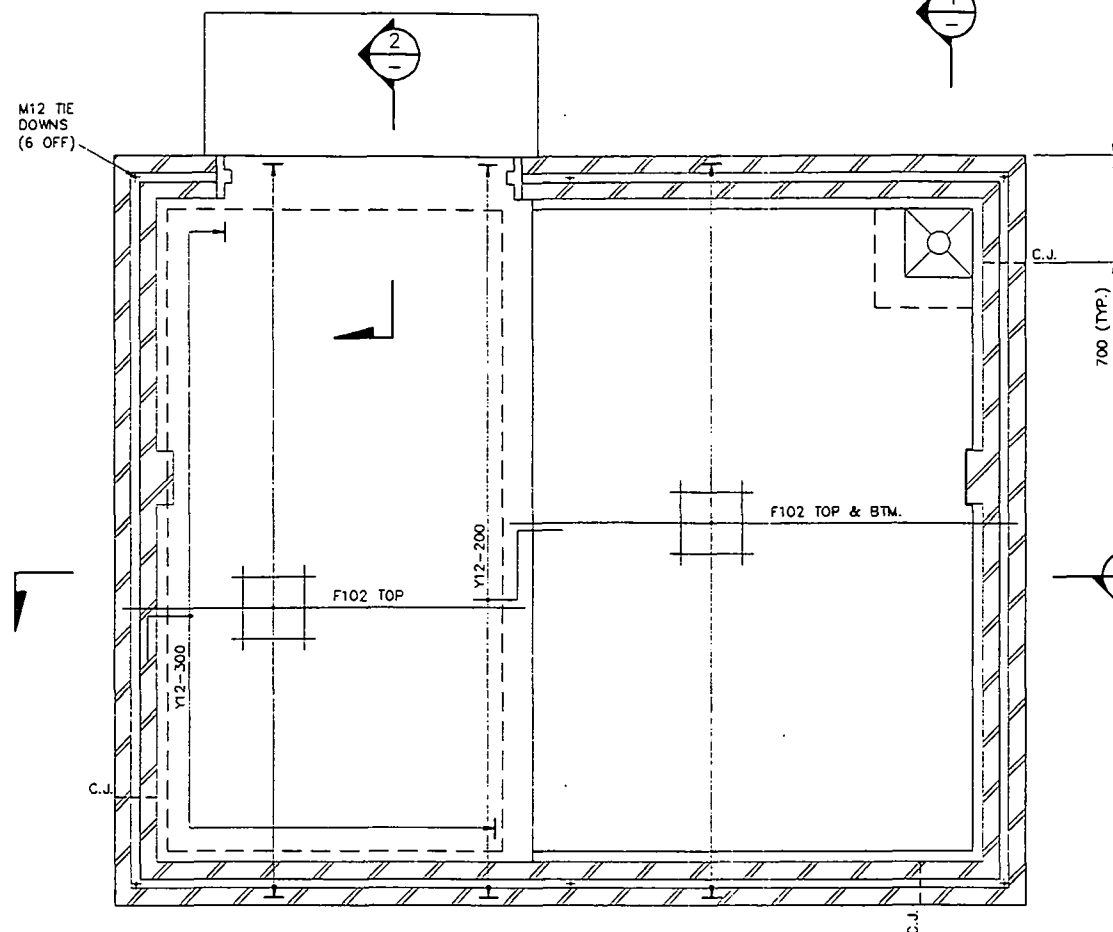
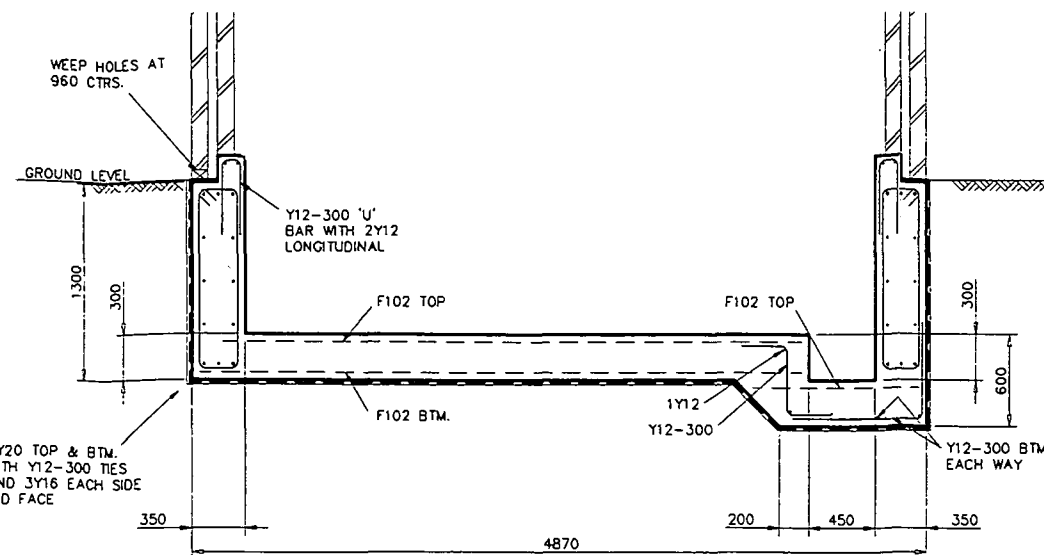
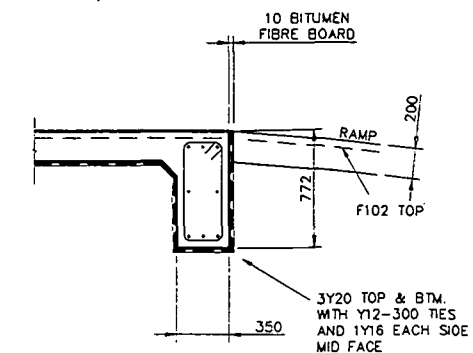
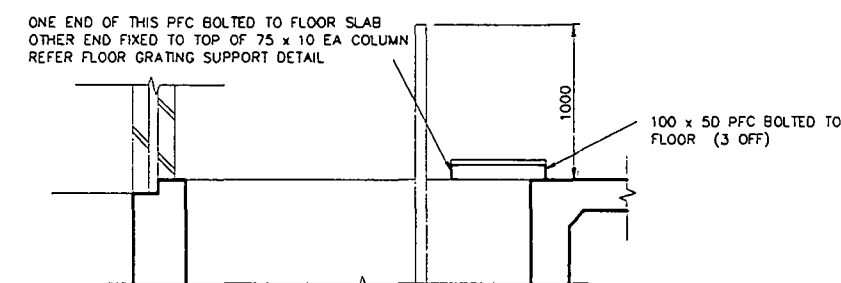
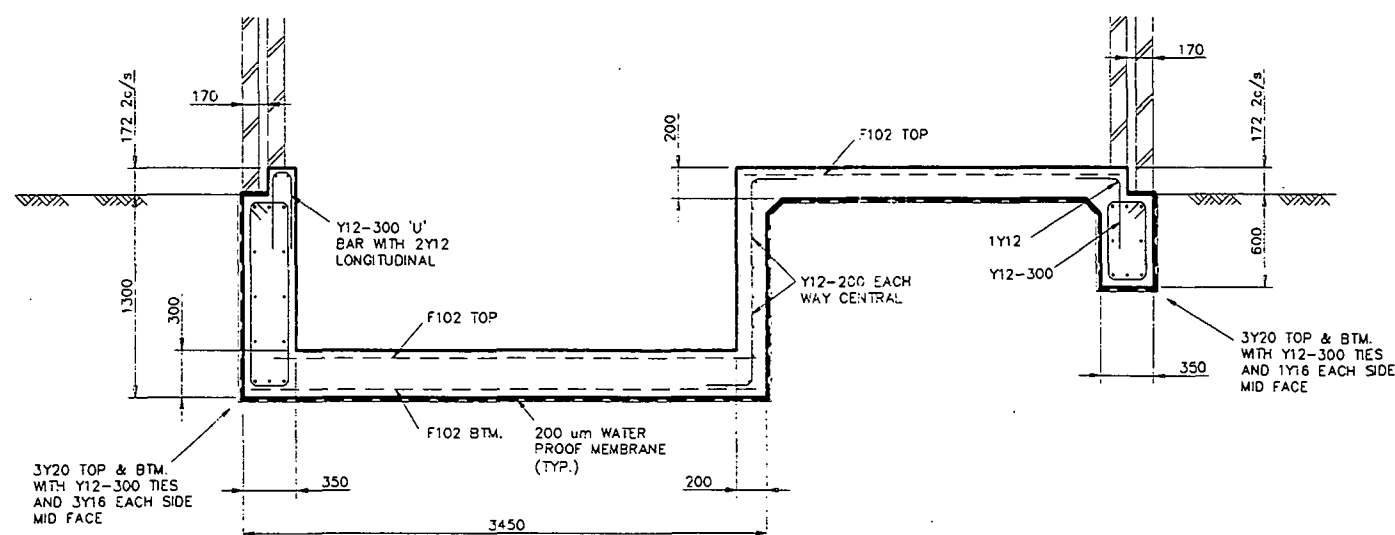
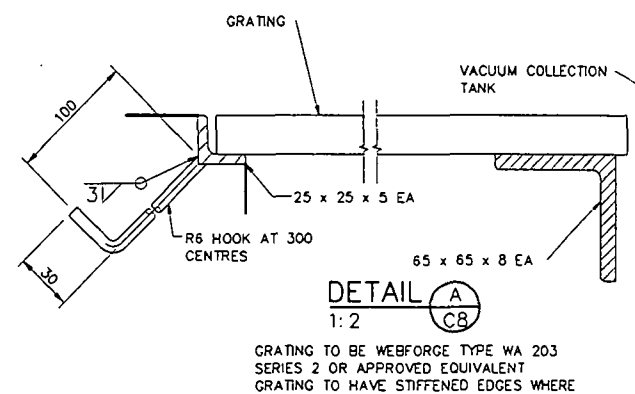
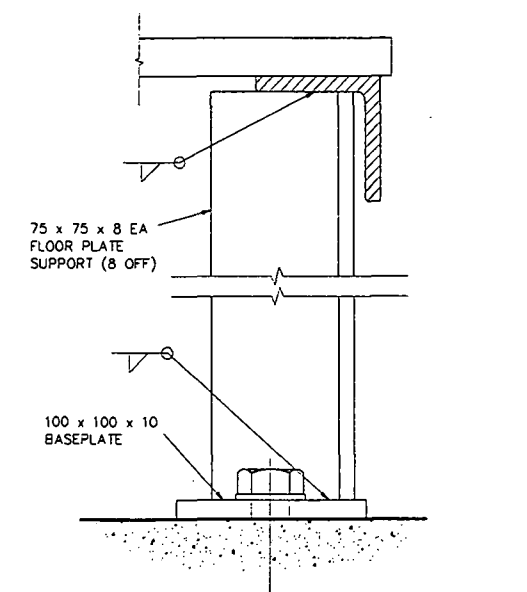
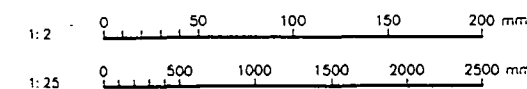
Amendment

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Ced File No.

9609-C5

Page 16 of 136

PLAN  
1:25SECTION 1  
1:25SECTION 2  
1:25SECTION 4  
1:25SECTION 3  
1:25DETAIL A  
1:2FLOOR GRATING SUPPORT COLUMN  
1:2

Mk	Details of Amendment	Approved
C	COUNCIL'S COMMENTS INCORPORATED	BE 09/12/96
B	GENERAL AMENDMENTS	BE 13/11/96
A	ISSUED FOR APPROVAL	BE 19/9/96

COUNCIL DELEGATE (BRISBANE WATERS)

THIS DRAWING IS VALID FOR 12 MONTHS  
FROM DATE OF SIGNING BY B.C.C.Edwards  
Environmental  
Enterprises  
Pty LtdP O Box 82  
Castlereag 2068 Tel: (612) 9958 3904  
NSW Australia Fax: (612) 9958 7258

ACN 003 215 692

EGE

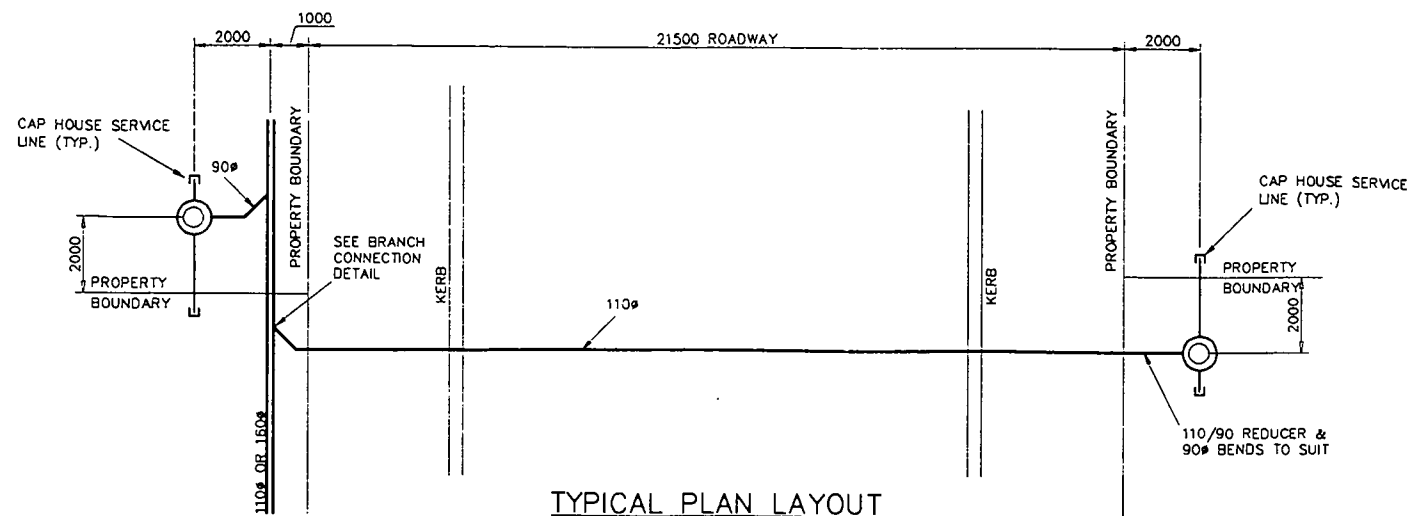
Client  
BRISBANE CITY COUNCILProject  
RAUBERS ROAD BANYO  
VACUUM SEWERAGE SYSTEMDesigned  
BEDrawn  
SACChecked  
(Drill)

(Eng)

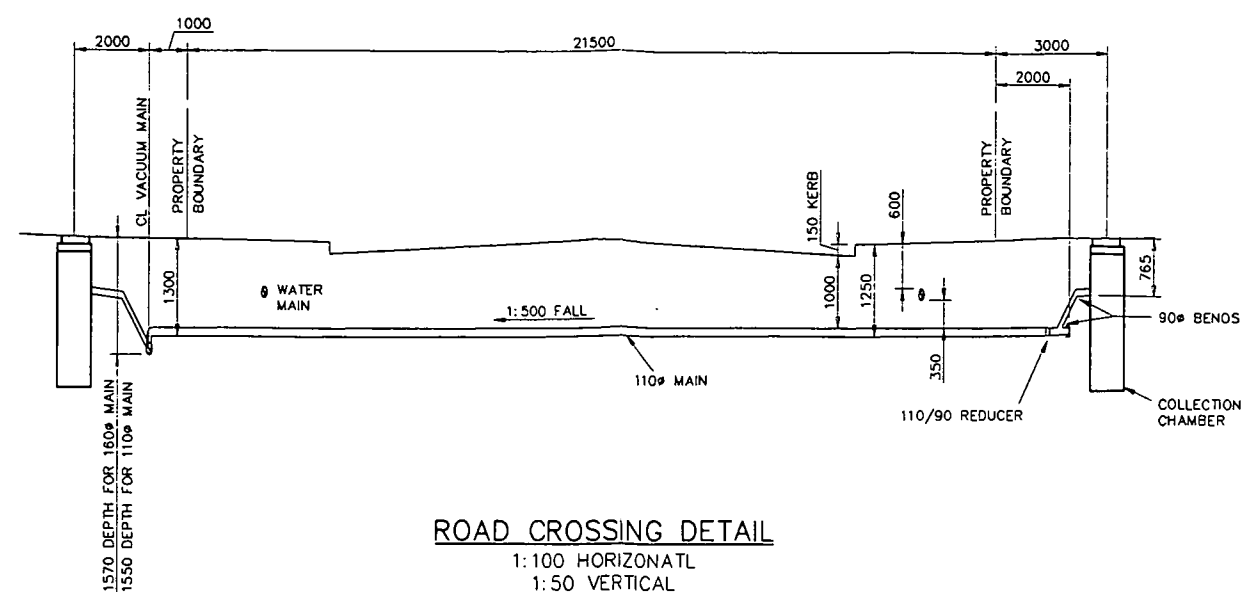
Approved

PUMPING STATION  
STRUCTURAL DETAILSDrawing No.  
3016/33189-92Amendment  
CCdd File No.  
9609-CF

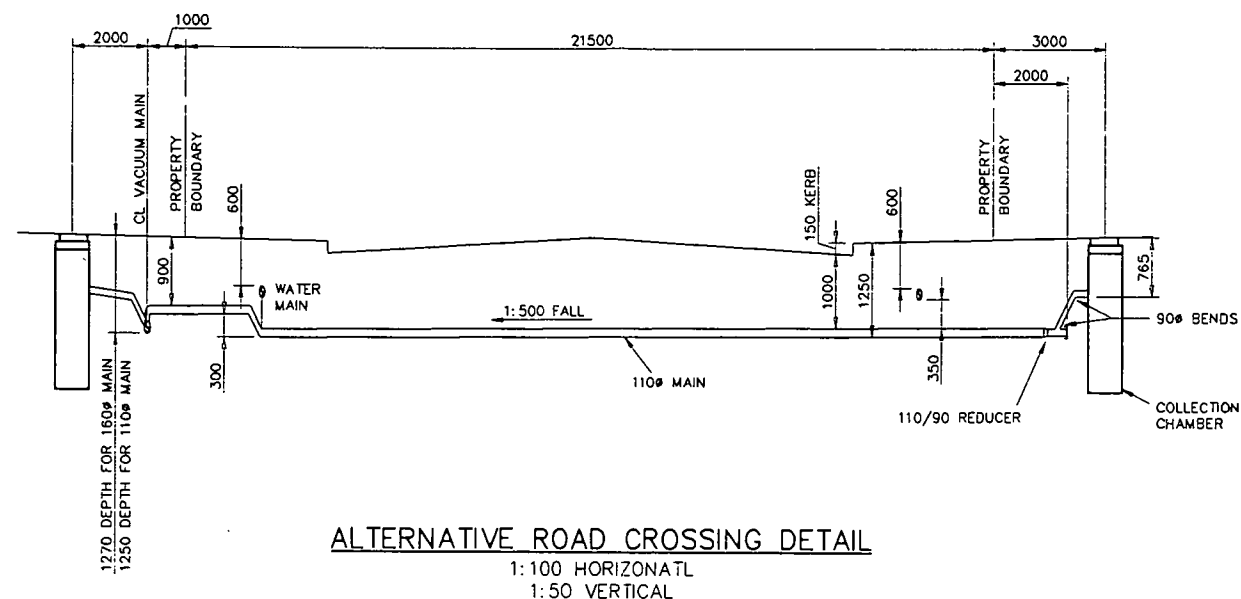
Page 19 of 136



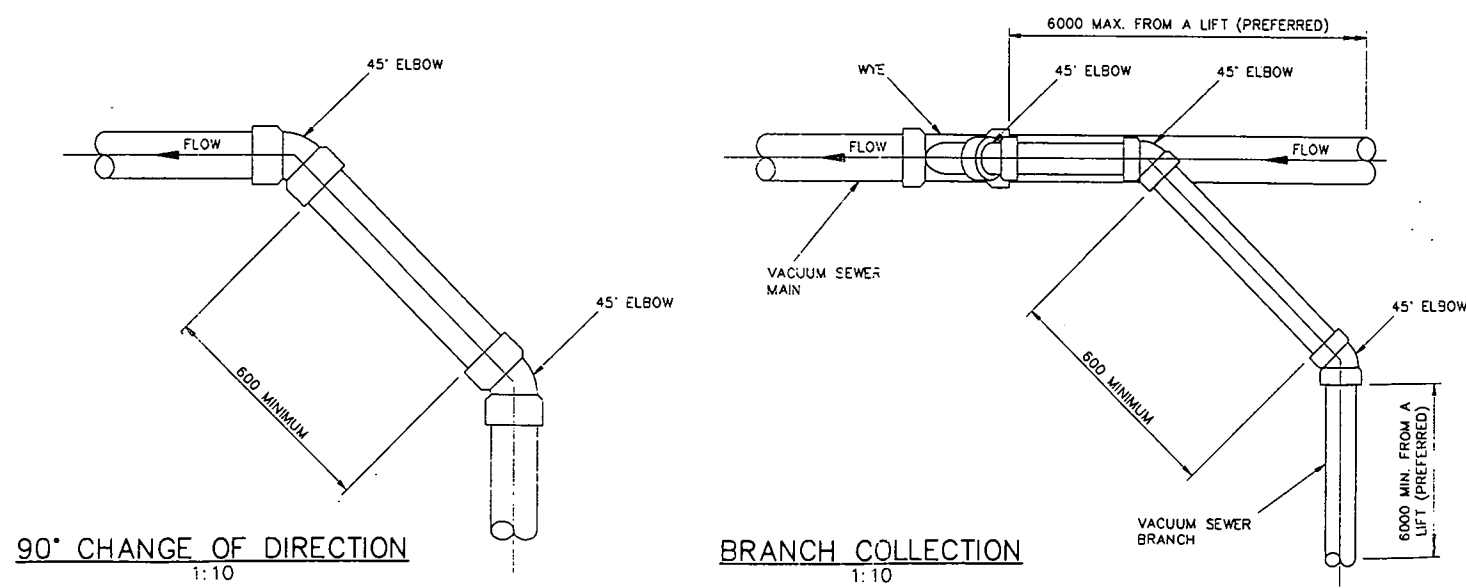
TYPICAL PLAN LAYOUT  
COLLECTION CHAMBERS INSTALLED  
1:100



ROAD CROSSING DETAIL  
1:100 HORIZONTAL  
1:50 VERTICAL

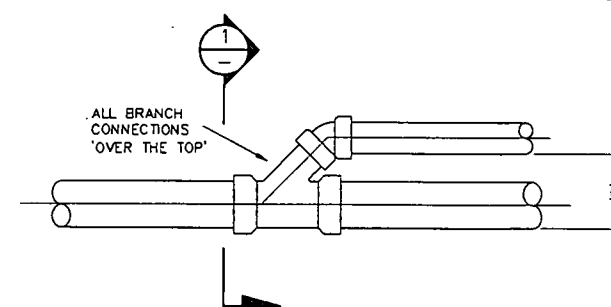


ALTERNATIVE ROAD CROSSING DETAIL  
1:100 HORIZONTAL  
1:50 VERTICAL



90° CHANGE OF DIRECTION  
1:10

BRANCH COLLECTION  
1:10



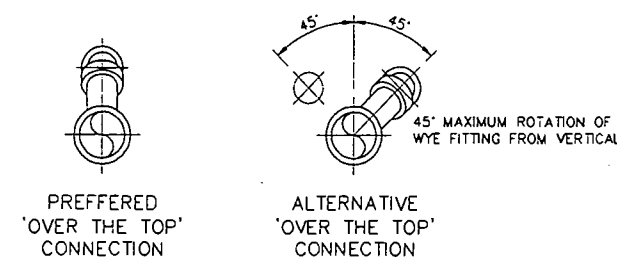
BRANCH TO MAIN CONNECTION  
1:10

MAIN	x	BRANCH	'D' mm*
160	x	110	270
160	x	90	250
110	x	110	250
110	x	90	200

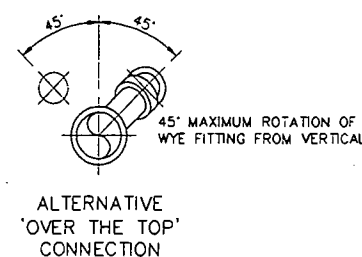
\* ASSUMED DIMENSION

NOTES:

- ALL CHANGES IN DIRECTION ARE TO BE MADE WITH 45° ELBOW OR LESSER DEVIATION.

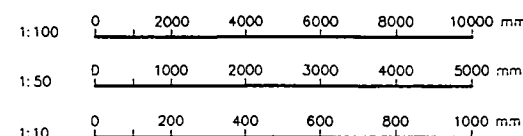


PREFERRED  
'OVER THE TOP'  
CONNECTION



ALTERNATIVE  
'OVER THE TOP'  
CONNECTION

SECTION 1  
1:10



C	COUNCIL'S COMMENTS INCORPORATED	BE 09/12/96
B	GENERAL AMENDMENTS	BE 13/11/96
A	ISSUED FOR APPROVAL	BE 19/9/96
Mk	Details of Amendment	Approved

COUNCIL DELEGATE (BRISBANE WATERS)  
THIS DRAWING IS VALID FOR 12 MONTHS  
FROM DATE OF SIGNING BY B.C.C

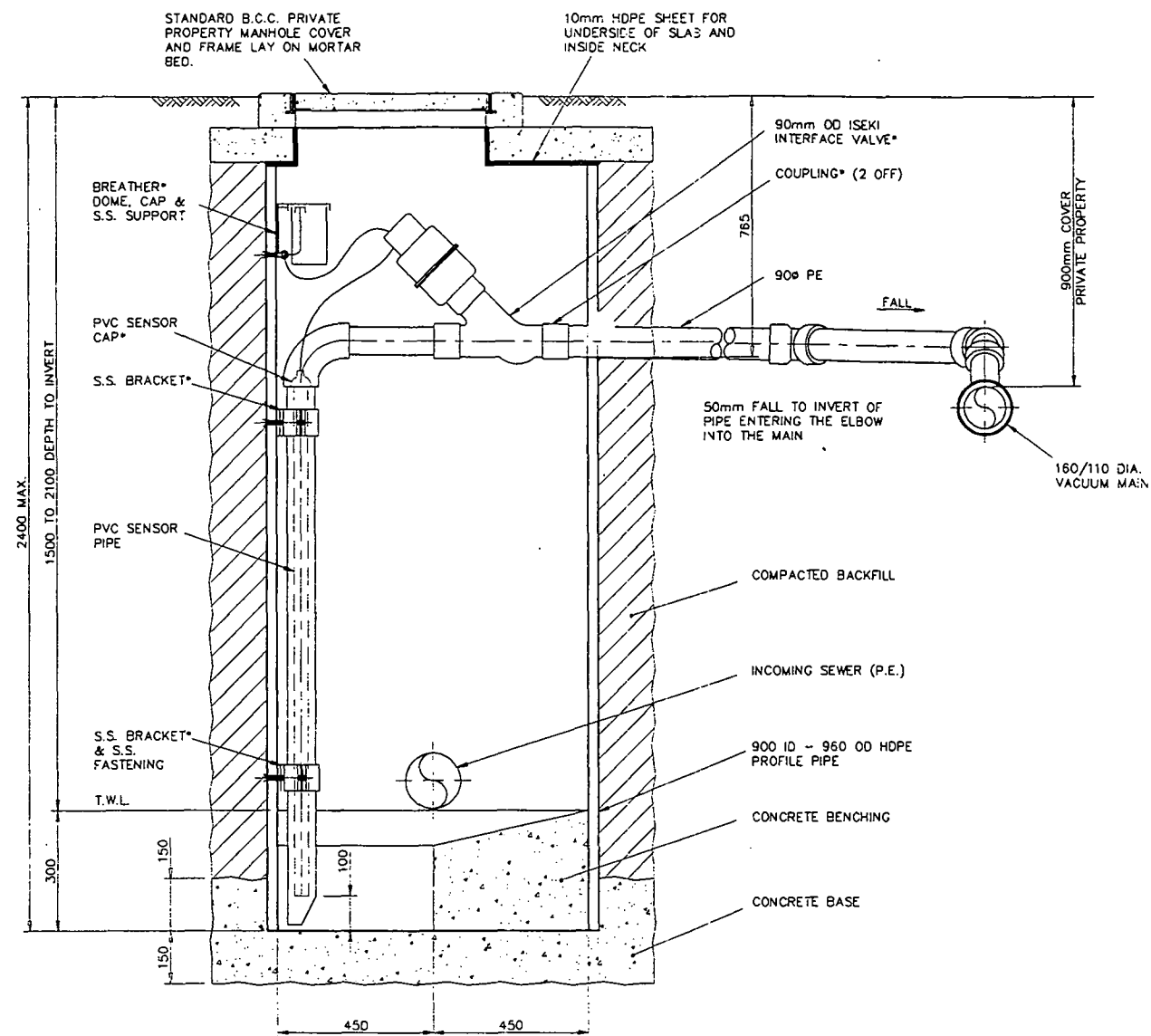
Edwards  
Environmental  
Enterprises  
Pty Ltd  
P O Box 82  
Castletown 2068 Tel: (612) 9958 3904  
ACN 003 215 892 NSW Australia Fax: (612) 9958 7258

eee

Client	BRISBANE CITY COUNCIL
Project	RAUBERS ROAD BANYO VACUUM SEWERAGE SYSTEM
Designed	BE
Drawn	SAC
Checked	UDratt
Eng	Eng
Approved	

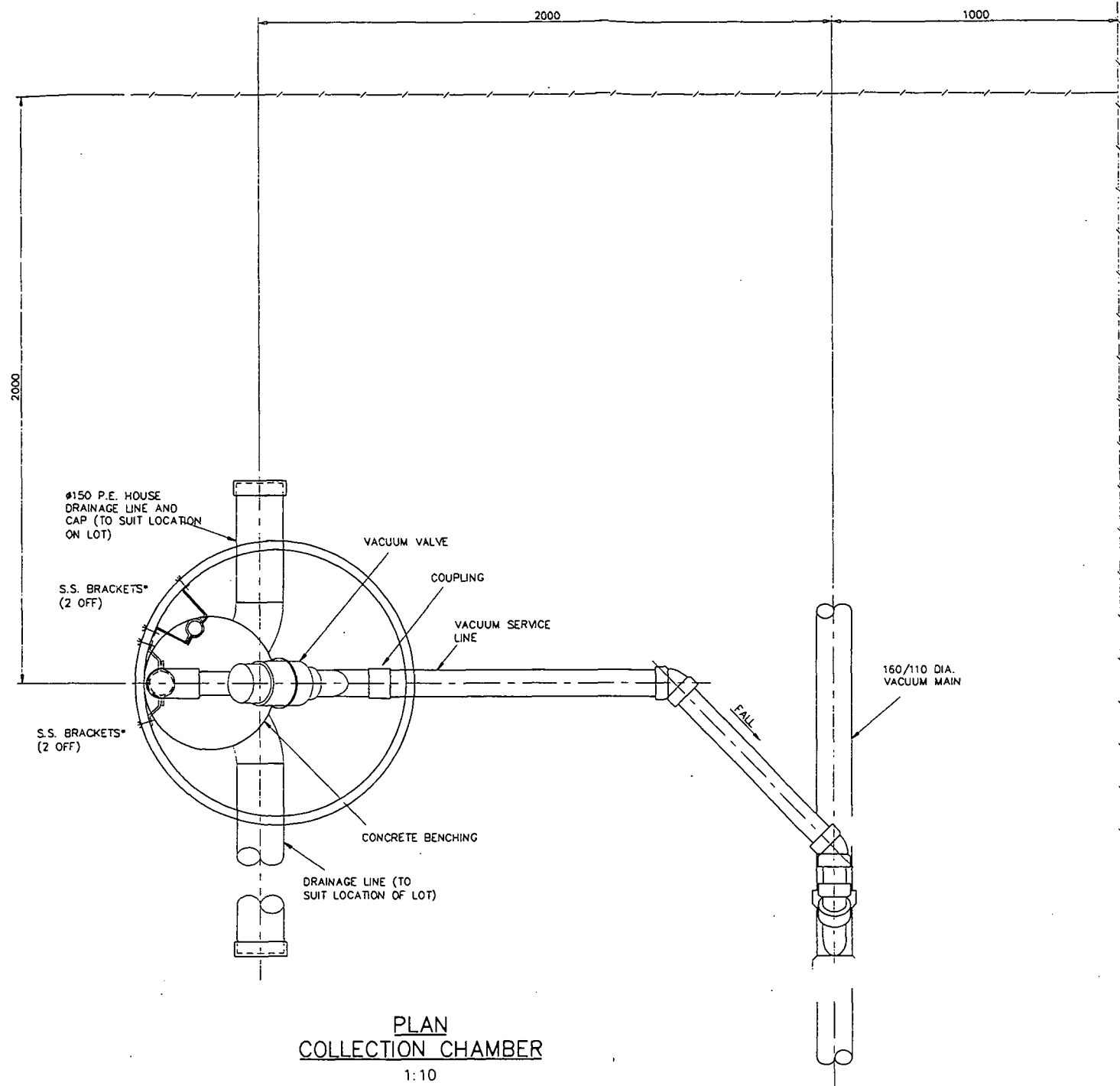
BRANCH LAYOUT  
AND  
DETAILS

Drawing No.  
3016/33189-93  
Amendment  
C  
Page 20 of 136



TYPICAL SECTION  
COLLECTION CHAMBER

1:10



PLAN  
COLLECTION CHAMBER

1:10

NOTE: ITEM SHOWN \* SUPPLIED BY EDWARDS ENVIRONMENTAL ENTERPRISES PTY LTD AND INSTALLED BY CONTRACTOR.

1:10 0 200 400 600 800 1000 mm

Mk	Details of Amendment	Approved
C	COUNCIL'S COMMENTS INCORPORATED	09/12/96
B	GENERAL AMENDMENTS	BE 13/11/96
A	ISSUED FOR APPROVAL	BE 19/5/96

COUNCIL DELEGATE (BRISBANE WATERS)

THIS DRAWING IS VALID FOR 12 MONTHS  
FROM DATE OF SIGNING BY B.C.C.

Edwards  
Environmental  
Enterprises  
Pty Ltd

P O Box 82  
Castlecrag 2068 Tel: (612) 9958 3904  
ACN 003 215 692 NSW Australia Fax: (612) 9958 7258

EGE

Client  
BRISBANE CITY COUNCIL

Project  
RAUBERS ROAD BANYO  
VACUUM SEWERAGE SYSTEM

Designed  
BE  
Drawn  
SAC  
Checked (Draft)  
(Eng.)  
Approved

COLLECTION CHAMBER  
AND  
DETAILS

Drawing No.

3016/33189-94

Amendment

C

Cell File No.

9506-C11

Page 21 of 136



### Major clients

EEE has worked with many clients including:

Sydney Water  
NSW Department of Public Works  
and Services  
Hunter Water Corporation  
Brisbane City Council  
Water Corporation of Western Australia  
Works Australia  
Brunei Government  
South Gippsland Regional Water Authority  
Gutteridge Haskins & Davey  
Airey Ryan & Hill  
Ove Arup  
CMP-HAMZAH  
Sinclair Knight Merz  
as well as many local and interstate  
developers and contractors.



**Edwards  
Environmental  
Enterprises  
Pty Ltd**

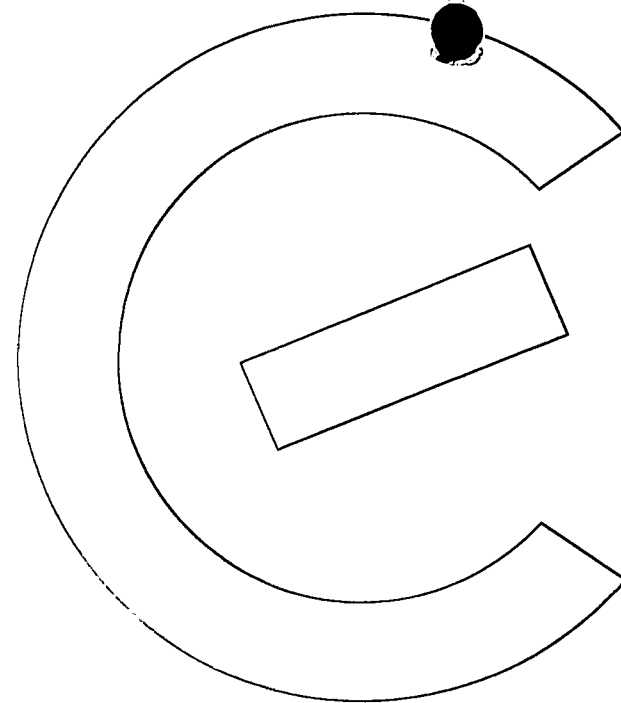
ACN 003 215 692

Bob Edwards  
Bachelor of Engineering (civil)  
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Castlecrag 2068

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# Vacuum Sewerage Systems

**Edwards  
Environmental  
Enterprises  
Pty Ltd**

# Edwards Environmental Enterprises Pty Ltd

Edwards Environmental Enterprises Pty Ltd (EEE) is responsible for many of the vacuum sewerage schemes constructed in Australia and South East Asia. We have been involved with designing and implementing vacuum sewerage systems since 1987.

EEE works with clients to achieve their goals, right through from evaluating the appropriateness of vacuum sewerage technology, to systems design, construction, training and maintenance documentation. We use state-of-the-art data logging equipment for evaluation and design verification of systems.

Bob Edwards has undertaken several study tours to talk to designers, associated valve suppliers, operating authorities and managers of existing schemes to further his understanding of vacuum sewerage technology.

	investigation	concept design	cost estimate	detail design	construction overview	commissioning	operation manual	training program	system evaluation
<b>NSW</b>									
Barrenjoey		✓	✓	✓	✓	✓	✓	✓	
Davistown		✓	✓	✓	✓	✓	✓	✓	
Davistown extn		✓	✓	✓	✓	✓	✓	✓	
Fishing point	✓	✓	✓	✓	✓	✓	✓	✓	
Kurnell		✓	✓	✓	✓	✓	✓	✓	
St Huberts Island									✓
Sandgate		✓	✓	✓	✓	✓	✓	✓	
West Byron—Stage 1	✓	✓	✓	✓	✓	✓	✓	✓	
West Gosford		✓	✓	✓	✓	✓	✓	✓	
<b>Queensland</b>									
Banyo	✓	✓	✓	✓	✓	✓	✓	✓	
Bribie Island	✓	✓	✓	✓	✓	✓	✓	✓	
Parker Island	✓	✓	✓	✓	✓	✓	✓	✓	
<b>WA</b>									
Bayswater		✓	✓	✓	✓	✓	✓	✓	
Busselton—14B		✓	✓	✓	✓	✓	✓	✓	
Dardanup		✓	✓	✓	✓	✓	✓	✓	
Guildford—1A		✓	✓	✓	✓	✓	✓	✓	
Port Mandurah	✓	✓	✓	✓	✓	✓	✓	✓	
Yaloo	✓	✓	✓	✓	✓	✓	✓	✓	
Yunderup—12A		✓	✓	✓	✓	✓	✓	✓	
Yunderup North		✓	✓	✓	✓	✓	✓	✓	
<b>Victoria</b>									
Port Albert		✓	✓	✓	✓	✓	✓	✓	
<b>SA</b>									
Hindmarsh Island	✓	✓	✓	✓	✓	✓	✓	✓	
Riverglenn		✓	✓	✓	✓	✓	✓	✓	
<b>Overseas</b>									
Polonesia—Bora Bora		✓	✓	✓	✓	✓	✓	✓	
Brunei—Bolkiah A	✓	✓	✓	✓	✓	✓	✓	✓	✓
Brunei—Bolkiah B		✓	✓	✓	✓	✓	✓	✓	✓
Brunei—Sungai Bunga		✓	✓	✓	✓	✓	✓	✓	
Cocos Islands	✓	✓	✓	✓	✓	✓	✓	✓	
Maung Thong Bangna	✓	✓	✓	✓	✓	✓	✓	✓	

## **BRISBANE CITY COUNCIL**

### **RAUBERS ROAD BANYO VACUUM SEWERAGE SYSTEM**

#### **SECTION 2 AUTOMATIC VACUUM INTERFACE VALVE**

- 2.1 Description and Specification
- 2.2 Operation and Maintenance
- 2.3 Trouble Shooting



## **2. ISEKI VACUUM INTERFACE VALVE**

### **2.1 Description and Specification**

The vacuum interface valve is vacuum operated on opening and spring assisted on closing. The valve is designed so that the sewer vacuum endures positive seating of the flexible elastomer seat. It is a 90mm outside diameter, 76mm inside diameter valve moulded in glass filled polypropylene and is capable of passing solids up to 69mm diameter.

It has a visual flow through area of at least 60%. The conical plunger and its stainless steel shaft are completely out of the flow path when the valve is in its open position.

The valve is equipped with a vacuum operator of the rolling diaphragm type which is of sufficient diameter to overcome all sealing forces and open the valve using sewer vacuum pressure from the downstream side of the valve.

The stainless steel shaft is provided with an elastomer wiper/lip seal to prevent sewage from entering the valve lower housing. A silicone rubber umbrella type check valve is connected to the lower housing of the operator, which removes any condensation each time the valve cycles. A second umbrella type check valve is fitted in the vacuum supply line from the vacuum side of the valve to the controller unit.

The valve operator is held in position on the lower housing and the Y body by a stainless steel three piece band clamp. This clamp is arranged to allow removal of the complete lower housing, shaft and plunger to give access to the seat.

The valve is fitted with a two position liquid level controller which has a robust mounting flange that is used to secure the unit with a stainless steel band clamp to the valve bonnet.

The silicone rubber sensor diaphragm is 100mm in diameter and activates the control system when 100-150mm water column air pressure is applied to it.

A stainless steel needle valve is moulded into the controller body and is capable of adjusting the controller delay circuit in the range 3-10 seconds.

The controller unit is fitted with a manual push button to override the automatic operation.



Sequence of operation of the controller is as follows:

Rising pressure is applied to the sensor diaphragm

This operates the pilot valve which admits sewer line vacuum to the 3 way valve actuator/timing volume. The 3 way valve then switches allowing sewer line vacuum to enter the upper valve body, which opens the interface valve.

When the pressure has been relieved from the sensor diaphragm atmospheric pressure flows through the needle valve into the timing volume until the vacuum in this chamber is overcome by the spring. The 3 way valve then switches and allows atmospheric air to enter the upper valve body thus closing the interface valve.

The power to operate the Iseki interface valve is provided by the sump liquid level and the sewer line vacuum. No mains power supply of batteries are required.

## 2.2 Operation and Maintenance

The Iseki interface valve has one field adjustable setting - that which alters the volume of air entering the vacuum sewer network with each valve operation. This is achieved by changing the period of time for which the valve remains open following the evacuation of sewage from the sump. In addition to this adjustment, certain simple physical checks should also be made in order to ensure the valve is operating correctly. These checks are described below.

Each valve should be checked once each year, using the following procedure.

- a) Check the sensor pipe is correctly set. To ensure the interface valve will operate when the correct level of sewage has accumulated within the collection sump the sensor pipe should be set 50mm above the sump invert. If the sensor pipe is lifted or lowered, then too much or too little sewage will be admitted during each valve firing.
- b) Check the suction pipe is located such that there is a 50mm gap between it and the sump invert. This helps to ensure blockage free operation of the vacuum system and correct emptying of the collection sump.
- c) Ensure all black plastic clips on the valve tubing are in place and fully tightened.
- d) Check the breather pipe is undamaged.

e) To check and if necessary adjust the interface valve timing, press and hold down the manual operation button for 3 seconds to allow the interface valve to open fully. The valve will remain open for a period, which is adjustable. To adjust the timing, tighten the small screw on the side of the interface valve controller to lengthen the air cycle time, unscrew to shorten the time.

#### Timing of Interface Valve

It is very important that the interface valves are timed correctly and are not staying open for too long. An air cycle of approximately 2 to 4 seconds following the removal of the sewage from the sump is correct.

Valves close to the pumping station experience a higher vacuum and hence should be set on a shorter open time than those far from the pumping station. The valves far from the pumping station experience lower vacuum and hence must have a longer open time to admit the optimum volume of air.

If the vacuum pumps were operating too frequently then the timing on the valves should be investigated.


Vacuum loss above the design level at the interface valves will affect adversely other interface valves on the system due to lower operating pressure. This will give rise to sluggish operation of the sewer network and may result in failure of valves caused by their closing on debris.



## 2.3 Trouble Shooting

Symptom	Possible Cause	Remedial Action
Interface valve fails to fire	1. Loss of pressure in sensor and tubing	1. Check connection of tubing with controller sensor cap. Black clips must be in place at all times 2. Check tubing and sensor cap for damage
	2. Flip flop valve in controller sensor broken or stuck in closed position	Check for this by using manual test button on controller. If no clicking sound is heard and valve still does not fire, replace controller unit
	3. Reflux valve in vacuum feed line to controller sensor unit blocked	Check for this by removing vacuum feed from controller unit, if no vacuum available, replace reflux valve for new item
	4. 90mm dia suction pipe blocked	Valve will almost invariably be in the open position with nothing passing through it. Dismantle pipework and clear blockage
Interface valve jammed in open position	1. Debris trapped in valve	The blockage may be cleared by pressing the manual operation button on the controller unit. If not, remove the interface

- |  |  |
|--|--|
|  | valve and strip down and clean or replace with spare valve.  |
| 2. Timing screw in side of controller unit screwed in too far                  | Check this by turning out a few turns on the screw. If the valve closes then reset timing by turning timing screw back until the valve stays open for 2-3 seconds only. Check this by using the manual operation button on the controller unit |
| 3. Moisture and/or dirt in controller unit                                     | Look for moisture in tubing. Swap controller for spare   |
| 4. Flip flop valve broken or jammed in open position                           | Check by pressing manual operation button on controller unit. If no clicking is heard, change controller unit  |
| 5. Tubing on interface valve and controller unit kinked and restricted airflow | Visually check all Tubing. Replace as necessary  |
| 6. Sensor pipe in collection chamber blocked                                   | Remove sensor tube from controller unit. If the valve closes, remove sensor pipe from collection chamber and clean. Be sure to replace all black clips after reassembling sensor   |



Slight continuous  
vacuum loss at  
interface valve

Debris trapped  
under seat

Fire interface valve by  
use of manual  
operation button on  
sensor unit. If this  
does not clear trapped  
item, remove valve for  
cleaning

Interface valve  
cycling repeatedly

1. Moisture and/or  
dirt in controller  
sensor unit

Look for moisture in  
tubing and replace  
controller if necessary

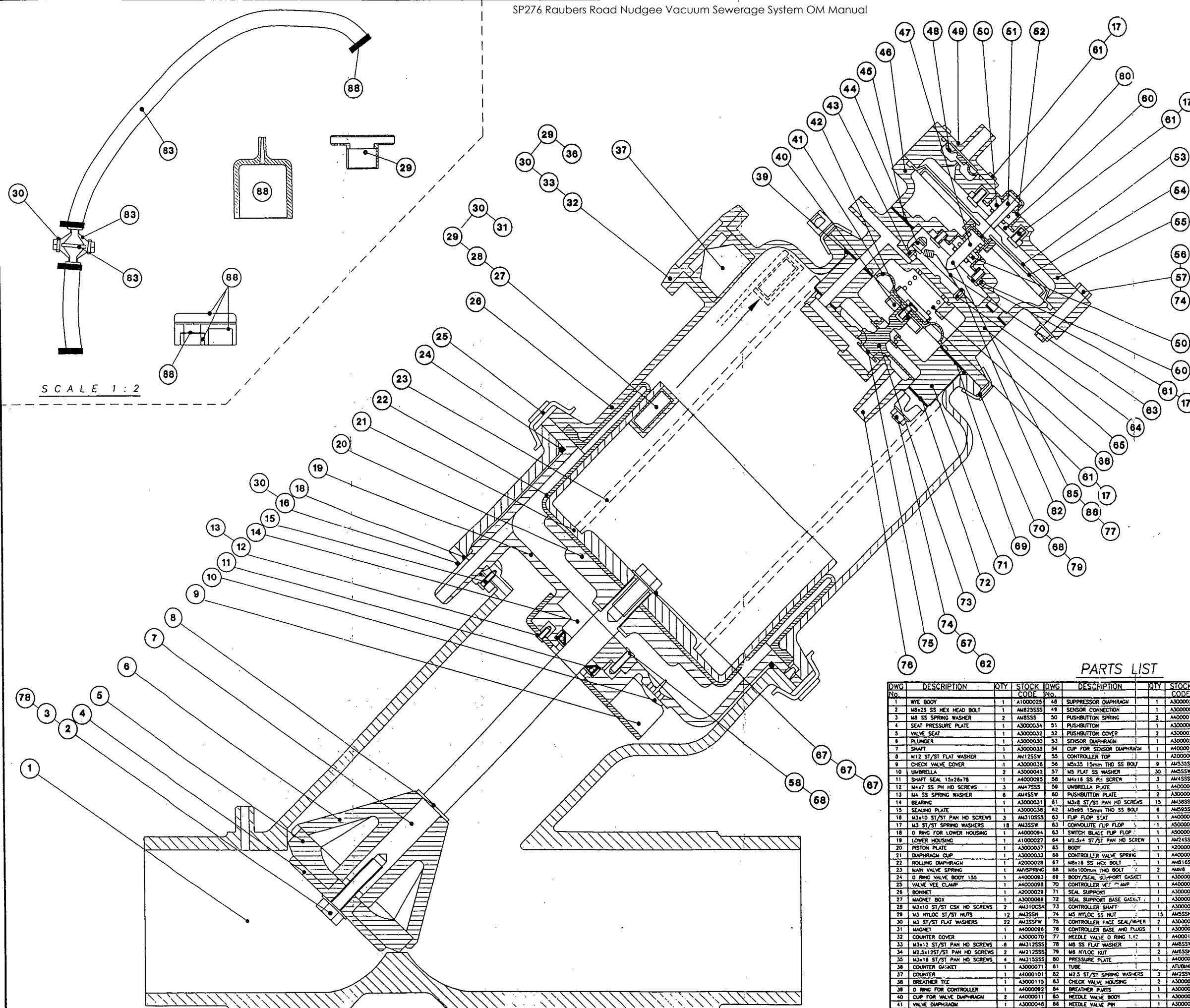
2. Timing screw in  
controller sensor  
screwed in too far

Check this by  
turning out the screw  
a few turns. If the  
valve stops cycling  
reset timing by  
turning screw back  
until valve stays  
open for 2-3 seconds  
only. Check by using  
manual operation  
button



## NOTES:

1. DO NOT SCALE MEASUREMENTS FROM THIS DRAWING. IF IN DOUBT ASK.



SCALE 1:2

CROSS-SECTIONAL VIEW THRO' 90mm INTERFACE VALVE ASSEMBLY

(SCALE 1:1)

## PARTS LIST

DWG No.	DESCRIPTION	QTY	STOCK CODE	DWG No.	DESCRIPTION	QTY	STOCK CODE
1	WYE BODY	1	A1000025	48	SUPPRESSOR DIAPHRAGM	1	A3000021
2	M8x25 SS HEX HEAD BOLT	1	AM825SSS	49	SENSOR CONNECTION	1	A3000005
3	M8 SS SPRING WASHER	2	AM8SSS	50	PUSHBUTTON SPRING	2	A4000017
4	SEAT PRESSURE PLATE	1	A3000034	51	PUSHBUTTON	1	A3000007
5	VALVE SEAT	1	A3000032	52	PUSHBUTTON COVER	2	A3000020
6	PLUNGER	1	A3000030	53	SENSOR DIAPHRAGM	1	A3000022
7	SHAFT	1	A3000035	54	CUP FOR SENSOR DIAPHRAGM	1	A4000012
8	M12 ST/ST FLAT WASHER	1	AM12SSW	55	CONTROLLER TOP	1	A2000001
9	CHECK VALVE COVER	1	A3000036	56	M5x35 15mm THD SS BOLT	9	AM535SS
10	UMBRELLA	2	A3000042	57	M5 FLAT SS WASHER	30	AM5SSW
11	SHAFT SEAL 15x26x78	1	A4000085	58	M4x18 SS PH SCREW	3	AM4SSS
12	M4x7 SS PH HD SCREWS	3	AM47SSS	59	UMBRELLA PLATE	1	A4000040
13	M4 SS SPRING WASHER	6	AM4SSW	60	PUSHBUTTON PLATE	2	A3000008
14	BEARING	1	A3000031	61	M3x8 ST/ST PAN HD SCREWS	15	AM38SSS
15	SEALING PLATE	1	A3000038	62	M5x95 15mm THD SS BOLT	8	AM595SS
16	M3x10 ST/ST PAN HD SCREWS	3	AM310SSS	63	FLIP FLOP SEAT	1	A4000078
17	M3 ST/ST SPRING WASHERS	18	AM3SSW	64	CONVOLUTE FLIP FLOP	1	A5000011
18	O RING FOR LOWER HOUSING	1	A4000084	65	SWITCH BLADE FLIP FLOP	1	A5000010
19	LOWER HOUSING	1	A1000027	66	M2.5x4 ST/ST PAN HD SCREW	1	AM24SSS
20	PISTON PLATE	1	A3000037	67	BODY	1	A2000035
21	DIAPHRAGM CLIP	1	A3000033	68	CONTROLLER VALVE SPRING	1	A4000018
22	ROLLING DIAPHRAGM	1	A2000028	69	M8x18 SS HEX BOLT	1	AM818SSS
23	MAIN VALVE SPRING	1	AMVSPRING	70	M8x100mm THD BOLT	2	AM8100
24	O RING VALVE BODY 135	1	A4000083	71	BODY/SEAL SI-FORT GASKET	1	A3000087
25	VALVE VEE CLAMP	1	A4000098	72	CONTROLLER VEE CLAMP	1	A4000097
26	BOHNET	1	A2000029	73	SEAL SUPPORT	1	A3000037
27	MAGNET BOX	1	A3000089	74	SEAL SUPPORT BASE GASKET	1	A3000086
28	M3x10 ST/ST CSK HD SCREWS	2	AM310CSK	75	CONTROLLER SHAFT	1	A3000039
29	M3 NYLOC ST/ST NUTS	12	AM3SSN	76	M5 NYLOC SS NUT	15	AM5SSN
30	M3 ST/ST FLAT WASHERS	22	AM3SSW	77	CONTROLLER FACE SEAL/WIPER	2	A3000019
31	MAGNET	1	A4000098	78	CONTROLLER BASE AND PLUGS	1	A3000058
32	COUNTER COVER	1	A3000070	79	NEEDLE VALVE O RING 1.42	1	A4000102
33	M3x12 ST/ST PAN HD SCREWS	8	AM312SSS	80	M8 SS FLAT WASHER	2	AM8SSW
34	M2.5x10 ST/ST PAN HD SCREWS	2	AM210SSS	81	M6 NYLOC NUT	2	AM6SSN
35	M3x18 ST/ST PAN HD SCREWS	4	AM318SSS	82	PRESSURE PLATE	1	A4000074
36	COUNTER GASKET	1	A3000071	83	TUBE	1	ATUBINO
37	COUNTER	1	A4000101	84	M2.5 ST/ST SPRING WASHERS	3	AM2SSW
38	BREATHER TFE	1	A4000092	85	CHECK VALVE HOUSING	2	A3000038
39	O RING FOR CONTROLLER	1	A4000092	86	BREATHER PARTS	1	A3000046
40	CLIP FOR VALVE DIAPHRAGM	2	A4000011	87	NEEDLE VALVE BODY	1	A3000081
41	VALVE DIAPHRAGM	1	A3000048	88	NEEDLE VALVE PIN	1	A3000082
42	SHAFT END SEAL	1	A4000013	89	CHECK VALVE HOUSING GASKET	2	A4000041
43	SENSOR SEAT INSERT	1	A3000044	90	SENSOR CAP	1	A2AP105
44	TOP STOP	1	A3000045	91	HOSE CLIPS	10	A4000098
45	UPPER BODY/BODY GASKET	1	A3000086	92	BREATHER SCREEN	1	A4000100
46	UPPER BODY	1	A2000054				
47	SENSOR PLUNGER	1	A3000080				

**Iseki** Utility Services  
Vacuum Fluid Handling Systems

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CLIENT

PROJECT

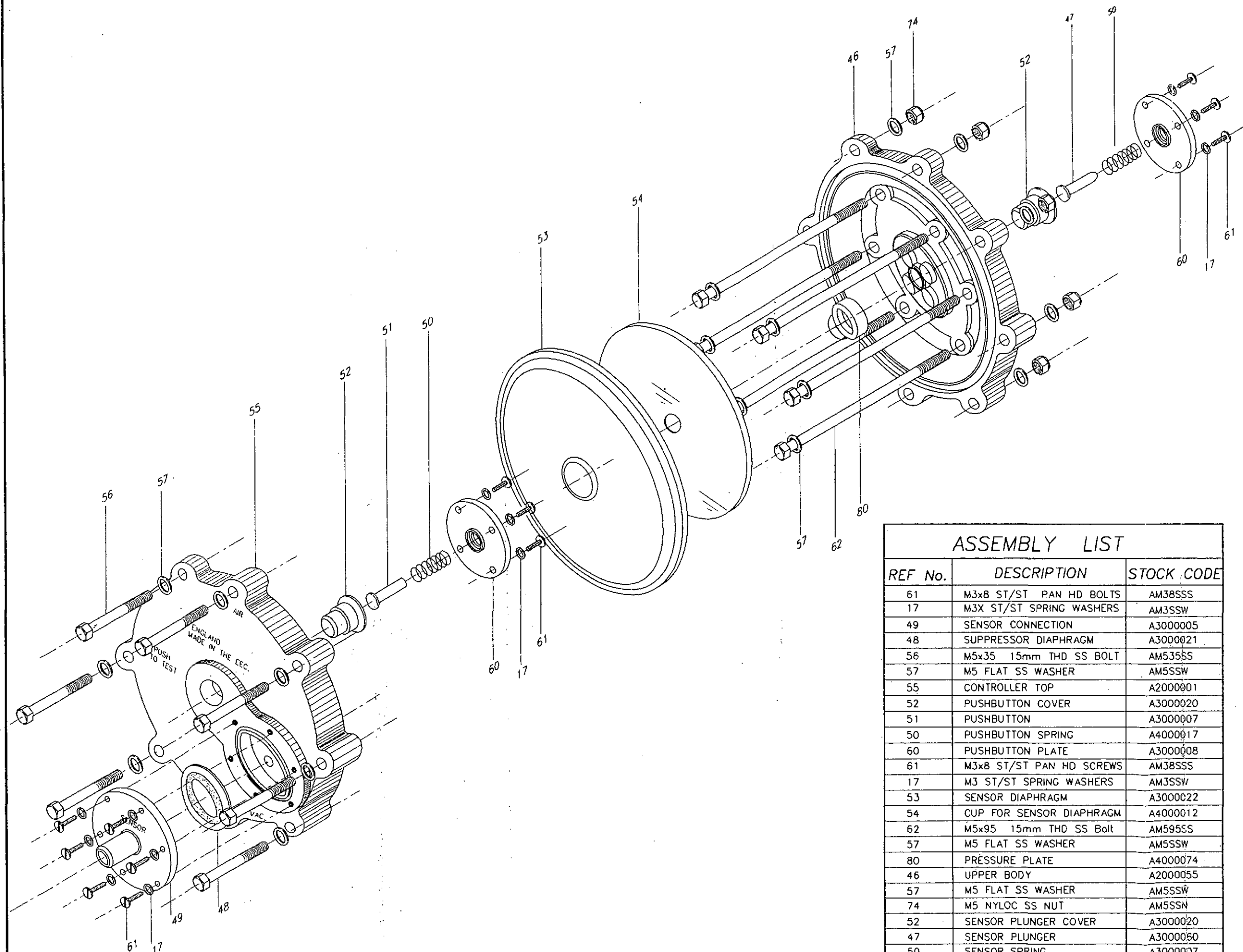
TITLE

90mm ISEKI VACUUM INTERFACE  
VALVE

SCALE	DRN.	DATE	CHK'D
1:1	NRS	MARCH 96	
PROJECT NO.	DRG. NO.	REV.	
IUS-VALVE	VALVE-01	REV.	

**NOTES:**

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2. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ISEKI'S DRAWINGS VALVE-01, CNTRL-02 & "INSTRUCTIONS FOR THE ASSEMBLY OF THE 90mm ISEKI VACUUM INTERFACE VALVE".

**ASSEMBLY LIST**

REF No.	DESCRIPTION	STOCK CODE
61	M3x8 ST/ST PAN HD BOLTS	AM38SSS
17	M3x ST/ST SPRING WASHERS	AM3SSW
49	SENSOR CONNECTION	A3000005
48	SUPPRESSOR DIAPHRAGM	A3000021
56	M5x35 15mm THD SS BOLT	AM535SS
57	M5 FLAT SS WASHER	AM5SSW
55	CONTROLLER TOP	A2000001
52	PUSHBUTTON COVER	A3000020
51	PUSHBUTTON	A3000007
50	PUSHBUTTON SPRING	A4000017
60	PUSHBUTTON PLATE	A3000008
61	M3x8 ST/ST PAN HD SCREWS	AM38SSS
17	M3 ST/ST SPRING WASHERS	AM3SSW
53	SENSOR DIAPHRAGM	A3000022
54	CUP FOR SENSOR DIAPHRAGM	A4000012
62	M5x95 15mm THD SS Bolt	AM595SS
57	M5 FLAT SS WASHER	AM5SSW
80	PRESSURE PLATE	A4000074
46	UPPER BODY	A2000055
57	M5 FLAT SS WASHER	AM5SSW
74	M5 NYLOC SS NUT	AM5SSN
52	SENSOR PLUNGER COVER	A3000020
47	SENSOR PLUNGER	A3000060
50	SENSOR SPRING	A3000007
60	SENSOR PLUNGER PLATE	A3000008
17	M3 ST/ST SPRING WASHERS	AM3SSW
61	M3x8 ST/ST PAN HD SCREWS	AM38SSS

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TITLE

EXPLODED VIEW OF ISEKI 90MM  
 INTERFACE VALVE CONTROLLER.  
 SHEET 1 OF 2

SCALE -	DRN.	DATE	CHK'D
N.T.S.	NRS	JUNE 96	
PROJECT NO.	DRG. NO.	REV.	
IUS-CNTRL.	CNTRL-01.	REV.	



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- 3. GASKETS/PARTS 72,69 & 45 MUST BE REPLACED EVERY TIME THE CONTROLLER SENSOR UNIT IS REASSEMBLED.

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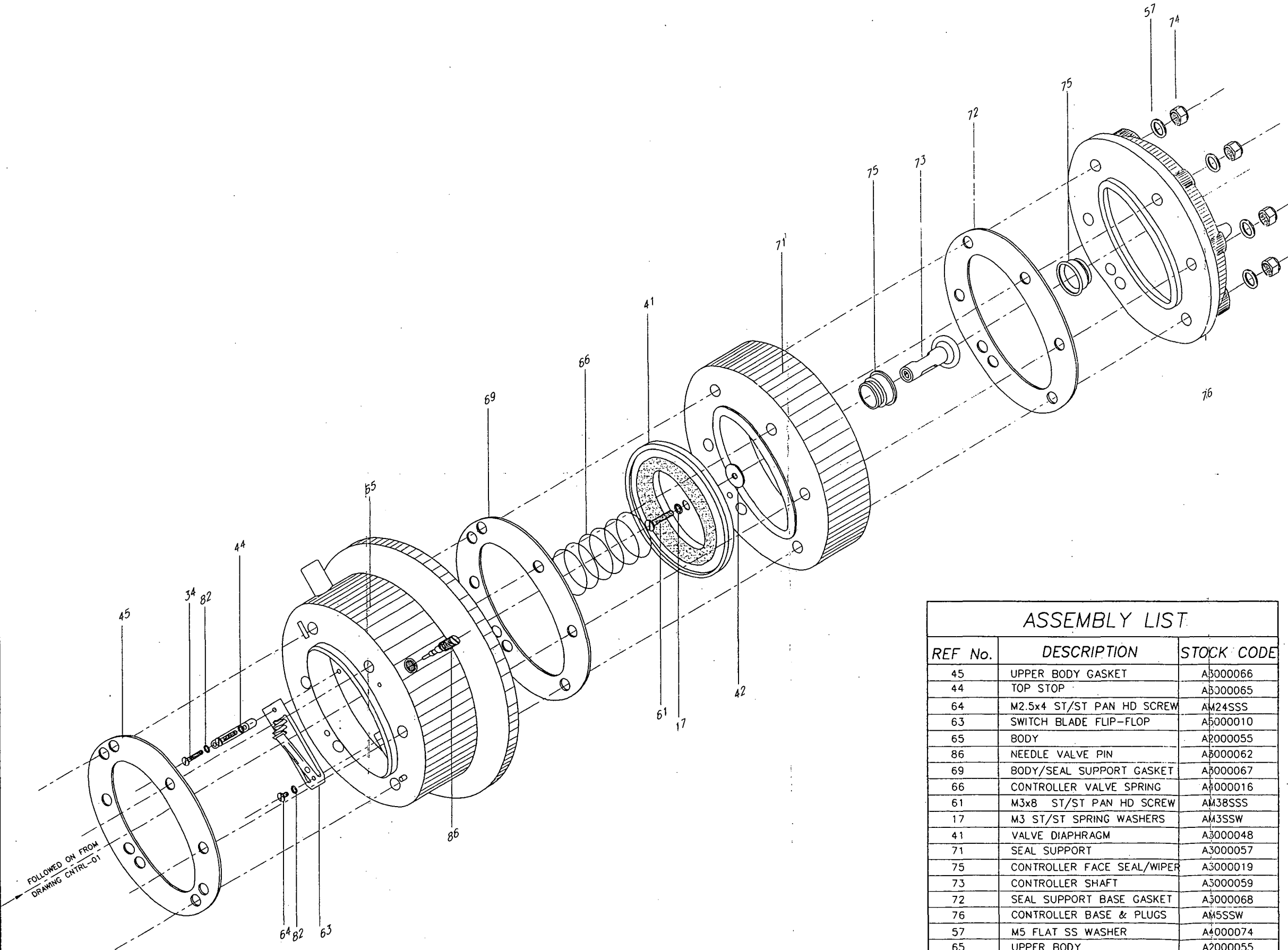
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PROJECT

TITLE  
EXPLODED VIEW OF ISEKI 90MM  
INTERFACE VALVE CONTROLLER.  
SHEET 2 OF 2

SCALE	DRN.	DATE	CHK'D
N.T.S.	NRS	JUNE 96	
PROJECT NO.	DRG. NO.	REV.	
IUS-CNTRL	CNTRL-02	REV.	



ASSEMBLY LIST		
REF No.	DESCRIPTION	STOCK CODE
45	UPPER BODY GASKET	A3000066
44	TOP STOP	A3000065
64	M2.5x4 ST/ST PAN HD SCREW	AM24SSS
63	SWITCH BLADE FLIP-FLOP	A5000010
65	BODY	A2000055
86	NEEDLE VALVE PIN	A3000062
69	BODY/SEAL SUPPORT GASKET	A3000067
66	CONTROLLER VALVE SPRING	A4000016
61	M3x8 ST/ST PAN HD SCREW	AM38SSS
17	M3 ST/ST SPRING WASHERS	AM3SSW
41	VALVE DIAPHRAGM	A3000048
71	SEAL SUPPORT	A3000057
75	CONTROLLER FACE SEAL/WIPER	A3000019
73	CONTROLLER SHAFT	A3000059
72	SEAL SUPPORT BASE GASKET	A3000068
76	CONTROLLER BASE & PLUGS	AM5SSW
57	M5 FLAT SS WASHER	A4000074
65	UPPER BODY	A2000055
57	M5 FLAT SS WASHER	AM5SSW
74	M5 NYLOC SS NUT	AM5SSN
42	SHAFT END SEAL	A4000013
82	M2.5 SPRING WASHER	AM2SSW
34	M2.5 x 12 PH SCREWS	AM212SSS

**BRISBANE CITY COUNCIL**

**RAUBERS ROAD  
BANYO  
VACUUM SEWERAGE SYSTEM**

**SECTION 3 VACUUM PUMPING EQUIPMENT**

- 3.1 Vacuum Pumps
- 3.2 Frequency of Operation
- 3.3 Trouble Shooting - Vacuum Pumps

## **BRISBANE CITY COUNCIL**

### **RAUBERS ROAD BANYO VACUUM SEWERAGE SYSTEM**

#### **3. VACUUM PUMPING EQUIPMENT**

##### **3.1 Vacuum Pumps**

There are two Siemens model 2BV 5111 vacuum pumps installed on a duty and stand by basis.

Each pump is capable of operating the system at design capacity with adequate operating vacuum within the system.

When the system is operating at design flow rate the vacuum pumps will run continuously. During low flow periods the vacuum pumps will only operate once or twice an hour.

The vacuum pumps are of the liquid ring type. Detail operating and maintenance instructions are attached.

##### **3.2 Frequency of Operation**

The vacuum pumps have been sized so that eight times the volume of air is pumped by the vacuum pumps compared to the volume of the sewage pumps.

The vacuum pumps will start very infrequently during the low flow part of the night and will run continuously if the flow into the system is at peak flow rate.

With the air to liquid ratio set correctly the pumps will start / stop most frequently when the need for air is half the vacuum pump exhaust rate.

### 3.3 Trouble Shooting - Vacuum Pumps

Symptom	Possible Cause	Remedial Action
One vacuum pump running continually	1. Interface valve stuck partially open	Identify problem valve Clear blockage, if necessary swap interface valve
	2. Check valve on one side of the other vacuum pump stuck partially open	Strip down check valve and clean
	3. Non-return valves on discharge pipework trapped in open position by debris	Operate sewage pump. If this fails to clear the blockage strip down valve and clean
	4. Interface valve is cycling, (opening repeatedly)	Identify valve by reference to the interface valve fault finding section.
One vacuum pump running repeatedly	Interface valve with extended cycle time	Identify valve by reference to the interface valve fault finding section

**SIEMENS****CE****ELMO-Flüssigkeitsring-Vakuumpumpen / -Kompressoren**

(Beschreibung s. Seite 2)

**Betriebsanleitung**  
**Instructions****ELMO Liquid-Ring Vacuum Pumps/Compressors**

(Description on page 6)

**Pompes à vide/compresseurs à anneau liquide ELMO**

(Description voir page 11)

**Bombas de vacío/compresores hidrorrotativos ELMO**

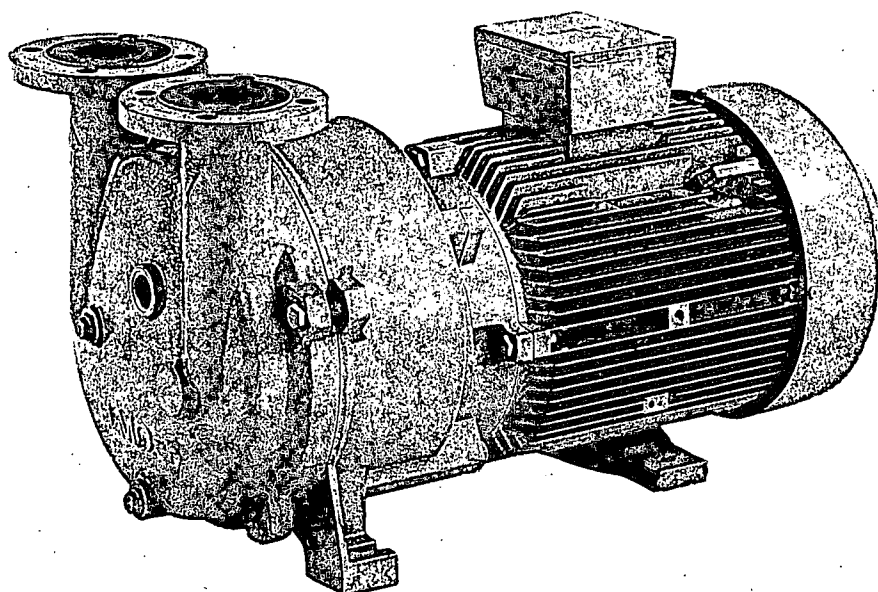
(Descripción en la pág. 16)

**ELMO pompe per vuoto/compressori ad anello liquido**

(Descrizione ved. 20)

**ELMO vakuumpumpar/kompressorer med vätskering**

(Beskrivning se sida 25)

**2BV5 161****2BV5 131****2BV5 121****2BV5 111****2BV5 110**

### 3.5.2 Ersatzteile, Normteile, Darstellung einer zerlegten 2BV5 (s. Fig. 17)

### 3.5.3 Hinweis zur Instandhaltungsanleitung

Für weitere Information steht neben dieser Betriebsanleitung eine **Instandhaltungsanleitung** zur Verfügung, die Hinweise für qualifiziertes Personal (Definition für Fachkräfte s. DIN VDE 0105 oder IEC 364) über Sicherheit, Zerlegen und Zusammenbau der ELMO-F-Vakuum-pumpen/-Kompressoren 2BV5 110 bis 2BV5 161 enthält.

Die **Instandhaltungsanleitung** kann mit

Bestell-Nr.: 610.44 416.02 (Deutsch/Englisch)

und vollständiger Absenderangabe beim Hersteller angefordert werden.

### 3.5.4 Instandhaltungs- / Gewährleistungsaufträge

Bei Rücksendungen in Gewährleistungsfällen sind die ELMO-F ungeöffnet anzuliefern. Sie sind vor dem Versand rückstandsfrei zu entleeren (s. Pkt. 2.3.2) und äußerlich zu reinigen. Für die Reinigungsmaßnahmen ist die Schutzart gemäß Leistungsschild zu beachten.

**⚠ WARNUNG** Zum Schutz der Umwelt und Schutz von Personen ist es erforderlich, daß kontaminierte ELMO-F vor dem Versand an die Reparaturwerkstatt dekontaminiert werden.

Um sicherzustellen, daß die zum Versand kommenden ELMO-F nicht mit gefährlichen Stoffen betrieben worden sind bzw. entsprechend dekontaminiert worden sind, ist eine rechtsverbindliche Erklärung (Vordruck siehe Fig. 18), ausgefüllt von autorisiertem Fachpersonal, der Lieferung beizugeben.

Als die Erklärung einer vorschriftsmäßigen Dekontaminierung beim Eintreffen des ELMO-F in der Reparaturwerkstatt nicht vorliegt, treten zur Einhaltung der Unfallverhütungsvorschriften Terminverzögerungen ein, da mit den Instandsetzungsarbeiten erst nach Vorliegen dieser Erklärung begonnen werden darf.

## 4 ELMO-F mit EEx e-Motoren

DIN EN 50014/VDE 0170/0171 Teil 1 und  
DIN EN 50019/VDE 0170/0171 Teil 6



Für diese Maschinen gelten ergänzend oder speziell die Informationen in kursiver Schrift!

Bei Aufstellung der Maschine in senkrechter Achslage ist eine Abdeckung anzuordnen, die ein Hineinfallen von Fremdkörpern in die Motorlüfterhaube verhindert (s. DIN EN 50014/ VDE 0170/0171 Teil 1, Abschnitt III, 16.1). Sie darf die Kühlung des Motors durch seinen Lüfter nicht behindern.

Die auf dem Leistungsschild angegebene Temperaturklasse des Motors muß mit der Temperaturklasse des möglicherweise auftretenden brennbaren Gases übereinstimmen. Jeder Maschine muß ein Motorschutzschalter vorgeschaltet sein, der auf den Motorbemessungsstrom einzustellen ist und der bei festgebremstem Läufer innerhalb der auf dem Leistungsschild angegebenen Zeit  $t_e$  auslöst (Prüfung anhand der dem Motorschutzschalter beiliegenden Auslösekennlinie). Bei Dreieckschaltung muß ein Überlastschutz mit Phasenausfallschutz vorgesehen werden.

Soll aber der Überlastschutz ausschließlich durch eine direkte Temperaturüberwachungseinrichtung mit Hilfe von Temperaturfühlern (s. DIN EN 50019/ VDE 0170/0171 Teil 6, Anhang A-A1.b) vorgenommen werden, muß die Ausführung der Maschine hierfür gesondert geprüft und bescheinigt sein.

Auf DIN 57165/ VDE 0165 wird hingewiesen.

Reparaturen müssen in Siemens-Werkstätten durchgeführt oder von einem amtlich anerkannten Sachverständigen abgenommen werden.

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Fig. 1 ...	



## General notes

Units which bear the **CE** sign conform to the EC directive 89/392/EEC (see EC declaration of conformity, Fig. 19) if they are used for the intended purpose.



### WARNING

The information and instructions given in all the operating instructions and other instructions supplied with the equipment must be followed.

This is essential in order to avoid danger and damage.

A supplementary safety bulletin (610.43083.21/yellow) which contains additional information on safety is included.

Special and modified versions may differ with regard to technical details! If anything is unclear, you are urged to contact the manufacturer, quoting the type designation and serial number (No. E ...; see rating plate) or to have the repair work carried out by a Siemens service centre.

The ELMO-F units are designed for use in the rough vacuum range; the maximum possible vacuum is determined in each case by the vapour pressure of the working liquid used.

*The appropriate safety regulations, see 2.1.2.1 Electrical connections, must be observed in the case of ELMO-F units with EEx e- drive motors; these ELMO-F units are approved for use in rooms in which explosive gases occasionally occur.*

*Explosive gases themselves must, however, not be pumped.*

*The temperature classes specified on the rating plate must be observed.*

## 1.4.2 Minimum gas suction pressure

The minimum gas suction pressure depends on the temperature and the type of working liquid used.

Please observe that:

- the pressure does not fall below 80 mbar when the pump is operated without cavitation protection, when water at 15°C is used as working liquid and when dry air at 20°C is extracted in order to avoid damage caused by cavitation. At higher temperatures, this limit is correspondingly higher in accordance with the vapour pressure of the working liquid used.
- the vacuum pump can be operated until it reaches its maximum vacuum, i.e. up to complete throttling, when it is operated without cavitation protection.

Higher temperatures reduce the suction capacity of the ELMO-F unit.

**NOTE:** Operation of the pump below the minimum permissible suction pressure for a prolonged period of time can result in the ELMO-F unit being damaged.

## 1.4.3 Maximum discharge pressure for vacuum operation

The maximum discharge pressure for vacuum operation is 1300 mbar absolute for all 2BV5 vacuum pumps if the nominal working-liquid flowrate indicated in 1.4.6, Fig. 5 is maintained.

## 1.4.4 Maximum differential pressure for compressor operation

At an inlet pressure of 1013 mbar, the maximum differential pressure and the recommended clean working-liquid flowrate for 2BV5 compressors with serial motors are as follows, see Fig. 3:

Maximum permissible pressure inside the ELMO-F unit

$$p_{\text{int max}} = 8 \text{ bar abs.}$$

## 1.4.5 Suction gas or vapour

The gas or gas/vapour mixture to be extracted must be free of solids. Minor quantities of light floating materials or liquids can be entrained.

See Fig. 4 for the maximum permissible quantity of water entrained via the suction flange.

We recommend that the working-liquid flowrate be increased to up to max. 2 times the nominal working-liquid flowrate (see 1.4.6; Fig. 5, cooling-circuit connection) or that an upstream condenser be used if hot gases and vapours from 80°C onwards are to be extracted.

## 1.4.6 Working liquid

During operation, the ELMO-F unit must be continually supplied with working liquid (Fig. 5) which must be free of solids such as sand. If necessary, connect a filter on the intake side.

The values specified in Fig. 5 apply to dry-air extraction. To ensure that a sufficient quantity of working liquid flows in, adjust the pressure in the feed pipe to approx. 1 bar above the necessary suction pressure.

# 1 Description

## 1.1 Validity

These Operating Instructions apply to single-stage ELMO liquid-ring vacuum pumps/compressors (ELMO-F), type 2BV5, in block design with direct-coupled standard and EEx e drive motors.

The Operating Instructions contain basic information and instructions which must be observed when the unit is being installed, operated and repaired. It is important, therefore, that these Operating Instructions are read by the fitter and the relevant technical personnel/operators before installation and start-up and that they are available at all times at the place at which the unit/system is being operated.

## 1.2 Mode of operation and type of construction

The ELMO-F, together with the drive motor, forms a compact and space-saving unit. A level surface is sufficient for installation. Baseplates are not required.

The ELMO-F units operate in accordance with the liquid-ring principle. An impeller is located in a cylindrical pump casing and is offset from the rotor axis. The impeller transmits the driving power to a liquid ring which forms concentrically to the casing when the pump is started up. As the liquid moves outwards, gas is drawn in through the inlet port in the port plate, compressed and expelled through the discharge port in the port plate.

See Fig. 1 for section through the compression chamber (viewed in the direction of the pump cover).

## 1.3 Measuring-surface sound-pressure level

See Fig. 13 for details on the measuring surface sound-pressure level.

## 1.4 Application range

### 1.4.1 Usage to the intended purpose

The ELMO-F are single-stage, liquid-ring units, which are designed for continuous operation, for generating vacuums or excessive pressure. The ELMO-F units are used to extract and pump all dry and moist gases, mainly air and air/vapour mixtures, which are not flammable, explosive, poisonous or corrosive.

Units for flammable, explosive, poisonous and corrosive media are supplied in accordance with customer specifications. The relevant safety precautions, must in this case, be taken by the user.

Water is generally used as working liquid.

Stainless steel versions are available for more stringent anti-corrosion and hygiene requirements.

The working liquid supplied is discharged through the delivery branch of the ELMO-F unit together with the extracted gas.

A separator is available as an accessory to separate the gas and liquid. It enables partial recirculation of the working liquid.

## 2 Operation

### 2.1 Installation

#### 2.1.1 Mounting

The ELMO-F unit has to be mounted horizontally on a level surface and can be bolted via holes in the feet. A special foundation or baseplate is not required.

Two adapter plates (888E, see Fig. 17) are supplied in each case for types **2BV5 110-...2-P** and **2BV5 121-...2-P** for adjusting the height by means of the feet on the pump casing (002A). These must be secured between the pump feet and the packaging. The two adapter plates must be placed underneath the pump feet in order to secure the unit.

If the pump is to be mounted in any other way, e.g. with the shaft in a vertical position, the manufacturer should be consulted.

If the ELMO-F unit is transported by crane, we recommend lifting the machine by the pump-side lug of the motor and by a hole in the suction flange.

**The load carrying capacity of the hoisting gear must be observed!** See Fig. 14 for details on the respective weights of the ELMO-F units.

#### 2.1.2 Connections

##### 2.1.2.1 Electrical connection


Connect the pump in accordance with the relevant VDE and national standards and the regulations of the utility company which apply to the installation site.

motor circuit-breakers for overload protection of the motors. They have to be set to the rated current indicated on the rating plate.



**WARNING** Do not carry out any work unless the machine is dead.

Before carrying out any work, open the main circuit-breaker and secure against being closed again.

The system voltage and frequency must be the same as those indicated on the rating plate.  $\pm 5\%$  voltage and/or  $\pm 2\%$  frequency deviations are permissible without power reduction. Connect and arrange the terminal links according to the circuit diagram in the terminal box. Connect the protective earth conductor to this terminal .

If terminal clamps are used for connection (e.g. as per DIN 46282), make the connections so that the terminal plate is at the same height on each side. Each conductor end must therefore be bent into a U or connected with a cable lug.

This also applies to the protective conductor and the external earth conductor (green/yellow) - see Fig. 2.

The ends of all conductors under external earthing brackets have to be bent into a U.

See Fig. 15 for the tightening torques for screwed electrical connections - terminal board connections (except for terminal strips).

##### 2.1.2.2 Pipe connections (see Fig. 7)

In order to prevent foreign particles from entering the pump, all connection openings are covered for delivery. Do not remove the coverings until piping is connected.

Piping has to be connected free of stress and the weight of the piping has to be supported.

#### a) Delivery branch connection

for 2BV5 16.: Flange 80 ND10-DIN 2501 or  
ANSI-B16.5-3-150,  
Seal 80 ND6 DIN 2690;

for 2BV513./2BV512.: Flange 65 ND 10-DIN 2501 or  
ANSI-B16.5-2 1/2-150,  
Seal 65 ND 6 DIN 2690;

for 2BV511.: Flange 50 ND 10 DIN 2501 or  
ANSI-B16.5-2-150,  
Seal 50 ND 40 DIN 2690.

If the discharged gas is passed on, ensure that the maximum discharge pressure given in 1.4.3 is not exceeded.

#### b) Suction flange connection

Same connection as on the delivery branch side (with flange and seal). To prevent installation residues, e.g. welding beads, from entering the ELMO-F unit, it is recommended that a start-up filter be fitted in the suction pipe for the first 100 operating hours.

#### c) Recommended working-liquid connection (Fig. 8)

### 2.1.3 Methods of supplying the working liquid (see Fig. 9)

#### 2.1.3.1 Cooling-circuit connection

This is preferred where there is an ample supply of working liquid and where a low suction pressure is required. The working liquid discharged from the pump is completely drained off and replaced by new liquid.

After initial priming, the ELMO-F unit can be operated in a self-priming mode. Ensure that the working liquid is on a level with the working-liquid connection when the ELMO-F unit is switched on.

#### 2.1.3.2 Connection with separator and partial recirculation of working liquid

The connection with separator and partial recirculation of working liquid is used where working liquid must be used sparingly. Part of the working liquid recovered from the discharge in the separator is recirculated to the ELMO-F unit without cooling, the remainder being replaced by new liquid. The necessary pipes are supplied together with the separator.

#### 2.1.4 Working-liquid separator (see Fig. 10)

The working-liquid separator can be supplied as an accessory with the corresponding connection pipe.

It separates the working liquid from the gas handled and permits recirculation of a part of the working liquid.

This enables a considerable reduction in the quantity of working liquid required (see Fig. 5).

The enclosed hose connection (50) must be fitted between the separator and the pump cover (see Fig. 10) for operation with cavitation protection (see 1.4.2).

#### Fitting the hoses

Hoses must be connected in such a way as to prevent them from twisting. The hoses must be protected against external mechanical damage.

#### Fitting the cutting-ring screwed connections

The inside taper, external thread and the inside of the union nut must be lubricated beforehand in the case of stainless steel cutting-ring screwed connections.

Loosely screw the union nut once onto the threaded coupling so that the entire thread becomes evenly coated.

#### 2.1.5 Non-return valve

To prevent recirculation of gas and working liquid when the pump is out of operation, a non-return valve with minimum resistance has to be fitted in the suction pipe (see accessories in the catalogue).

### 2.1.6 Suction pressure between 40 and 10 mbar with ELMO-F unit and gas ejector

When extracting gases in the pressure range 40 to 10 mbar, a gas ejector is connected on the line side of the 2BV5 vacuum pump which compresses the extracted gas to the suction pressure of the 2BV5 vacuum pump.

A suction pressure of 10 mbar is possible with a gas ejector.

The power requirements of the 2BV5 vacuum pump remain within the permissible range with a line-side gas ejector. No special energy source is, therefore, necessary in order to operate gas ejectors. There are no regulations for the mounting position of the gas ejector as the position does not affect operation in any way.

Seals must sit concentrically in order to avoid reducing the flow area. The connecting leads should be short and have a sufficient nominal diameter. A cone-shaped adapter is recommended if the mixing connection of the gas ejector is smaller than the suction connection of the 2BV5 vacuum pump.



**CAUTION** The motive gas (ambient air at 20°C, 1013 mbar) must not contain any drops of liquid.

When evacuating tanks, the gas ejector acts as a throttle in the range 1000 to approx. 100 mbar. The gas ejector can be bypassed here in order to obtain short evacuating times. The bypass must be closed if the gas ejector is to become active. The optimum switchover point for the gas ejector to become active is approx. 40 mbar (Fig. 12).

## 2.2 Initial start-up

### 2.2.1 Preparations

If a shut-off valve is installed in the discharge pipe, make sure that the ELMO-F unit is **not** started or stopped with the shut-off valve closed.

**NOTE:** Do not run the ELMO-F unit dry!

Before start-up, prime the ELMO-F unit through the suction or delivery branch

- with approx. 8 litres in the case of the 2BV5161
- with approx. 3 litres in the case of the 2BV5131, 2BV5121, 2BV5111, 2BV5110

of working liquid or open the shut-off valve in the bypass (Fig. 8) for approx. 20 s to enable the working liquid to flow into the vacuum pump.

Check the connection of the supply and discharge pipes for tightness.

To check the direction of rotation, switch on the ELMO-F unit briefly. The direction of the gas flow and the direction of rotation of the shaft are marked on the ELMO-F unit with arrows. Compare the direction of rotation of the motor fan with the direction of the arrow on the back of the pump casing (002A, Fig. 17). If necessary, change the direction of rotation by reversing two connection cables when the pump is electrically isolated.

### 2.2.2 Start-up

If the pump is supplied via converters, high-frequency current and voltage harmonics in the motor supply leads can cause electromagnetic emitted interference. Screened supply leads are, therefore, recommended.

The noise level and vibrations increase if the operating speed (see rating plate) is exceeded and the useful life of the grease and the bearing replacement intervals are reduced as a result.

If necessary, contact the manufacturer to determine the limit speed in order to avoid damage being caused as a result of excessively high speeds.

Switch on the ELMO-F unit. Check the working-liquid flowrate (cf. 1.4.6) and, if necessary, adjust it with the control valve (16, see Fig. 8). The flowmeter (15) is used to regulate the nominal working-liquid flowrate. The liquid flow can also be measured in litres on the discharge side at the overflow (7, see Fig. 9).

## 2.3 Operating notes

### 2.3.1 Starting, shutting down

When the pump is controlled automatically (when installed in accordance with 2.1.2.2 c), the clean working-liquid supply is controlled by a solenoid valve (17) which is dependent on the motor operation (see Fig. 8).

ELMO-F on indicates valve open.

ELMO-F off indicates valve closed.

**When the pump is not controlled automatically, proceed as follows:**

**Starting:** Start ELMO-F, immediately afterwards open shut-off valve (18) (Fig. 8)

**Shutting down:** Close shut-off valve (18) and shut down ELMO-F immediately (Fig. 8).

The control valve (16) remains in the closed position when operation is interrupted (Fig. 8).

### 2.3.2 Draining



**WARNING** ELMO-F units that are operated with working liquids that may be hazardous to persons or the environment must for safety's sake be flushed with the machine running before they are opened up.

For draining, open all three screw plugs (068A) of the pump cover (061A) to allow the liquid to run out. When draining, rotate the motor occasionally in the opposite direction to the running direction (see direction arrow on the pump housing) (002A) by hand at the motor fan (502A) until no more working liquid runs out.

By tilting the ELMO-F unit at an angle of 45 degrees towards the pump cover (061A), the ELMO-F unit can be drained almost completely thus preventing any damage even when the unit is not operated for a prolonged period of time or in the event of frost.

### 2.3.3 Measures after prolonged standstill

If the ELMO-F unit is out of operation for longer than approx. 4 weeks or in the event of frost, it should be completely drained - in accordance with 2.3.2 - and then conserved (cast-iron version), i.e. 1/2 litre of anti-corrosive oil (e.g. Mobilarm 247 from Mobil Oil) poured into the suction or discharge branch and the pump then briefly switched on.

If the impeller (047A) jams after a prolonged standstill period because hard water has been used, the compression chamber of the ELMO-F unit should be filled with 10 % oxalic acid which is allowed to work in for approx. 30 minutes.



**CAUTION** Oxalic acid can cause damage to health if swallowed or in contact with skin.

## 3 Repair

### 3.1 General

To avoid wear of the impeller (047A) and the pump casing (002A) or jamming of the impeller (047A), fine dirt particles, which enter the compression chamber of the ELMO-F unit together with the gas being handled or the working liquid, can be flushed out during operation through the flushing outlet (3/8" BSP) (see Fig. 7) at the bottom of the pump.

If very hard water is used as working liquid, it must either be softened or the compression chamber of the ELMO-F unit flushed with a solvent at appropriate intervals.

## ENGLISH

**NOTE** If the motor design incorporates sealed condensate drain holes (e.g. protection class IP55 or IP56, see rating plate), the latter must be opened from time to time to allow any condensate that has accumulated to drain off.

### 3.2 Lubrication

**Under normal operating conditions at 50 Hz the following applies:** After approx. 20,000 operating hours, however after 3 years at the latest, the rolling-contact bearings and the adjacent spaces should have the spent grease and other dirt deposits removed and be recharged with fresh grease. Fill approx. 50 % of the free space in the rolling-contact bearing and approx. 65 % of the volume of the adjacent spaces in the bearing cover with grease. Locked bearings must be replaced and the associated adjacent spaces must remain free of grease.

The relubrication intervals must be shortened accordingly when the pump is operated under **unfavourable conditions**, e.g. different frequencies, converter operation at high speeds.

UNIREX N3 from ESSO or an equivalent grease as per DIN 51825-K3N must be used. Details on the service life of the unit and the useful life of the grease specified in the warranty only apply if UNIREX N3 is used. Different types of grease should not be mixed.

See Fig. 11 for bearing sizes and lubrication table.

When using new rolling-contact bearings, heat the bearings uniformly to approx. 80 - 100°C and fit them in place. Avoid sharp knocks (with hammers, for example).

When relubricating or replacing rolling-contact bearings (007A, 008A), we recommend that any sealing elements that have become worn (e.g. V ring (033A)) are also replaced.

**NOTE:** Observe the location of the side plate when replacing the bearings! Material of the side plate should be stable at temperatures between -20°C and +150°C, e.g. polyacrylic rubber (ACM). Damaged parts must be replaced.

### 3.3 Faults and how to eliminate them (see Fig. 16)

### 3.4 Tightening torques for screwed connections

Unless otherwise specified, the tightening torque values specified in Fig. 15 apply for tightening nuts and bolts:

### 3.5 Spare parts

#### 3.5.1 General instructions

When ordering spare parts, please state the part designation, the part number, the complete type of ELMO-F unit and the serial number. The type and serial number are indicated on the nameplate. The part designation should correspond to the designation in the spare parts list (Fig. 17).

**Ordering example:** 2BV5131 - 0KC00-7P  
No E. F2 62 2621 04201/95  
Impeller 047A

Standard parts can be procured from local suppliers. Ensure that these parts have the same type of construction, dimensions, strength class etc.

#### 3.5.2 Spare parts, standard parts, exploded view of a 2BV5 (see Fig. 17)

#### 3.5.3 Notes on Repair Instructions

**Repair Instructions** are available in addition to these operating instructions which contains further information for qualified personnel (see DIN VDE 0105 or IEC 364 for definition of qualified personnel) on safety, disassembling and reassembling ELMO-F vacuum pumps/compressors 2BV5110 to 2BV5161.

**The Repair Instructions can be obtained from the manufacturer by specifying the**

Order number: 610.44 416.02 (German/English)

together with full name and address of the sender.

#### 3.5.4 Repair work/work carried out under warranty

ELMO-F units which are returned in cases of warranty claims must be sealed on delivery. They must be completely drained (see 2.3.2) and their exteriors cleaned prior to shipment. Refer to the protection class indicated on the rating plate for the appropriate cleaning instructions.



**WARNING** Contaminated ELMO-F units which may be hazardous to the environment and persons must be decontaminated before they are sent to the repair workshop.

A legally-binding declaration (see Fig. 18) must be filled out by authorized personnel and enclosed with the delivery in order to guarantee that the ELMO-F unit to be shipped has not been operated with hazardous substances and that it has been decontaminated accordingly.

If this declaration indicating decontamination in accordance with the appropriate regulations has not been received when the ELMO-F unit arrives at the repair workshop, repair work will be unavoidably delayed until this declaration has been received as the accident prevention regulations must be observed in this case.

## 4 ELMO-F units with EEx e motors

DIN EN 50014/VDE 0170/0171 Part 1 and  
DIN EN 50019/VDE 0170/0171 Part 6



*Information printed in italics is additional or special information for these units.*

*When the unit is mounted vertically, a cover must be fitted in order to prevent foreign bodies falling into the motor fan cowl (see DIN EN 50014/VDE 0170/0171 Part 1, Section III, 16.1). This cover must not prevent the motor from being cooled by the fan.*

*The temperature class of the motor indicated on the rating plate must correspond to the temperature class of the flammable gas that might occur. A motor circuit-breaker must be connected on the line side of each unit which must be set to the nominal motor current and must trip within the time  $t_e$  indicated on the rating plate when the rotor is locked (test this function against the tripping characteristic enclosed with the motor circuit-breaker). An overload protection device with phase-failure protection must be connected if delta circuits are used.*

*If overload protection is to be carried out exclusively via a direct temperature monitoring device with the aid of temperature sensors (see DIN EN 50019/VDE 0170/0171 Part 6, Annex A-A1.b), the design of the motor has to be ordered, tested and certified separately.*

**Reference should be made to DIN 57165/VDE 0165.**

*Repair work must be carried out in Siemens workshops or be acceptance-tested by an authorized expert.*

## ENGLISH

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## TERMINOLOGY

In accordance with all supplied operating and repair manuals and the warnings on the machines and devices themselves.

## Operation

encompasses the installation, commissioning (preparation for use) and controls by operator (actuation, switching on and off, etc.).

## Servicing

encompasses the testing and preventive maintenance (inspections and overhauls), maintenance, corrective maintenance (troubleshooting with repair).



## ...WARNING NOTICES



## DANGER

means that death, grievous injury or extensive damage to property **will** occur if the appropriate precautions are not taken.



## WARNING

means that death, grievous injury or extensive damage to property **may** occur if the appropriate precautions are not taken.



## CAUTION

means that minor injury or damage to property **may** occur if the appropriate precautions are not taken.

**NOTE** means that particular attention is drawn to the interaction of technical processes because they may not be obvious even to qualified personnel.

Even though not specifically mentioned, compliance with transport, assembly, operating and maintenance notes and technical data (in the operating manuals, the product documents or on the machine itself) is, however, equally crucial in order to avoid disruptions which might in turn directly or indirectly cause grievous injury or serious damage to property.

**Qualified personnel** are persons who, due to their training, experience and instruction and their knowledge of pertinent standards, specifications, accident prevention regulations and operating conditions, have been authorized by the party responsible for the safety of the system to carry out the activities necessary in each case and are capable of recognizing and avoiding possible inherent dangers in doing so. Among other skills, a knowledge of first aid is required.

## GENERAL NOTE

In the interest of clarity and in view of the possible wealth of information, these operating and repair manuals do not detail every bit of information and, in particular, cannot discuss every possible operational or servicing-related situation.

If you wish additional information, or if specific problems arise which are not dealt with in sufficient detail in the operating and repair manuals supplied, you can request the information required through your local Siemens office.

The contents of these operating and repair manuals are neither part of, nor are they intended to alter a former or existing agreement, commitment or legal relationship. All obligations on Siemens' part arise from the pertinent purchase agreement, which also contains the complete and sole valid warranty terms. These contractual warranty terms are neither extended nor restricted by the statements made in these operating and repair manuals.

## GENERAL INFORMATION, DESCRIPTION

## Basic Information about Safety



## DANGER

Due to their function-related electrical and mechanical properties, the machines can cause extremely serious damage to health and property if they are not used, operated and serviced as intended or if they are tampered with. It is therefore assumed that planning and execution of all mechanical and electrical facilities and transport, operation and servicing will be executed and supervised by responsible, qualified personnel.



## WARNING

When electric machines or devices are running some of their components are conducting dangerous electricity and/or are subjected to mechanical stress. The persons working on the machine and/or the device must be appropriately qualified. They must be thoroughly acquainted with the contents of these and all other operating and repair manuals provided. Correct, safe use of this machine and the device requires proper transport, proper storage, operation as intended and careful servicing. All notes and information on the machines or devices must be observed.

## APPLICATIONS, DESIGN, OPERATING MODE

**NOTE:** The electrical machines for which these operating manuals are intended are component parts of electrical power installations, units and equipment chiefly for industrial applications and have been constructed in accordance with the information specified on their rating and other plates, in certificates, order documents and catalogs, e.g. VDE 0530, IEC 34-1. Accordingly, the operating manuals contain basically only information pertaining to safety which must be observed when used as intended in industrial applications. The pertinent applicable national, local and system-specific specifications and requirements must also be taken into account.

## ENGLISH

The machines are also employed in **non-industrial** applications, however, i.e. in commercial or private sectors (e.g. the trades, farming, home and garden, etc.). If the safety precautions according to rating plate data and certificates are not adequate for these or special industrial applications due to special safety regulations or requirements, the operator of this machine or the manufacturer of the system, unit or device in which the machine is installed must make certain that these special safety regulations and requirements are complied with (e.g. by ordering special models of the machines, installing additional protective equipment, appropriate installation, etc.).

## TRANSPORT, STORAGE

**NOTE:** Certain machines must be picked up only at the main lifting fittings provided for this purpose, at lifting lugs for example. Use hoisting tackle appropriate in terms of machine weight. Use suitable cable guides or spreading devices if the machine in the delivery state has any attachments, etc. fitted (see Operating Manual).

## OPERATION AND MAINTENANCE

### General Safety Notes



#### WARNING

To be safe, operation and servicing of the machine or device must be performed properly by qualified personnel who observe the

warnings in these and other operating and repair manuals supplied and the notes on the machines and devices.

In particular, the general standards for installation and safety (DIN and VDE for example), are to be followed for work on power installations, are the standards for the proper use of lifting tackle and equipment and the use of personal protective equipment such as safety goggles, etc.



#### DANGER

Do not reach into the machine through air intake or discharge ports: The rotor is very dangerous.

Keep in mind that, due to its rotating mass, the machine may continue to turn several minutes after being shut off. If the gas in the system has not expanded, the machine can start to rotate due to leakage through shut-off units.

The rotor can cause injury even when the machine is switched off if the rotor is rotated manually.

## INSTALLATION



#### CAUTION

Under unfavourable operating conditions, parts of the housing may reach temperatures of over 80 °C, possibly necessitating the use of a touch

guard - depending on the installation conditions. Note, too, that material being handled can be ejected at these temperatures through discharge ports and pressure control valves. Site these openings so that they are not directed towards personnel and flammable or explosive materials. Temperature-sensitive parts such as cables or electronic components are not to be placed next to or attached to parts of the housing or incoming or outgoing piping.

The machines can be installed in a dusty or damp location. The insulation is tropic-proof. Normally, no special protective measures are required to protect the machines against the weather when they are properly stored or installed out of doors. When installing machines with the shaft in the vertical position, **EEx-e** motors require a cover to prevent foreign bodies from falling into the motor fan cowl (see

EN 50 014/VDE 0170/0171, Part 1, Section III, 16.1). This cover must not hinder the cooling of the motor by its fan.

The vacuum pumps and compressors are only suitable for conveying dust-free air and other noncombustible, noncorrosive and nonexplosive gases, vapours or liquids.

Solids and contaminants must be removed before the intake port (intake filter).

The use of machines with **EEx-e** drive motors is permitted in rooms in which explosive gases are occasionally present. However, the conveyance of explosive gases and liquids is not permitted. The temperature class specified on the rating plate must be complied with.

Where machines with cooling by ambient air are involved, there must be unrestricted passage of the cooling air to and from the machines.

The re-intake of heated exhausted air is not permitted.



**WARNING** Ensure that water cannot enter the motor.

Attention is drawn to the general requirements for **protection against contact** with moving parts such as pulleys.

## CONNECTIONS

Comply with data in the manuals supplied. Connection cables must be selected according to the type of use and to the voltages and current levels at hand. Connect machine in accordance with the circuit diagram in the terminal box or - if the machine has no terminal box - in accordance with the separate circuit diagram.

Tighten the connection terminals of the machines to the torques stated in the terminal box.



#### CAUTION

To avoid danger, the feeder cables in the terminal box must be professionally connected. In particular, this means that:

- the inside of the terminal box is clean and contains no cable remains
- protective conductor or protective earthing is connected
- all terminal lugs are tight
- the minimum clearances in air are adhered to (beware of protruding wire ends)
- unused penetrations are sealed and the cover elements are screwed in tight
- all sealing surfaces of the terminal box are in a proper state to maintain the type of protection. If tightness of the joints is achieved only with metal sealing surfaces, these have to be cleaned and then lightly lubricated.
- Before the initial start-up, connect liquid pumps and liquid ring pumps to the pipes provided so that no fluid can reach energized components.
- The material and dimensioning of all pipes, containers and fittings must be matched to the pressure and temperature conditions involved and must be suitable for the type of material to be conveyed.



#### CAUTION

There is a danger of bursts if the machine is subjected to impermissibly high pressure from the plant. Where applicable, suitable pressure-relief devices must be used to prevent this.



#### CAUTION

Where pumps or compressors are involved which conduct hot or dangerous gases, vapours or liquids, or are operated with dangerous working liquids, or have to be emptied at temperatures over 60 °C, all drain connections must be equipped with shut-off fittings and the material conveyed and/or the working liquids must be taken away in closed systems.



## ENGLISH

"Dangerous" materials are, for example, materials which are hazardous to the health or the environment. Local statutory regulations are to be observed for their appropriate disposal.

## COMMISSIONING

**CAUTION**

If the machine is started up without being connected or fastened, for example, for test purposes the initial torque of the motor may cause it to move suddenly and topple over.

**NOTE:** For safe operation of the machine the following conditions as a minimum must be observed:

- The machine is assembled and operated in accordance with the data on the plate and, where applicable, with the documentation supplied (voltage, current, frequency, connection, model, type of protection, cooling method).
- When frequency converters are used, operating speeds are not to exceed those permitted according to plate data.
- The machine is properly assembled, aligned and connected to piping or hoses, as appropriate.
- The elevation of the installation location is taken into account when adjusting the pressure control valves.
- The drive elements are adjusted correctly for their type, e.g. belt tension if belt-driven, alignment of couplings.
- The cooling air circuit is not impaired; the cooling effect must also not be impaired by dirt on the cooling surfaces.
- The rotor can be rotated without it touching.
- The direction of rotation of the machine is as specified.
- All fastening screws/bolts, fasteners and electrical connections are tightened as specified in the operating manual or in the terminal box cover.
- The earthing and equipotential bonding connections have been made properly.
- Any supplementary equipment present (thermostat in coil, anti-condensation heater, etc.) are properly connected and operative.
- All measures have been taken to protect against contact with moving or energized parts.
- Any separate fans are ready for operation and are connected for the specified direction of rotation and do not impair the running smoothness of the machine during operation.

**CAUTION**

The intake ports must be sited so that no foreign elements can be sucked in and ejected through the discharge port (hazard for eyes and skin, danger of poisoning).

**CAUTION**

When air is sucked in from the atmosphere, the intake ports must be covered with protective devices (gratings or the like) in order to prevent foreign elements including parts of the body and clothing from being sucked in.

It is not possible for this listing to be exhaustive. Additional tests in accordance with other manuals or system-specific conditions may be required.

**NOTE:** To ensure that the machine is also permanently safe, the following precautions are recommended for commissioning and then at protracted intervals, initially after about 500 operating hours:

- Check whether all screw/bolt connections are tightened to the torques given in the operating manual.
- Make certain that cables and insulation parts - where accessible - are in good condition and are not discoloured.
- During operation, check for noises or vibrations at the bearings, end shields, covers and housing components.

- Switch off the machine if it is not running smoothly or is making abnormal noises; initiate immediate repair.
- If the machine is running satisfactorily, check the values for voltage, current and performance.
- As far as possible, monitor the temperatures of the bearings, etc., until the steady-state point is reached.

## OPERATION

## Safety Notes

**WARNING**

Covers which prevent contact with active or rotating parts or are required to direct the flow of air for effective cooling are not to be open during operation.

**WARNING**

Sound pressure levels over 85 dB (A) may cause prolonged damage to health. Where applicable, suitable corrective action must be initiated.

After protracted machine shutdowns the measures recommended under "Commissioning" in the section "Operation and Servicing" are to be performed as appropriate, depending on the length of the standstill period.

## SERVICING

**NOTE:** Careful and regular inspections, overhauls and maintenance are required to detect any malfunctions at an early stage and to eliminate them before extensive damage results.

## GENERAL SAFETY PRECAUTIONS

**DANGER**

Before any work is performed on the machine or equipment, especially covers over energized or moving parts are removed, the machine, item of equipment or system is to be properly disconnected from the supply. Apart from the main electrical circuits, particular attention is to be paid to any supplementary or auxiliary electrical circuits, especially anti-condensation heaters. Wait until the machine is at a standstill (coasting due to flywheel). See note on danger, page 5, 6.

The standard safety rules, according to VDE 0105 for example, are:

- disconnect from supply
- secure against re-actuation
- confirm de-energization
- cover or provide barriers for adjacent live components.


**DANGER**

The above measures are not to be reversed until the machine has been completely assembled and the servicing concluded.

**CAUTION**


The operational reliability of the machine can only be maintained if original parts or authorized replacement parts are used during every corrective maintenance and the repair manual is consistently adhered to.

## CORRECTIVE MAINTENANCE

 **WARNING** Repairs to EEx-e motors must be carried out in Siemens shops or acceptance-tested by an officially recognized expert.

### DISMANTLING


Sectional diagrams and representations in operating manuals and other manuals contain information regarding the technical design of normal machines and assemblies. However, special models and versions may deviate in technical details. If any uncertainty exists, we strongly recommend that you contact us, stating the machine type and serial number, or that you have the maintenance work performed at a SIEMENS service centre.

 **CAUTION** After fastening screws/bolts are removed, some parts are just held in centring fits. Even during proper dismantling it is still possible that some heavy parts may therefore suddenly become loose and drop off, possibly causing injuries and damage. Take suitable measures to secure all parts being worked on.

### ASSEMBLY

Joints that are sealed due to stringent requirements for type of protection must be resealed during assembly with a suitable non-hardening sealant (type: consult the proper operating and repair manuals).

If gaskets and sealing elements are installed to ensure the degree of protection, they must be examined and replaced if they are no longer effective.

 **CAUTION** Tightening torques are specified in the terminal box for bolted connections of electrical terminals. If these are not complied with, some cables may become loose and pose a danger.

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## TERMINOLOGIE

Au sens des instructions de service et de dépannage accompagnant le produit ainsi que des marques d'avertissement figurant sur les machines et les appareils mêmes :


### Exploitation


concerne la mise en place, la mise en service (préparatifs pour l'utilisation) et l'utilisation (manoeuvres, mise en marche et à l'arrêt, etc.)


### Maintenance

concerne le contrôle (inspections, révisions), l'entretien et le dépannage (localisation du défaut et réparation).

## ... MARQUES D'AVERTISSEMENT

 **DANGER** signifie que la non-application des mesures de précaution appropriées conduit à la mort, à des lésions corporelles graves ou à un dommage matériel important.

 **ATTENTION** signifie que la non-application des mesures de précautions appropriées peut conduire à la mort, à des lésions corporelles graves ou à un dommage matériel important.

 **AVERTISSEMENT** signifie que la non-application des mesures de précautions appropriées peut conduire à des lésions corporelles légères ou à un dommage matériel.

**NOTA** attire l'attention sur des interdépendances techniques qui ne sont pas toujours évidentes, mêmes aux yeux des personnes compétentes.

Afin d'éviter les incidents susceptibles d'occasionner directement ou indirectement des lésions corporelles graves ou des dommages matériels importants, il importe aussi de respecter les autres instructions de transport, de montage, d'exploitation et d'entretien, qui ne sont pas mises spécialement en relief, de même que les caractéristiques techniques (figurant dans les instructions de service, dans la documentation des produits et sur la machine même).

**4 ELMO-G med EEx e-drivmotorer**

DIN EN 50 014/ VDE 0170/0171 Del 1 samt  
DIN EN 50 019/ VDE 0170/0171 Del 6



För dessa maskiner gäller dessutom kompletterande eller speciell information i kursiv stil.

Om maskinen monteras med axeln vertikalt måste man ordna ett skydd ovanför, så att främmande partiklar inte kan falla in i fläkthuv (se DIN EN 50014/ VDE 0170/0171 del 1, avsnitt III, 16.1). Detta får dock inte innebära ett hinder för fläktens kylning av motorn.

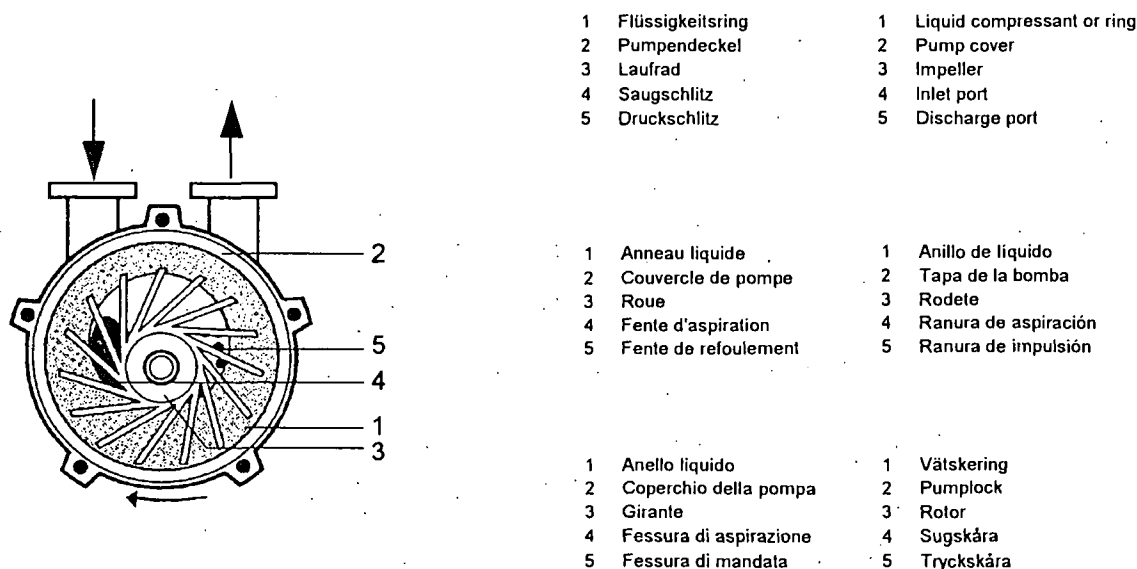
Den på märkplåten angivna temperaturklassen för motorn måste stämma med temperaturklassen för de brännbara gaser som eventuellt kan förekomma. En motorskydds brytare måste vara inkopplad framför varje motor. Denna ställs in på motorns märkström och skall lösa ut inom den på märkplåten angivna tiden  $t_e$  och rotorn kör fast. (Kontroll med ledning av den utlösningsskurva som medföljer motorskydds brytaren.) Vid triangelkoppling måste det finnas ett överbelastningsskydd med skydd mot fasbortfall.

Om överbelastningsskyddet emellertid bara erhålls genom direkt temperaturövervakning med hjälp av temperatursensorer (se DIN EN 50019/ VDE 0170/0171 del 6, bilaga A-A1.b), så måste maskinen besiktigas och godkännas speciellt för att fastställa att dess konstruktion passar för detta.

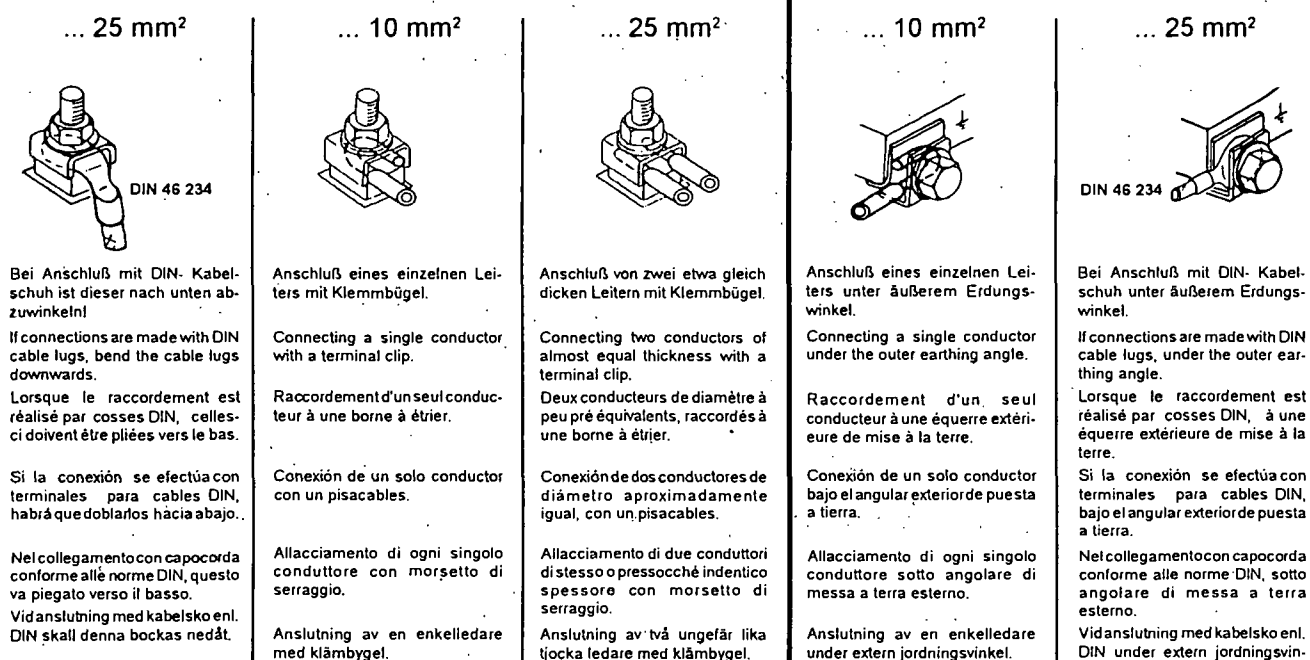
**Vi hänvisar till DIN 57 165/ VDE 0165.**

Reparationer måste utföras på Siemens verkstäder eller av officiellt godkänd specialist.

## ANHANG / ANNEX / APPENDICE / APENDICE / APPENDICE / BILAGA



**Fig. 1** Schematischer Schnitt durch den Arbeitsraum (in Richtung Pumpendeckel gesehen)  
**Section through the compression chamber** (viewed in the direction of the pump cover)  
**Coupe schématisée de la chambre de travail** (vue en direction du couvercle)  
**Sección esquemática de la cámara de operación** (visto en dirección hacia la tapa de la bomba)  
**Sez. schematica della camera di compressione** (vista verso il Coperchio della pompa)  
**Genomskärning av pumpkammaren, (sett mot pumplocket)**



**Fig. 2** Anschließbare Querschnitt je nach Klemmengröße (ggf. reduziert durch Größe der Leitungseinführungen)  
**Conductor cross-sections connectable to the various terminals** (may be reduced by size of cable entries)  
**Sections raccordable suivant la taille de la borne** (réduction éventuelle par la taille des entrées de câbles)  
**Sección conectable según tamaño del borne** (en caso dado, más pequeña debido al tamaño de las entradas de línea)  
**Diamentri dei collegamenti a sec. delle misure dei morsetti** (eventualmente sono ridotte le dimensioni delle aperture per i conduttori)  
**Anslutningsbara ledarear för olika klämbügelstorlekar** (ev. reducerat med hänsyn till genomföringens storlek)

Typ Type Tipo	max. Differenzdruck Maximum differential pressure Pression différentielle maxi à Presión diferencial máx. en servicio Pressione differenziale max. Maximalt differenstryck		Empfohlener Frischflüssigkeitsstrom Recommended flowrate of fresh liquid Débit de liquide frais recommandé Caudal recomendado de líquido nuevo Portata raccomandata di liquido fresco Rekommenderat flöde av ny vätska
	50 Hz	60 Hz	
2BV5 161	550 mbar	650 mbar	2,4 m³/h
2BV5 131	450 mbar	500 mbar	1,8 m³/h
2BV5 121	450 mbar	400 mbar	1,5 m³/h
2BV5 111	500 mbar	550 mbar	1,2 m³/h
2BV5 110	500 mbar	600 mbar	0,9 m³/h

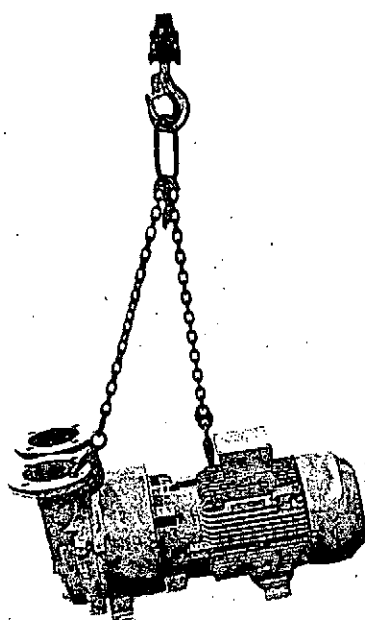
**Fig. 3 Maximaler Differenzdruck bei Kompressorbetrieb**  
**Maximum differential pressure for compressor operation**  
**Pression différentielle maximale en fonctionnement en compresseur**  
**Presión diferencial máx. en servicio como compresor**  
**Pressione differenziale max. per funzionamento compressore**  
**Maximalt differenstryck vid kompressordrift**

Typ Type Tipo	Max. zulässige Mitförderung von Wasser beträgt über den Ansaugstutzen bei Max. permissible quantity of water entrained via the suction flange Quantité maxi admissible d'eau entraînée à l'aspiration Contenido máx. adm. de agua arrastrada a través de la boca de aspiración Contenuto max. di acqua ammesso tramite il bocchettone di aspirazione Max. tillåten medtransport av vatten via insugningsstutsen	
	Dauerbetrieb / Continuous operation Service continu / En servicio permanente Funzionamento continuo / Kontinuerlig drift	Kurzzeitbetrieb / Short-time operation Service temporaire / En servicio de breve duración Funzionamento brevi periodi / Intermittent drift
2BV5 161 50 Hz	3,0 m³/h	6,0 m³/h
2BV5 161 60 Hz	4,5 m³/h	6,0 m³/h
2BV5 131	5,0 m³/h	5,0 m³/h
2BV5 121	3,5 m³/h	4,5 m³/h
2BV5 111	3,0 m³/h	3,4 m³/h
2BV5 110	2,0 m³/h	2,5 m³/h

**Fig. 4 Ansauggas bzw. -dampf**  
**Suction gas or vapour**  
**Aspiration de gaz ou de vapeur**  
**Gas y vapores aspirados**  
**Gas rispettivamente vapore di aspirazione**  
**Insugningsgas/-ånga**

<b>Bemessungsbetriebsflüssigkeitsstrom bei Vakuumbetrieb</b> (bei Wasser als Betriebsflüssigkeit von 15 °C) <b>Nominal working liquid flowrate for vacuum operation</b> (using water with a temperature of 15 °C as working liquid) <b>Débit nominal de liquide de fonctionnement en pompe à vide</b> (pour de l'eau à 15 °C) <b>Caudal asignado del liquido de servicio para operación en vacío</b> (con agua como liquido de servicio a 15 °C) <b>Portata di taratura del liquido in funzionamento a vuoto</b> (liquido di funzionamento: acqua, 15 °C) <b>Märkflöde av driftvätska vid vakuumbetrieb</b> (driftvätska = vatten vid 15 °C)						
<div style="display: flex; justify-content: space-between;"> <div> Betriebsart / Mode fonct. / Modo di funzionamento </div> <div> / / /  Mode of operation / Clase de servicio / Driftsätt </div> </div>						
<div style="display: flex; justify-content: space-between;"> <div> Kühlschaltung  Cooling circuit  Montage froid  Circuito frío  Circuito refrigerante  Kytöppling </div> <div> Schaltung mit Abscheider und Betriebsflüssigkeitsrückführung  Circuit with separator and recirculation of working liquid  Montage avec séparateur et recyclage du liquide de fonctionnement  Circuito con separador y reciclaje del liquido de servicio  Circuito con separatore e recupero parziale del liquido di funzionamento  Köppling med avskiljare och återflöde av driftvätska </div> </div>						
<b>Typ</b> <b>Type</b> <b>Tipo</b>	33-200 mbar	200-500 mbar	>500 mbar	33-200 mbar	200-500 mbar	>500 mbar
28V5 161	2,40 m³/h	0,70 m³/h	0,50 m³/h	1,20 m³/h	0,60 m³/h	0,25 m³/h
28V5 131	1,80 m³/h	0,45 m³/h	0,40 m³/h	0,90 m³/h	0,40 m³/h	0,18 m³/h
28V5 121	1,20 m³/h	0,40 m³/h	0,35 m³/h	0,60 m³/h	0,30 m³/h	0,12 m³/h
28V5 111	1,00 m³/h	0,40 m³/h	0,35 m³/h	0,50 m³/h	0,30 m³/h	0,12 m³/h
28V5 110	0,80 m³/h	0,35 m³/h	0,30 m³/h	0,45 m³/h	0,25 m³/h	0,12 m³/h

**Fig. 5 Betriebsflüssigkeit** (angegebene Werte sind für Trockenluftabsaugung)  
**Working liquid** (the values given in the table apply to dry-air extraction)  
**Liquide de fonctionnement** (les valeurs indiquées s'appliquent à l'aspiration d'air sec)  
**Líquido de servicio** (los valores indicados son para aspiración con aire seco)  
**Liquido di funzionamento** (i valori riportati in tabella valgono per aspirazione di aria asciutta)  
**Driftvätska** (angivna värden gäller vid utsugning av torr luft)



mit Kette und Haken / with chain and hook  
avec chaîne et crochet / con cadena y ganchos  
con catena e gancio / med kedja och krok

**Fig. 6 Krantransport / Crane transport**  
**Manutention par engin de levage / Transporte con grúa**  
**Trasporto con gru / Krantransport**



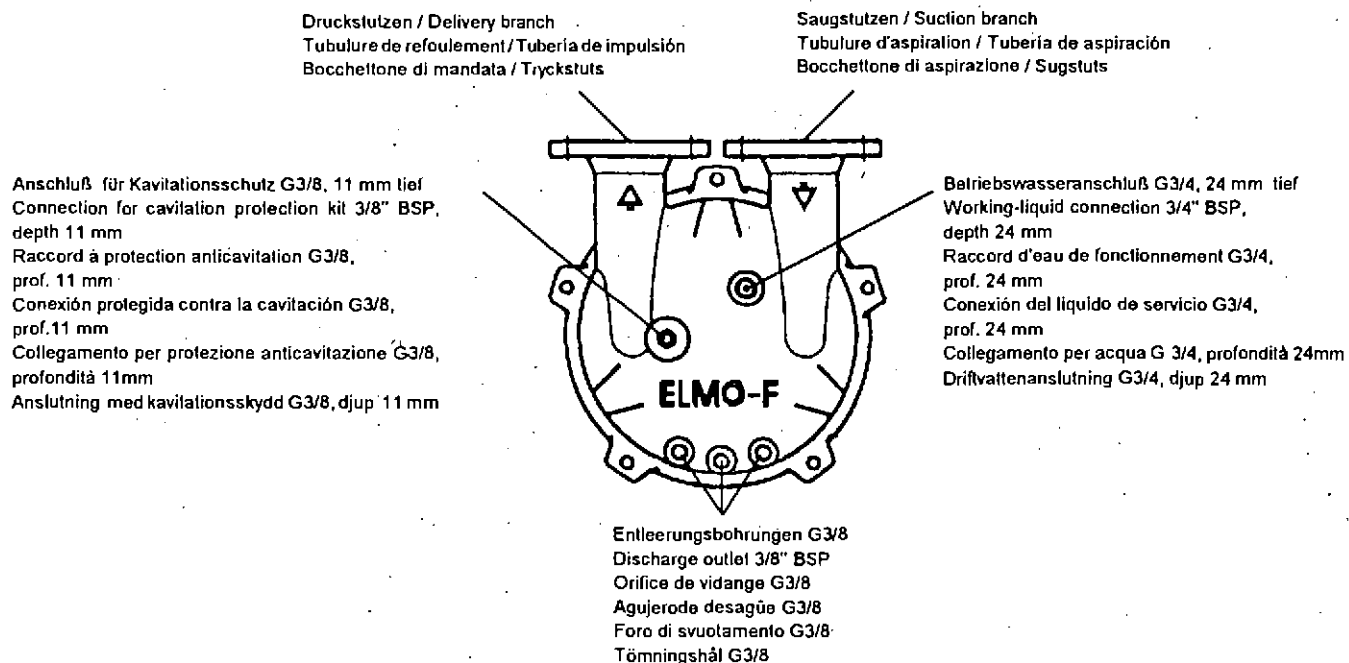
## DEUTSCH / ENGLISH / FRANÇAIS / ESPAÑOL / ITALIANO / SVENSKA

Graugußausführung (Pumpenteile aus Grauguß)

/ Cast-iron version (pump parts made from cast iron)

Exécution en fonte grise (éléments de pompe en fonte grise) / Modelo de fundición gris (piezas de la bomba de fundición gris)

Esecuzione in ghisa grigia (parti della pompa in ghisa grigia) / Gråjärnsutförande (pumpens delar av gråjärn)

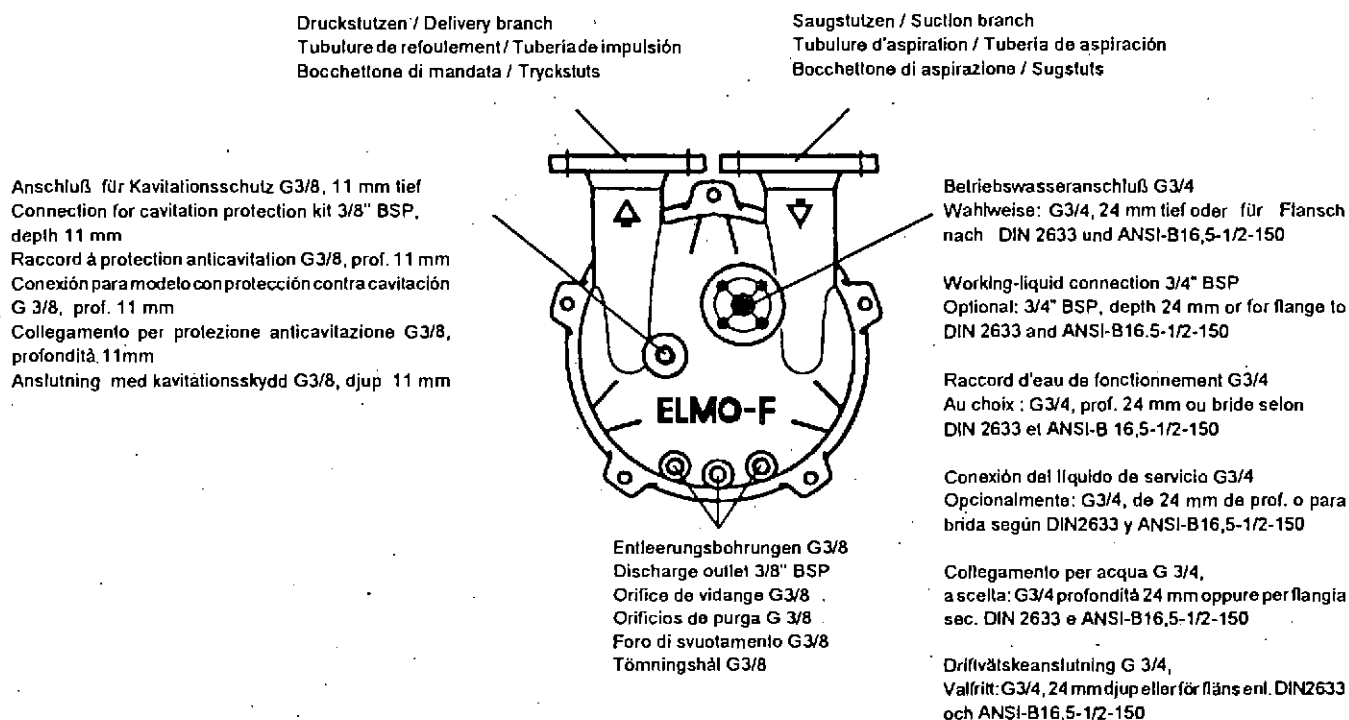


Edelstahlausführung (Pumpenteile aus Edelstahl)

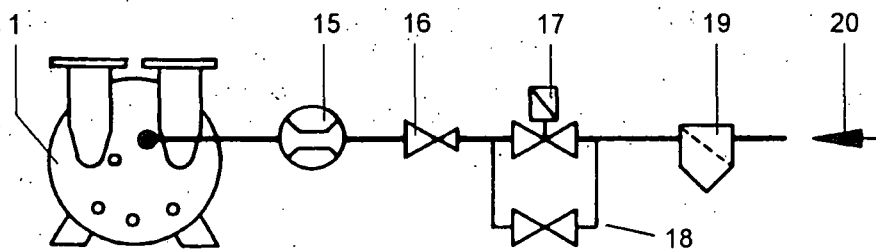
/ Stainless steel version (pump parts made from stainless steel)

Exécution en acier inoxydable (éléments de pompe en acier inox) / Modelo de acero inoxidable (piezas de la bomba de acero inoxidable)

Esecuzione in acciaio pregiato (parti della pompa in acciaio pregiato) / Specialstålutförande (pumpens delar av specialstål)



**Fig. 7 Rohranschlüsse / Pipe connections**  
Raccords de tuyauterie / Conexión de tuberías  
Collegamento delle tubazioni / Röranslutningar



- 1 ELMO-F
- 15 Durchflußmesser (Option)
- 16 Stellventil
- 17 Magnetventil mit Motor gekoppelt:  
(Motor an → Ventil auf)  
(Motor aus → Ventil zu)
- 18 Bypass mit Absperrventil
- 19 Schmutzfänger (Option)
- 20 Betriebsflüssigkeitszuführung  
(z. B. Gewinderohr DIN 2440-DN 20)

- 1 ELMO-F
- 15 Flowmeter (option)
- 16 Control valve
- 17 Solenoid valve, coupled with motor  
(Motor on → Valve open)  
(Motor off → Valve closed)
- 18 Bypass with shutoff valve
- 19 Filter (option)
- 20 Working-liquid feed pipe  
(e. g. threaded pipe DIN 2440-DN 20)

- 1 ELMO-F
- 15 Débitmètre (option)
- 16 Robinet de réglage
- 17 Electrovanne asservie au moteur  
(Moteur en marche → Vanne ouverte)  
(Moteur à l'arrêt → Vanne fermée)
- 18 Bybass avec robinet d'arrêt
- 19 Crépine (option)
- 20 Arrivée de liquide de fonctionnement  
(tube fileté DIN 2440-DN 20)

- 1 ELMO F
- 15 Caudalímetro (opcional)
- 16 Válvula de regulación
- 17 Electroválvula acoplada al motor  
(Motor en marcha → Válvula abierta)  
(Motor parado → Válvula cerrada)
- 18 Derivación con válvula de cierre
- 19 Colector de impurezas (opcional)
- 20 Alimentación del líquido de servicio  
(p. ej., tubo roscado DIN 2440-DN 20)

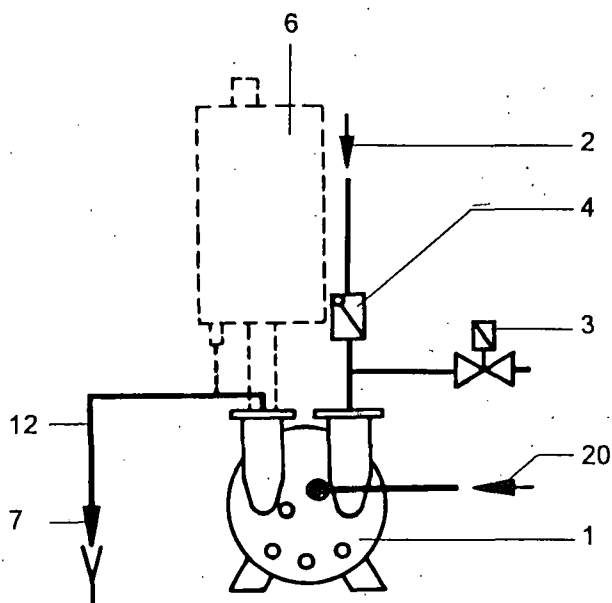
- 1 ELMO-F
- 15 Flussometro (opzionale)
- 16 Valvola di comando
- 17 Elettrovalvola accoppiata al motore  
(Motore acceso → valvola aperta)  
(Motore spento → valvola chiusa)
- 18 By-pass con valvola di intercettazione
- 19 Filtro (opzionale)
- 20 Adduzione del liquido di funzionamento  
(per es. tubazione filettata DIN 2440-DN20)

- 1 ELMO-F
- 15 Genomflödesmätare (valfri)
- 16 Ställventil
- 17 Magenventil koppland med motorn  
(Motor till → Vent. öppen)  
(Motor från → Vent. stängd)
- 18 Shuntkoppling med spärrventil
- 19 Smutsuppsamlare (valfri)
- 20 Driftvätsketillförsel  
(t. ex. gängat rör DIN 2440-DN 20)

**Fig. 8** **Empfohlener Betriebsflüssigkeitsanschluß**  
**Recommended working-liquid connection**  
**Raccordement recommandé pour le liquide de fonctionnement**  
**Conexión recomendada del líquido de servicio**  
**Collegamento consigliato per il liquido di funzionamento**  
**Rekommenderad anslutning av driftvätska**

## DEUTSCH / ENGLISH / FRANÇAIS / ESPAÑOL / ITALIANO / SVENSKA

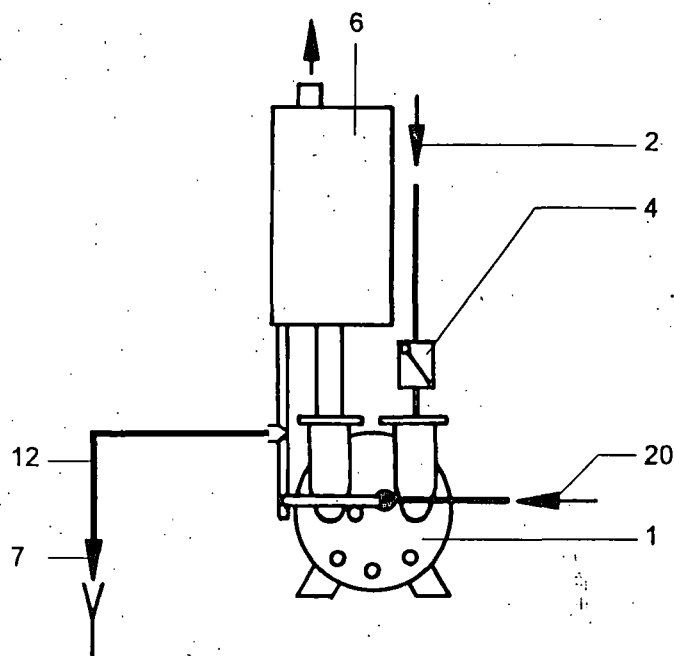
Kühlschaltung  
Cooling-circuit connection  
Montage froid  
Circuito frío  
Circuito refrigerante  
Kylkoppling



- 1 ELMO-F
- 2 Saugleitung
- 3 Entlüftungsventil (Magnetventil)
- 4 Rückschlagklappe
- 6 Flüssigkeitsabscheider
- 7 Überlauf
- 12 Druckleitung
- 20 Betriebsflüssigkeitszuführung (beachte Fig. 8)

- 1 ELMO-F
- 2 Tubería de aspiración
- 3 Válvula de purga de aire (magnética)
- 4 Válvula de retención
- 6 Separador del líquido
- 7 Rebose
- 12 Tubería de impulsión
- 20 Alimentación del líquido de servicio (vease Fig. 8)

Schaltung mit Abscheider und teilweiser Betriebsflüssigkeitsrückführung  
Connection with separator and partial recirculation of working liquid  
Montage avec séparateur et recyclage partiel du liquide de fonctionnement  
Circuito con separador y reciclaje parcial del líquido de servicio  
Circuito con separatoro e recupero parziale del liquido di funzionamento  
Koppling med avskiljare och delvis återmatning av driftvätska



- 1 ELMO-F
- 2 Suction pipe
- 3 Vent valve (solenoid valve)
- 4 Non-return valve
- 6 Liquid separator
- 7 Overflow
- 12 Delivery pipe
- 20 Working-liquid feed pipe (s. Fig. 8)

- 1 ELMO-F
- 2 Tubo di aspirazione
- 3 Valvola di disaerazione (elettrovalvola)
- 4 Valvola di ritegno
- 6 Separatore del liquido
- 7 Tubo di supero
- 12 Tubo di mandata
- 20 Adduzione del liquido di funzionamento (ved. Fig. 8)

- 1 ELMO-F
- 2 Conduite d'aspiration
- 3 Valve de purge (électrovanne)
- 4 Clapet de non-retour
- 6 Séparateur de liquide
- 7 Trop-plein
- 12 Conduite d'écoulement
- 20 Arrivée de liquide de fonctionnement (v. Fig. 8)

- 1 ELMO-F
- 2 Sugledning
- 3 Avluftningsventil (magnetventil)
- 4 Backventil
- 6 Vätskeavskiljare
- 7 Bräddavlopp
- 12 Tryckledning
- 20 Tillförsel av driftvätska (s. Fig. 8)

**Fig. 9** Möglichkeiten zur Zuführung der Betriebsflüssigkeit (Schematische Aufbausketzen)

Methods of supplying the working liquid (schematic diagrams of pump designs)

Possibilités d'alimentation en liquide de fonctionnement (représentation schématique)

Posibilidades de alimentación del líquido de servicio (representación esquemática)

Possibilità di adduzione del liquido di funzionamento (schema)

Två sätt att tillföra driftvätskan (schematiska principskisser)

# **Kunststoffausführung**

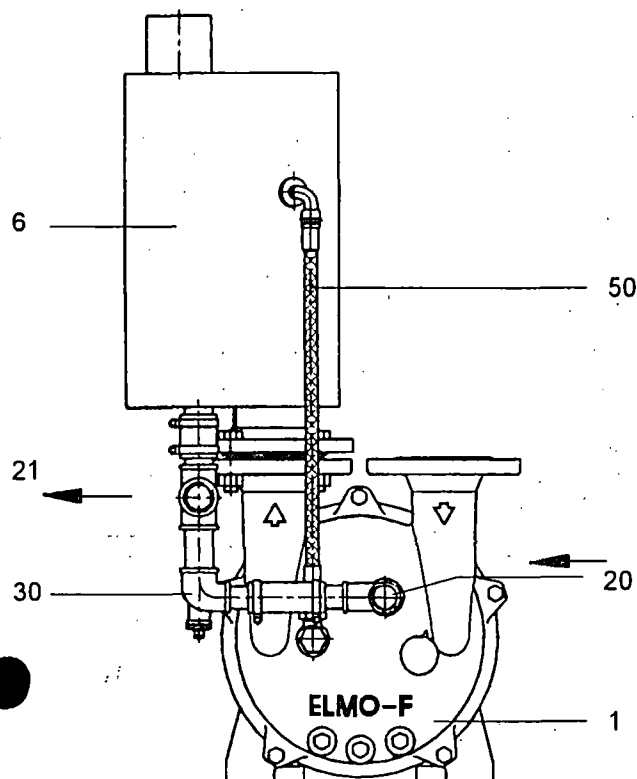
## **Plastic version**

## **Exécution en matière plastique**

## **Modelo de plástico**

## **Esecuzione in materia plastica**

## **Plastutförande**



- 1 ELMO-F
- 6 Betriebsflüssigkeitsabscheider
- 20 Zufuhr Betriebsflüssigkeit  
(s. Fig. 8)
- 21 Ablauf Betriebsflüssigkeit
- 30 Rohr bzw. Schlauch, vollständig
- 50 Kavitationsschutz-Anschlußschlauch

- 1 ELMO-F
- 6 Separador del líquido de servicio
- 20 Alimentación del líquido de servicio (v. Fig. 8)
- 21 Orificios de purga del líquido de servicio
- 30 Tubería o manguera, completa
- 50 Manguera de unión para la protección  
contra la cavitación

# **Edelstahlausführung**

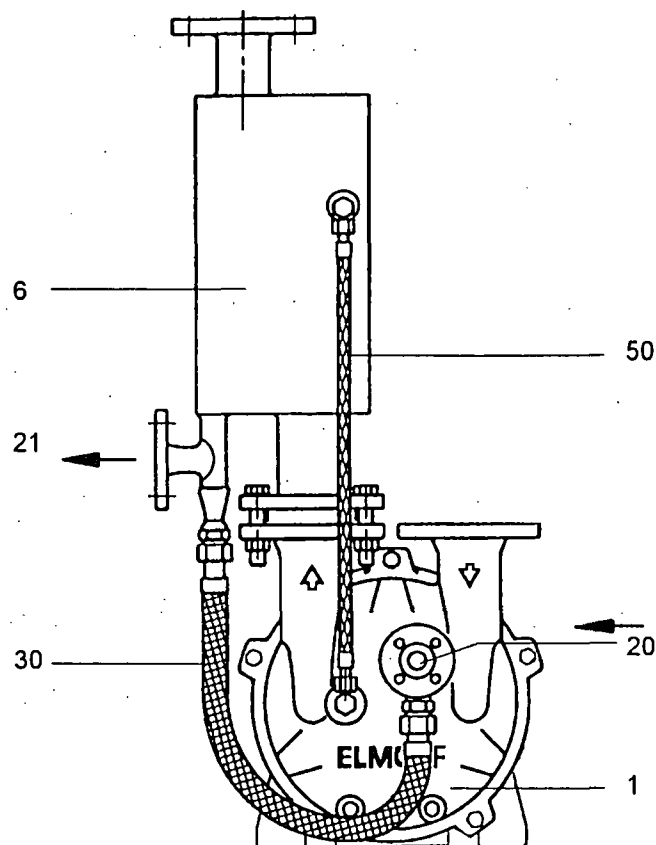
## **Stainless steel version**

## **Exécution en acier inoxydable**

## **Modelo de acero inoxidable**

## **Esecuzione in acciaio pregiato**

## **Specialstålutförande**



- 1 ELMO-F
- 6 Working-liquid separator
- 20 Working-liquid feed pipe  
(see Fig. 8)
- 21 Working-liquid discharge
- 30 Pipe or hose, complete
- 50 Connection tube for cavitation protection

- 1 ELMO-F
- 6 Separatore del liquido di funzionamento
- 20 Adduzione del liquido di funzionamento  
(ved. Fig. 8)
- 21 Scarico del liquido di funzionamento
- 30 Tubo flessibile (completo)
- 50 Tubo di raccordo della  
protezione anticavitazione

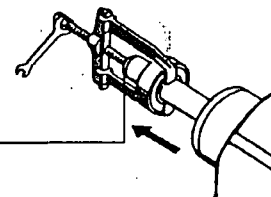
- 1 ELMO-F
- 6 Séparateur de liquide de fonctionnement
- 20 Arrivée de liquide de  
fonctionnement (v. Fig. 8)
- 21 Écoulement de liquide de fonctionnement
- 30 Tube ou flexible, complet
- 50 Tuyau flexible de raccordement de la  
protection anticavitation

- 1 ELMO-F
- 6 Driftsvätskefrånskiljare
- 20 Tillförsel av driftsvätska  
(Fig. 8)
- 21 Driftvätskeutsläpp
- 30 Rör eller slang, komplett
- 50 Anslutningsslang för kavitationsskydd

**Fig. 10 ELMO-F mit Betriebsflüssigkeitsabscheider und Kavitationsschutz**  
**ELMO-F unit with working-liquid separator and cavitation protection**  
**ELMO-F avec séparateur de liquide et protection anticavitation**  
**ELMO F con separador de líquido de servicio y protección contra cavitación**  
**ELMO-F con separatore di liquido e protezione anticavitazione**  
**ELMO-F med driftvätskeavskiljare och kavitationsskydd**

Typ / Type / Tipo	007A	DIN 625	008A	DIN 625	027A	450A
	Rillenkugellager AS Deep-groove ball bearing, D-end Roulement à billes côté D Rodamientos radiales rígidos LA Cuscinetti a sfera a gola profonda lato A Spårkullager AS		Rillenkugellager BS Deep-groove ball bearing, ND-end Roulement à billes côté N Rodamientos radiales rígidos LCA Cuscinetti a sfera a gola profonda lato B Spårkullager BS		Lagerdeckel Bearing cap Couvercle de palier Tapa del cojinete Coperchio cuscinetto Lagerlock	Lagerschild Endshield Flasque-palier Escudo portacojinetes Scudo del cuscinetto Lagerlock, yttre
	Kurzzeichen Abbreviation Réf. abrégée Código Sigla Förkortn.	Fettmenge Grease filling Qté de graisse Carga de grasa Quantità di grasso Fettmängd	Kurzzeichen Abbreviation Réf. abrégée Código Sigla Förkortn.	Fettmenge Grease filling Qté de graisse Carga de grasa Quantità di grasso Fettmängd	Fettmenge Grease filling Qté de graisse Carga de grasa Quantità di grasso Fettmängd	Fettmenge Grease filling Qté de graisse Carga de grasa Quantità di grasso Fettmängd
		[g]		[g]	[g]	[g]
2BV5 161-.....0 - . 2BV5 161-.....2 - .	6313-JC3	45	6209-ZJC3 6210-ZJC3	10 12	40	22 18
2BV5 131-.....0 - . 2BV5 131-.....1 - . 2BV5 131-.....2 - .	6211-ZJC3	14	6209-ZJC3	10	21	22
2BV5 121-.....0 - . 2BV5 121-.....1 - . 2BV5 121-.....2 - .			6208-ZJC3 6209-ZJC3	8 10		10 22
2BV5 111-.....0 - . 2BV5 111-.....1 - . 2BV5 111-.....2 - .			6209-ZJC3	10		6208-ZJC3 6205-ZJC3 6208-ZJC3

Zwischenscheibe (Schutz der Zentrierung im Wellenende)  
 Spacer washer (to protect centring bore in shaft end)  
 Rondelle (protection du centrage en bout d'arbre)  
 Arandela intermedia (protege el centrado en el extremo del eje)  
 Spessore (protezione della centratura sull'estremità d'albero)  
 Mellanbricka (skydd av centeringen i axeltappen)



**Fig. 11 Lagergrößen und Schmiertabelle (Fettmengenangabe gelten nur für Schmierfett UNIREX N3)**

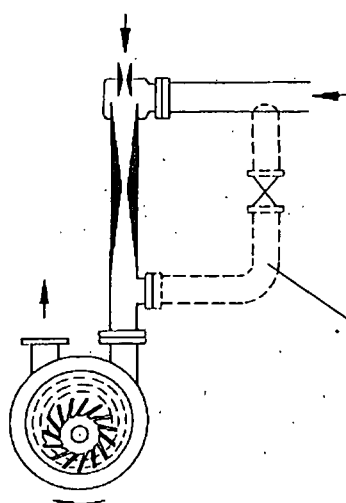
**Bearing sizes and lubrication table (grease filling values only apply for UNIREX N3)**

**Tailles de roulements et tableau de graissage (quantités de graisse valables seulement pour de la graisse UNIREX N3)**

**Tamaño de los rodamientos y tabla de lubricación (la cantidad indicada rige solo para la grasa UNIREX N3)**

**Dimensioni dei cuscinetti e tabella lubrificazione (le quantità di lubrificante riportate in tabella valgono solo per il lubrificante UNIREX N3)**

**Lagerstorlekar och smörjtabell (uppgifter rörande fettmängd gäller enbart smörjfettet UNIREX N3)**



Bypaß  
 Bypass  
 Bybass  
 Derivación  
 By-pass  
 Shuntkoppling

Schematischer Schnitt durch den Arbeitsraum (in Richtung Pumpendeckel gesehen)  
 Section through the compression chamber (viewed in the direction of the pump cover)  
 Coupe schématisée de la chambre de travail (vue en direction du couvercle)  
 Sección esquemática de la cámara de operación (visto en dirección hacia la tapa de la bomba)  
 Sez. schematica della camera di compressione (vista verso il Coperchio della pompa)  
 Genomskärning av pumpkammaren, (sett mot pumplocket)

**Fig. 12 Betrieb mit Gasstrahler / Operation with gas ejector / Fonctionnement avec éjecteur à gaz  
 Servicio con eyector de gas / Funzionamento con eiettore a gas / Drift med gasejektor**

Typ Type Tipo	Meßflächenschalldruckpegel / Measuring-surface sound-pressure level Niveau de pression acoustique / Nivel de presión acústica Livello di pressione sonora / Ljudtrycksnivå	
	50 Hz [ dB (A) ]	60 Hz [ dB (A) ]
2BV5 161	74	75
2BV5 131	73	77
2BV5 121	69	75
2BV5 111	68	74
2BV5 110	63	67

**Fig. 13** Meßflächenschalldruckpegel nach DIN 45635, T 13 gemessen in 1 m Abstand bei mittlerer Drosselung und angeschlossenen Leitungen

Measuring-surface sound-pressure level to DIN 45635, Part 13 measured at distance of 1 m with average throttling and connected pipes

Niveau de pression acoustique selon DIN 45635, partie 13, mesuré à 1 m de distance pour un étranglement moyen et avec conduites raccordées

Nivel de presión acústica según DIN 45635, parte 13, medido a 1 m de distancia con estrangulamiento mediano y conductores conectados

Livello di pressione sonora sec DIN 45635, T13 misurato a 1 m di distanza con strozzamento medio e condotti collegati

Ljudtrycksnivå enl. DIN 45635, T13, mätt på 1 m avstånd, medelstor strypning och anslutna ledningar

Typ Type Tipo	Einzelgewicht <sup>1)</sup> ohne Betriebsflüssigkeitsfüllung Individual weight <sup>1)</sup> without working liquid Poids <sup>1)</sup> sans remplissage en liquide de fonctionnement Peso por unidad <sup>1)</sup> sin liquido de servicio Peso singolo <sup>1)</sup> (senza liquido di funzionamento) Enhetens vikt <sup>1)</sup> utan driftvätska påfylld	
	Graugußausführung Cast-iron version Exécution mat. plastique Modelo de fundición gris Esecuzione in ghisa grigia Gråjärnsutförande	Edelstahlausführung Stainless steel version Exécution acier inox Modelo de acero inoxidable Esecuzione in acciaio pregiato Specialstålutförande
	ca / approx./aprox. [ kg ]	
2BV5 161	252	272
2BV5 131	185	192
2BV5 121	165	172
2BV5 111	105	111
2BV5 110	83	87

- <sup>1)</sup> Katalogtypen, bei Sonderausführungen sind höhere Gewichte möglich
- <sup>1)</sup> Catalogue types, special versions may weigh more
- <sup>1)</sup> Types en catalogue ; les modèles spéciaux peuvent peser plus lourd
- <sup>1)</sup> Tipos según catálogo; los modelos especiales pueden pesar más
- <sup>1)</sup> Vale per tipi riportati nel catalogo; per esecuzioni speciali sono possibili pesi differenti
- <sup>1)</sup> Katalogtyper, specialutföranden kan väga mer



Auf Tragfähigkeit der Lastaufnahmemittel und Hebezeuge achten! Die Tragfähigkeit ist entsprechend dem Maschinengewicht auszulegen.

Observe the load carrying capacity of the load suspension devices and hoisting gear! The load carrying capacity must be in accordance with the machine weight.


Veiller à la portance des éléments de suspension et des engins de levage ! La portance devra être adaptée au poids de la machine.

¡Observar la oapacidad de carga de los aparatos elevadores! La capacidad de carga se configurará según el peso de la máquina.

Assicurarsi che la capacità degli attrezzi di sollevamento sia sufficiente per il peso della macchina!

Se till att lyftdonen har erforderlig kapacitet! Deras bärförmåga skall räckta för maskinens vikt.

**Fig. 14** Gewichtsangaben  
Pump weights  
Poids des machines  
Pesos  
Indicazione del peso  
Viktuppgifter

	Gewinde- $\varnothing$ / Thread- $\varnothing$ $\varnothing$ du filetage / $\varnothing$ de la rosca Filetto- $\varnothing$ / Gängdiameter	M4	M5	M6	M8	M10	M12	M16
	Festigkeitsklassen / Strength classes Classes de résistance / Clases de resistencia Classi di resistenza / Hållfasthetsklasserna	5.6	5.6	8.8	8.8	8.8	8.8	5.6
	Anziehdrehmoment / Tightening torque Couple de serrage / Par de apriete Coppia di serraggio / Åtdragningsmoment [N m] $\pm 10\%$	1,4	3	8	20	40	70	100

**Anziehdrehmomente für Schraubenverbindungen** (nicht für elektrische Anschlüsse)


**Tightening torques for screwed connections** (not for electrical connections)

**Couples de serrage des assemblages vissés** (ne concerne pas les connexions électriques)

**Pares de apriete para uniones atornilladas** (no para conexiones eléctricas)

**Coppie di serraggio per viti di attacco** (non per allacciamenti elettrici)

**Åtdragningsmoment för skruvförband** (ej för elektriska anslutningar)

	Gewinde- $\varnothing$ / Thread- $\varnothing$ $\varnothing$ du filetage / $\varnothing$ de la rosca Filetto- $\varnothing$ / Gängdiameter	M4	M5	M6	M8	M10		
	Anziehdrehmoment / Tightening torque Couple de serrage / Par de apriete Coppia di serraggio / Åtdragningsmoment [N m] $\pm 10\%$	1,0	2,2	3	7	11		

**Anziehdrehmomente für Schraubenverbindungen der elektrischen Anschlüsse - Klemmenbrettanschlüsse** (außer Klemmenleisten)

**Tightening torques for screwed electrical connections - terminal board connections** (except for terminal strips)

**Couples de serrage des bornes de la plaque à bornes** (ne concerne pas les borniers)

**Pares de apriete para uniones atornilladas de las conexiones eléctricas en la placa de bornes** (exceptuando las regletas de bornes).

**Coppie di serraggio per le viti di attacco di collegamenti elettrici / dei portamorsetti** (escluse morsettiere)

**Åtdragningsmoment för de elektriska anslutningarnas skruvförband** (utom på kontakttrader för hjälpanslutningar)

**Fig. 15 Anziehdrehmomente** (Die obigen Anziehdrehmomente gelten soweit keine anderen Werte angegeben sind!)

**Tightening torques** (The above tightening torques apply unless other values are specified!)

**Couples de serrage** (Les couples de serrage indiqués ci-dessus sont valables pour autant qu'aucune valeur spécifique ne soit donnée.)

**Pares de apriete** (Los pares indicados son válidos mientras no se especifiquen otros!)

**Coppie di serraggio** (Le coppie di serraggio indicate qui di sopra sono valide se non sono indicati altri valori!)

**Åtdragningsmoment** (Ovanstående åtdragningsmoment gäller om ej andra värden angivits!)



Störungen	Ursache	Abhilfe
Motor läuft nicht an, kein Laufgeräusch	Unterbrechung in mindestens zwei Leitungen der Stromversorgung	Unterbrechung an Sicherungen, Klemmen bzw. Zuleitung beseitigen
Motor läuft nicht an, Brummgeräusch	Unterbrechung in einer Leitung der Stromversorgung Motorläufer sitzt fest  Laufrad defekt Motorlager defekt	s. "Motor läuft nicht an, kein Laufgeräusch" Pumpe entkalken (s. 2.3.3) ggf. Pumpe entleeren und säubern (s. 2.3.2) ggf. Laufrad-Spalleinstellung prüfen bzw. korrigieren (s. 2.4*) Laufrad ersetzen (s. 2.3* und 2.4*) Lager ersetzen (s. 2.3* und 2.4*)
Motorschutzscharter löst nach Einschalten wieder aus	Kurzschluß in der Wicklung Motor überlastet Gegendruck im Druckstutzen zu hoch mitgeführter Flüssigkeitsanteil zu hoch ELMO-F sitzt fest	Wicklung prüfen lassen Betriebsflüssigkeitsstrom drosseln Gegendruck verkleinern Flüssigkeitsanteil verkleinern s. "Motor läuft nicht an, Brummgeräusch"
Leistungsaufnahme zu hoch	Verkalkung oder Ablagerung	ELMO-F entkalken bzw. säubern (s. 2.3.3 und 2.1*, 2.2*)
ELMO-F erzeugt kein Vakuum	keine Betriebsflüssigkeit vorhanden große Undichtheit in der Anlage falsche Drehrichtung	Richtigen Betriebsflüssigkeitsstromes gewährleisten Anlage abdichten Drehrichtung ändern durch Vertauschen von 2 elektr. Anschlußleitungen
ELMO-F erzeugt zu geringes Vakuum	ELMO-F zu klein Betriebsflüssigkeitsstrom zu gering  Betriebsflüssigkeit zu warm > 15 °C Erosion kleine Undichtheit in der Anlage Gleitringdichtung undicht	größere ELMO-F einsetzen Betriebsflüssigkeitsstrom bis zum 2-fachen erhöhen des Nennförderstromes erhöhen Betriebsflüssigkeitsstrom kühlen bzw. erhöhen betroffene Bauteile erneuern Anlage abdichten Gleitringdichtung erneuern (s. 2.3* und 2.4*)
Anomale, kreischende Geräusche	Kavitation der ELMO-F Betriebsflüssigkeitsstrom zu groß	Kavitationsschutzleitung anschließen Betriebsflüssigkeitsstrom prüfen und reduzieren
ELMO-F undicht	Dichtungen defekt	Dichtungen überprüfen

Fig. 16 Beseitigung von Störungen (\* = s. Instandhaltungsanleitung 610.44 416.02).

## ENGLISH

Fault	Cause	Remedy
Motor doesn't start; no motor noise	At least two of the power supply leads are interrupted	Check the fuses, terminals and supply leads
Motor doesn't start; humming noise	One of the supply leads is interrupted Motor rotor is jammed  Impeller faulty Motor bearing faulty	See "Motor doesn't start; humming noise" Decalcify ELMO-F s. 2.3.3 If necessary, drain and clean ELMO-F s. 2.3.2 Check and, if necessary correct impeller gap s.2.4* Replace impeller s. 2.3* and 2.4* Replace bearing s. 2.3* and 2.4*
Motor circuit-breaker trips when the motor is switched on	Winding short-circuit Motor overloaded Counterpressure in discharge too high Too much liquid compressant entrained ELMO-F stuck	Check the motor winding Reduce the liquid compressant flow Reduce the counterpressure Reduce quantity of compressant See under "Motor doesn't start; humming noise"
Power consumption too high	Lime or other deposits	ELMO-F Clean and remove deposits s. 2.3.3 und 2.1*, 2.2*
ELMO-F doesn't generate vacuum	No liquid compressant Severe leak in the system Wrong direction of rotation	Check supply of compressant is correct Repair any leaks in the system Reverse the direction of rotation by changing over two of the leads
ELMO-F produces too little vacuum	ELMO-F too small Liquid compressant flow too low Liquid compressant too warm (> 15 °C) Erosion Slight leak in the system Sliding ring packing leaking	Use a bigger ELMO-F Increase compressant flow to maximum value (2 times nominal value) Cool the compressant or increase compressant flow Replace relevant parts Repair the leak Check the mechanical seal s. 2.3* und 2.4*
Abnormal screeching noises	ELMO-F cavitation Liquid compressant flow too high	Connect cavitation protection line Check flow of liquid compressant and reduce it
ELMO-F leaking	Gaskets seals faulty	Check all gaskets and seals

Fig. 16 Faults and how to eliminate them (\* = s. Repair Instructions 610.44 416.02)

**Ersatzteile (Fig. 17), vom Werk lieferbar**  
(s. Bestellbeispiel)

001A	Motorgehäuse vollständig
002A	Pumpengehäuse
005A	Motorläufer
007A	Rillenkugellager
008A	Rillenkugellager
011A	Spiral-Spannstift
018A	Feder-Scheibe
022A	Scheibe
026A	Lagerschild, AS
027A	Lagerdeckel
030A	Spiral-Spannstift für 035A
033A	V-Ring
035A	Gleitringdichtung
036A	Scheibe
037A	Spiral-Spannstift
040A	Leistungsschild
041A	Schraube
042A	Klemmenkasten, komplett
047A	Laufrolle
048A	Toleranzring f. Laufrolle
048B	Steuerscheibe
050A	Ventilplatte
051A	Fangplatte
058A	Dichtring
061A	Pumpendeckel
064A	Platte für Pumpendeckel

065A	Schutzstopfen
066A	Kappe
068A	Verschlußschraube
068B	Dichtring
071A	Rohr für Kavitationsschutz
072A	Scheibe für Kavitationsschutz
078B	Verschlußschraube
080A	Dichtring
080C	Klemmplatte
081A	Erdungsschraube
083A	Erdungswinkel
083C	Fuß
084A	Kontaktwinkel
084C	Tesamoll
085C	Abdeckung
088C	Dichtung
102A	Scheibe
164A	V-Ring
165A	Stiftschraube
300A	Scheibe
450A	Lagerschild BS
455A	Federband
500A	Lüfterhaube
502A	Außenlüfter
503A	Schraube

504A	Tülle
505A	Paßfeder für Außenlüfter
511A	Klemmenplatte
512A	Gummistopfen
513A	Verbindungsschiene
514A	Klemmbügel
515A	Winkel
520A	Scheibe
544A	Klemmenkasten-Oberteil (mit Schnurdichtung)
571A	Klemmplatte
582A	O-Ring
584A	Klemmenkasten-Deckel (mit Schnurdichtung)
640A	Klemmenbrett
648A	Zwischenstück
654A	Dichtung
656A	Oberteil
660A	Verschlußstopfen
662A	Erdung
663A	Dichtung
665A	Deckel
667A	Schraube für Klemmenkastendeckel
668A	Schild (Schutzzeichen)
674A	Leitung
888E	Platte

**ENGLISH****Spare parts (Fig. 17), available from**  
the works (see order example)

001A	Motor casing, complete
002A	Pump casing
005A	Motor rotor
007A	Deep-groove ball bearing
008A	Deep-groove ball bearing
011A	Centering pin
018A	Spring washer
022A	Washer
026A	Bearing shield, D-end
027A	Bearing cap
030A	Centering pin for 035A
033A	V ring
035A	Mechanical seal
036A	Washer
037A	Centering pin
040A	Rating plate
041A	Bolt
042A	Terminal box, complete
047A	Impeller
048A	Tolerance ring for impeller
048B	Port plate
050A	Valve plate
051A	Intercepting plate
058A	Sealing ring
061A	Pump cover
064A	Plate for pump cover

065A	Protective plug
066A	Cap
068A	Screw plug
068B	Sealing ring
071A	Pipe for cavitation protection
072A	Washer for cavitation protection
078B	Screw plug
080A	Sealing ring
080C	Clamping plate
081A	Earthing screw
083A	Earthing bracket
083C	Foot
084A	Contact bracket
084C	Adhesive tape
085C	Cover
088C	Seal
102A	Washer
164A	V ring
165A	Stud bolt
300A	Washer
450A	Bearing shield, ND-end
455A	Spring strip
500A	Fan cowl
502A	External fan
503A	Screw

504A	Support sleeve
505A	Featherkey for external fan
511A	Terminal board
512A	Rubber plug
513A	Connecting bar
514A	Terminal clip
515A	Bracket
520A	Washer
544A	Terminal box, upper section (with cord seal)
571A	Clamping plate
582A	O-ring
584A	Terminal box, cover (with cord seal)
640A	Terminal board
648A	Adapter
654A	Seal
656A	Upper section
660A	Sealing plug
662A	Earthing
663A	Seal
665A	Cover
667A	Screw for terminal box cover
668A	Mark of conformity
674A	Lead
888E	Adapter plate

Normteile sind nach Abmessung, Werkstoff und Oberfläche im freien Handel zu beziehen.






Standard commercially available parts are to be purchased in accordance with the specified dimensions, material and surface finish.




Les pièces normalisées peuvent être obtenues dans le commerce d'après leurs dimensions, le matériau et l'état de surface.

Las piezas homologadas pueden adquirirse en el mercado indicando dimensiones, material y superficie.

Le parti di ricambio normalizzate circa dimensioni, materiali e superficie sono reperibili in commercio.

Standarddetaljer med önskade dimensioner, material och yta kan erhållas i öppna handeln.

160A	DIN 125	
505A		
082A 548A 670A		
087C 578A 675A	DIN 128	
516A 651A		
518A 653A		
506A	DIN 471	
100A	DIN 580	
	DIN 582	

007A	DIN 625	
008A		
081C 161A	DIN 934	
082C 458A		
006A	DIN 6885	

Lagertyp  
Type of bearing:  
Type de roulement:  
Tipo de cojinetes:  
Tipo di cuscinetti:  
Lagertyp:

Parti di ricambio (Fig. 17), fornibili dalla fabbrica (vedi esempio)

001A	Carcassa completa del motore	065A	Tappo di protezione	504A	Terminale isolante
002A	Carcassa della pompa	066A	Cappa	505A	Chiavetta per ventilatore esterno
005A	Rotore	068A	Vite di chiusura	511A	Piastra morsetti
007A	Cuscinetto a sfere a gola profonda	068B	Anello di tenuta	512A	Tappo in gomma
008A	Cuscinetto a sfere a gola profonda	071A	Tubo per protezione anticavitazione	513A	Sbarra di collegamento
011A	Spina spiroidale	072A	Piastrina per protezione anticavitazione	514A	Staffa di serraggio
018A	Rondella elastica	078B	Vite di chiusura	515A	Angolare
022A	Rondella	080A	Anello di tenuta	520A	Rondella
026A	Scudo, lato A	080C	Piastra di fissaggio	544A	Parte superiore della scatola morsetti (con tenuta a nastro)
027A	Copricuscinetto, lato A	081A	Vite per messa a terra	640A	Morsettiera
030A	Spina spiroidale per 035A	083A	Angolare per messa a terra	648A	Adattatore
033A	Anello V	083C	Piedino	654A	Guarnizione
035A	Tenuta ad anello scorrevole	084A	Angolare di contatto	656A	Parte superiore
037A	Spina spiroidale	084C	Materiale di ermetizzazione "tesamoll"	660A	Tappo di chiusura
040A	Targhetta dati	085C	Copertura	662A	Messa a terra
041A	Vite	088C	Guarnizione	663A	Guarnizione
042A	Scatola morsetti, completa	102A	Rondella	665A	Coperchio
047A	Girante	164A	Anello V	667A	Vite per il coperchio della scatola morsetti
048A	Anello per girante	165A	Vite prigioniera	668A	Targhetta (simbolo di protezione)
048B	Disco distributore	300A	Rondella	674A	Conduttore
050A	Piastrina di valvola	450A	Scudo, lato B	888E	Piastra
051A	Piastrina di rilegno	455A	Nastro elastico		
058A	Anello di tenuta	500A	Cuffia del ventilatore		
061A	Coperchio della pompa	502A	Ventilatore esterno		
064A	Piastra per il coperchio della pompa	503A	Vite		

#### SVENSKA

Reservdelar (Fig. 17), kan erhållas från fabriken (se Beställningsexempel)

001A	Motorhus, komplett	065A	Skyddspropp	504A	Skyddshylsa
002A	Pumphus	066A	Hätta	505A	Passkil för ytterfläkt
005A	Motorrotor	068A	Skruvpropp	511A	Klämplatta
007A	Spårkullager	068B	Tätningssring	512A	Gummipropp
008A	Spårkullager	071A	Rör för kavitationsskydd	513A	Förbindelseskena
011A	Spiralspännstift	072A	Bricka för kavitationsskydd	514A	Klämbygel
018A	Fjäderbricka	078B	Skruvpropp	515A	Vinkelstycke
022A	Bricka	080A	Tätningssring	520A	Bricka
026A	Lagersköld, A-sidan	080C	Klämplatta	544A	Uttagslådans överdel (med tätningssnöre)
027A	Lagerlock	081A	Jordningsskruv	571A	Klämplatta
030A	Spiralspännstift för 035A	083A	Jordningsbeslag	582A	O-ring
033A	V-ring	083C	Fot	584A	Lock för uttagslåda (med tätningssnöre)
035A	Glidringtätning	084A	Kontaktbeslag	640A	Kontaktplint
037A	Spiralspännstift	084C	Tesamoll	648A	Mellanstycke
040A	Märkskylt	085C	Beröringsskydd	654A	Packning
041A	Skruv	088C	Packning	656A	Överdel
042A	Uttagslåda, komplett	102A	Bricka	660A	Skruvpropp
047A	Löphjul	164A	V-ring	662A	Jordning
048A	Toleransring för löphjul	165A	Stiftskruv	663A	Packning
048B	Styrskiva	300A	Bricka	665A	Lock
050A	Ventilplatta	450A	Lagersköld, B-sidan	667A	Skruv för uttagslådans lock
051A	Hållplatta	455A	Bandfjäder	668A	Märkskylt (skyddssymbol)
058A	Tätningssring	500A	Fläkthuv	674A	Ledning
061A	Pumplock	502A	Ytterfläkt	888E	Platta
064A	Platta för pumplock	503A	Skruv		

Normteile sind nach Abmessung, Werkstoff und Oberfläche im freien Handel zu beziehen.

Standard commercially available parts are to be purchased in accordance with the specified dimensions, material and surface finish.

Les pièces normalisées peuvent être obtenues dans le commerce d'après leurs dimensions, le matériau et l'état de surface.

Las piezas homologadas pueden adquirirse en el mercado indicando dimensiones, material y superficie.

Le parti di ricambio normalizzate circa dimensioni, materiali e superficie sono reperibili in commercio.

Standarddetaljer med önskade dimensioner, material och yta kan erhållas i öppna handeln.

035A

DIN 24960



552A

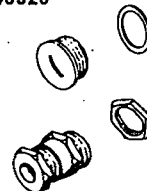
658B

DIN 46320

554A

658A

688D



**Klemmenkasten in Normal- und EEx e - Ausführung**

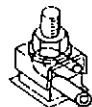
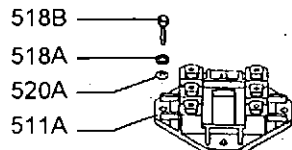
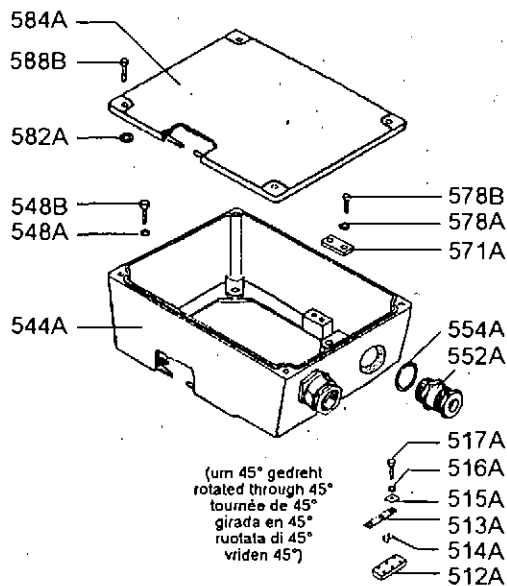
Terminal box in standard and EEx e design

Boîte à bornes en exécution normale exécution normale et EEx e

Caja de bornes en ejecución normal y EEx e

Scatola morsetti in esecuzione normale ed EEx e

Uttagslåda in normalt och EEx e utförande

**2BV5 161 - 0..02**

Anschluß eines einzelnen Leiters mit Klemmbügel.  
Connecting a single conductor with a terminal clip.  
Raccordement d'un seul conducteur à une borne à étrier.  
Conexión de un solo conductor con un pisacables.  
Allacciamento di ogni singolo conduttore con morsetto di serraggio.  
Anslutning av en enkelledder med klämbygel

**Klemmenkasten in Normalausführung**

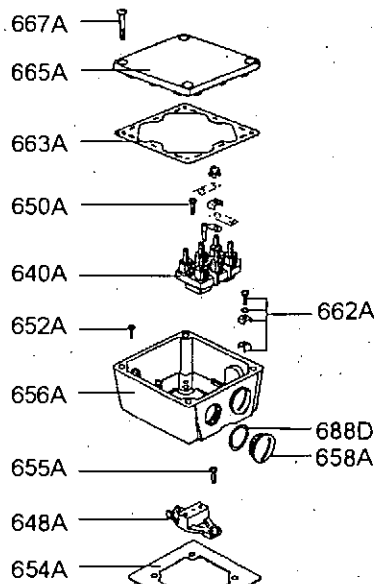
Terminal box in standard design

Boîte à bornes en exécution normale

Caja de bornes en ejecución normal

Scatola morsetti in esecuzione normale

Uttagslåda in normalt utförande

**Klemmenkasten in EEx e-Ausführung**

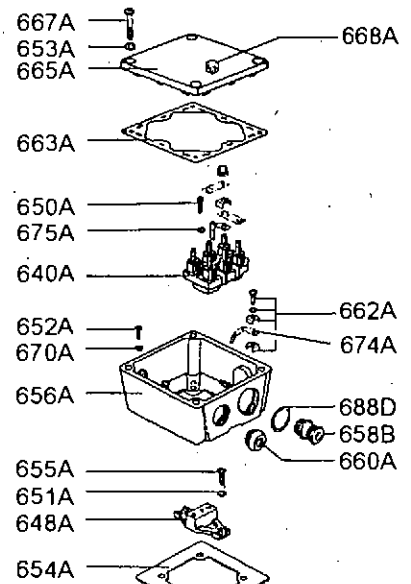
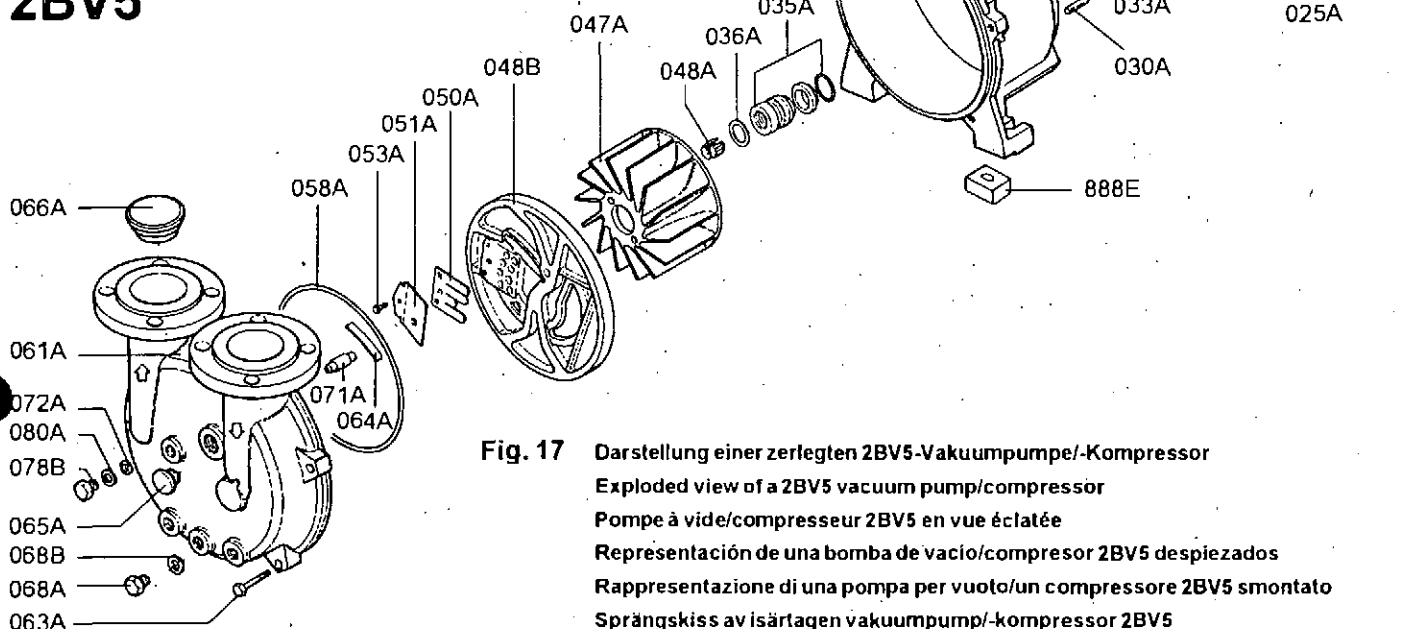
Terminal box in EEx e design

Boîte à bornes en exécution EEx e

Caja de bornes de la ejecución EEx e

Scatola morsetti in esecuzione EEx e

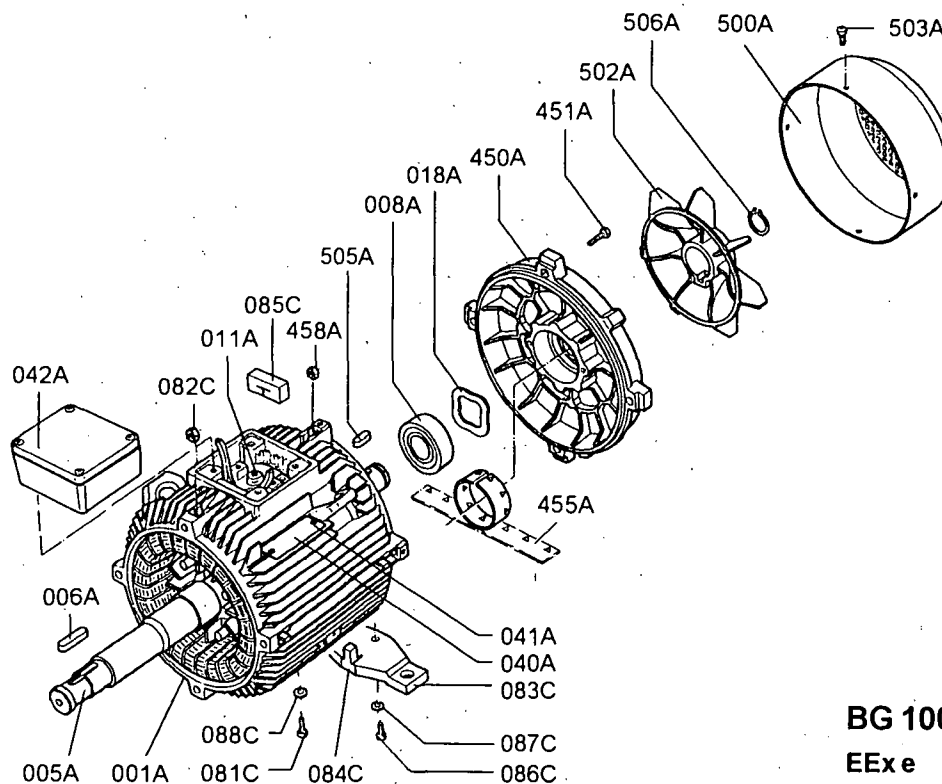
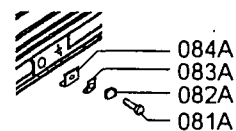
Uttagslåda i explosionsskyddat utförande EEx e

**2BV5****Fig. 17****Darstellung einer zerlegten 2BV5-Vakuumpumpe/-Kompressor****Exploded view of a 2BV5 vacuum pump/compressor****Pompe à vide/compresseur 2BV5 en vue éclatée****Representación de una bomba de vacío/compresor 2BV5 despiezados****Rappresentazione di una pompa per vuoto/un compressore 2BV5 smontato****Sprängskiss av isärtagen vakuumpump/-kompressor 2BV5**

**BG 100L ...112M**

2BV5 110 - ....0.

- ....1.


**BG 100L ... 160L**
**EEx e**

**BG 132S ... 160L**

2BV5 110 - ....2.

- ....3.

2BV5 111 - ....0.

- ....1.

- ....2.

2BV5 121 - ....0.

- ....1.

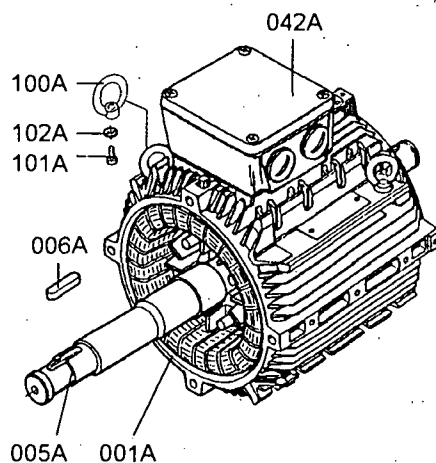
- ....2.

2BV5 131 - ....0.

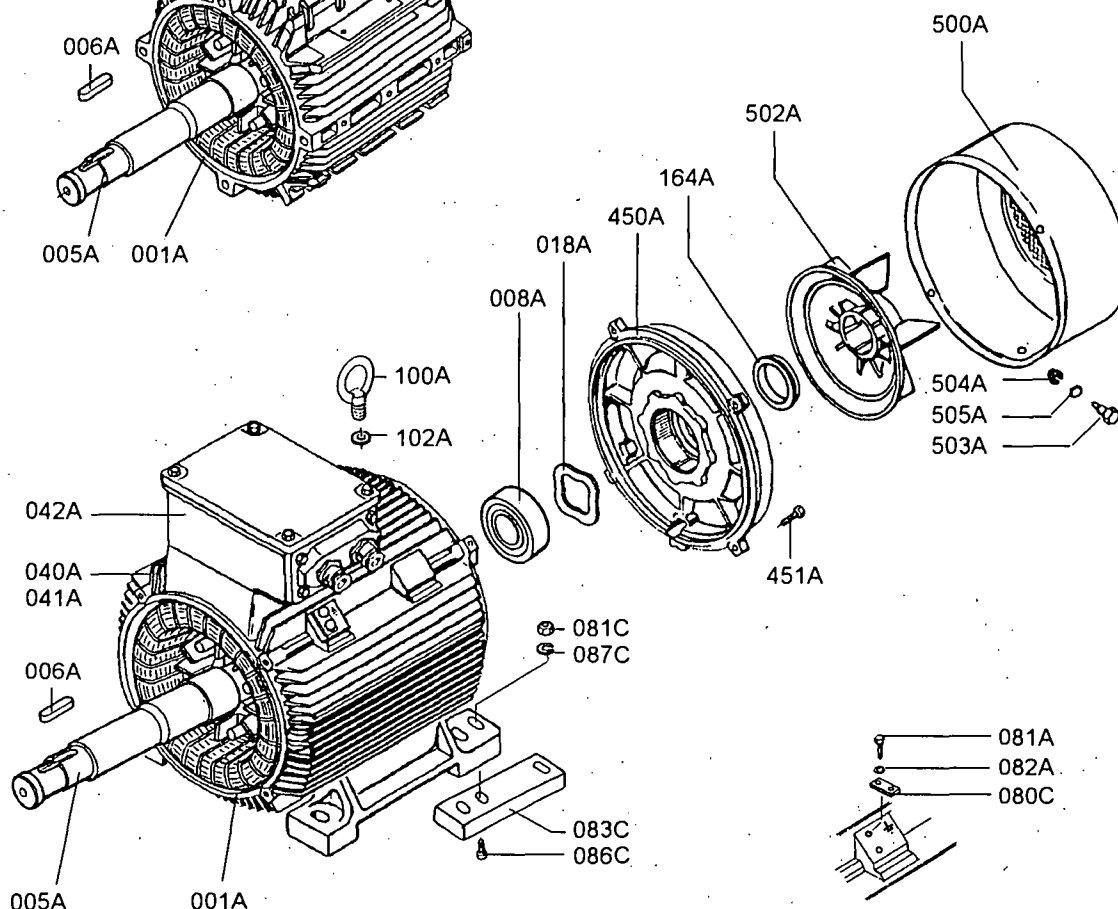
- ....1.

- ....2.

2BV5 161 - ....0.


**BG 180M**

2BV5 161 - ....2.



BG = Motorbaugröße / Motor size / Dés. de carcasse du moteur / Tamaño del motor / Grandezza del motore / Motorstorlek

## ERKLÄRUNG zur Unbedenklichkeit der Vakuumpumpen/-Kompressoren Demontage

Die von uns, der Unterzeichner/in, zwecks Instandhaltungsmaßnahmen zurückgesandte Vakuumpumpe/-Kompressor:

Typ ..... Fabriknummer (No E) .....

- 1) ☐ kam nicht mit gefährlichen Stoffen in Berührung
- 1) ☐ hatte als Einsatzgebiet .....  
und kam mit kennzeichnungspflichtigen bzw. gesundheitsgefährdenden Stoffen in Kontakt. Die Vakuumpumpen/-Kompressoren ist vor Versand außen und innen vollständig gereinigt und nach Betriebsanleitung gespült und vollständig entleert worden
- 1) ☐ besondere Sicherheitsvorkehrungen sind bei der weiteren Handhabung nicht erforderlich
- 1) ☐ folgende Sicherheitsvorkehrungen sind erforderlich:
- 1) ☐ DIN-Sicherheitsdatenblatt (blätter) nach DIN 52900 liegen bei

Wir versichern, daß die vorstehenden Angaben korrekt und vollständig sind und der Versand gemäß den gesetzlichen Bestimmungen erfolgt.

Firma ..... Telefon ..... Fax .....

Anschrift ..... Name ..... Position .....  
(in Druckbuchstaben)

Datum ..... Firmenstempel, Unterschrift

1) Zutreffendes ankreuzen

Fig. 18 Erklärung zur Unbedenklichkeit der Vakuumpumpen/-Kompressoren Demontage

## ENGLISH

## Declaration of Clearance for the disassembly of vacuum pumps/compressors

For the purpose of repair work, we, the undersigned, hereby declare that vacuum pump/compressor:

Type ..... Serial (No E) .....

- 1) ☐ Did not come into contact with hazardous substances
- 1) ☐ Was located at .....  
and came into contact with substances which are subject to identification requirements and detrimental to health. The vacuum pump/compressor was cleaned thoroughly, both inside and outside and rinsed and completely drained in accordance with the operating instructions
- 1) ☐ Special safety precautions are not necessary for further handling
- 1) ☐ The following safety precautions are necessary:
- 1) ☐ DIN safety sheet(s) to DIN 52900 are enclosed

We assure that the above information is correct and complete and that shipment was carried out in accordance with the relevant statutory provisions.

Company ..... Tel ..... Fax .....

Address ..... Name ..... Position .....  
(in block capitals)

Date ..... Company stamp, signature

1) tick where applicable

Fig. 18 Declaration of clearance for the disassembly of vacuum pumps/compressors

**SIEMENS**

## EG-Konformitätserklärung

EC declaration of conformity / Déclaration de conformité CE / Declaración de conformidad CE  
Dichiarazione di conformità alle direttive CE / EG-deklaration om överensstämmelse

Hersteller / Manufacturer / Constructeur / Fabricante / Costruttore / Tillverkare

**Siemens AG** Geschäftsgebiet Antriebstechnik / Motors and Drive Systems Division  
Geschäftszweig Niederspannungsmotoren / Low-Voltage Motors  
D-97615 Bad Neustadt / Saale

Produktbezeichnung / Product name / Désignation du produit / Designación del producto / Denominazione del prodotto / Produktbeteckning

**ELMO-Flüssigkeitsring-Vakuumpumpen /-Kompressoren / ELMO-Liquid-ring vacuum pumps /- compressors**  
**Pompes à vide/compresseurs à anneau liquide ELMO / Bombas de vacío/compresores hidrorrotativos para anillo líquido ELMO**  
**ELMO pompe per vuoto/compressori ad anello liquido / ELMO vattenring- vakuumpump/-kompressor**

**Typ / Type / Tipo 2BV5 110, 2BV5 111, 2BV5 121, 2BV5 131, 2BV5 161**

Das bezeichnete Produkt stimmt mit den Vorschriften folgender Europäischer Richtlinie überein:

The named product is in conformity with the requirements of the following European Directive:

Le produit sus-mentionné est conforme aux prescriptions de la Directive Européenne suivante :

El producto designado cumple con las prescripciones de las siguientes directivas europeas:

Il prodotto denominato corrisponde alle normative delle seguenti direttive CE:

Produkten i fråga överensstämmer med följande EU-direktiv:

- 89/392/EWG** Richtlinie des Rates zur Rechtsangleichung der Rechtsvorschriften der Mitgliedsstaaten für Maschinen geändert durch 91/368/EWG, 93/44/EWG und 93/68/EWG
- 89/392/EEC** Concil Directive on the approximation of the laws of the Member States relating to machinery amended by 91/368/EEC, 93/44/EEC and 93/68/EEC
- 89/392/CEE** Directive du Conseil visant l'harmonisation des législations des pays membres relatives aux machines modifiée par 91/368/CEE, 93/44/CEE et 93/68/CEE
- 89/392/CEE** Directivas del Consejo para la armonización de la legislación de los estados-miembro, relativa a maquinaria modificada por 91/368/CEE, 93/44/CEE y 93/68/CEE
- 89/392/CEE** Direttiva del Consiglio per l'unificazione delle normative dei paesi CE sulle macchine modif. da 91/368/EWG, 93/44/EWG e 93/68/CEE
- 89/392/EEC** Rådets direktiv för anpassning av medlemsstaternas rättsföreskrifter, ändrad genom 91/368/EEC, 93/44/EEC och 93/68/EEC

Die Übereinstimmung mit den Vorschriften dieser Richtlinie wird nachgewiesen durch die vollständige Einhaltung folgender Normen:

Conformity with the requirements of this Directive is testified by complete adherence to the following standards:

La conformité aux prescriptions de cette Directive est démontrée par la conformité intégrale avec les normes suivantes :

La conformidad con las prescripciones de estas directivas queda justificada por haber cumplido totalmente las siguientes normas:

La conformità prescritta dalla direttiva è garantita dall'adempimento a tutti gli effetti delle norme seguenti :

Överensstämmelse med dessa direktiv dokumenteras genom att följande standarder gäller utan inskränkning:

Harmonisierte Europ. Normen / Harmonised Europ. Standards / Normes europ. harmonisées

Normas europ. armonizadas / Norma CE omologata / Harmoniserade europ. standarder

**EN 292-1 EN 292-2 EN 294 EN 60204-1 /16 EN 60034-5 EN 1012-1 EN 1012-2 EN563**

Nationale Normen / National Standards / Normes nationales / Normas nacionales / Norme nazionali / Nationella standarder

**DIN VDE 0530-1**

**Siemens AG**

**Produktionseinheit Strömungsmaschinen**

**Development and Manufacturing Vacuum Pumps and Compressors**

Bad Neustadt / Saale, 9.11.94

*K. Lottig*

(Karlheinz Lottig)

*N. Aust*

(Dr. Norbert Aust)

Leiter / Manager / Directeur / Director / Direttore / Chef

Technischer Leiter / Technical Manager / Directeur technique  
Director técnico / Direttore técnico / Teknisk chef

Diese Erklärung bescheinigt die Übereinstimmung mit der genannten Richtlinie, ist jedoch keine Zusicherung von Eigenschaften im Sinne des Produkthaftungsgesetz.  
This Declaration certifies conformity with the above-mentioned Directive, but gives no assurance of properties within the meaning of the Law Concerning Product Liability.  
Cette déclaration certifie la conformité avec la Directive sus-mentionnée mais n'est pas une garantie de propriétés au sens de la loi sur la responsabilité du fait du produit.  
Esta declaración certifica la conformidad con las directivas nombradas, pero no garantiza características según la ley de responsabilidad sobre productos.  
La presente dichiarazione certifica soltanto la conformità alla direttiva sopracitata e non rappresenta una garanzia ai sensi della legge sulla responsabilità del produttore.  
Denna deklaration bekräftar överensstämmelse med ovan nämnda direktiv men får inte uppfattas som försäkran om egenskaper enligt krav i Lagen om produktansvar.

Fig. 19



Der Text der Betriebsanleitung kann in unten angeführten Sprachen angefordert werden!

Käyttöohjeen tekstin voi tilata alla mainituilla kielillä!

Driftsinstruksens tekst kan bestilles på følgende språk!

Driftsvejledningen kan rekvireres på de nedenstående sprog!

De tekst van de gebruiksaanwijzing kan besteld worden in de hieronder vermelde talen!

O texto das instruções de funcionamento pode ser solicitado nos idiomas abaixo citados!

Το κείμενο της επιχειρησιακής οδηγίας διατίθεται στις παρακάτω γλώσσες!

Bitte hierzu vollständige Absenderangaben: / Tähän kohtaan lähettäjän täydelliset osoitiedot:  
 Angi fullstendige avsenderopplysninger: / Husk fuldstændig afsender:  
 Onder vermelding van het volledige adres: / Para isso é favor enviar os dados completos do remetente:  
 Παρακαλούμε γράψτε την πλήρη σας διεύθυνση:

2BV5 161, 2BV6 131, 2BV5 121, 2BV5 111, 2BV5 110  
 610.44 415.21

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**Siemens AG**

ASI 7 PE S

D-97615 Bad Neustadt



Fax.: 09771 / 95 4024

**Bereich** Antriebs-, Schalt- und Installationstechnik / Drives and Standard Products Group  
**Geschäftsgebiet** Strömungsmaschinen / Development and Manufacturing of Vacuum Pumps and Compressors  
 D-97615 Bad Neustadt an der Saale

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**BRISBANE CITY COUNCIL**

**RAUBERS ROAD  
BANYO  
VACUUM SEWERAGE SYSTEM**

**SECTION 4 SEWAGE PUMPING EQUIPMENT**

- 4.1 Sewage Pumps
- 4.2 Trouble Shooting - Sewage Pumps
- 4.3 Frequency of Operation

## BRISBANE CITY COUNCIL

### RAUBERS ROAD BANYO VACUUM SEWERAGE SYSTEM

#### 4. SEWAGE PUMPING EQUIPMENT

##### 4.1 Sewage Pumps

There are two Hidrostral model CO80 - LH1R sewage pumps electrical connected on a duty and standby basis.

Each pump is capable of operating the system at design capacity. When the sewage pumps are operating at the design flow rate they will pump continuously. During low flow periods the vacuum pumps will only operate infrequently, maybe once an hour.

##### 4.2 Trouble Shooting - Sewage Pumps

Symptoms	Possible Cause	Remedial Action
Discharge pump running on after vessel empty	Stop level probe fouled	Remove probe and clean

##### 4.3 Frequency of Operation

If sewage is being generated by the community at the pumping station rated capacity which is the pump flow rate then the sewage pumps will operate continuously. If inflow rates were able to exceed pump flow rate then the vacuum collection tank will fill, with the pump running, until the high sewage level probe stops the vacuum pumps and hence limits the flow to the pumping station. Any excess flows will be temporarily stored in the system until the sewage pumps can pump the sewage out to the treatment plant.

The maximum number of starts (per hour) will occur when the inflow to the pumping station is half the pump rate and this has been designed for 10 per hour ie 5 per hour on each sewage pump.

At times of extremely low flow the sewage pumps may only start once or twice per hour.



**PUMPS**

**INSTALLATION  
OPERATION  
AND MAINTENANCE  
MANUAL**



**EnviroTech**   
**AUSTRALIA**  
A division of WEIR ENGINEERING PTY LTD  
A.C.N. 000 373 339

**EDWARDS ENVIRONMENTAL ENTERPRISES**

**BRISBANE CITY COUNCIL**

**CLIENT ORDER No: 716276**

**WEIR/ENVIROTECH JOB No: 200341**



# PUMPS

**EDWARDS ENVIRONMENTAL ENTERPRISES**

**BRISBANE CITY COUNCIL**

**CLIENT ORDER No: 716276**

**WEIR/ENVIROTECH JOB No: 200341**

## SALES AND TECHNICAL SERVICE

**WEIR ENGINEERING PTY LTD-FRENCHS FOREST**  
Charles Bunn

**TELEPHONE** (02) 9950 5100  
**FACSIMILE** (02) 9950 5101

## PARTS SERVICE AND SALES

**ENVIROTECH AUSTRALIA-SOMERSBY**  
A division of Weir Engineering Pty Ltd  
Steve Lenton/Susan Dolphin

**TELEPHONE** (043) 49 2999  
**FACSIMILE** (043) 49 2900

## PRODUCT MANAGER

**WEIR ENGINEERING PTY LTD-FRENCHS FOREST**  
Charles Bunn

**TELEPHONE** (02) 9950 5100  
**FACSIMILE** (02) 9950 5101



## HIDROSTAL PUMPS

C080-LH1R+CCMIX-M112+D0

SERIAL No.	TAG No.
H 2588	
H 2589	-----

408 504



5 702236 210059

NE  
STRONG

6210

**Bantex**  
DENMARK

1

**INSTALLATION AND OPERATION**

2

**MAINTENANCE OF HYDRAULIC PARTS**

3

**SPARE PARTS**

4

**DISASSEMBLY/ASSEMBLY**

5

**REPAIR OF BEARING FRAME**

6

**PERFORMANCE CURVES**

7

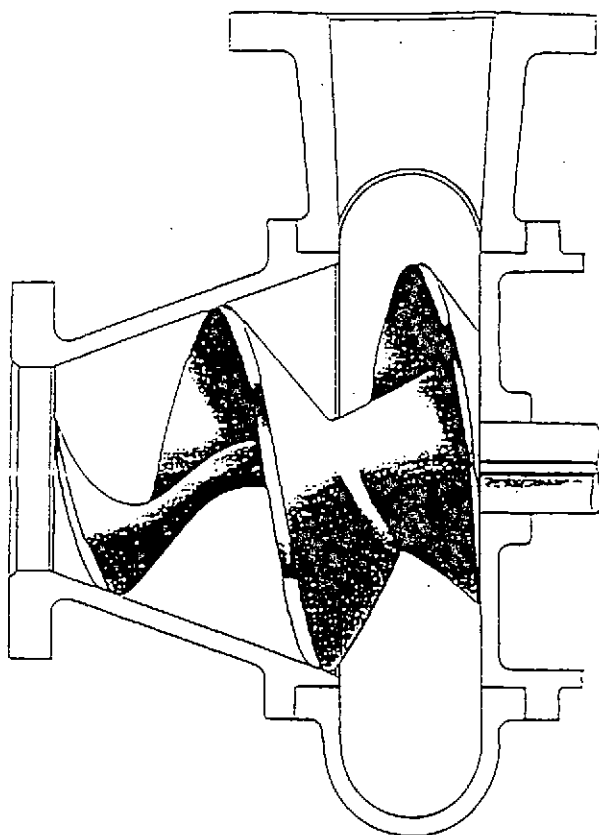
**DRAWINGS**

8

9

10

# SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS



This Pump is Fitted with the unique  
**HIDROSTAL**  
Screw Centrifugal Impeller

## IMPORTANT

When using this manual please refer to the "REFERENCE INFORMATION SHEET" at the front of this manual. This will give the full pump code and the codes for the hydraulic end, bearing frame and product side mechanical seal.

## SPARE PARTS

When ordering spare parts or requiring technical assistance, it is important that you quote the full **PUMP CODE** shown on the name-plate and the Serial Number. Spare parts can be obtained via your local Hidrostal agent/service centre or directly from Hidrostal.

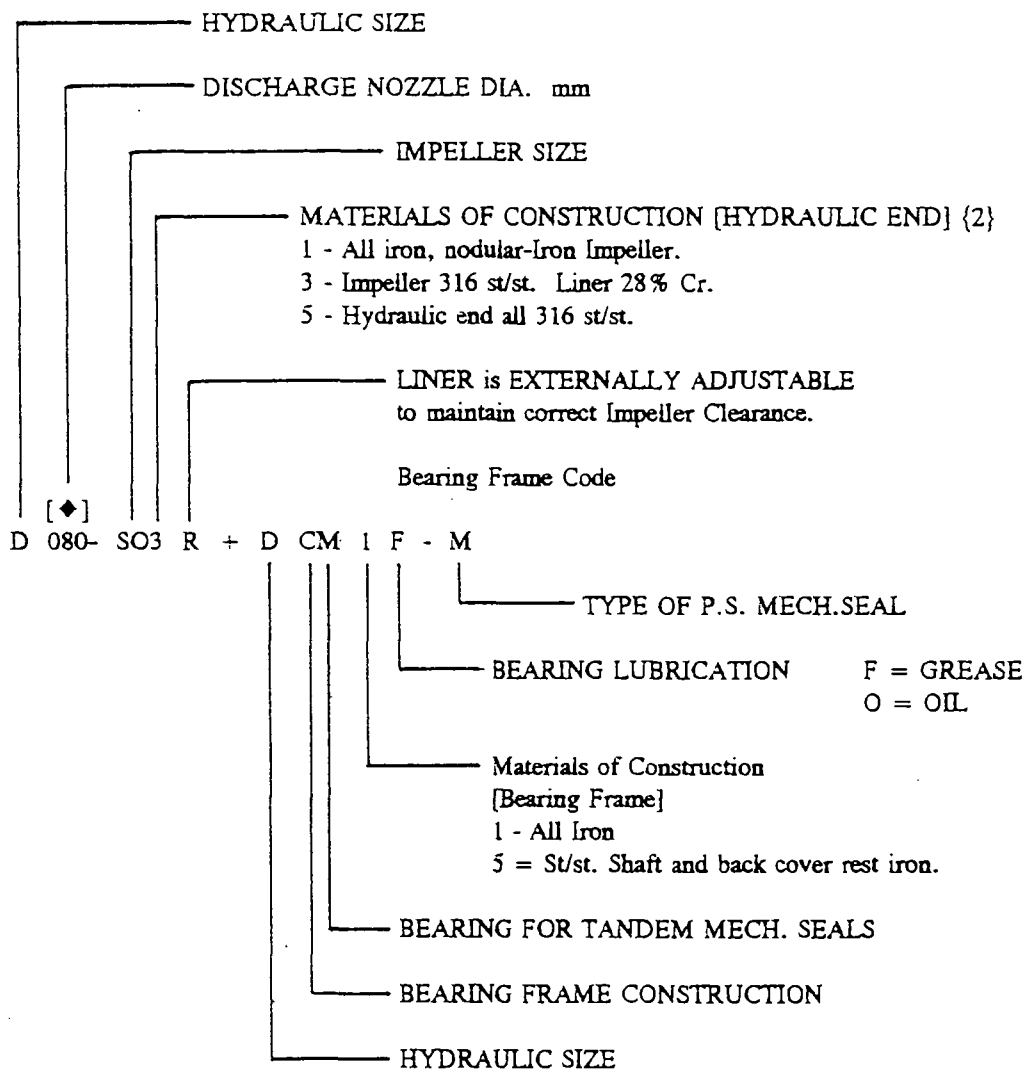
Local Agent:

EnviroTech Australia  
Gindurra Rd  
SOMERSBY NSW 2250  
TEL: (043) 40 2388  
FAX: (043) 40 1080

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### PUMP CODE EXPLANATION

The Hidrostral pump code shown on the nameplate and referred to on our order confirmation uniquely defines all features of the pump. It is essential to give the complete data shown on the nameplate when enquiring about spares or service.



[2] For further details see sectional drawing and parts list for Hydraulic end.

[♦] For Code	Discharge
B02Q/B050	50 mm
D03Q/D080	80 mm
D04Q/D100	100 mm
E05Q/E125	125 mm
E08Q/E200	200 mm



## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### 1.0 INSTALLATION AND OPERATION

**HIDROSTAL** will not assume responsibility for damage to the pump that has been caused due to not following instructions in this manual, nor for consequential damages of any kind.

#### DELIVERY AND RECEPTION OF PUMP UNIT

Prior to signing any shipping documents, inspect the shipment for shortages or damage. Report any discrepancies to the Carrier.

#### STORAGE

If the unit is not to be installed immediately, store in a dry and clean place without extreme changes in temperature. Make sure that storage room temperature stays within the limits of -10° to +40° C (14° to 104°F). The shaft must be rotated by turning the impeller one every two weeks to ensure positive coating on the lubricated surfaces and to prevent sticking of surfaces due to rust or oxidation. Do not store in a location where the pump would be subject to vibrations, otherwise brinelling of the bearings could occur.

#### NAMEPLATE DATA

Each pump is equipped with a nameplate showing the pump code, which uniquely defines the pump construction, and the pump duty. It is essential to give the complete data shown on the nameplate when enquiring about parts or service.

An explanation of the meaning of this code can be found at the beginning of the manual under "PRODUCT DESCRIPTION".

#### LOCATION OF PUMP

The pump should be placed as near to the liquid source as possible, and as low as possible, to provide the maximum possible suction head, avoiding elbows and excessive pipe lengths wherever possible.

The above conditions are important when pumping thick viscous materials and sufficient positive suction head should be available so that the liquid flows to the pump suction at the pumping rate under the influence of the suction head.

Should this condition not exist, it can be rectified by either increasing the static head or reducing the friction between the holding vessel and the pump which can be achieved by decreasing the length of pipe work or simplifying the suction pipe work arrangement, i.e. by reducing the number of bends, T's and valves etc.

Provide adequate ventilation of pump room.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### MOUNTING

The pump can be mounted in a horizontal or vertical position.

When mounted horizontally hydraulic size B pumps should be mounted using the feet provided on the volute, and size C, D and E hydraulics should use a DO-type bracket attached to the rear of the volute, using the tapped holes provided for this purpose.

When mounted vertically the unit can be stood on its suction flange using a special suction elbow BO-mounting which can be provided by Hidrostal, or in the case of size C, D and E pumps, by using independent mounting plates bolted to the volute casing.

For information on the availability of standard mounting accessories you should contact your local Hidrostal representative, or Hidrostal direct.

### PIPING

The suction and discharge piping should be independently supported near the pump and be installed in such a manner so as not to impose stresses and strains on the pump casing.

### SUCTION PIPING

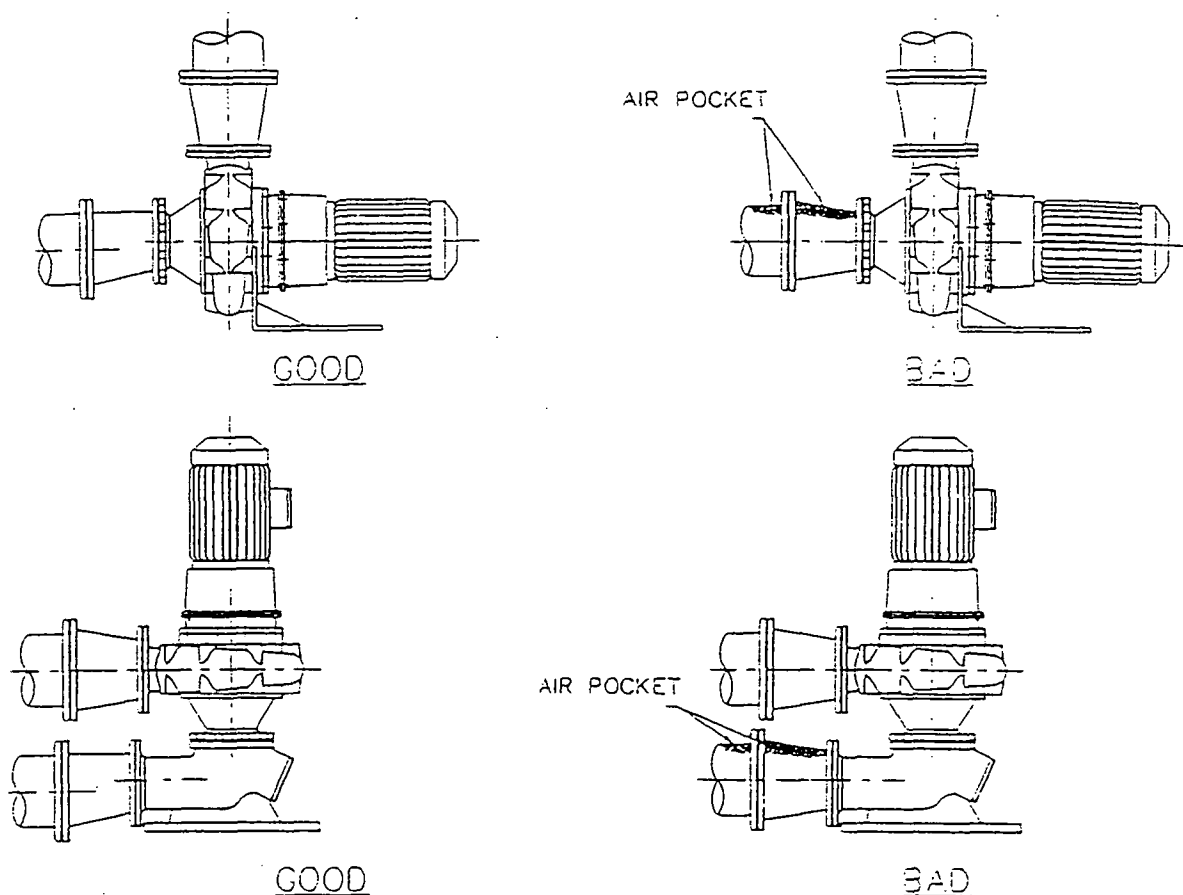
To obtain maximum available suction head, the suction line should be as direct and as short as possible, avoiding elbows. If elbows must be used, a long radius type is preferred. It is important to avoid any sagging in a suction line in which air may accumulate and cause loss of prime. For the same reason, it is important to have the suction line airtight when suction lift exists.

The suction pipe must be such that no air pockets can form, and must slope upward to the pump intake.

### SIZING OF SUCTION PIPEWORK

The losses of the suction side should be kept to a minimum, the pipework should never be less than the suction diameter of the pump and preferably be one pipe size larger. When larger diameter pipework is required the transition should be made close to the pump using flat-topped tapers [See diagram]. Concentric tapers should never be used, as air pockets could result.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS



Unusual suction conditions such as high liquid temperature, altitude above sea level and high specific gravity or viscous liquids should be compensated for, by proper engineering of a sufficiently sized suction pipe.

The pump should not operate on a suction lift when pumping liquids with entrained air or gas. Non-return valves should not be used in the suction line. Gate valves should preferably be installed with the spindle horizontal to prevent trapping air or gas. Suction valves must be fully open during operation.

When pumping viscous materials careful consideration should be given to the head available [Suction head - losses] to promote flow of liquid to the pump, under the worst operating conditions, this is usually at lowest liquid level in suction tank. The liquid must flow under the influence of the available suction head to the pump at the specified pump rate, i.e. the pump should not be relied upon to draw the viscous material into the pump.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### DISCHARGE PIPING

Use as few fittings as possible and when elevating to any height, go vertically upward from the pump, then horizontal to the point of discharge.

When using non return valves in the discharge line it is important the maximum permitted velocity specified by the manufacturer is not exceeded. For single-flap valves operating on dirty liquids a typical maximum velocity is 3.5 m/second.

If these values are exceeded shock waves can result when the valve closes, which may cause the face of mechanical seals to open and allow material to become trapped between the faces resulting in premature seal failure and contamination/loss of the seal oil.

### CONNECTION OF PIPING

This should only be undertaken after the grout [if used] has thorough set and holding down bolts have been tightened.

The pipework should be connected to the pump flanges with gaskets in place and the bolts properly tightened. Make sure the pipe flanges are parallel and in line.

#### **WARNING**

All pumps in material codes 1 to 4 are constructed of cast iron and great care must be used in connecting these flanges. Tighten evenly and adjust to a snug fit. Under no circumstances should the casing be subjected to piping strains. Such strains could result in structural failure leading to operator injury.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### ALIGNMENT

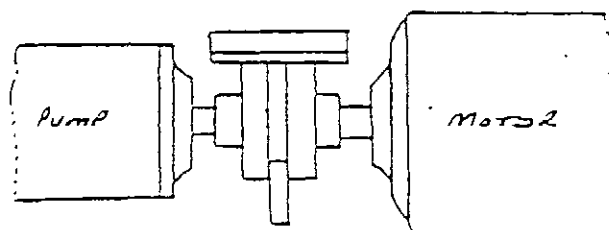
The electric motor, if supplied, is correctly aligned on its base-plate at the factory. However, during transit and in particular during site installation it is possible for a certain amount of deformation of the base-plate to occur. Resulting in some misalignment of the shaft ends.

#### IMPORTANT

IT IS THEREFORE ESSENTIAL THAT A SHAFT COUPLING ALIGNMENT CHECK IS MADE AFTER THE INSTALLATION IS COMPLETE, JUST PRIOR TO START-UP.

The pump shaft should be checked for both angular and parallel alignment, a flexible coupling will not compensate for misalignment. Inaccurate alignment will result in vibration and excessive wear on the coupling elements, bearings, shaft sleeve and mechanical seal faces.

The check for angular alignment should be made by inserting an inside calliper or taper gauge at four points, 90° apart, between the coupling faces which must be within 0.1mm [.004"]. To check for parallel alignment place a straight edge across the coupling rims at the top, bottom and both sides. The unit will be in parallel alignment when the straight rests evenly on the coupling rim at all positions.



Alternatively, clock gauges can be mounted on the coupling halves and the axial and radial movements measured as the coupling is rotated.

For more specific information, refer to coupling manufacturers' catalogue.

### GROUTING

A space of approximately 25mm [1"] should be left between the base-plate and top of the foundation to be filled with grout. After the grouting has dried the foundation bolts should be firmly tightened and the ALIGNMENT RECHECKED.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### ELECTRIC MOTOR PROTECTION

Pumps driven by electric motors must be provided with a starter incorporating overload protection to prevent the motor from being damaged by overload. The overload should be set so that it trips if the current exceeds the nominal values shown on motor nameplate. Failure to observe this requirement will invalidate motor warranty.

### BEFORE START-UP

The pump is ready to start when the following has been completed:-

1. All construction debris has been removed from suction tank.
2. Pump baseplate or suction elbow is grouted and bolted to the foundation.
3. Pump and Motor have been checked after grouting of base-plate for correct alignment.
4. Oil lubricated bearing frames have been filled with lubricating oil, see specific instructions Re: "Bearing Lubrication".
5. Motor has been checked for correct rotation, which is clockwise looking on Motor Fan.
6. All rotating parts are found to turn freely by hand.
7. Suction and discharge valves are OPEN.
8. All level controls are correctly set, and that the off-level is sufficiently high to prevent air entrance to the pump suction.
9. Pump is primed. Never run a pump dry, as the liquid in the pump serves as lubricant for close running surfaces. Damage may be caused to the pump if operated dry for extended periods of time. If installed with suction lift, the pump may be primed by using an ejector, vacuum pump or priming tank. Vertically installed HIDROSTAL solids handling pumps will prime themselves if impeller tip is submerged in the pumping liquid, and an automatic air vent is connected to the discharge pipe work (between pump and non-return valve).

### STARTING OF PUMP

1. Never start pump against closed valves.
2. Start the pump using manual operation. Measure and record and amperage drawn on each phase leg and verify these readings with the nameplate ratings. If measured amperage is more than 5% higher than maximum permitted amperage, stop the pump and check probable causes according to "Operating Problems" chart.
3. Once preliminary checks are complete, place the pump into automatic operation. Cycle the system through several liquid draw-downs to observe that level controls are properly set and functioning correctly. Also, observe that the alarm system and charge-over switch (if included in control panel) are working properly.
4. Log date and hours run meter reading and set pump for automatic operation. Perform maintenance as recommended in this manual, according to total hours run.
5. It is advisable to recheck shaft coupling alignment after one week of operation.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### SHUT-DOWN OF PUMP

1. Disconnect power to the Motor.
2. Close all valves
3. Shut off flushing water, if supplied.
4. If pump is to be out of service for a prolonged period, it is recommended that shaft is rotated several times every two weeks to assure a positive coating of lubricated services, also to prevent seal faces from sticking together.
5. If subject to freezing, the pump must be completely drained.

### GENERAL OPERATING CONDITIONS

The pump should not be allowed to operate on continuous-duty to the left of lowest efficiency line or dotted line on performance curve (high discharge pressures with low flow); bearing life is shortened and abrasive wear is accelerated in this operating condition. For the same reasons, we do not recommend starting this type pump against a closed discharge valve.

### OPERATING PROBLEMS

Some of the more common problems that can occur when operating solids handling pumps are listed in the 'Operating Problems' table along with recommendations as to possible cause of the problems.

Should a solution to a particular site problem not be found in the table we would strongly recommend you contact your nearest Hidrosta representative or Hidrosta directly. If the problem is one of pump specification not being suitable for the application we would like to advise that the Hidrosta pump line is very flexible from a specification point of view and many of the features such as the wear-plates, impellers, mechanical seals etc., have various forms and material specifications and it could be a particular site problem such as corrosion or wear can be resolved by substituting an interchangeable part with that of a different specification. In such cases full description of the application including liquid specification and a sketch of the installation along with a description, or better still supplying the damaged parts would greatly assist in recommending a solution.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### OPERATING TROUBLES

The following table is provided as a guide to common operating troubles and their causes. Should the trouble continue, consult your HIDROSTAL representative.

PROBABLE CAUSES	No Flow	Flow not sufficient	Head not sufficient	Reduction of flow or head after start-up	Vibrations	Motor overload	Motor does not start
1. RPM too low	x		x				
2. RPM too high					x	x	
3. Air entrance into suction line (flanges not tight)	x	x		x	x		
4. Discharge line clogged/valve closed	x				x	x	
5. Air or gas in pumped liquid	x	x	x	x	x		
6. TDH too high	x	x			x		
7. Suction head too high				x	x		
8. Not sufficient suction head on hot liquids		x			x		
9. Insufficient submergence of suction	x	x	x	x	x		
10. Sludge concentration higher than assumed		x	x			x	
11. Specific weight of medium higher than assumed						x	
12. Impeller or suction line clogged	x	x			x		
13. Wrong direction of rotation	x	x	x		x	x	
14. Impeller clearance too high		x	x				
15. Damaged impeller		x	x		x		
16. Thermal overloads tripped: control switch off							x
17. Motor damage					x	x	x
18. Low voltage		x	x			x	x
19. Humidity switch tripped							x
20. Attachments loose					x		
21. Coolant loss							x
22. Bearings worn out					x		
23. Impeller out of balance					x		
24. On-level switch not overflowed, or damaged							x
25. Impeller too small			x				
26. Impeller dragging against suction cover					x	x	
27. Thick sludge and tight impeller clearance						x	
28. Air or gas on impeller backside	x		x				
29. Pump is not vented	x						
30. Pump and motor not correctly aligned					x		
31. Shaft bent					x		



## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### 2.0 SERVICE CONNECTIONS

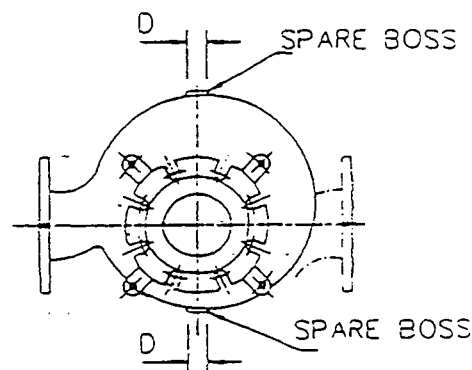
#### On Volute

These comprise of a gauge connection [Pos 424] on the discharge flange [except B02Q].

When the pump is mounted horizontally with the discharge flange vertical, and drain plug. (Pos 423) is provided at the lowest part of the volute casing.

In situations where it is necessary to rotate the discharge flange to either side, i.e. to discharge horizontally on a horizontally mounted pump, the volute has two spare bosses of diameter 'D' which can be tapped to provide vent and chain connections, [factory supply pumps with these bosses untapped]. [Except B02Q/B050/C080]

Pos Type	423	424	D [MM]
B02Q B050	R ½"	R ¼"	-
C080	R ½"	R ¼"	-
D03Q/D04Q D080/D100	R ½"	R ¼"	35
E03Q/E080	R ½"	R ½"	35
E050/E125			50
E08Q/E200			50



For exact details of hydraulic end see "Sectional Drawing" at end of this manual.

#### On Bearing Frame

The service connections that are built into all pumps as standard are listed below. Please refer to sectional drawing of bearing frame at end of the manual for specific details.

#### 552a/552b Seal Flushing Connections

For applications handling lightly contaminated liquids this connection is not used: However, in special cases when pumping high concentrations of solids with a tendency to dehydration or sedimentation, such as high concentrations of sludge or mud, there should be a connection to clean water flush. This connection will conduct clean water between the impeller and the lower mechanical seal (515), providing periodic removal of accumulated solids.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

Flushing water must be pressure-regulated between 7 and 14 psi ( $\frac{1}{2}$  to 1 bar) above pump discharge pressure. Typically, water is controlled by a solenoid valve on a time clock. Adequate duration of each flushing is 60 seconds; frequency of flushing must be established for each different installation, starting with once per day.

The quantity of flushing water varies according to pump size and application: In most cases, flow rates of 6-8 l/min will be sufficient.

Alternatively or even in addition to the above function, this connection may be used to manually bleed the air from the casing prior to start-up, if there is no other place for air to escape through the discharge piping.

In most cases the connection 552b will be closed and flushing water mixes with product pumped. In cases where the solid accumulate, could form lumps or be fibrous, flushing out via 552b would be the preferred-solution. Connection 552b also permits complete draining of horizontal units if required.

### 536a/536b Oil fill and Oil Drain Connections

Connections 536a is positioned in such a manner that it should always be regarded as the oil fill connection.

Connections 536b is the oil drain connection.

### IMPORTANT

**SEE SECTION DESCRIBING 'SEAL OIL CHECKING' AND 'SEAL OIL CHANGING' FOR DETAILED INFORMATION.**

### Connection D (Refer page 13):-

This connection tapped -  $\frac{1}{4}$ " BSP permits any leakage through the inboard mechanical seal (POS 516) to drain away thus preventing contamination of bearing grease and premature failure of bearing (POS 125).

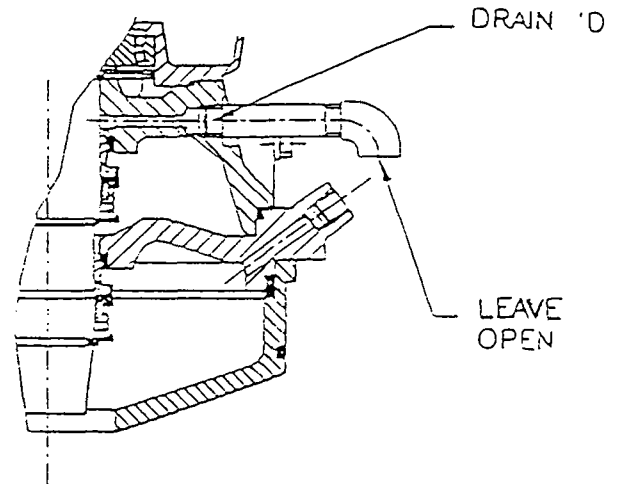
This drain must be left open. As soon as leakage via 'D' is noted the pump should be removed to a workshop for inspection.

On horizontally units Connection D must always be at the bottom of the bearing frame. The factory build pumps with drain 'D' on the opposite side to pump discharge flange, as most horizontally mounted pumps have the discharge flange vertically. If the discharge flange is in any other position the bearing frame must be unbolted from the hydraulic end and re-positioned so drain is vertically down.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

On vertical units the drain can be in any position relative to the discharge nozzle.

When installed in dry environment, the drain can be left open. When installed out-doors, or in a situation where water could spray onto the bearing frame, i.e. when washing down, an elbow should be fitted to prevent ingress of casual water.



### Connection 163

On bearing frames	BCM.0	Connection 163 is
	DCM.0	permanently plugged
	DFM.0	

These bearing frames are oil lubricated, 163 is the grease nipple connections [Pos 131] on the grease lubricated version of this pump.

### Connection 131

Greasing point for bearings on grease-lubricated version.

**SEE SECTION "BEARING LUBRICATION" FOR FULL DETAILS**

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### 3.0 BEARING LUBRICATION

#### 1. Grease Lubricated Bearings

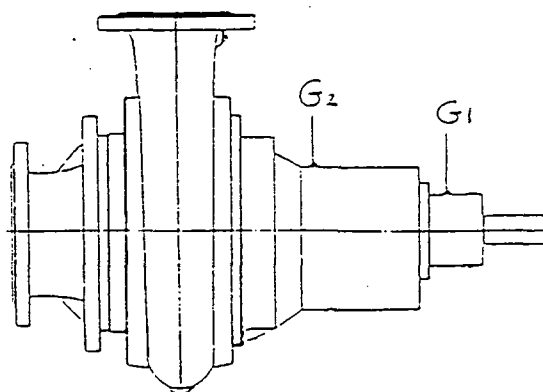
The following Bearing frames require periodic greasing according to table below:

HYD. SIZE	BEARING FRAME CODE	SECTION DRAWING	R.P.M.	LUBRICATION INTERVAL HOURS	AMOUNT OF GREASE [GRAMS]	
					G1	G2
B	BCM.F	90-TU-4115	3,000	500	3	2
			5,000			
D	DBM.F	90-TU 4110	2,900	500	-	2
	DCM.F	90-TU-4157	3,500	500	3	2
E	ECM.F	90-TU 4163	1,500 2,000	500	3	1
	EFM.F		2,900 1,500	500 1,000	5 5	
F	FFM.F FGM.G	90-TU 4165	1,500			
			1,500			
			2,100			

The factory grease the bearings with the following grease and we recommend that, where possible, the same grease is used for periodic greasing. STABUAGS NBU 8 EP by Kluber-Lubrication.

Equivalent Lubricants:

1. Mobilux EP2 (Mobil)
2. Lidok EP2 (Exxon)
3. SKF LGEP2 (SKF)
4. Alvania EP2 (Shell)
5. Multifak EP2 (Texaco)
6. Amolith Grease #2EP (Amoco)



When it is not possible to use this grease, a grease of similar specification should be used.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

STABURAGS NBU 8 EP by Kluber-Lubrication.

This grease is of a mineral oil base containing a barium complex as thickener.

Typical characteristics:

Colour	beige	
Apparent dynamic visco. [approx]	6000	mPas
Operating temp. range	-30..150	°C
Max. temp [short time]	170	°C
Consistency class [NLGI]	2	
Penetration DIN ISO 2137 [0.1mm]	280	
Dropping point DIN ISO 2176	>220	°C
Corrosion protection DIN 51802	0	
RPM-parameter [n x d m]	5 x 10 <sup>5</sup>	

STABURAGS NBU 8 EP is:

Rolling Bearing High Pressure Grease

suitable for long-life lubrication under high specific bearing loads and for the protection against unusual bearing wear. Proven for vehicle motors, axle bearings, electric motors, pumps and above all for taper roller bearings.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### OIL LUBRICATED BEARINGS

For high speed and heavy duty applications, Hidrostral pumps can be supplied with oil lubricated bearings. These can only be used on horizontal applications. Bearing frames for oil lubrication can be identified by the letter 'O' at the end of the bearing frame code [ie BCM10]

### **IMPORTANT**

When factory supply bare-shaft pumps they are shipped without bearing lubricating oil. The oil fill is to be made either by local agent, who may fit the pump to a base-plate or by installer. Commissioning engineer should check oil fill has been made prior to start-up.

The following Bearing Frames are oil lubricated and the oil should be changed according to table below or when oil looks dirty and/or contaminated.

HYD CODE	BEARING FRAME CODE	SECTION DRAWING	R.P.M.	OIL CHANGE INTERVAL	QUANTITY OF OIL [LITRES]
B	DCM.0	90-TU 4123	3,000 6,300	Once per year or every 5,000 hours	0.15
D	DCM.0	91-TU 4159	3,000 6,300		0.15
D	DFM.0	90-TU 4161	2,900 4,100		0.85
E	EGM.0		2,900 3,500		1.2
F	FHM.0		2,900		1.5

The correct level for the lubrication oil is the centre line of the sight-glass [Pos 536].

The factory recommend the following oil for bearing lubrication.

Automobile Transmission Fluid [ATF] Universal Oil. Factory fill with version having red additive.

### **WARNING**

Oil temperature should not be allowed to exceed 80°C. For applications where this would occur consult your local Hidrostral agent.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### 4.0 CHECKING OF SEAL OIL

The condition of the Seal Oil gives a direct indication as to the condition of the product side mechanical seal. [Pos 515].

**An oil condition check must be made after the first 1,000 hours of operation and once a year thereafter. Or more frequently, if site experience indicates.**

Immediately before checking the oil, either run the pump for a few minutes or if the pump has been removed from site shake the pump to distribute any impurities through the oil.

**NOTE:** Before proceeding to check the oil condition, carefully clean the area around the oil-sight-glass [Pos 549] and the oil plugs 536a and 536b.

**IMPORTANT:** When a bearing frame is fitted with an oil-sight-glass it should only be used to obtain a quick visual indication as to the oil condition. It should not be regarded as an indication of the correct oil level.

**BE CAREFUL** in oil lubricated bearing frames to check the correct sight-glass. Seal oil sight-glass [Pos 549] is located nearest the hydraulic end; whereas the bearing lubrication oil sight-glass [Pos 536] is low down, between the bearings.

The correct oil level is above the level of the sight-glass for both horizontally and vertically mounted pumps and, as long as oil level surface cannot be seen through the sight-glass it can be regarded as having sufficient oil for satisfactory operation, even though it may be nominally below the original fill level.

If the oil appears through the sight-glass to be relatively clean a small sample of oil should be removed from the bearing frame through plug 536b into a suitable container and examined. If the oil is clear, there is no problem with the pump side seal [Pos 515] and the removed oil can be refilled into the chamber, [Pos 515] and plus 536a and the oil topped up, using the correct grade of oil to the required level.

If the oil appears through the sight-glass to be somewhat milky, dirty, or the oil level is not apparent, a full oil check must be made by draining all of the oil through the plus 536a into a suitable container and examined.

If the oil is relatively clean and the water readily separates from the oil, the separated oil can be returned to the oil chamber and topped up with the same grade of oil to the required level. In this case is advisable that the seal oil is then checked after a further 500 hours of operation.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

However, if too much water has entered the oil the viscosity will be much higher- as thick as motor oil or even thicker. In such cases it can be concluded that the pump side mechanical seal [Pos 515] must be repaired or replaced, which is best undertaken in an authorised workshop.

If there is a small quantity of water in the oil, but the oil is otherwise clean, it does not indicate a failure of the mechanical seal, as it is possible that a small quantity of water passed through the seal during the initial running-in period.

If the oil is dirty, or there has been a significant loss of oil, then it is recommended that the pump is removed to a workshop so that the mechanical seal assembly can be carefully examined.

If the oil level is at, or below the sight-glass, then there has been significant leakage of oil and the pump side mechanical seal 515 may require replacement, particularly if no oil leakage has been observed through drain connection "D". In this instance the pump should be scheduled for a workshop overhaul in the very near future.

**NOTE:** When re-installing plugs 536a and 536b always use a new copper sealing washer. The copper sealing washer must be softened as follows:-

Heat until red and quench immediately in cold water.

### SUMMARY

#### OIL CONDITION

#### ACTION

Oil is clean	Top up to correct level*	PUMP INSITU
Oil is milky	Draining oil, separate water refill separated oil. Top up to correct level* with same grade of oil CHECK AGAIN AFTER 500 HOURS	PUMP INSITU
Oil looks dirty but of low viscosity and free of sludge [Small amount of dirty liquid discolours oil]	Completely drain old oil, flush out, refill* with new oil CHECK AGAIN AFTER 500 HOURS	PUMP INSITU
Seal Oil Very Dirty	Remove pump to authorised workshop for inspection	
Seal Oil Below Sight-Glass	Remove pump to authorised workshop for inspection	

\*SEE SECTION COVERING 'CHANGING SEAL OIL WITH PUMP INSITU' FOR METHOD OF DETERMINING CORRECT OIL LEVEL



## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### SEAL OIL QUANTITIES

To refill the seal oil chamber to the required level the following oil quantities can be used as a guide:-

BEARING FRAME	QUANTITY [Litres]
DBM.F	0.9 - 1.0
BCM.F/BCM.0 DCM.F/DCM.0	0.9 - 1.0
ECM.F -	1.2 - 1.3
DFM.0	1.5
EFM.F -	3.3
FFM.F - EGM.0	3.3
FGM.F -	
- FHM.0	3.8

### RECOMMENDED OIL

Shell Tellus C10  
Castrol Magna AB5

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### SEAL OIL SPECIFICATION

#### General

The factory fill the seal oil chamber on double-mechanically sealed close-coupled pumps with the same low viscosity oil used for cooling systems on immersible motors.

#### TYPICAL ANALYSIS

Specific gravity at 20°C	0.812 g/ml
Viscosity at 20°C	6.75 mm <sup>2</sup> /s [cst]
Viscosity at 40°C	3.52 mm <sup>2</sup> /s [cst]
Solidification point	-38.0°C
Flash point	132.0°C
Burning point	142.0°C
Evaporation energy	251.0 kJ/kg
Solubility in water	none

For installations which are exposed to temperatures far below freezing point [e.g. outdoor installations], the solidification point is very important.

#### IMPORTANT FEATURES FOR APPLICATION IN PUMPS

Instead of this oil, another oil or even another liquid can be used. When selecting an alternative cooling medium the following features must be considered.

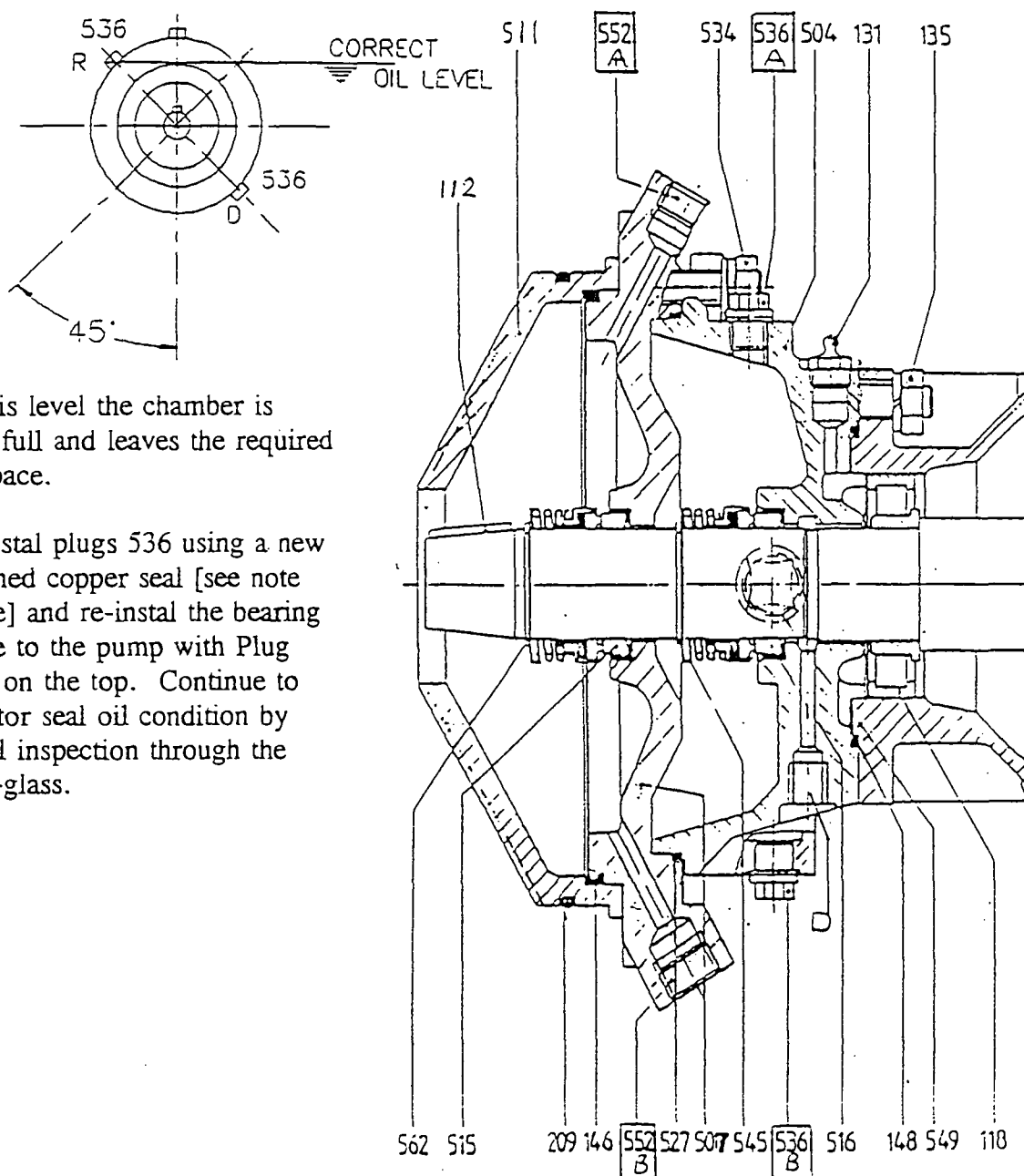
1. The viscosity may not be higher than indicated by ISO VG.
2. Emulsification with water is not acceptable, as water penetration could not be detected.
3. Corrosion resistance and non-aging quality are required.
4. Following temperatures must be considered:-
  - Solidification point and lowest possible surrounding temperature.
  - Boiling point and highest possible temperature of pump liquid.
5. In case of Bearing Frames equipped with electrical moisture probes, it is important that the liquid has good electric insulation qualities.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### CHANGING SEAL OIL ON INSITU HORIZONTAL PUMPS

For horizontally installed pumps the oil can be drained via plug 536b into a suitable container.

To refill the oil disconnect the bearing frame from the volute end, turn the bearing frame so that Plug 536a and the sight-glass [when fitted 549] are both lying at 45 degrees from the vertical [see sketch]. The oil should be refilled using Plug 536a and the correct level for the refilled oil is when the level is at the centre of the sight-glass, which is also the same level of the filling hole 536a.



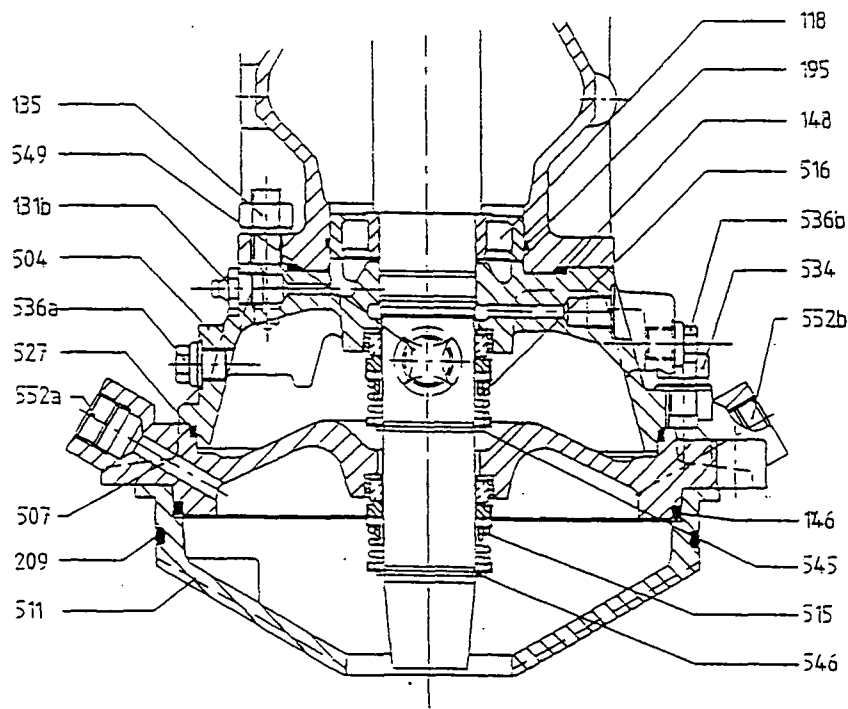
At this level the chamber is 90% full and leaves the required air space.

Re-install plugs 536 using a new softened copper seal [see note above] and re-install the bearing frame to the pump with Plug 536a on the top. Continue to monitor seal oil condition by visual inspection through the sight-glass.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### CHANGING SEAL OIL ON INSITU VERTICAL PUMPS

The oil must be removed by firstly draining down to the level of 536b and then using some means to remove the remaining oil below the level of Plug 536b. This could be done by either using a rubber tube as a syphon or by employing some form of device. This is best undertaken after removing Plug 536a.



Having removed all the old oil, flush with a little clean oil and refill with clean oil up to the level of 536a.

#### **IMPORTANT**

It is important the correct sectional drawing is studied to determine Plug 536a. The level of this plug ensures the correct air space is left above the oil. If connection 536b is used this would not be the case.

Plugs 536a and 536b should be replaced using a soft copper washer.

Continue to monitor seal oil conditions by visual inspection through sight-glass.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### MAINTENANCE OF HYDRAULIC PARTS

#### PUMPS WITH HEAVY DUTY HYDRAULIC END AND REGULABLE LINERS

B050 Sectional Drawing 90-TU 4144 Mat Code 1R/3R/5R

D080-D100 Sectional Drawing 90-TU 4148 Mat Code 3R/5R

E080-E200 Sectional Drawing 90-TU 4150 Mat Code 3R

This family of pumps have been designed for the more arduous applications where ease of impeller clearance adjustment is a requirement, particular in situations where the liquid may contain abrasive solids. In this case the clearance is adjusted by three external screws without disturbing the pump or pipework.

For a pump on a new application the impeller clearance should be checked and re-adjusted whenever a significant decrease in pump performance is noticed or at least once every six months, until a history is developed as to how often adjustment will be required.

Excessive clearance is not desirable especially in the smaller pump sizes, as a greater percentage of total flow can thus re-circulate causing a drop in performance. Conversely, less clearance than the minimum listed can overload the motor and/or cause vibration due to too great a friction between the impeller and the liner.

When pumping thick sludges or viscous material, larger clearances may be necessary to avoid friction; larger clearances may actually increase flow capability. Therefore, for thick sludges and high consistency materials, set clearance to 2 times that shown in table.

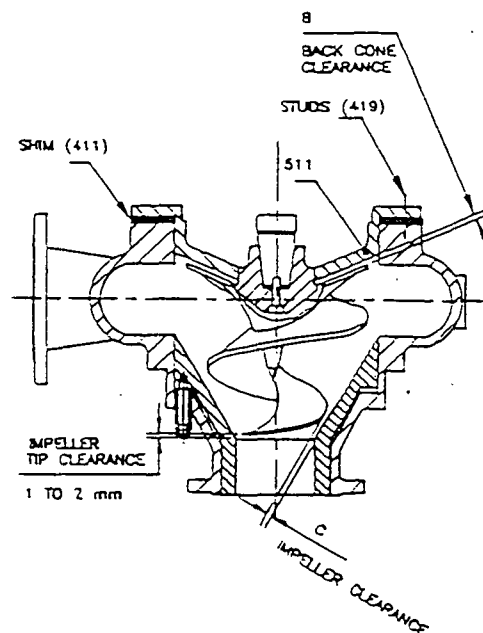
The three adjusting screws can be found on the suction side of the volute, immediately behind the suction flange.

#### A. IMPELLER CLEARANCE ADJUSTMENT OF PUMPS WITH REGULABLE LINER

Loosen and back-off lock nuts [Pos 412] on end of each regulator assembly. Now slowly and evenly screw-in each regulator bush [Pos 422] just until pump shaft cannot be turned [this will eliminate all clearance between the impeller and the liner]. Be sure to take the same number of turns on each threaded regulator bush; this keeps the liner concentric to the impeller.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

If the impeller tip is binding on the lip in the suction eye, or if there is less than 1mm clearance, between the impeller tip and the lip when the spiral edge of the impeller is firmly seated against the conical taper inside the volute, then the tip clearance must be opened up. To adjust the tip clearance the impeller tip must be ground off parallel to the suction flange, until 1-2mm clearance is obtained.



Now back off the threaded regulator bush [Pos 422] exactly the number of turns specified in the table [according to pump size]. Holding each threaded regulator bush from turning, tighten the three standard hex lock nuts [Pos 412]. This pulls liner away from impeller the required clearance, and also locks the regulator bush in place.

Ideally a feeler gauge should then be used to check the actual clearance between the impeller and liner, access being via the suction of the pump.

If the clearance is significantly different than 'C' shown in table, it is possible that the wear is excessive or uneven, disassembly and inspection is recommended.

In situations where the actual clearance 'C' cannot be measured, i.e. pump is installed in a system, it can only be assumed the clearance is correct, unless a noticeable reduction in performance would indicate otherwise. In this case, the pump should be removed so that the hydraulic end can be disassembled and inspected for wear.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### REPLACEMENT OF WORN HYDRAULIC PARTS

If, after re-adjusting the impeller clearance "C" there remains big discrepancies in this clearance and the reset pumps does not sufficiently restore the pump performance then the impeller and/or suction liner are worn beyond their service life and should be replaced.

**An impeller is considered worn when:-**

- a) The outer edge [that which runs next to the liner] no longer presents a smooth continuous surface but is grooved and is no longer conical. This is best checked by placing the impeller into a new liner, if available.
- b) The discharge edge is worn so thin that small abraded valleys on the surface of the blade have, or are about to break through.
- c) The impeller tip is worn such, that it is no longer hidden behind the shoulder [lip] in the suction eye of the liner [check that it is the impeller that is worn and, not the entrance to the liner, which forms the shoulder].

Wear patterns on the flat surfaces of the impeller are not critical to the performance, nor is a gentle rounding of the impeller edge.

**The liner/suction cover is considered worn when:-**

- a) Deep circumferential grooving is present on the conical surface.
- b) The spiral groove is no longer visible, or it is generally less than 1.5mm deeper than the conical surface.
- c) The shoulder lip at the inlet eye is not longer of sufficient width to protect the impeller tip.

**NOTE:** If the impeller tip is visible through the suction eye of the assembled pumps, it is possible that fibrous materials and rags will hang up on this tip and the pump will no longer provide the excellent 'solids handling capability' for which it was originally purchased.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### ADJUSTMENT OF BACK CLEARANCE "B"

Experience in the field has indicated that very little wear takes place between the back of the impeller and the back cone [Pos 511] and factory tests have shown that even with quite large back clearances "B" there is only a marginal effect on pump performance.

In most instances adjustment of this back clearance will be unnecessary between major overhauls. The factory build the pumps with "B" according to the dimensions shown in the table and in most instances it will be reasonable to allow this clearance to open up by 1-2mm. However, should it become necessary to reduce this clearance, shims should be placed between the back cone [511] and sealplate [507]. This might be particularly necessary if the pump is handling fibrous material which may become trapped between the impeller and the back cone.

**The back cone is considered worn when;** the spiral groove is heavily worn and is barely visible or has disappeared altogether. If the spiral groove is still clearly visible but the corners have become somewhat rounded, the pump will still operate at its design flow rate and head, but the cutting action of the impeller against the back cone will be somewhat reduced and if handling fibrous material it maybe worth considering replacing this back cone particularly if jamming of the material between the impeller and the cone has become a problem.

### REMOVAL OF IMPELLER

Hold the impeller [401] from turning by hand, or by a strap wrench, or by locking pliers clamped to the impeller. Insert a hexagonal key wrench [allen-head wrench] into the impeller bolt [415] and with a hammer, tap the wrench counterclockwise to loosen the bolt.

#### Wrench Sizes

Pump Size:	C	B	D	E
Wrench Sizes:	10 mm	10 mm	10 mm or 14 mm	14 mm

After removal of bolt, the impeller can be tapped loose using a plastic hammer, rap the impeller face [NOT edge or tip!] to free it from the shaft taper. If it does not pop-off the taper after a few sharp raps, then heat the hub of the impeller [near the impeller bolt hole] with a soft-flame torch, then rap again.



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Before fitting a new impeller [or a new impeller bolt], the length of the impeller bolt should be checked, as follows:-

1. Place impeller into shaft and using a thin rod measure distance from end of shaft to the shoulder in the impeller bolt-hole. Remove impeller.
2. Now measure impeller bolt length, from tip to underside of head and, subtract  $1\frac{1}{4}$  times the bolt diameter. If remaining distance is shorter than [1] above, a longer impeller bolt is needed, to ensure adequate engagement of threads.
3. Now screw impeller bolt into shaft end as far as it will go without excessive force and, measure distance from shaft end to underside of bolt head. If this distance is longer than [1] above, the bolt must be shortened, [to ensure that the bolt pulls the impeller tight against shaft before the bolt "bottoms out" in the shaft threads]. If the impeller bolt must be shortened a significant amount, check if the threads on the bolt must be re-cut to permit the required assembled length.

### NOTE:

Coat shaft taper with a light oil **ONLY** [do NOT use grease or anti-size compound here], then install impeller directly onto shaft.

Coat the impeller bolt with grease or anti-size compound. Install and tighten to the torque listed below:

### FACTORY FITTED IMPELLER BOLTS

HYDRAULIC	SIZE	HEXAGON	TORQUE N-M
B050	M12	10	60
D050] DDM1B			
D080] DDM1C	M16	14	147
D100]			
D080]			
E125]			
E200]			

**NOTE:** If torque wrench not available, correct tightness can be approximated by hitting long end of standard 'L'-shaped allen-wrench with several sharp hammer blows.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### REMOVAL OF "REGULABLE" LINER

The liner [Pos 421] is housed in the front portion of the volute in the case of the smaller pumps B050/D080/D100. The larger pumps E080→ have a removable suction casing [Pos 416] in which is housed with regulable liner [Pos 421]. See section drawing of each pump for exact construction details.

Pumps with regulable liners can easily be recognised by the presence of three large regulation bushes with lock nuts just behind the suction flange.

If the conical surfaces is worn, only the liner needs to be replaced. The liner can be removed while the volute casing and suction casing remain attached to the piping, if desired.

To remove liner, completely remove small lock nuts [Pos 412] on end of regulator bush [Pos 422], then push the three screws [Pos 413] through the holes in the large regulator bushes. If stubborn, the large regulator bushes can be turned all the way into the casing to force the liner out. No attempt should be made to disassemble the regulator screws [Pos 413] from the liner until the liner is removed from the pump; they are loctited in place and must be heated with a torch to break the loctite bond.

The wear ring [Pos 408] should not typically require disassembly; remove from suction casing only if badly damaged by unusual circumstances. It will be necessary to heat the mating surfaces with a torch to destroy the special adhesive between these two parts. Then press out wear ring with a hydraulic press.

### REPLACEMENT OF "REGULABLE" LINER

Install three regulator screws [Pos 413] into liner, using 'Loctite' "stud-mount".

Thoroughly grease 'O'-ring [Pos 430] and install into groove in casing [Pos 400] - this groove is nearly hidden by the suction ring in some pump models. Grease 'O'-ring [Pos 431] and install into groove in wear ring [Pos 408]. Assemble ring into suction casing with a lead hammer, until suction ring is flush with flange surface.

#### IMPORTANT

Make sure wear ring is flush with or slightly below flange surface. If it is protruding above surface the connection of the suction pipework will push wear ring into casing and close-up tip clearance, or in extreme cases bind on impeller tip which could cause bearing or seal failures.

Grease and install 'O'-ring [Pos 406] onto large end of liner.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

Coat the external threaded portion of large regulator bushes with anti-size compound and, install these into the casing [Pos 400] or [Pos 416] hex-side toward the outside [toward the suction flange]. Screw these into the casing until they are flush with the inside of the casing.

Now place liner into casing, engaging the three screws into the holes through the three regulator bushes. [Note: The three screws are not spaced evenly around the liner, so there is only one orientation of the liner where the screws will correctly fit through the regulator bushes].

### REPLACEMENT OF BACK CONE [Pos 511]

Firstly, remove impeller as previously described. The back cone [Pos 511] is an easy fit onto seal plate [Pos 507] and should remove easily, any resistance will be caused by the interference of 'O'-ring [Pos 146].

To replace back case, grease a new 'O'-ring [Pos 527] and fit into spigot of sealplate [Pos 507]. Hand press a new back cone into place. On the larger sizes, a light tap with a plastic hammer maybe required to overcome the resistance of the 'O'-ring.

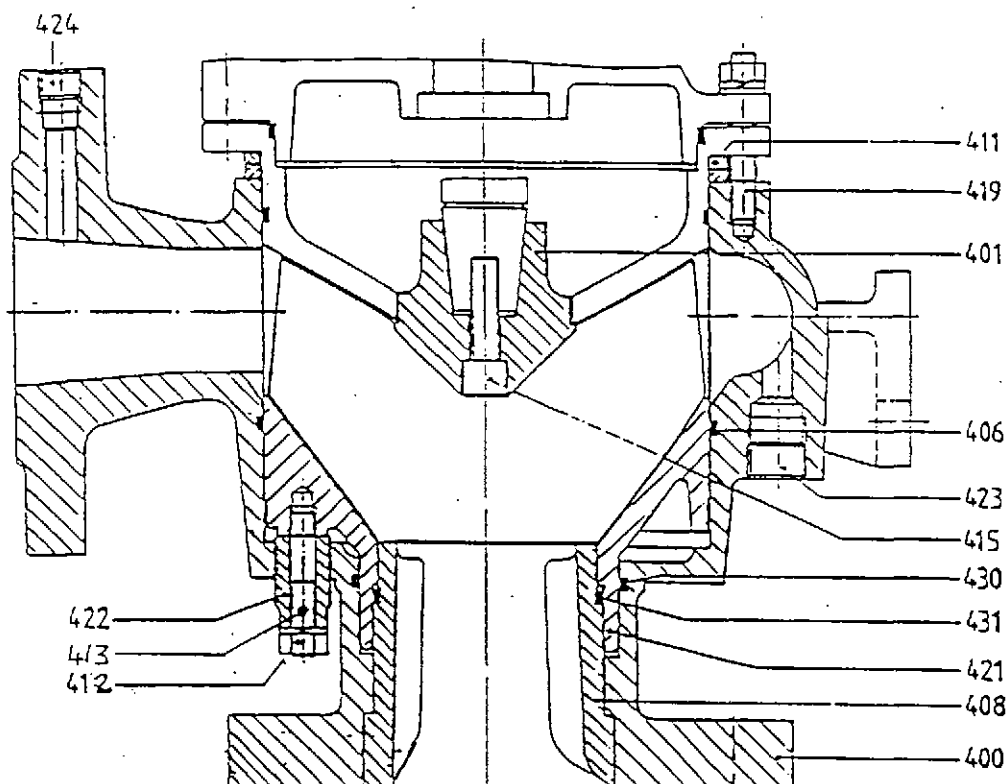
### FINAL ASSEMBLY

After fitting a new impeller and/or liner the correct impeller clearance should be set by following the steps defined in "Adjustment of Impeller Clearance for Wear" taking particular care to check and, if necessary, adjust the impeller tip clearance.

#### **IMPORTANT**

Should a complete strip-down of the pump be required and mechanical seals need replacing, we recommend this work is done in a Hidrostal authorised repair centre, who will have complete repair manuals and any special tools and facilities necessary to properly assemble and re-assemble the pumps.

# SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS



PART	DESCRIPTION	MATERIAL CODE		
		1R	3R	5R
400	VOLUTE	GREY CAST IRON	GREY CAST IRON	STAINLESS STEEL A4
401	IMPELLER	NODULAR IRON	STAINLESS STEEL A4	STAINLESS STEEL A4
406	'O'-RING	NITRILE		
408	WEAR RING	GREY CAST IRON	HIDRO HARD	STAINLESS STEEL A4
411	SHIMS	STEEL		
413	ADJUSTING BOLT	STAINLESS STEEL A4		
415	IMPELLER BOLT	RUSTLESS STEEL	RUSTLESS STEEL	STAINLESS STEEL A4
419	FASTENING SET	RUSTLESS STEEL		
421	LINER	GREY CAST IRON	HIDRO HARD	STAINLESS STEEL A4
422	REGULATION NUT	STAINLESS STEEL A4		
423	DRAIN PLUG	STEEL	STEEL	STAINLESS STEEL A4
424	PLUG	STEEL	STEEL	STAINLESS STEEL A4
430	'O' - RING	NITRILE		
431	'O' - RING	NITRILE		

Hidrostat reserves the right to make changes without giving prior notice.

# SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

POS	DESCRIPTION	CODE	MATERIAL*	
			1 (2)	5
<b>GENERAL</b>				
100	Bearing Housing	1GL	A	A
101	Bearing Support	1TL/1TS	A	A
102	Bearing Cap P.S.	1DL	A	A
103	Bearing cap M.S.	1DL	A	A
104	Spacer ring P.S.	1RD/8RS	K	K
105	Spacer ring M.S.	1RD/1SF	K	K
106	Bearing spacer	1RD	K	K
107	Spacer ring	1RD	K	K
108	Fastening set 116-101	8BB	M	M
109	Spacer ring for 119 disassembly	1SA/5SA	K	K
110	Shaft	1WO	H/L**	F+L
112	Woodruff key	2FK	L	F
114	Coupling key	8FK	L	L
115	Oil seal sleeve for 128 (bearing frame size 7)	8DB	I	I
116	Intermediate supporting frame	1TZ	A	A
117	Deep groove ball bearing M.S.	8LW	-	-
118	Roller bearing P.S.	8LW	-	-
119	Roller bearing M.S.	8LW	-	-
120	Deep groove ball bearing (old execution P.S.)	8LW	-	-
121	Angular contact ball bearing	8LW	-	-
122	Spherical roller bearing (old execution P.S.)	8LW	-	-
123	Axial-spherical roller bearing	8LW	-	-
124	Spherical roller bearing (oil execution M.S.)	8LW	-	-
125	Double row angular contact ball bearing	8LW	-	-
126	Lock nut for shaft/Locking sleeve	8LM	L	L
127	Lock washer for 126	8LF	O	O
128	Oil seal M.S. for bearing frame size 7	8DS	Q	Q
129	V-ring P.S.	8DV	Q	Q
130	Labyrinth M.S.	1RL/3RL	K/A	K/A
131	Grease nipple	8NF	N	N
132	Grease cup R 1/4"	8NS	N	N
133	Plug M10	8FO	M	M
134	Lubricant drain plug for 101 or 116	8FO	N	N
135	Fastening set 100-101 and 116	8BB	M	M
140	Thrower disc P.S.	8DG	K	K
141	Fastening set 102-101	8BB	M	M
144	Labyrinth P.S.	1RL	K/A	F
145	O-ring for 144	8D0	Q	Q
146	O-ring	8D0	Q	Q
147	O-ring for 100	8D0	Q	Q
148	O-ring for 100-116 or 102-300	8D0	Q	Q
149	Snap ring for 144	8RF	O	O
150	Snap ring for 102	8RF	O	O
151	Spacer ring for bearing 118	1RD	K	K
152	Oil seal P.S. for bearing frame size 7	8DS	Q	Q
153	Snap ring for 152, bearing frame size 7	8RF	O	O
154	Lubricant drain plug for 100	8FV	N	N
157	Spacer ring	1RD	K	K
158	Distance ring for 152 (for immersible inst.)		K	K
159	Driving pin, bearing size 7	8FG	O	O
<p>*For material explanation see material</p> <p>**Depending on size</p> <p>***Brass</p>				

# SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

POS	DESCRIPTION	CODE	MATERIAL*	
			1 (2)	5
<b>GENERAL</b>				
160	Snap ring for 118	8RF	O	O
161	Spring	8LD	O	O
162	Snap Ring M.S.	8RF	O	O
163	Plug	3FO	N	N
164	O-ring for 130/126	8DO	Q	Q
165	Impeller flange	2SF	B	C
166	Impeller nut	2FM	K	F
167	Impeller locking washer for 165	2FF	K	F
168	Fastening set 102-116	8BB	M	M
169	Spacer ring for L2 + I4	1RV	K	K
170	Bearing cap for 102 (L20DA)	1DD	A	A
171	Fastening set for 102-170 102-172	8BB	M	M
172	Sleeve bearing frame M28DA	1GG	A	A
173	Housing for Mechanical seal seat P.S. (M28DA)	1DD	A	A
174	Oil Impeller for oil circ for bearing frame 2A		A	A
175	Cap for mech. seal 516 M.S. (M28DA old execution)		A	A
176	Fastening set 173-400	8BB	M	M
177	O-ring for 172	8DO	Q	Q
178	Sleeve bearing for (M28DA)	8LG		
179	Nozzle for bearing lubrication frame size 7S	179-01	***	***
191	O-ring for 173	8DO	Q	Q
192	Masher for 165		M	F
<b>STUFFING BOX</b>				
200	Back cover for stuffing box	1GD	A	C
201	Stuffing box sealplate	1PS	A	C
202	Gland	1DS	A	C
203	Neck bush	1RP	K	F
204	Lantern ring	1RS	E	C
205				
206	Fastening set 101-200	-	M	F
208	Shaft sleeve	1DB	I(J)	F
209	O-ring for 200	8DO	Q	Q
210	O-ring for 201	8DO	Q	Q
213	Shaft sleeve pin	8FZ	G	F
214	Rubber sealing washer for 208	8DG	Q	Q
215	Soft packing	8DP	**	**
216	O-ring for 208	8DO	Q	Q
218	Plug for flushing connection 2	8FO	N	F
219	Plug for flushing connection (old execution)		N	F
220	Stuffing box gland bolt	8FS	F	F
221	Fastening set 201-200	8BB	M	F
222	Nipple	8NB	N	-
226	Socket head screw (for DA old execution)	8FI	M	-
227	Insert ring (for DA old execution)		K	-
228	Rubber ring for 227 (for DA old execution)		Q	-
229	Flat washer for 220		M	F
230	Set of shims of wire between 200-101	8FU	M	F
<p>*For material explanation see material</p> <p>**Depending on size</p> <p>***Brass</p>				

# SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

POS	DESCRIPTION	CODE	MATERIAL	
			1 (2)	5
<b>MECHANICAL SEAL</b>				
209	O-ring for 507	8DO	Q	Q
346	Filling plug with air relief device	8OE	-	-
350	Magnetic lubricant drain plug	8OM	-	-
355	FEY laminar ring P.S.	8DF	O	O
356	FEY laminar ring M.S.	8DF	O	O
549	Oil sight glass	8OG	-	-
563	Oil sight glass	8OG	-	-
544	Backcover	1K.	A	c/D
515	Mechanical seal P.S.	8DM/8dm	**	**
516	Mechanical seal M.S.	8DM	**	**
527	O-ring for 200 M.S.	8DO	Q	Q
534	Fastening set 101-507	8BB	M	F
536	Plug with gasket	8FV	F+P	F
545	Snap ring for 516	8RF	O	O
552	Plug for flushing connection 581	8FO	N	F
562	Snap ring for mechanical seal 515	8RF	O	F
507	Mech seal plate	1PM	A	C
<p>*For material explanation see material</p> <p>**Depending on size</p> <p>***Brass</p>				

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### DISASSEMBLY

- a) Remove hydraulic end as described in "Maintenance of Hydraulic Parts".
- b) Remove both 'Mechanical Seal' seals, as previously described in this section.

To remove shaft and bearing assembly from bearing housing [Pos 100] proceed as follows:-

- c) Remove shaft key [114] labyrinth [130] unfasten nuts [136] and remove bearing cap [103] and 'O'-ring [147].
- d) Remove oil chamber casing [504] if still fixed to [100], taking care not to damage the stationary mech seal face. Press shaft and bearing assembly from pump end out of bearing housing [100].
- e) Unfasten lock washer [127] and remove lock nut [126].
- f) If bearings are to be replaced remove from shaft using pullers or press - depending on facilities available in workshop.

### AFTER DISASSEMBLING

Wash all lubricants from bearings, bearing housing and bearing caps with kerosene and dry bearings by thoroughly spinning by hand or gently with clean and dry compressed air. Replace bearings if they do not rotate freely or its running surfaces show signs of deterioration. Coat bearings with a rust preventive oil and wrap in protective paper.

Mount shaft [110] between two centres and using a dial indicator, check shaft trueness at four positions by turning shaft by hand. These readings must not vary more than 0.002" [0.05mm]. If so, replace the shaft. Examine all parts to be refitted for wear and deterioration. Replace any which are beyond reconditioning.

Scour scale from all parts with kerosene and wire brush. Coat all parts with a rust inhibiting lubricant, with special care given to impeller bolt [415], and all threads on shaft [110]. If unit is not to be installed immediately, store in a clean and dry place.



## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### ASSEMBLING PREPARATION

- a) Insure all parts to be refitted are free from burrs, with screws and abutting faces clean and free from damage. Replace all 'O'-rings. All studs to be refitted must be coated with **Loctite Adhesive 307**. Wrap threads on all grease nipples and plugs with Teflon tape. 'O'-rings must be greased before assembling.
- b) Special recommendation:- To facilitate the mounting of the rolling bearing on shaft, place bearing on an electric heating plate; do not exceed 80°C. Temperatures above 130°C may cause damage. After mounting of rolling bearings on the shaft, hand-pack bearings full with grease.
- c) Once lubricated, as explained, making sure that cavities between bearings are grease packed, there will be no need for further lubrication until first lubrication service [refer to lubrication chart] this will prevent excessive heating of bearings during initial pump operation.
- d) When mounting rolling bearing into the bearing housing, the bearing should be at ambient temperature. It is recommended to preheat the bearing housing to 80°C maximum.
- e) For disassembling rolling bearings from bearing housing or from the shaft, use special extractor or press. Do not use hammer or other conventional tools, which might damage bearing. When mounting roller bearings, take care to rotate shaft in order to avoid damage to inner face of bearing race.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### RE-ASSEMBLY

When new bearings are to be used in the re-assembly, it is very important that the bearings are of 'good quality' and of exactly the correct specification. This is particularly important in respect of the rating of the thrust bearings.

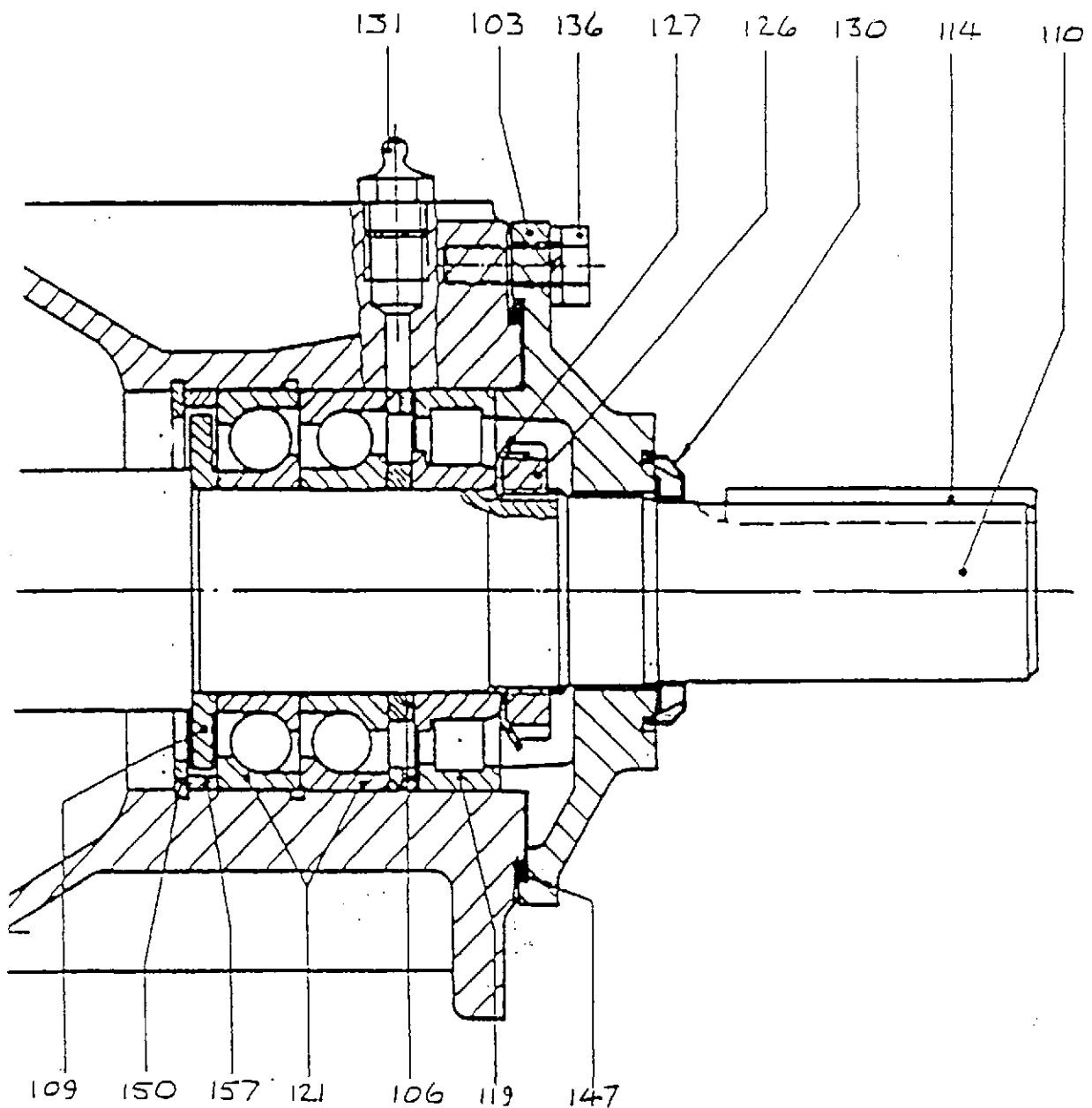
When re-assembling this Bearing Frame, it is important that Sectional Drawing stated at the beginning of the manual, is available and the assembly should be made as follows:-

1. Assemble the bearings at the driven end of the shaft as follows: NOTE: This operation is best done with the shaft vertical.
  - a) Place spacer ring [109] on shaft then fit thrust bearings [121] taking care to ensure that they are installed according to the orientation shown on the Sectional Drawing.
 

In order to assist the fitting of these bearings on the shaft, it is best that they are first pre-heated on a suitable hot-plate prior to attempting to slide them over the shaft. After each bearing has cooled, it should be packed with grease, see 'Maintenance Section' of the Manual for appropriate grade of grease.
  - b) Place spacer ring [106] on bearings, taking note that this ring has an inner and outer piece, when fitting the larger diameter outer ring would you please note that the slots on one side should be placed so that they face the pump end of the bearing frame, i.e., they face the two bearings that are already fitted to the shaft.
  - c) Fit inner ring of roller bearing [119], again after pre-heating. Once the inner race has cooled, fit outside ring of bearing and pack with grease.
  - d) Place locking-washer [127] and tighten bearing assembly, using locking nut [126] bend over locking tab on washer [127].
2. Pre-heat inner ring of roller bearing [118] and fit onto shaft pushing up hard against shoulder.
3. Prepare bearing housing [100] for assembly of shaft by fitting snap-ring [150] and spacer ring [157].
4. Heat bearing frame by gas torch to a temperature of approximately 80°C and install shaft bearing assembly, pushing down by hand hard up against the shoulder provided by snap ring [150].

# SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

## Re-assembly, continued



## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

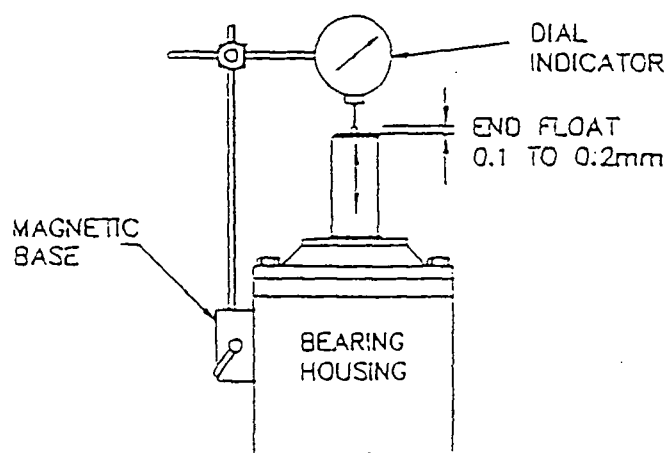
### Re-assembly, continued

5. Install 'O'-ring [147] and mount cap [103] and secure using fastening set [136].
6. Press labyrinth [130] onto shaft using special tool number . This special tool is used to prevent the labyrinth being pressed too far and rubbing against and the stationary cap.
7. Heat bearing frame [100] at pump end, using gas torch, and install outer part of bearing [118] this should be pushed into place by fitting oil chamber casing [504]. Having put the bearing into the correct position part [504] should again be removed and after allowing for the bearing to cool, the bearings packed with grease, according to appropriate specification.
8. Place 'O'-ring [148] onto [100] and fit oil chamber casing [504] by fastening set [534].

### WARNING

When fitting position [504] ensure that drain position 'D' is on the bottom of the casing, i.e. on the same side as the mounting bracket at the shaft-end of the bearing frame. Refer page 13.

9. The end float in the bearings must now be checked at this stage of the assembly. This is best done by fitting a magnetic base to the bearing frame and positioning a clock-gauge on the end of the shaft. The shaft should now be lifted and pushed down, so as to register the amount of end float that is available. This lifting can sometimes be best achieved by screwing an 'eye bolt' into the tapped hole on the end of the shaft and lifting the bearing frame on a crane.



The correct end-float for this Bearing frame is 1/10th to 2/10th of a millimetre [4/1000 to 8/1000 inch].

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### 10. ASSEMBLY OF INNER MECHANICAL SEAL 516

Unless the bearing frame has been built for a special application this inner seal will always be Hidrostal type 'C' with open spring and a ceramic stationary face and carbon rotating face.

#### WARNING:

While cleanliness is important during the entire bearing frame assembly, it is of utmost importance when re-assembling the mechanical seals.

Lubricate outside of the rubber seal which supports the ceramic part and carefully press ceramic face and rubber enclosure all the way into its seat in oil chamber housing [504]. The ring must fit tightly and square in its seat. **TAKE CARE TO PROTECT THE FACE DURING THIS OPERATION.** Examine gap between shaft and inner diameter of seal face; when face is correctly installed, gap will be uniform all round the shaft.

#### WARNING

The seal face is brittle and can easily chip if the inside edge catches a shoulder or groove when sliding along shaft. Take care to keep the seal square when sliding along shaft, also apply uniform gentle pressure when installing into seat.

#### IMPORTANT

Carefully clean faces of stationary and rotating parts using clean Tissue and lightly oil **ABSOLUTE CLEANLINESS OF SEAL FACES IS ESSENTIAL IF SEAL IS TO BE TIGHT.**

Remove spring and spring-retaining ring from mechanical seal lightly lubricate the bore of the rubber part of the seal with oil, at the same time, lightly oil the shaft, as this will assist in sliding the mechanical seal into place.

Install rotating part of the seal by carefully sliding along the shaft, taking care that the face does not 'catch' on any of the snap-ring grooves [545], when installed the carbon face should touch the stationary face. Be sure the rubber part sits uniformly on the shaft and that it has been rolled out from under the metal part of the seal face.

Install seal-spring and spring-retaining ring.

Compress spring by pushing on the retaining ring and install snap-ring [546] then turn shaft by hand, to check for free-running.

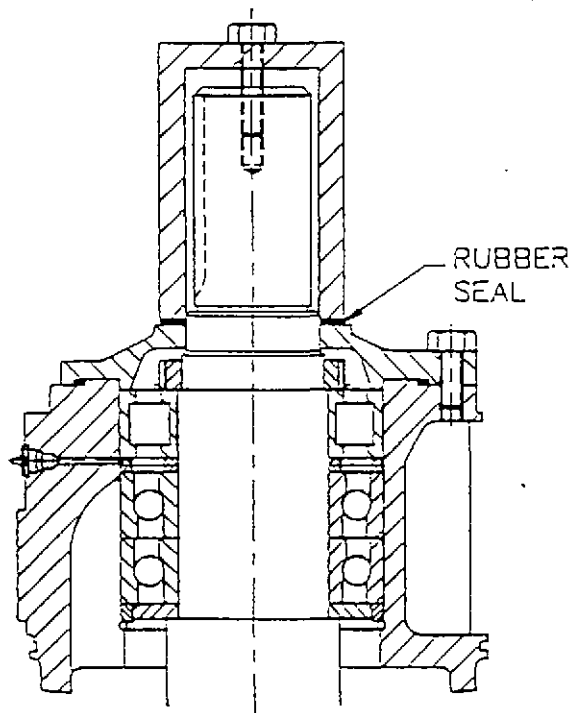
## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

11. The next step is to prepare the bearing frame, so that the tightness of mechanical seal [516] can be checked.

Seal off shaft end of Bearing frame, using hydraulic test tool ensuring a rubber sealing ring is placed between the end of the tool and the bearing cap.

All plugs in bearing frame must be installed at this stage.

Connect a dry-air supply to connection 'D' using a length of rubber/plastic hose.



The interior of the bearing frame should now be pressurised using dry-air to a pressure not exceeding 0.5 bar. We have found from experience, a bicycle pump is often a convenient method of carrying out this function. Immerse bearing frame in a tank of water and carefully check for bubbles leaking through the mechanical seal assembly. If a water-tank is not available, stand bearing frame vertical and fill the 'open end' of oil chamber casing [504] with water and observe for air leaks around mechanical seal.

12. Fit 'O'-ring [527] onto [504] and secure mechanical seal-plate [507] using fastening set [534]. Install pump side seal according to type of seal, as follows:-
13. ASSEMBLY OF OUTER MECHANICAL SEAL 515

Install stationary part into seal following same instructions and precautions as for inner seal 516, as instructions and precautions as for inner seal 516, as previously described.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

The rotating part should be installed according to type of seal.

a) OPEN-SPRING Type 'C' and 'V' Seals

Follow instructions as previously described for inner seal [516]

b) RUBBER BELLOWS Type 'M' Seal

Lubricate with oil the rotating part of the mechanical seal, put the retaining ring 'A' on the rubber boot with rounded edge towards the rubber boot. [See figure 29]. Push the whole assembly nut hand over the shaft as far as possible. Mount the special tool over the shaft tip [See figure 30], and compress the mechanical seal until the lip of the rubber boot is engaged in the shaft groove. Remove special tool. Turn the shaft by hand and watch that the retaining ring turns perfectly in line with the rubber boot and that it is not cocked. Then try to pull the rubber boot off shaft by hand to make sure that the lip has reliably engaged in the shaft groove.

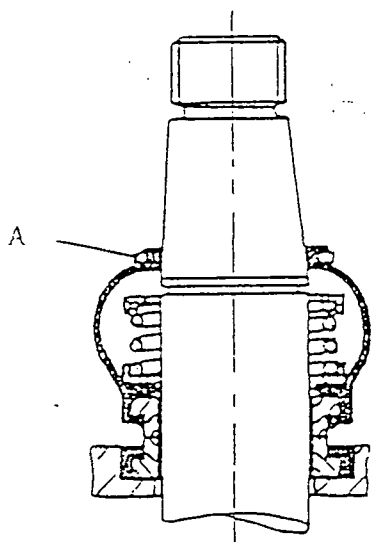


FIG 29

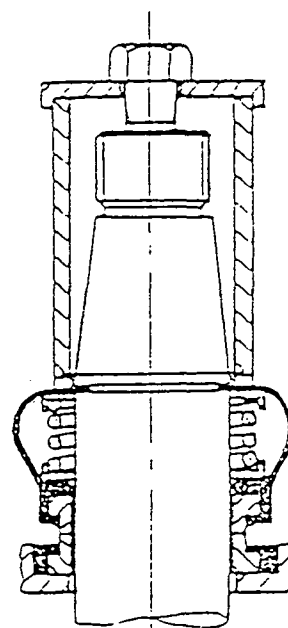


FIG 30

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### c) STAINLESS STEEL BODIED Type 'X' Seal

Lubricate inner rubber 'O'-rings of seal with light oil, and put a small amount of oil onto shaft. Install entire seal over shaft, and press gently down shaft until rotating face touches stationary face. Now install snap-ring over shaft, and push on snap-ring [compressing springs in seal] until snap-ring snaps into its groove. It may be necessary to use the special tool pushing against the snap-ring, turning the tool's bolt to provide sufficient pressure to start the snap-ring. Remove special tool. Then re-install the three small setscrews into the seal rotating part, and tighten firmly.

14. The outer seal 515 has now to be air tested for tightness.

Ensure a length of open ended rubber pipe is connected to 'D' and the special tool enclosing drive shaft is still fitted.

Connect dry air supply to connection 536 and pressurise oil seal chamber to 0.5 bar. Immerse bearing frame into tank of water and check for leaks. Take care not to immerse free end of tube connected to 'D'. To check seal 516 is still tight when pressurised from opposite side carefully immerse free end of tube connected to 'D' from above into water, after a short while bubbles will appear if seal 516 is leaking.

If seals are tight fill seal chamber with oil according to instructions given in section dealing with seal oil and assembly to hydraulic end, according to instructions given in "Maintenance of Hydraulic Parts".



## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### REPAIR OF BEARING FRAMES

#### GENERAL

Before proceeding to strip-down the bearing frame, check the pump code, by referring to the stainless steel nameplate secured to the bearing frame and, then check you have the correct manual. The 'Reference Data' sheet at the front of every manual states the complete pump code to which manual refers and separately states:

- a) Bearing Frame Code
- b) Type of Product side seal [Pos 515] fitted by factory
- c) Number of the 'Sectional Drawing' of bearing frame.
- d) Serial number of pump[s] to which manual relates.

Only when it has been established that the correct manual is available, should the service engineer proceed to strip down the bearing frame. In situations where the nameplate has been removed or damaged, each bearing frame has the serial number heavily stamped into the casting, which can be used to select the correct service manual. In case of difficulty, contact your authorised service centre or Hidrostal agent.

#### Essential Facilities

In order that repair can be carried out in accordance with this manual, it is essential that the repair centre has available any special tools required for fitting Hidrostal 'M'-type Mechanical Seal, [if fitted] plus other tools as described in the manual and have available a water tank and means of pressurising the bearing frames with dry air at 0.5 bar.

it is assumed that the usual facilities of clean work benches, presses, metric tools, oils and greases to the correct specification will be available.

### REPAIRS TO BEARING FRAME

In order to repair the bearing frame the volute and impeller will have already have been removed per instructions under heading "Maintenance of Hydraulic Parts" and the seal oil drained out per instructions, under heading "Checking of Seal Oil".

To strip down the bearing frame, place on a suitable bench and strip from the impeller side, as follows:

1. Remove the back-cone [Pos 511] by gently tapping with a lead or plastic hammer, or gently lever off using screw drivers, this will expose the product side mechanical seal.

## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### 2. REMOVAL OF PRODUCT SIDE MECH. SEAL [Pos 515]

#### General

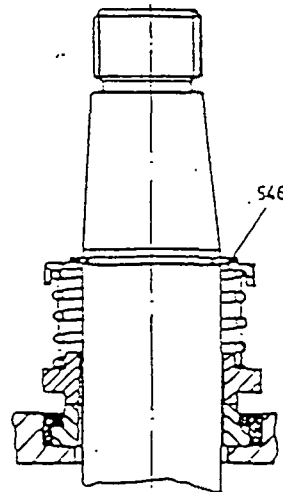
The first step is to determine the type of seal which is fitted. Factory provide the option of four types 'C' + 'V' + 'M' + 'X' and can be identified as follows:

- a) Referral to the 'Reference Data' sheet at the front of the manual.
- b) Examination of the pump code, product side seal type is the single digit at the end of the code, i.e. BCMIF-M. [Refer to explanation of pump code at the front of this manual].
- c) Examine the seal and refer to following diagrams. In certain instances, the application may have required a change of seal type to that originally fitted.

**NOTE:** All seal options, are interchangeable and therefore a different type of seal can be fitted during repair if it is felt this is necessary refer to your nearest Hidrosta agent for the correct selection of an alternative seal, giving full application details and the reason for requesting an alternative seal.

### REMOVAL OF OPEN-SPRING 'C' AND 'V' TYPE SEALS

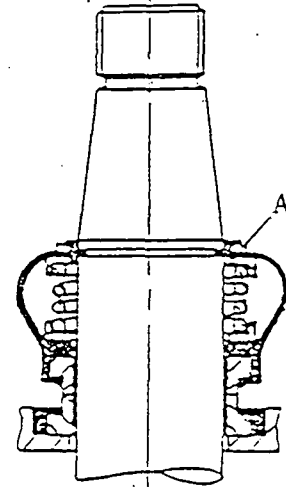
Remove snap ring [Pos 546]. Make sure the Woodruff key groove has no sharp edges to that the rubber parts of the seal cannot be damaged as they are removed. Oil the shaft for ease of disassembly. Now the seal rotating parts can be pulled off the shaft by hand.



## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

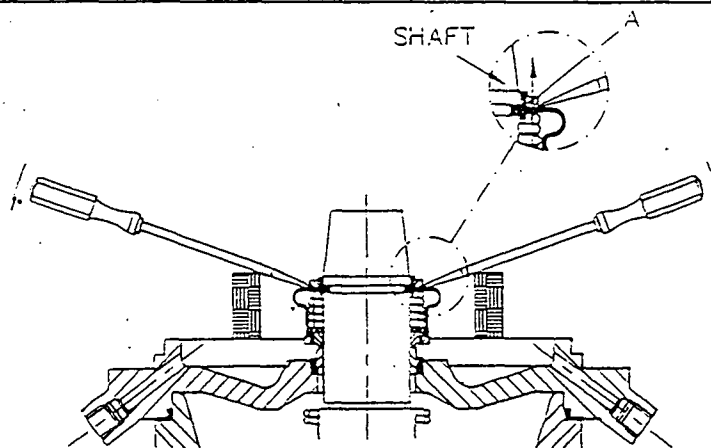
### REMOVAL OF RUBBER-BOOT, 'M'-TYPE SEALS

Remove retaining ring "A" from the rubber boot of the seal by gently prying with two dull-edged screwdrivers, as this can puncture rubber boot. Rather, lay some convenient object onto back-plate, to act as a fulcrum for each screwdriver, and pry ring directly up, away from rubber boot.

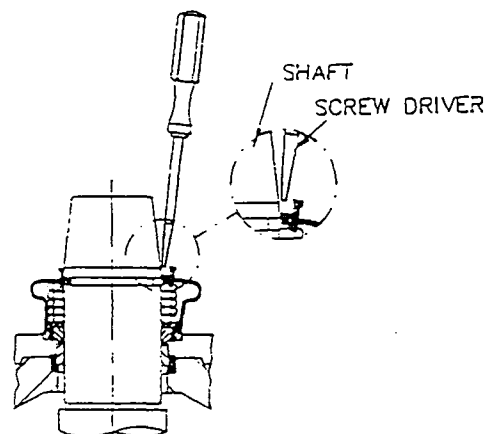


### CAUTION:

Use only dull-edged screwdrivers since sharp edges could cut the rubber-boot. Do not twist screwdriver, as this can puncture rubber boot. Rather, lay some convenient object onto back-plate, to act as a fulcrum for each screwdriver, and pry ring directly up, away from rubber boot.



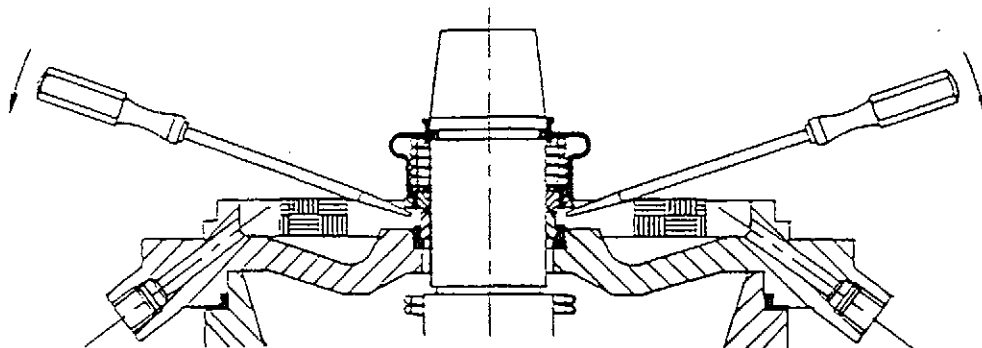
Make sure the Woodruff key groove has no sharp edges so that the rubber parts cannot be damaged as they are removed. Gently insert a small dull screwdriver between the shaft and the rubber boot.



By lifting and turning the screwdriver around the shaft, the lip of the rubber boot can be lifted out of the shaft groove. Lubrication of the shaft and the boot helps this disassembly. Once the boot is free of the groove, the entire rotating part of the seal with boot can be pulled off the shaft.

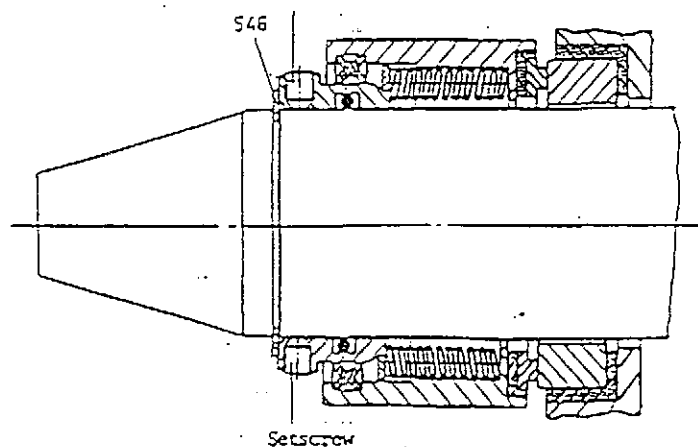
## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

If necessary, use two blunt ended screwdrivers to pry the seal face loose, see below:-



### REMOVAL OF STAINLESS STEEL BODIES 'X'-TYPE SEAL

Remove all three small set-screws from outer body of rotating part. Remove snap-ring [546]. Oil the shaft for ease of disassembly. Now the seal rotating part can be pulled off the shaft by hand.

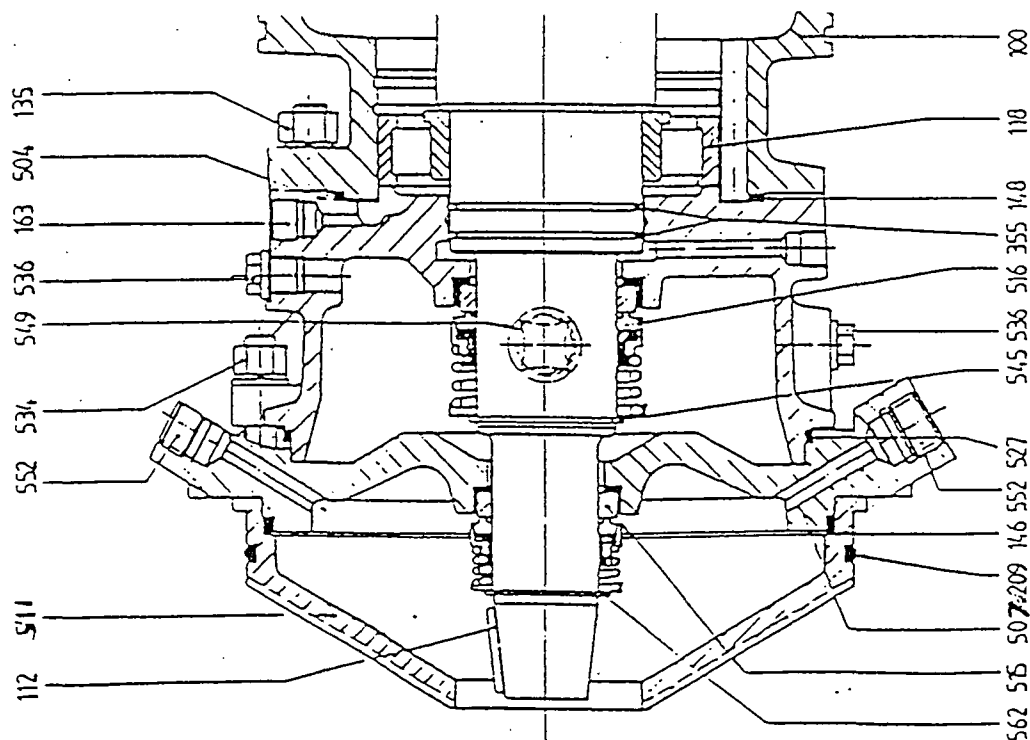


## SERVICE MANUAL FOR INSTALLATION AND OPERATION FOR BEARING FRAME PUMPS/Q-TYPE HYDRAULICS

### REMOVAL OF STATIONARY SEAT [ALL SEAL TYPES]

Unfasten nuts [Pos 534] and carefully remove seal-plate [Pos 507] taking care that the stationary seat of the seal does not contact the shaft. The seat can easily become chipped and, therefore unusable if contact is made with the shaft, pay particular attention as seal passes over grooves for snap-ring [Pos 545].

The stationary seal can now be pushed out of its seal-plate from the back-side.

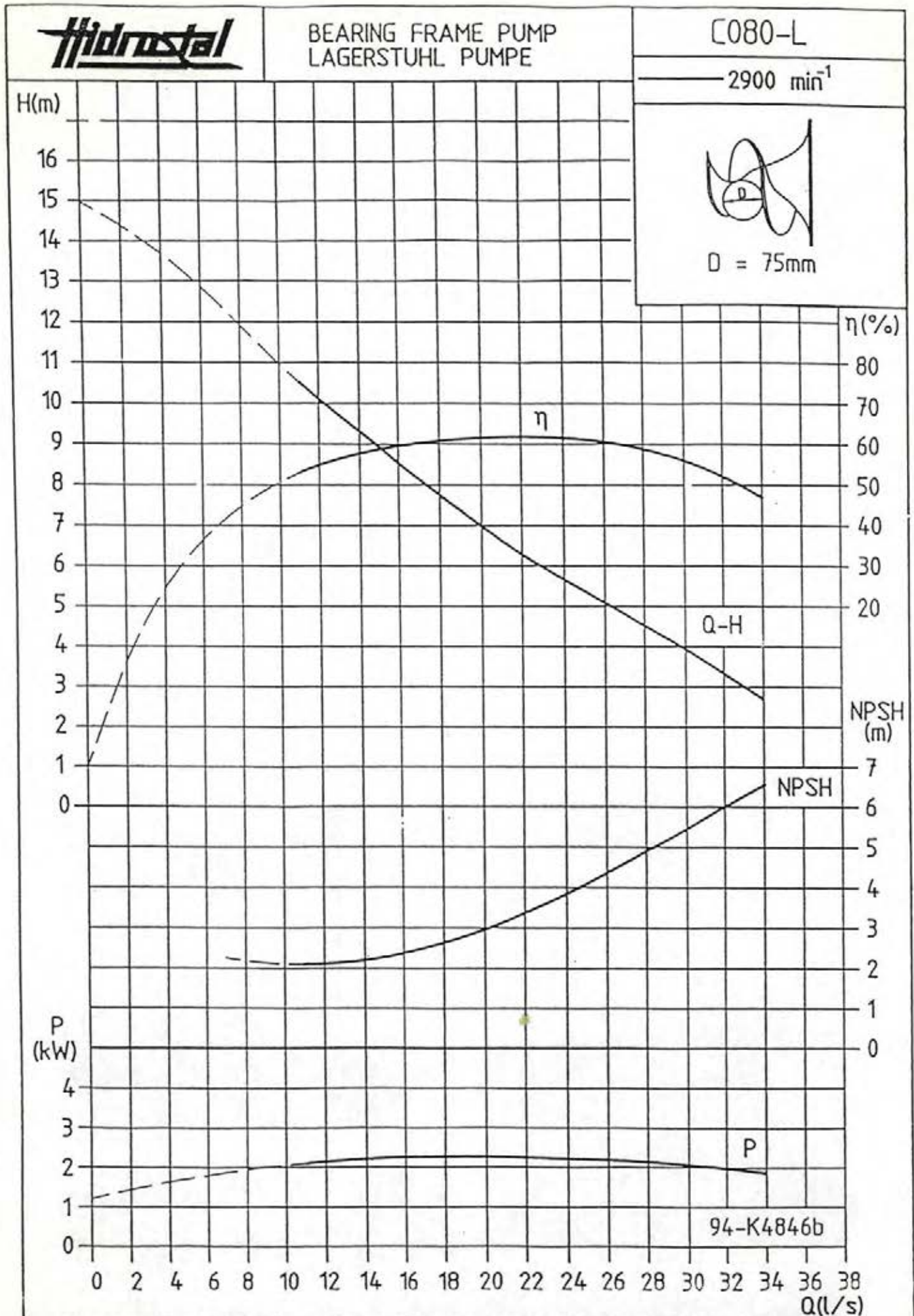


### REMOVAL OF INNER SEAL [POS 516].

Except for special circumstances this seal will always be Hidrostat type 'C' and therefore proceed to remove per instructions for 'C'-type seal.

Any alternative seal will be 'M' or 'X' and can easily be identified by its construction and therefore should be removed per instructions for product side seal [Pos 515].

The stationary seat for Seal 516 can be removed by the same procedure as for Seal [Pos 515], after the oil chamber casing [Pos 504] has been stripped from the bearing frame taking the same precautions to protect seal from contacting the shaft.



NOTE: PUMP POWER P, INCLUDE MECH. SEAL FRICTION AND BEARING FRAME LOSS, FROM RUN-IN BEARING FRAME TYPE Z VERMERK. LEISTUNG P, MIT REIBVERLUSTE DER LAGERUNG UND DICHTUNG EINES EINGELAUFENEN LAGERSTUHL TYP Z

124.07.95PK b120.03.96PK

Drawn by/Bearb. Dat. Vis. 05.01.94 PK I ..

**Hidrostat**

## SECTIONAL DRAWINGS Q-HYDRAULIC

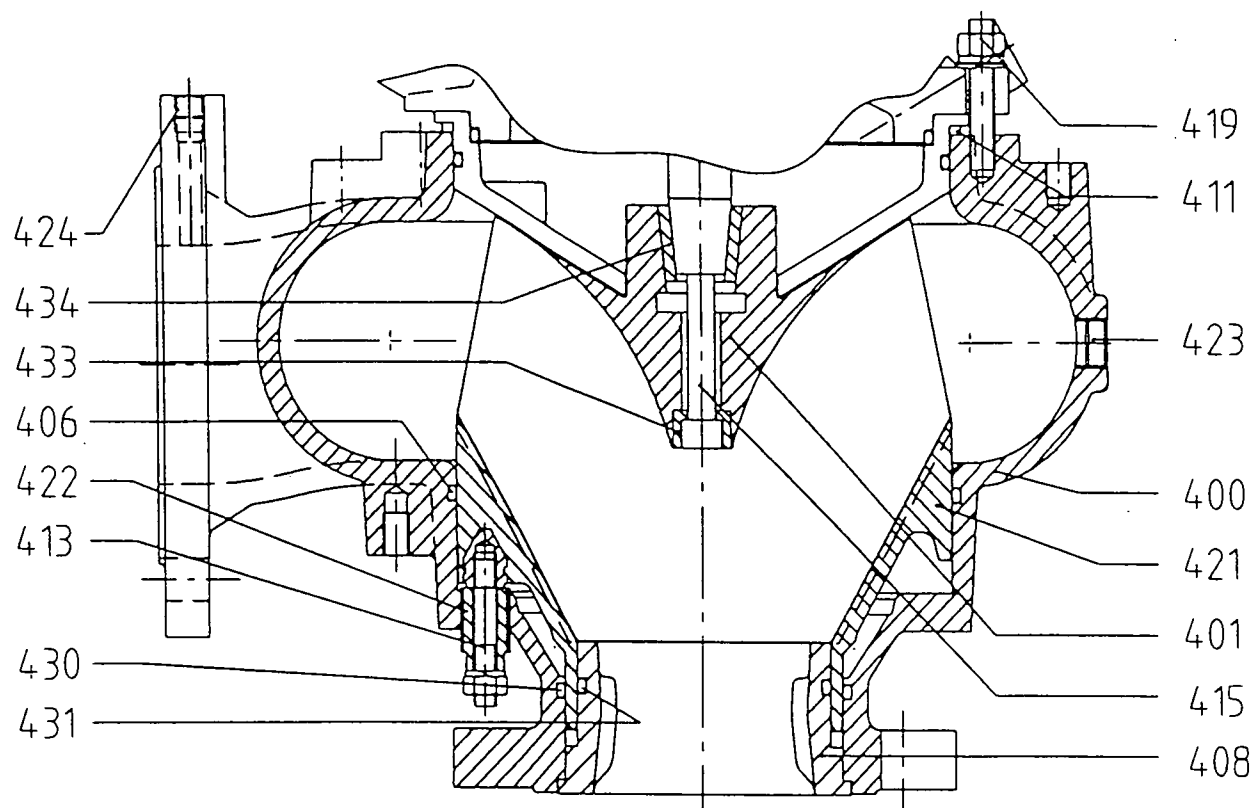
C080 / D080 / D100

REGULABLE MAT CODE 1 - 5R

Dat: 16.08.95

No: 90-TU 4148E/b

File: QEDATA1



PART	DESCRIPTION	MATERIAL OF CONSTRUCTION		
		1R	3R	5R
400	VOLUTE	GREY CAST IRON		STAINLESS STEEL A4
401	IMPELLER	NODULAR IRON	STAINLESS STEEL A4	
406	O-RING	NITRILE		
408	WEAR RING	GREY CAST IRON	HIDRO HARD	STAINLESS STEEL A4
411	SHIMS	STEEL		
413	ADJUSTING BOLT	STAINLESS STEEL A4		
415	IMPELLER BOLT	STAINLESS STEEL A4		
419	FASTENING SET	RUSTLESS STEEL		STAINLESS STEEL A4
421	LINER	GREY CAST IRON	HIDRO HARD	STAINLESS STEEL A4
422	REGULATION NUT	STAINLESS STEEL A4		
423	PLUG	STEEL		STAINLESS STEEL A4
424	PLUG	STEEL		STAINLESS STEEL A4
430	O-RING	NITRILE		
431	O-RING	NITRILE		

Konstruktionsänderungen vorbehalten  
Hidrostat reserves the right to make changes without giving prior notice.  
Hidrostat se réserve tous droits de changement de construction.

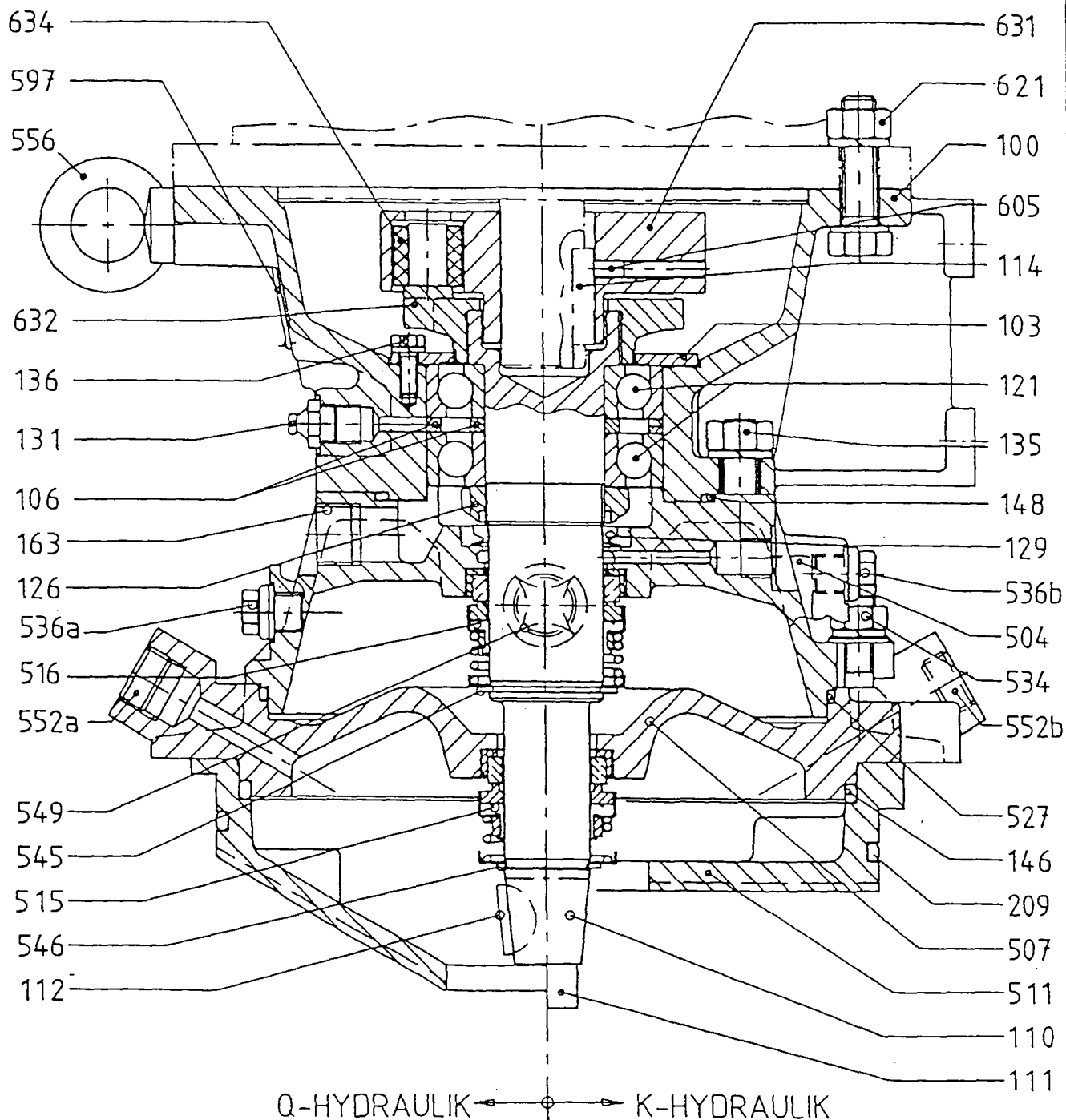
**hidrostal**

SECTIONAL DRAWINGS BEARING FRAME DIRECT COUPLED  
 SCHNITTZEICHNUNGEN LAGERSTUHL DIREKT GEKUPPELT  
 B/C/DCM.X MOT 112

Dat: 07.07.94

No: 94-S4946a

File: B/C/DCM.X



Aend.: 210.03.95pk

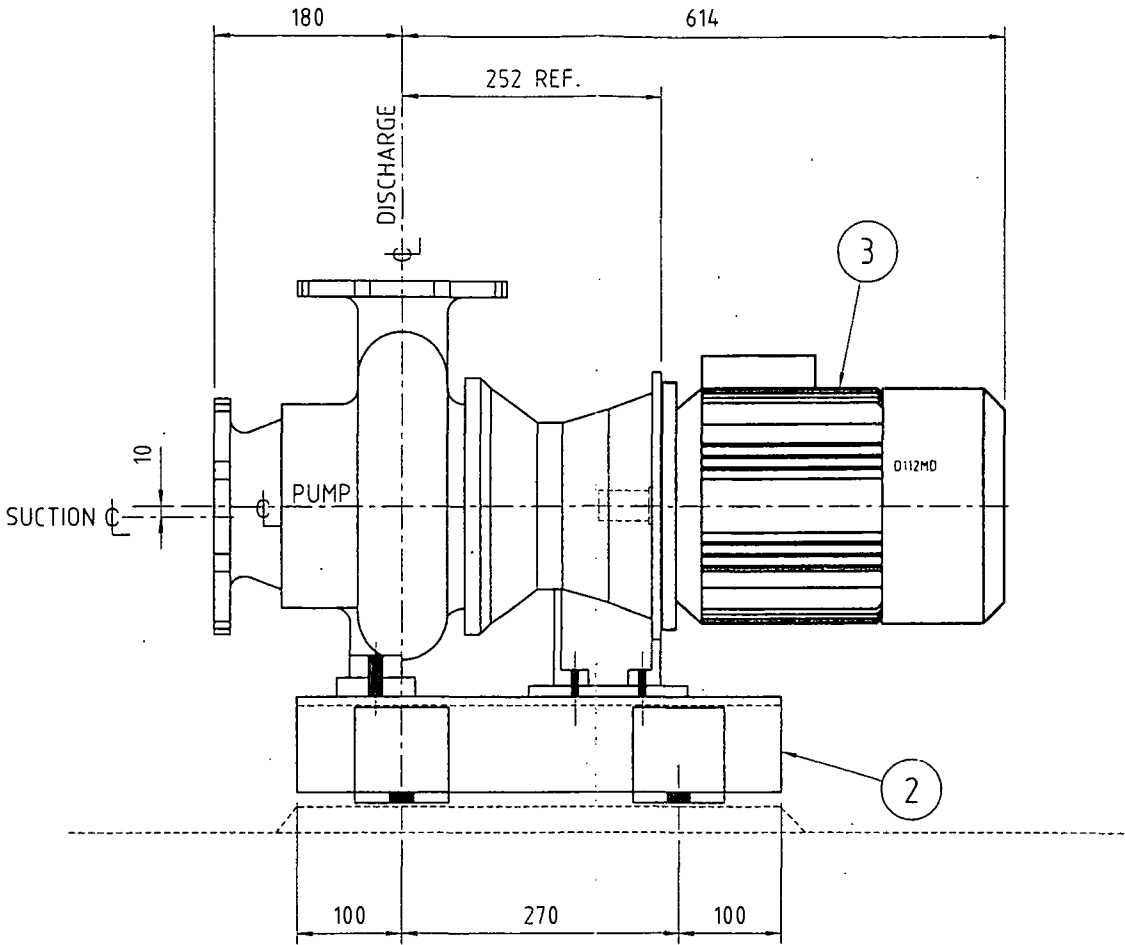
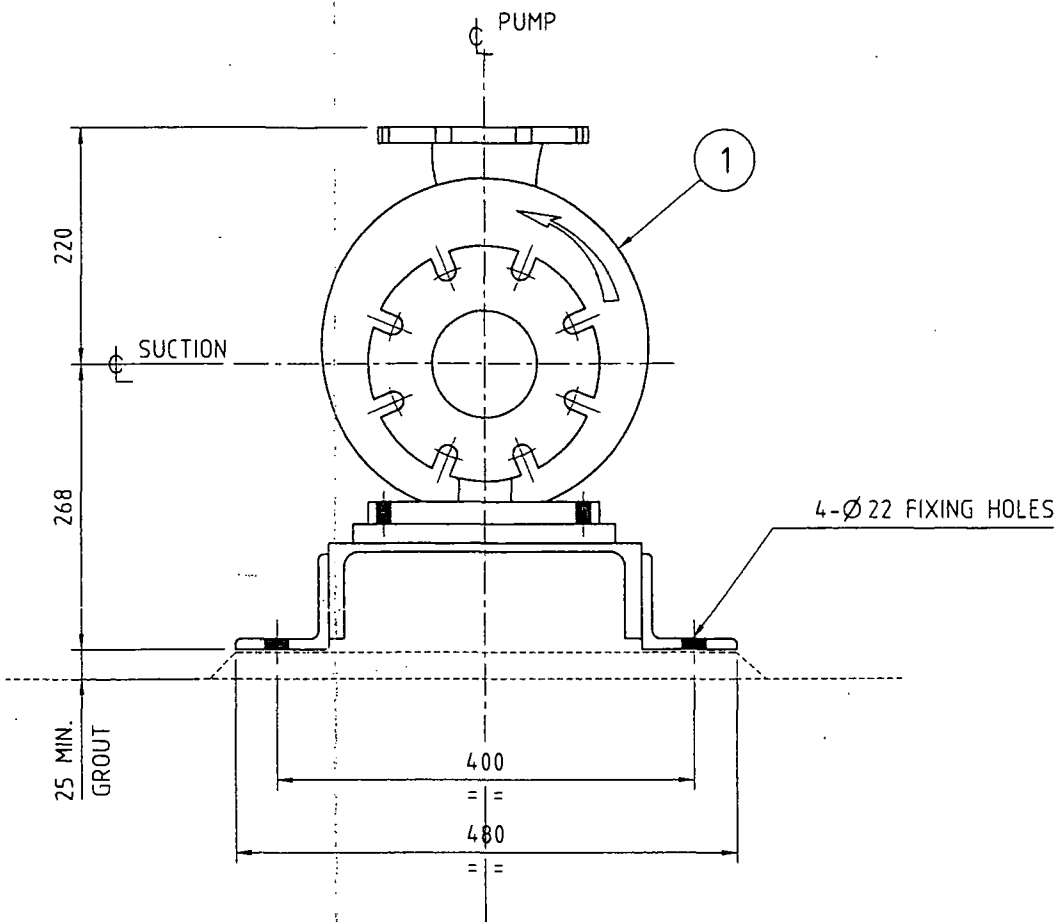


NOTES :

1. MATING FLANGES -

SUCTION : 100NB DIN16 220 O/D 8-Ø18 HOLES ON 180 P.C.D

DISCHARGE : 80NB DIN16 200 O/D 8-Ø18 HOLES ON 160 P.C.D



PUMP MODEL	SERIAL NO.	EQUIP. TAG NO.	EQUIP. NAME	MASS
C080-LH1R+CCM1X-M112+D0	H2588	-	-	155 KG
C080-LH1R+CCM1X-M112+D0	H2589	-	-	155 KG

JOB : EDWARDS ENVIRONMENTAL ENTERPRISES  
JOB NO : 200341  
CLIENT NO : 716276

WEIR ENGINEERING PTY. LTD.  
ON 2003/11/10  
Signed: [Signature] Date: 10/11/03



ITEM	PART No	QTY	PART NAME
3	D112MD	1	MOTOR - "TECO" 4 KW 2880 RPM
2	15676902	1	PUMP BASE
1	C080-LH1R+CCM1X-M112+D0	1	HIDROSTAL PUMP

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**EnviroTech AUSTRALIA**  
EnviroTech Australia  
Gindurra Road, Somersby, NSW 2250  
PO Box 461, Gosford, NSW 2250  
Phone: (043) 49 2999 Fax: (043) 49 2900  
A division of Weir Engineering Pty Limited A.C.N. 000 373 336

**HIDROSTAL C080 PUMP  
GENERAL ARRANGEMENT**

PROJECTION: A1 ORG. No. 20034101 REV. 1

**BRISBANE CITY COUNCIL**

**RAUBERS ROAD**  
**BANYO**  
**VACUUM SEWERAGE SYSTEM**

**SECTION 5 PUMPING STATION ITEMS**

- 5.1 Vacuum Collection Tank
- 5.2 Stop Valves

**BRISBANE CITY COUNCIL**

**RAUBERS ROAD**  
**BANYO**  
**VACUUM SEWERAGE SYSTEM**

**5. PUMPING STATION ITEMS**

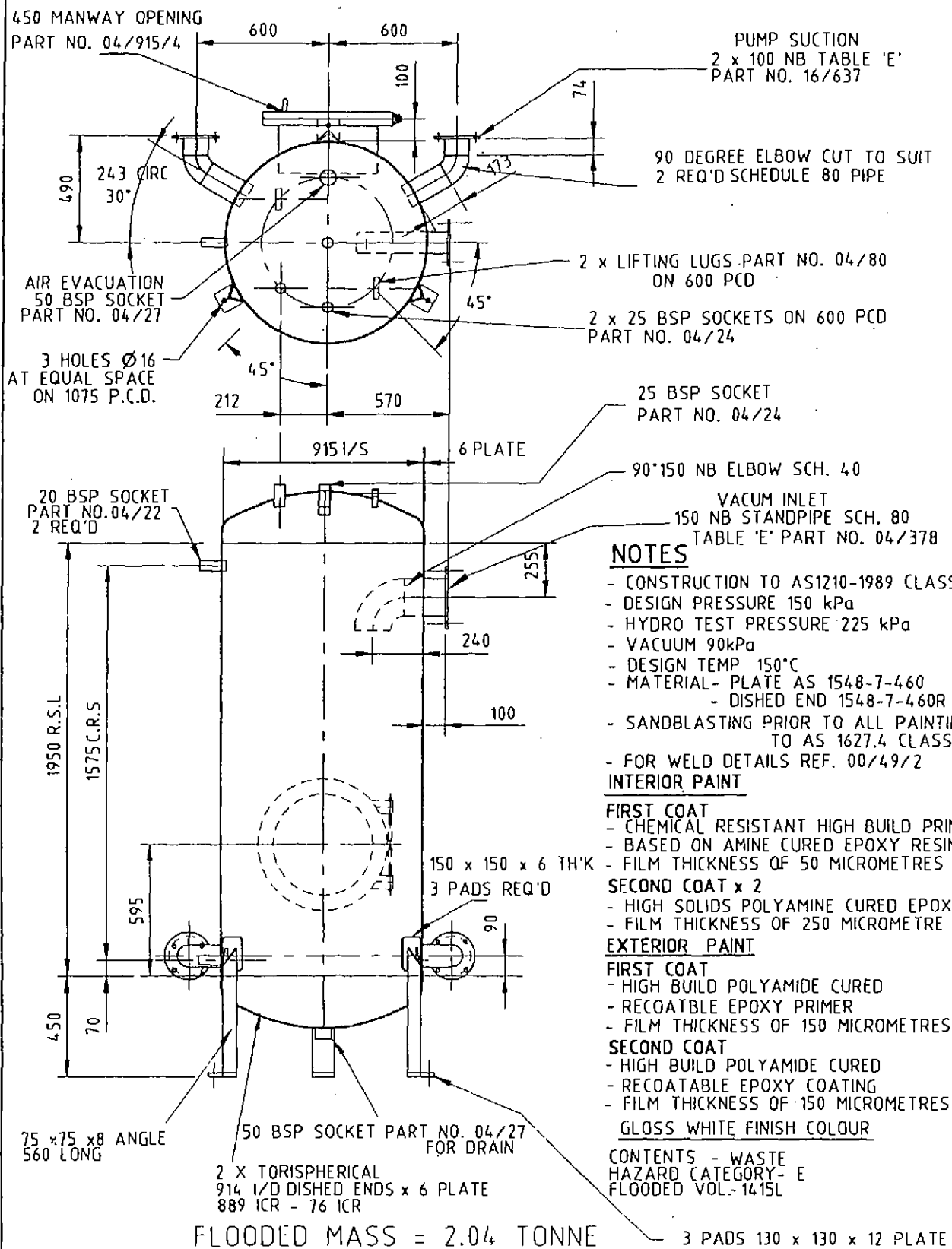
**5.1 Vacuum Collection Tank**

The Maxitherm Boilers Pty Ltd fabrication drawing for the Collection Vessel Model 915V 1.75/150 and the manufacturers Data Report are included.

**5.2 Stop Valves**

The data sheet for the OBE Valves Australia Pty Ltd resilient seated wedge valve is included.





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/	****	****	---/---/---
B	L.R		20/2/97
REV.	BY	CHECK	DATE

CHANGED FLANGES TO TABLE E FROM C  
CHANGED R.S.L. TO 1950 FROM 1750

REVISION DETAILS



DRAWN	L.R	DATE	12/ 2/ 97
CHECK	<i>John To</i>	DATE	21 FEB 97
SCALE	1:25		

**COLLECTION VESSEL**  
**MODEL 915V 1.75/150**

**MAXITHERM**  
BOILERS PTY. LIMITED

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FILE No. 24037040.dwg

DWG.No

24/370/4



**MANUFACTURER'S DATA REPORT - PRESSURE VESSEL\***

(To be Completed and Forwarded to Respective Statutory Authority where Installed)

MANUFACTURED BY (Name and Address) **MAXITHERM BOILERS PTY LTD**  
**329 HORSLEY RD, MILPERRA NSW 2214**

MANUFACTURED FOR (Name and Address) **EDWARDS ENVIRONMENTAL ENT.**

TO BE INSTALLED AT (Name and Address) **TO BE ADVISED**

DESIGN APPROVAL -- S.A. N.S.W. VIC QLD W.A. TAS  
 Number.....  
 Date .....

MANUF. SERIAL NO. **MMV880** REGISTRATION NO.

TYPE **915V1.95/150** ITEM 1 TO 6 DES. PRESSURE **150 kPa** MAX. TEMP **150°C** MIN. TEMP  
 ITEM 10 TO 12 DES. PRESSURE MAX. TEMP MIN. TEMP  
 APPROVED DRG.NO. **24/370/4** CODE **AS1210-1989** CLASS OF CONSTRUCTION **CLASS 3**  
 PRESSURISING MEDIUM **NONE** VOLUME OF PRESS. VESSEL **3.009 m<sup>3</sup>**

ITEMS 1 TO 6 INCLUSIVE TO BE COMPLETED FOR ALL SINGLE WALL VESSELS, JACKETS OF JACKETS  
 VESSELS OR SHELLS OF HEAT EXCHANGERS

- SHELL Matl. (Spec. and Grade) **AS1548-7-460** Actual Thickness **6** Corr. Allow. **1**  
 Diameter **915** Length **1950**
- SEAMS-Long **DOUBLE-BUTT** H.T. **NO** R.T. **NONE** Joint Eff. **0.65**  
 (Weld, Double, Single Butt) (Yes/No) (Spot/Full)  
 Circum. **DOUBLE-BUTT** H.T. **NO** R.T. **NONE** Joint Eff. **0.65**
- HEADS-Matl. **AS1548-7-460R** Joint Eff. Shape **DISH** Side To **CONCAVE**  
 (Spec. and Grade) (In Head) (Dish/Flat) Press (Concave/Conve)  
 Location **ENDS** Thick **6** Crown Rad **787** Flange Rad **914 I/D**  
 (Top/Bottom)  
 Ellip. Ratio Conical Angle  
 If Removable: Bolting Matl. Size and No.  
 (Spec. and Grade)  
 Other Fastenings  
 (Attach Sketch or Describe)
- STAYS/STAYBARS  
 Matl. No. Attach Pitch O/Diam. I/Diam.  
 (Spec. and Grade) (Hor. Vert.) (If Tube)
- JACKET CLOSURE  
 (Describe, Ogee, Bar, Dimensions)

6. PRESSURE RELIEF DEVICES-Type **SOCKET** No **1** Size **50** Location **TOP END**

\*Where Components are manufacture or assembled in different locations a part manufacturer's data report is to be completed by the relevant manufacturer covering the extent of manufacture and testing involved.





## ITEM 7 TO BE COMPLETED, AS APPLICABLE, FOR ALL VESSELS

## 7. NOZZLES

Purpose	Matl. Spec.	Diam.	Thick	Nozzle Attach.	Reinf. Matl. And Attach.	Flange Spec. and Rating
INLET	ASTM A106 B	100NB		WELDED	WELDED	AS2129 TABLE 'E'
MANHOLE	AS1548-7-460R	450NB		WELDED	WELDED	AS1548-7-460R
VACUUM INLET	ASTM A106 B	150NB		WELDED	WELDED	AS2129 TABLE 'E'

## ITEMS 8 AND 9 INCLUSIVE TO BE COMPLETED FOR TUBE SECTIONS

## 8. TUBEPLATES (State Stationary, Floating etc.)

Type..... Matl.(Spec. and Grade)..... Diam..... Thick..... Attach.....

9. TUBES Matl..... O/Diam..... Thick..... No..... Type.....  
(Spec. and Grade) ("U" Straight)

Pitch.....  
(Pattern and Size)

ITEMS 10 TO 12 INCLUSIVE TO BE COMPLETED FOR INNER CHAMBERS OF JACKETED VESSELS  
CHANNELS OF HEAT EXCHANGERS.

## 10. SHELL Matl (Spec.and Grade)..... Actual Thickness..... Corr. Allow.....

Diameter..... Length.....

11. SEAMS - Long..... H.T..... R.T..... Joint Eff.....  
(Weld, Double, Single Butt) (Yes/No) (Spot/Full)

Circum..... H.T..... R.T..... Joint Eff.....

12. HEADS - Matl..... Joint Eff..... Shape..... Side To.....  
(Spec. and Grade) (In Head) (Dish/Flat) Press (Concave/Conv)

Location..... Thick..... Crown Rad..... Flange Rad..... Ellip. Ratio..... Conic Angl.....

(Top/Bottom Ends) .....

Channel .....

Floating .....

If Removable - (a) Location..... Matl.(Spec. and Grade)..... Size and No.....

Bolting Details - (b) .....

Other Fastenings .....

(Attach Sketch or Describe)

## 13. INSPECTION OPENINGS (State Manhole, Handhole, Socket etc)

Type	No.	Size	Location	Reinf. Material	Reinf. Attach.
MANHOLE	1	450NB	SIDE		

REMARKS -

1. The purpose of this manual is to provide information on the operation and maintenance of the SP276 Raubers Road Nudgee Vacuum Sewerage System. This manual should be read and understood by all personnel responsible for the operation and maintenance of the system.

2. The system is designed to collect and transport sewage from the Raubers Road Nudgee area to the Nudgee Sewerage Treatment Plant. The system consists of a network of vacuum sewerage pipes, manholes, and a central vacuum station.

3. The system is operated by the Nudgee Sewerage Treatment Plant. The plant operator is responsible for monitoring the system and ensuring that it is operating correctly. The plant operator should also be responsible for the maintenance of the system.

**MATERIALS**

Description (Shell, End, etc)	Certificate Number	Plate Number	Thick- ness mm	Standard Test Piece (Size, Gauge, Length)	Yield Point MPa	Ultimate Stress MPa	Elongation (percent)	Bend Test	Impact J	Code or Specification	Inspector's Initials
SHELL	P94448	MT873	6	A	410	500	36	-	-	7-460R	DAH
DISHED END	J04051	EFF9761	6	A	365	500	38	-	-	7-460R	DAH
MANWAY FLANGES	S81304	MT883	36	A	340	510	30	-	-	7-460R	DAH
MANWAY PIPE	S71973	MT839	10	A	390	510	33	-	-	7-460R	DAH
100NB ELBOW	4951200017	MT1764	6.02		305	490	65	-	-	A106B	DAH
100NB PIPE	32.253/93	MT1666	8.56		313	467	39	-	-	A106B	DAH

**MECHANICAL TEST-WELDED JOINTS**

Testing Authority..... Testing Officer..... File or Reference No..... Code.....

Test	Branding	Dimensions mm	Yield MPa	Ultimate Tensile MPa	Elong. %	Impact J	Temp. of Impact Specimen	Remarks	Date of Test	Inspector's Initials
Tensile .....										
Bend (Inner) .....										
Bend (Outer) .....										
Impact (Root) .....										
Impact (Face) .....										
Impact (H.A.Z.) .....										
All Weld. Tensile .....										
Nick Break .....										
Macro .....										

**NON-DESTRUCTIVE TESTING**

Description (Radiological, Ultrasonic, etc)	Report No.	Order No.	Date	Code	Testing Authority	Remarks	Inspector's Initials
LIQUID DYE PENETRANT			10/03/97	AS1210	MAXITHERM	COMPLIES	S. S. S. S.

Description		Location	
1.0	1.0	1.0	1.0
2.0	2.0	2.0	2.0
3.0	3.0	3.0	3.0
4.0	4.0	4.0	4.0
5.0	5.0	5.0	5.0
6.0	6.0	6.0	6.0
7.0	7.0	7.0	7.0
8.0	8.0	8.0	8.0
9.0	9.0	9.0	9.0
10.0	10.0	10.0	10.0

Description		Location	
1.0	1.0	1.0	1.0
2.0	2.0	2.0	2.0
3.0	3.0	3.0	3.0
4.0	4.0	4.0	4.0
5.0	5.0	5.0	5.0
6.0	6.0	6.0	6.0
7.0	7.0	7.0	7.0
8.0	8.0	8.0	8.0
9.0	9.0	9.0	9.0
10.0	10.0	10.0	10.0

1.0	1.0	1.0	1.0
2.0	2.0	2.0	2.0
3.0	3.0	3.0	3.0
4.0	4.0	4.0	4.0
5.0	5.0	5.0	5.0
6.0	6.0	6.0	6.0
7.0	7.0	7.0	7.0
8.0	8.0	8.0	8.0
9.0	9.0	9.0	9.0
10.0	10.0	10.0	10.0

1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0

HEAT TREATMENT

Description (Shell, End, Nozzle, etc)	Report No.	Date	Company or Organisation	Code or Specification	Details of Treatment	Remarks	Inspector's Initials

WELDER'S CERTIFICATES

WELDERS			SUPERVISORS		
Name	Certificate No.	Remarks	Name	Certificate No.	Remarks
Y B FU	23872 (W.C.A.-NSW)	LONG & CIRCS SEAMS (S.M.A.W.)	S STYLIANOU	15063 (W.C.A.-NSW)	COMPLIES TO THE CODE
Y B FU	23872 (W.C.A.-NSW)	FILLET WELDS (M.M.A.W.)	S STYLIANOU	15063 (W.C.A.-NSW)	COMPLIES TO THE CODE

HYDROSTATIC TESTS

Description	Hydrostatic Test	Date	Inspector	Remarks and Stampings	
SHELL	225 kPa (30 MIN)	18/03/97	S STYLIANOU	STAMPING ON RIM OF MANWAY RING	
				MMV880	
				D.P. 150 kPa	T.P. 225 kPa
				D.T. 150°C	AS1210-3
				09/QA/94	18/03/97

General Remarks

Does manufacture conform to approved drawings ..... YES ..... YES/NO\*

Are all conditions in letter of approval complied with ..... YES ..... YES/NO\*

I/We certify the above data to be correct and that all details of material, construction and workmanship on this pressure vessel satisfy the provisions of the Boiler and Pressure Vessel Regulations under the relevant State legislation.

Signed S. Stilianou Manufacturer 18 / 3 / 97 Inspecting Authority   /  / 19



# OBE/Elypso VALVE *flanged ends*

The only resilient seated valve with more than 45 years of service under the severest conditions throughout the world.

FIG No	MATERIAL	RATING	RANGE	FACE TO FACE DIMENSION
406	DUCTILE	16 BAR	DN80-375	AS 2638 ISO 5996 BS 5163
400	DUCTILE	16 BAR	DN50-400	DIN 3202 F4
470	DUCTILE	16 BAR	DN450-500	DIN 3202 F5

**Spindle:** Stainless Steel. AS 2837 Grade 431.  
Clockwise or Anti clockwise closing.

**Wiper Ring:** Nitrile.

**'O' Rings:** Nitrile. Housed directly into one piece bonnet.

**Thrust Collar:** DR Brass AS 1567  
Grade 486.

**Socket Screws:** H.T.S. AS 1420.  
Permanently sealed against corrosion.

**Spindle Nut:**  
Dn 50 to 100 DR Brass AS 1567 - Grade 486.  
Dn 150 to 500. Gunmetal to AS 1565.

**Feet:** This valve stands on its own feet.

**Temperature:** 70° C. Higher temperatures on request.

**Lifting Rings:** On request. Central lifting point for larger valves.

**Pressure Seal:** Nitrile. A positive seal in itself.

**Bonnet:** Ductile Iron - Coated  
Internally and externally with Rilsan Nylon 11.\*

**Body Gasket:** Nitrile.

**Wedge Guide:** Differential pressure in the main acting against the wedge is absorbed at its uppermost point by the unique three point guide system.

**Body:** Ductile Iron - Continuously coated internally and externally with Rilsan Nylon 11.\*

**Wedge:** Nitrile. Perfectly bonded to ductile iron wedge by vulcanisation. Bottom drain hole. Lined with Inertol.

**Bore:** Clear, unobstructed waterway. No seating recess or debris trap.

**Flange Drilling:** To AS 4087 or other as specified.

**Packaging:** Smaller valves are individually packed to protect coating during transport etc.

The **OBE/Elypso Valve** is of a smooth compact design, protected against corrosion and tuberculation by Rilsan Nylon 11\* coating. The multiple 'O' ring and pressure seal arrangement in the bonnet spindle housing ensures a permanent seal. To date there is not a recorded failure of the spindle seals in the millions of valves installed throughout the world. In the event of accidental damage, the bonnet, spindle and wedge can be replaced without removing the valve from the pipeline.

\* Other coatings available.

UNSURPASSED  TECHNOLOGY

**OBEVALVES AUSTRALIA**  
**PTY LIMITED**

PH: (02) 792 3822

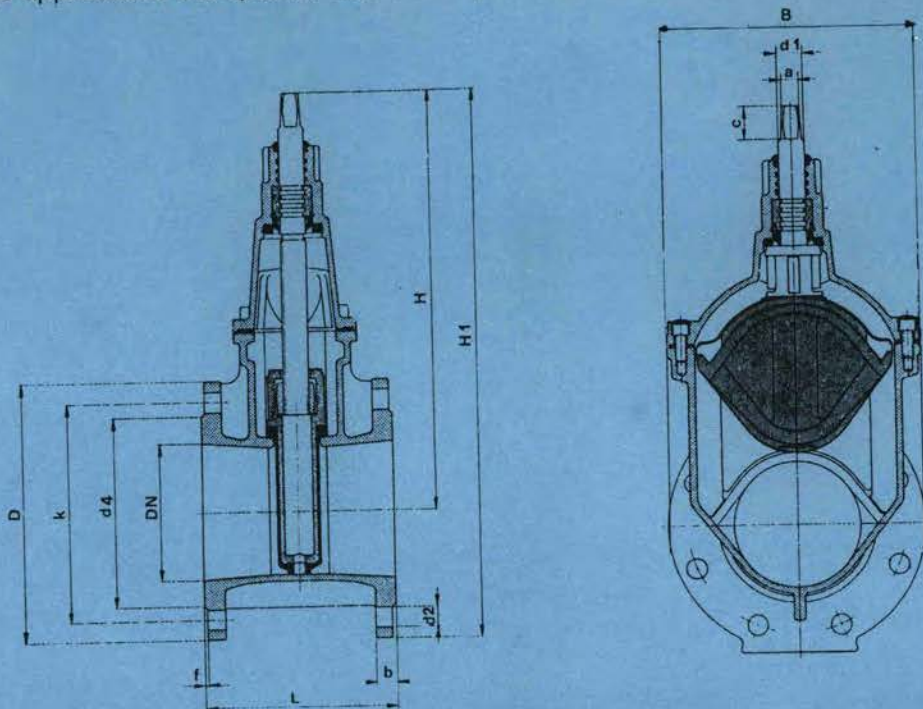
FAX: (02) 792 3648



**Application:** Water, Sewerage,\* Air, Natural Oils & Gases (up to 16 Bar) and are suitable for other fluids subject to our confirmation. Valves required for either gas or vacuum should be ordered specifically for the purpose intended as additional tests are applied.

**OBE/Elypso** valves can be supplied with Handwheel, Spindle Cap, Extension Spindle, Actuators (geared or electric) and positional indicators.

\* In sewerage applications the optional Grade 316 spindles are recommended.



Illustrations, technical data, dimensions and weights shown are subject to alterations without notice.

Dn 450 & 500 valves have a reduced port.

DN	PN	VALVE DIMENSIONS									FLANGE DETAILS									WEIGHT		
DIA	CL	FIG														AS 4087		AS 2129		KG		
		400	470	406												C		E				
mm	BAR	L	L	L	H	H1	B	a	c	d1	D	b	k	d4	f	No	d2	No	d2	400	470	406
50	16	165			225	300	118	14.8	30	22	150	18	114	90	3	4	18	4	18	10		
65	16	170			245	328	144	16.3	31	22	165	18	127	103	3	4	18	4	18	12		
80	16	180		203	288	381	160	17.3	35	25	185	18	146	122	3	4	18	4	18	16		17
100	16	190		229	334	442	188	19.3	38	25	215	20	178	154	3	4	18	8	18	22		23
125	16	200			403	528	240	19.3	38	28	250	22	210	183	3	8	18	8	18	28		
150	16	210		267	465	605	280	19.3	38	28	280	23	235	209	3	8	18	8	22	42		44
200	16			292	551	719	348	24.3	48	32	335	23	292	264	3	8	18	8	22			66
225	16			305	551	736	348	24.3	48	32	370	24	324	296	3	8	18	12	22			72
250	16			330	666	869	434	27.3	48	36	405	24	356	328	3	8	22	12	22			111
300	16			356	758	986	512	27.3	48	36	455	33	406	376	4	12	22	12	26			146
350	16	290			882	1112	570	27.3	48	40	520	33	470	427	4	12	26	12	26	188		
375	16			381	882	1157	570	27.3	48	40	550	33	495	463	4	12	26	12	26			288
400	16	310			929	1234	676	32.3	55	44	580	33	521	477	4	12	26	12	26	260		
450	16		650		929	1249	696	32.3	55	44	640	33	584	552	4	12	26	16	26		355	
500	16		700		929	1282	696	32.3	55	44	705	35	641	609	4	16	26	16	26		385	