Western Water Constructors, Inc.
license no. 188068

Submittal Cover

Job no. 16-05

CONTRACT NAME:	Manteca WQCF Digester Improvements	**SUB #:**	233
SPEC SECTION:	11247 Hose Pumps	**REV #:**	0
SUBMITTAL TITLE:	Hose Pumps – O&M	**CODE:**	11247-02
FILE NAME:	233-R0_11247-02_Hose Pumps-OM	**DATE:**	12/5/2017

WWC REVIEW/COMMENTS: ☒ **NO EXCEPTIONS** ☐ **EXCEPTIONS / DEVIATIONS AS NOTED**

REVIEWED BY: ST **SIGNED:**

WWC HAS REVIEWED THIS SUBMITTAL FOR CONFORMANCE WITH THE PROJECT PLANS & SPECIFICATIONS.

OWNER REVIEW:

ITEM	DESCRIPTION	REVIEW STATUS				
		A	B	C	D	E
1	Hose Pumps O&M	☐	☐	☐	☐	☐
2		☐	☐	☐	☐	☐
3		☐	☐	☐	☐	☐
4		☐	☐	☐	☐	☐
5		☐	☐	☐	☐	☐

LEGEND: **A =** No Exceptions Taken **B =** Make Correction Noted **C =** Correct & Resubmit
D = Rejected **E** = Accepted for Record

OWNER COMMENTS:

REVIEWER'S NAME: _____

REVIEWER'S SIGNATURE: _____ **DATE:** _____

707 Aviation Blvd
Santa Rosa, CA 95403

www.westernwater.com
general engineering contractors

p 707.540.9640
f 707.540.9641

Operation & Maintenance

Project Name:	Manteca WWTP
Project Location:	Manteca, CA
PO Number:	1605-01
WMFTG Job Number:	S025882
Section Number	Section 11247: Hose Pumps
Equipment:	Qty. (4) Bredel 50 Hose Pump Assemblies
Engineer:	Herwit Engineering
Contractor:	Western Water Constructors, Inc.
Manufacturer:	Watson-Marlow Fluid Technology Group 37 Upton Technology Drive Wilmington, MA 01887 Tel: 800-282-8823 Fax: 978-658-0041
Manufacturer's Contact:	Ambarneil Roy
Mfg. Representative:	Miscowater 27101 Burbank, Suite B Foothill Ranch, CA 92610 Tel: 949-458-5555 Fax: 949-458-5500
Submittal Number:	11247-002-01
Number of Copies:	1 EC
Submitted	11/29/17

Table of Contents

Part 1: Design Parameters and Outline Specification

I. Contact Information
II. Design Parameters & Scope of Supply
III. Engineering Comments
IV. Equipment Outline Specifications
V. Equipment Summary Form
VI. Seismic Calculations

Part 2: Bredel 50 Peristaltic Pump Specification and Performance

I. Pump Specification Sheets
II. Pump Dimensional Drawing
III. Outline Recommended Operation and Installation Instructions
IV. Operation, Maintenance & Parts List
V. Paint Specification
VI. High Lubricant Level Sensor
VII. Magnetic Speed Sensor
VIII. Rotational Speed Sensor
IX. Cover Lifting Device
X. Lubricant Material Safety Data Sheet

Part 3: Gear Reducer

I. Gear Reducer Specifications
II. Installation and Maintenance Instruction

Part 4: Motor

I. Product Information Packet
II. Installation and Maintenance Manual

WATSON MARLOW
Fluid Technology Group

Part 1: Design Parameters and Outline Specification

CONTACT INFORMATION

The following points of contact are available if you have any questions regarding the associated support categories.

Equipment Inquiry Support

Ambarneil Roy
Ambarneil.Roy@wmftg.com
Tel: 949-371-2487

Submittals, Response Letters, Resubmittal, O&M Manuals, Lesson/Training Plans, Warranty Statements, Miscellaneous Documentation Requests

Rebecca Whalen
Rebecca.Whalen@wmftg.com
Tel: 978-658-4381

Customer Support, New Orders, Order Status, Shipping, Insurance Requests, W-9 Forms, Contract Review

Sophie Critchlow
Sophie.Critchlow@wmftg.com
Tel: 949-371-2483

Schedule Field Service

Tanim Ahmed
Tanim.Ahmed@wmftg.com
Tel: 978-988-5325

Ordering Spare Parts (Note: This is your local Manufacturer Representative)

Miscowater
27101 Burbank, Suite B
Foothill Ranch, CA 92610
Tel: 949-458-5555
Fax: 949-458-5500

Post-Sale Technical Engineer

After Sales
aftersales@wmftg.us
Tel: 1-800-282-8823

DESIGN PARAMETERS

Scope

Watson-Marlow, as the contracted tubing pump manufacturer, is pleased to submit its Shop Drawings for review detailing all items supplied by Watson-Marlow under Section 11247: Hose Pumps. Watson-Marlow's intended scope of supply, as offered in our Bid Date Scope Letter and described below is based upon requirements listed by the above specification section.

This proposal includes only equipment mentioned herein and does not include, nor infers inclusion of, any additional equipment, piping, valves, wiring, services, testing, etc. regardless of its relation to the listed equipment. Such services and equipment are to be supplied by the Contractor.

WATSON-MARLOW SCOPE OF EQUIPMENT SUPPLY / BILL OF MATERIALS		
Item Number	Quantity	Description
1	4	Bredel 50 Hose Pump Assembly • Nominal Flow: 21.44 GPM • Nominal Displacement: 0.766 Gallons/Rev • Pump Supports: 316SS • Pump Hardware and Hose Clamps: 316SS • 2.0" 150# ANSI Flanges and Flange Brackets for Suction and Discharge: 316SS • 50mm Machined Hose with Inner Layer in EPDM • 316SS Wetted Hose Inserts • Bredel Genuine Hose Lubricant • High Lubricant Level Sensor • Epoxy Pressing Shoes with 316SS Inserts • Inductive Speed Sensor • Rotational Speed Monitor • Cover Lifting Device • 2-Stage Planetary Gearing, 28 RPM Output • Baldor 5.0 HP Premium Efficient Motor, Inverter Duty • Pump Position 2: Ports Facing Right • Bredel Red Paint • Custom Pump Nameplates
2	5	5-Gallon Can Hose Lubricant
3	4	**SPARE** Bredel 50 EPDM Hose

ENGINEERING COMMENTS MADE AT TIME OF BID

The following comments were issued at the time of bid and are again listed below for your consideration.

SPECIFICATION	COMMENTS
General	Watson-Marlow is an equipment supplier, not a contractor and assumes no roles of the contractor.

EQUIPMENT OUTLINE SPECIFICATION

BREDEL 50 HOSE PUMP ASSEMBLY (QUANTITY: 4)	
Name of Pump Manufacturer	Watson-Marlow, Inc.
Model	Bredel 50
Flow/Revolution	0.766 Gallons/Rev
Pump Speed	28 RPM
Nominal Flow	21.44 GPM
Port Sizes	50mm, 2.0" 150# ANSI Flange
Hose/Insert Material	EPDM Hose/316SS Hose Insert
Construction	Pump Supports: 316 SS Pump Hardware and Hose clamps: 316 SS 2" 150# ANSI Flanges & Flange Brackets for Suction & Discharge: 316 SS Epoxy shoes with SS Inserts High Level Sensor Sensor-Magnetic Rotational Speed Sensor Cover lifting Device
Assembly Details	See Drawing
Paint	Bredel Red
Port Position	2 (Ports Right [Standard])
Net Weight of Pumphead	227kg (500lbs)

NOTE: Pump is supplied with the control input and output functionality as shown in the enclosed Technical Data sheets and Operation & Maintenance manual. Please reference these sections for control cable information.

GEAR REDUCER (QUANTITY: 4)	
Name of Manufacturer	Brevini
P/N	GRD2020-63-B3
Speed	28RPM
Gearing Ratio	63.00:1
Number of Gearing Stages	8-Stage Gear
Gearbox Frame	180TC
Paint	Bredel Red
Net Weight of Gearing	49 lbs

MOTOR (QUANTITY: 4)	
Name of Manufacturer	Baldor
P/N	VEM3615T+M23A
Horsepower	5.0 HP
Enclosure/Turndown	TEFC
Voltage	230/460V
Service Factor	1.15
Nominal Efficiency Rating	89.5
Synch RPM	1800
Frame Size	184TC
Insulation	F
Paint	Bredel Red
Weight	88 lbs
NEMA Design Code	B
Full Load Amperage	6.7
Modifications	M23A – Thermostats

ANCILLARY EQUIPMENT/CONTRACTED SPARES			
ITEM	QUANTITY	DESCRIPTION	PART NUMBER
1	5	**SPARE** 5 gallon lubricant	28-912143
2	4	**SPARE** 50mm EPDM Hose	050075

EQUIPMENT SUMMARY FORM

1. EQUIPMENT ITEM Bredel 50 Hose Pump Assemblies

2. MANUFACTURER Watson-Marlow Fluid Technology Group

3. EQUIPMENT IDENTIFICATION NUMBER(S) FOG-PMP-07-730, FOG-PMP-07-740, DCS-PMP-07-760, DCS-PMP-07-770
(maps equipment number)

4. LOCATION OF EQUIPMENT FOG Tank & Food Waste Tank

5. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS)

Complete Pump Assembly = 644 lbs; Pumphead = 500 lbs; Gearbox = 49 lbs; Motor = 95 lbs

6. NAMEPLATE DATA - Horsepower 5
Amperage 6.7
Voltage 230/460V
Service Factor (S.F.) 1.15
Speed 28 RPM
ENC Type TEFC
Capacity 21.44 GPM
Other

7. MANUFACTURER'S LOCAL REPRESENTATIVE

Name MISCOWater

Address 27101 Burbank, Suite B, Foothill Ranch, CA 92610

Telephone Number 949-458-5555

8. MAINTENANCE REQUIREMENTS Pumphead: Remove/replace hose, change hose lubricant

Gear Reducer: Drain and replace oil after 20,000 operating hours

Motor Lubrication: Speed & duty dependent

9. LUBRICANT LIST Bredel Genuine Hose Lubricant; Motor: Mobil Polyrex EM (see O&M for alternates)

Gear Reducer: Mobil SHC 630 (see O&M for alternates)

10. SPARE PARTS (recommendations) Bredel 50 EPDM Hose and Bredel Genuine Hose Lubricant

11. COMMENTS

Notes:

1. Frequency of hose change is dependent upon typical operational speed, typical discharge & suction pressures, fluids, and temperature. Watson-Marlow recommends that the operator log the running hours of the pump and achieved life of the first hose and place all subsequent hoses on a PM schedule based on 100 hrs less than that duration.
2. In the event of hose failure where fluid has contaminated the pump chamber, the pump should be flushed prior to installation of a new hose. Rotor should be inspected for surface roughness or damage and replaced if necessary. Rotor need not be replaced unless damaged.

Anchor Bolt Design
Bredel 50 PERISTALTIC Pumps
Pump Tag No."s
FOG-PMP-07-730 ,740 FWST-PMP-07-760 ,770
Wastewater Quality Control Facility Digester Improvements Project

2450 West Yosemite Ave., Manteca, CA 95337

Prepared for Watson Marlow

5/6/2017

Submitted by:
SSC Engineering, Inc.
Scott Szymborski, P.E.
Phone No. (949) 460-3224
scotts@sscengineering.net

TABLE OF CONTENTS

Description	Page #
Table of Contnets	2
Scope and References:	3
Design Criteria per the 2013 CBC and ASCE 7-10	4
Earthquake Loads per CBC 2013 and ASCE 7-10 Chapter 11 and 13 – Nonstructural Components.	5
Load Factors	6
Load Calculation	7

SCOPE AND REFERENCES

SCOPE:

To provide structural calculations for the analysis and design of anchor bolts for the installation of (4) peristaltic pumps. All other elements including but not limited to the existing foundation, pump pedestal, connecting piping not specifically referenced in these calculations are outside the purview of these calculations and are designed by others.

IMPORTANT SPECIAL INSTALLATION REQUIREMENTS:

(1) Contractor shall determine bolt length considering all elements (beams, grout bed depth, nuts, washers etc) and SSC takes no responsibility for correctness of length.

2) Contractor is required to avoid drilling into new or existing rebar reinforcement. All uncertainties and unkown locations of rebar shall be determined by testing methods to determine precise locations prior to anchor bolt installations for any and all equipment.Marked locations shall be dimensioned and sent to this engineer to verify there are no conflicts with the information within these calculations.

REFERENCES:

1. ASCE/SEI 7-10, Second Edition, Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers (ASCE)
2. 2013 CBC - California Building Code
4. 2015 IBC Section 1613
5. 2011 Building Code Requirements for Structural Concrete, ACI 318-11, and Commentary (ACI)
6. 2011 Manual of Steel Construction, 14th Edition, American Institute of Steel Construction (AISC)
7. Seismic Design Criteria Section 01612
8. Project Drawings

DESIGN CRITERIA PER THE 2013 CBC AND ASCE 7-10

Unless otherwise noted design references are to ASCE 7 (Reference 1) when allowed by the 2013 CBC

Site Address - 2450 West Yosemite Ave., Manteca, CA 95337

http://itouchmap.com/latlong.html

Latitude	37.79
Longitude	-121.26

USGS–Provided Output (Verifies Project Dwgs.)

S_S =	1.051 g	S_{MS} =	1.135 g	S_{DS} =	0.757 g
S_1 =	0.369 g	S_{M1} =	0.613 g	S_{D1} =	0.409 g

Seismic Design Category	D		
Risk Category	III		
Design Category	D		
Spectral Response Criteria	S_{DS} =	0.753	Project Dwg. T-13
Importance Factor	1.5		

Loads

Dead Loads - Provided by Manufacturer and Listed on pages that follow

Seismic Loads

Live Loads –N/A

Wind Load – N/A

EARTHQUAKE LOADS PER 2013 CBC AND
ASCE 7-10 CHAPTER 11 AND 13 – NONSTRUCTURAL COMPONENTS

Equipment Seismic Loads, ASCE Chapter 13.4.2

Variations in heights, weight, and anchorage will modify the applied anchorage force for each piece of equipment. The variables below outline the equations used and their application in determining the applied horizontal and vertical seismic design forces.

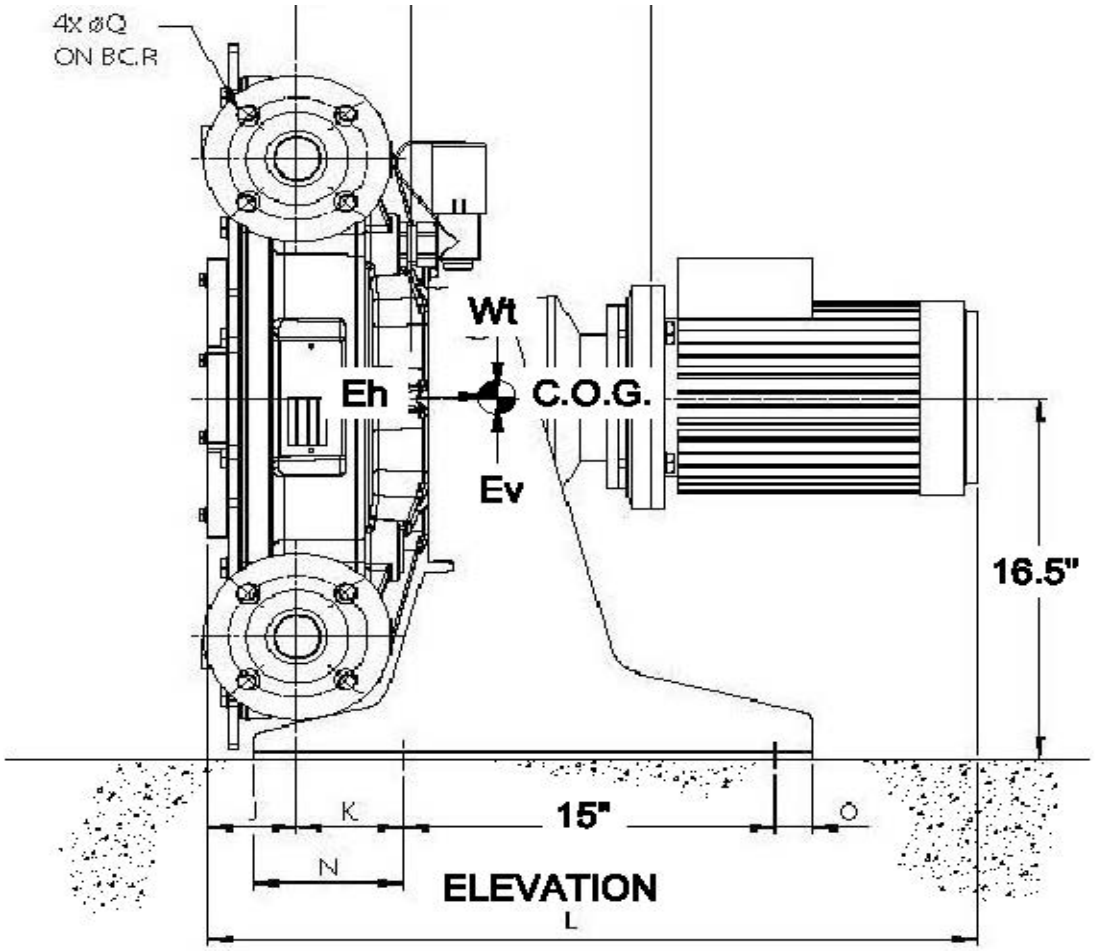
Component Importance Factor , I_p =	1.5	Category IV components, Section 13.1.3
Component Amplification Factor	a_p	Table 13.5-1 or 13.6-1
Component Response Mod. Factor	R_p	Table 13.5-1 or 13.6-1
Height in Structure where attached	z, ft.	
Average Roof Height	ht, disregard as all PUMPS are floor mounted (i.e. z = 0ft)	
Weight of Component or Section	W_p	

Horizontal Seismic Design Force	$Fp= [(0.4*a_p*S_{DS}*W_p)/(R_p/I_p)]*(1+2*(z/h_a))$	Eqn 13.3-1
Not greater than	$Fp,max=1.6*S_{DS}*I_p*W_p$	Eqn 13.2-2
Not Less than	$Fp,min=0.3*S_{DS}*I_p*W_p$	Eqn 13.2-3
Vertical Design Force	$Fpv=0.2*S_{DS}*W_p$	Sec 13.3.1

LOAD FACTORS

Component Type:	Pumps in accordance with ASME B31, Table 13.6-1		
Component Amplification Factor	a_p = 1		
Component Response Mod. Factor	R_p = 2.5		
Overstrength	Ω_0 = 2.5		
Height in Structure where attached, ft.	z = 0		
Overall Height of structure,ft.	h= 0		
Horizontal Seismic Design Force	$Fp= [(0.4*a_p*S_{DS}*W_p)/(R_p/I_p)]*(1+2*(z/h_a))$	0.181	Not Governing
Not greater than	$Fp,max=1.6*S_{DS}*I_p*W_p$	1.81	
Not Less than	$Fp,min=0.3*S_{DS}*I_p*W_p$	0.339	Governs
Vertical Design Force	$Fpv=0.2*S_{DS}*W_p$	0.15	

TYPICAL LOAD DIAGRAM



LOADS CALCULATION

Pump Type - Peristaltic Pump Tag#'s- FOG-PMP-07-730 ,740 FWST-PMP-07-760 ,770			
Make-Bredel			
	Total Weight	500	lbs
	Center of Gravity relative to base	16.50	in
	Bolt Hole Dia. Check	3/4"	in
	Estimated Bolt Dia. to check	5/8"	in
	# of Bolts	4	ea
	Bolt Hole spacing critical direction	15	in
	Base Thickness estimated	1/4"	in

Assume 60 percent weight resisting uplift=	60%			
F_p=	0.34			
Seismic Shear, $E_h = F_p$ x Weight x Ω =		424	lbs	
Seismic Vertical, Ev = Fpv x Weight =		75	lbs	
Resisting weight→ F1=(Ev)-(60 % x weight) =		(225)	lbs	No Uplift due to Ev
(OTM) Overturning moment=E_h x C.O.G.=		6,989	in-lbs	

REFER TO HILTI CALCULATIONS		
Anchor Type	Post Installed Epoxy-Hilti HIT-RE 500 V3 + HAS-R □	
Material	316 SS ASTM F 593	
# of Bolts	4	ea
Bolt Hole Dia.	3/4"	in
Bolt Diameter	5/8"	in
Min Edge Distance	6	in
Grout Bed max	1.5	in
Embedment	6.25	in
Min Pad	38 X 28 X 8" h	in

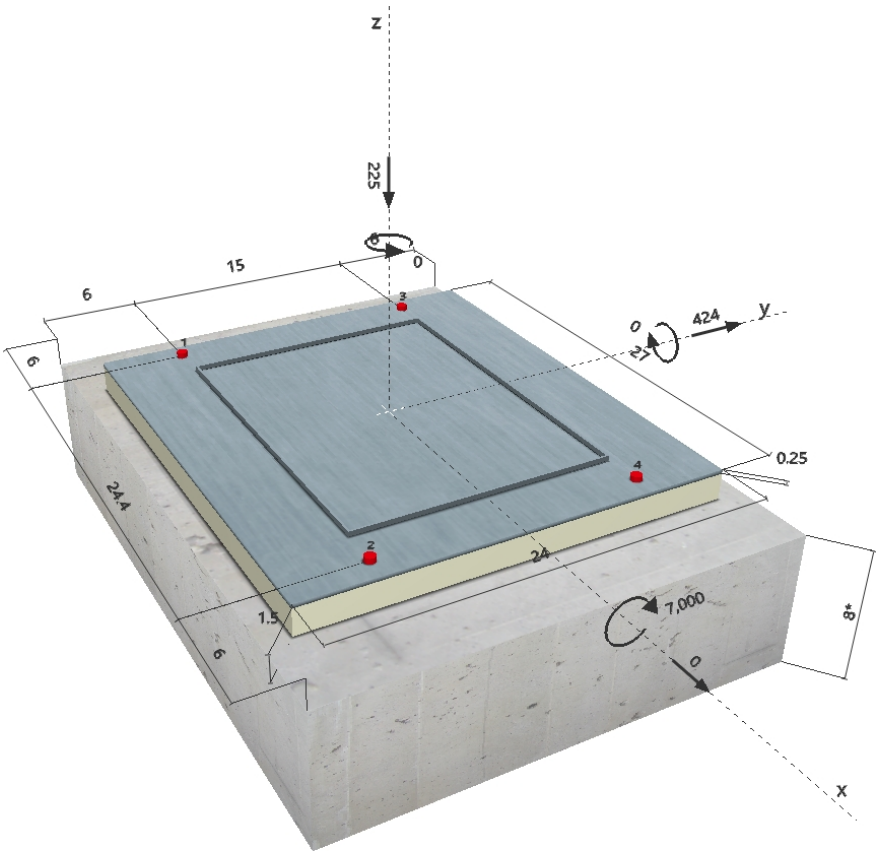
Company:	SSC ENGINEERING INC.	Page:	1
Specifier:		Project:	Manteca,Digester Impr
Address:		Sub-Project I Pos. No.:	
Phone I Fax:	|	Date:	5/4/2017
E-Mail:	SCOTTS@SSCENGINEERING.NET		

Specifier's comments: Wastewater Quality Control Facility Digester Improvements Project Bredel 50 PERSTALTIC Hose Pumps FOG-PMP-07-730 ,740 FWST-07-760 ,770

1 Input data

Anchor type and diameter:	**HIT-RE 500 V3 + HAS-R 316 5/8**
Effective embedment depth:	$h_{ef,act}$ = 6.250 in. ($h_{ef,limit}$ = - in.)
Material:	ASTM F 593
Evaluation Service Report:	ESR-3814
Issued I Valid:	6/1/2016 | 1/1/2017
Proof:	Design method ACI 318-11 / Chem
Stand-off installation:	without clamping (anchor); restraint level (anchor plate): 2.00; e_b = 1.500 in.; t = 0.250 in.
	Hilti Grout: CB-G EG, epoxy, $f_{c,Grout}$ = 14939 psi
Anchor plate:	l_x x l_y x t = 27.000 in. x 24.000 in. x 0.250 in.; (Recommended plate thickness: not calculated
Profile:	Rectangular HSS (AISC); (L x W x T) = 20.000 in. x 15.000 in. x 0.125 in.
Base material:	cracked concrete, 4000, f_c' = 4000 psi; h = 8.000 in., Temp. short/long: 32/32 °F
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present
	edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	Tension load: yes (D.3.3.4.3 (d))
	Shear load: yes (D.3.3.5.3 (c))

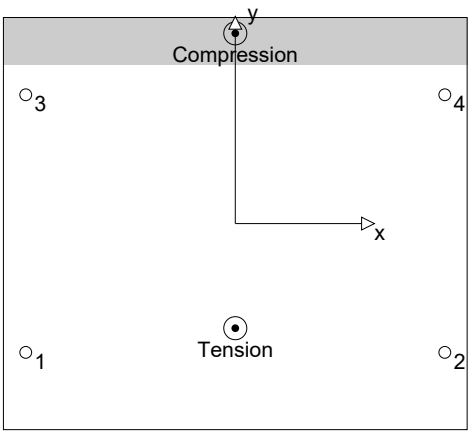
Geometry [in.] & Loading [lb, in.lb]



Company: SSC ENGINEERING INC.
Specifier:
Address:
Phone I Fax: |
E-Mail: SCOTTS@SSCENGINEERING.NET

2 Load case/Resulting anchor forces

Load case: Design loads



Anchor reactions [lb]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	119	106	0	106
2	119	106	0	106
3	12	106	0	106
4	12	106	0	106

max. concrete compressive strain: 0.00 [‰]
max. concrete compressive stress: 13 [psi]
resulting tension force in (x/y)=(0.000/-6.092): 263 [lb]
resulting compression force in (x/y)=(0.000/11.078): 488 [lb]

3 Tension load

	Load N_{ua} [lb]	Capacity ϕN_n [lb]	Utilization $\beta_N = N_{ua}/\phi N_n$	Status
Steel Strength*	119	14690	1	OK
Bond Strength**	263	9840	3	OK
Sustained Tension Load Bond Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Strength**	263	10457	3	OK

* anchor having the highest loading **anchor group (anchors in tension)

3.1 Steel Strength

N_{sa} = ESR value refer to ICC-ES ESR-3814
$\phi N_{sa} \geq N_{ua}$ ACI 318-11 Table D.4.1.1

Variables

$A_{se,N}$ [in.^{2}]	f_{uta} [psi]
0.23	100000

Calculations

N_{sa} [lb]
22600

Results

N_{sa} [lb]	ϕ steel	ϕ nonductile	ϕN_{sa} [lb]	N_{ua} [lb]
22600	0.650	1.000	14690	119

Company: SSC ENGINEERING INC.
Specifier:
Address:
Phone I Fax: |
E-Mail: SCOTTS@SSCENGINEERING.NET

3.2 Bond Strength

$N_{ag} = \left(\frac{A_{Na}}{A_{Na0}}\right) \psi_{ec1,Na} \psi_{ec2,Na} \psi_{ed,Na} \psi_{cp,Na} N_{ba}$ ACI 318-11 Eq. (D-19)

$\phi N_{ag} \geq N_{ua}$ ACI 318-11 Table D.4.1.1

A_{Na} = see ACI 318-11, Part D.5.5.1, Fig. RD.5.5.1(b)

$A_{Na0} = (2 c_{Na})^2$ ACI 318-11 Eq. (D-20)

$c_{Na} = 10 d_a \sqrt{\frac{\tau_{uncr}}{1100}}$ ACI 318-11 Eq. (D-21)

$\psi_{ec,Na} = \left(\frac{1}{1 + \frac{e'_N}{c_{Na}}}\right) \leq 1.0$ ACI 318-11 Eq. (D-23)

$\psi_{ed,Na} = 0.7 + 0.3 \left(\frac{c_{a,min}}{c_{Na}}\right) \leq 1.0$ ACI 318-11 Eq. (D-25)

$\psi_{cp,Na} = MAX\left(\frac{c_{a,min}}{c_{ac}}, \frac{c_{Na}}{c_{ac}}\right) \leq 1.0$ ACI 318-11 Eq. (D-27)

$N_{ba} = \lambda_a \cdot \tau_{k,c} \cdot \alpha_{N,seis} \cdot \pi \cdot d_a \cdot h_{ef}$ ACI 318-11 Eq. (D-22)

Variables

$\tau_{k,c,uncr}$ [psi]	d_a [in.]	h_{ef} [in.]	$c_{a,min}$ [in.]	$\tau_{k,c}$ [psi]
2486	0.625	6.250	6.000	1352

$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	c_{ac} [in.]	λ_a	$\alpha_{N,seis}$
0.000	6.092	16.895	1.000	0.950

Calculations

c_{Na} [in.]	A_{Na} [in.^{2}]	A_{Na0} [in.^{2}]	$\psi_{ed,Na}$
9.353	829.04	349.88	0.892

$\psi_{ec1,Na}$	$\psi_{ec2,Na}$	$\psi_{cp,Na}$	N_{ba} [lb]
1.000	0.606	1.000	15762

Results

N_{ag} [lb]	ϕ_{bond}	$\phi_{seismic}$	$\phi_{nonductile}$	ϕN_{ag} [lb]	N_{ua} [lb]
20184	0.650	0.750	1.000	9840	263

Company: SSC ENGINEERING INC.
Specifier:
Address:
Phone I Fax: |
E-Mail: SCOTTS@SSCENGINEERING.NET

3.3 Concrete Breakout Strength

$N_{cbg} = \left(\frac{A_{Nc}}{A_{Nc0}}\right) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b$ ACI 318-11 Eq. (D-4)

$\phi N_{cbg} \geq N_{ua}$ ACI 318-11 Table D.4.1.1

A_{Nc} see ACI 318-11, Part D.5.2.1, Fig. RD.5.2.1(b)

$A_{Nc0} = 9 h_{ef}^2$ ACI 318-11 Eq. (D-5)

$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 e'_N}{3 h_{ef}}}\right) \leq 1.0$ ACI 318-11 Eq. (D-8)

$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}}\right) \leq 1.0$ ACI 318-11 Eq. (D-10)

$\psi_{cp,N} = MAX\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}}\right) \leq 1.0$ ACI 318-11 Eq. (D-12)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ ACI 318-11 Eq. (D-6)

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
6.250	0.000	6.092	6.000	1.000

c_{ac} [in.]	k_c	λ_a	f'_c [psi]
16.895	17	1.000	4000

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
830.25	351.56	1.000	0.606	0.892	1.000	16800

Results

N_{cbg} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	ϕN_{cbg} [lb]	N_{ua} [lb]
21450	0.650	0.750	1.000	10457	263

Company:	SSC ENGINEERING INC.	Page:	5
Specifier:		Project:	Manteca,Digester Impr
Address:		Sub-Project I Pos. No.:	
Phone I Fax:	|	Date:	5/4/2017
E-Mail:	SCOTTS@SSCENGINEERING.NET		

4 Shear load

	Load V_{ua} [lb]	Capacity ϕV_n [lb]	Utilization $\beta_V = V_{ua}/\phi V_n$	Status
Steel Strength*	106	5207	3	OK
Steel failure (with lever arm)*	106	1116	10	OK
Pryout Strength (Bond Strength controls)**	424	46665	1	OK
Concrete edge failure in direction y+**	424	7718	6	OK

* anchor having the highest loading **anchor group (relevant anchors)

4.1 Steel Strength

$V_{sa,eq}$ = ESR value refer to ICC-ES ESR-3814
$\phi\ V_{steel} \geq V_{ua}$ ACI 318-11 Table D.4.1.1

Variables

$A_{se,V}$ [in.^{2}]	f_{uta} [psi]
0.23	100000

Calculations

$V_{sa,eq}$ [lb]
10848

Results

$V_{sa,eq}$ [lb]	ϕ steel	ϕ eb	ϕ nonductile	$\phi\ V_{sa}$ [lb]	V_{ua} [lb]
10848	0.600	0.800	1.000	5207	106

4.2 Steel failure (with lever arm)

$V_s^M = \frac{\alpha_M \cdot M_s}{L_b}$ bending equation for stand-off

$M_s = M_s^0 \left(1 - \frac{N_{ua}}{\phi N_{sa}}\right)$ resultant flexural resistance of anchor

$M_s^0 = (1.2)\ (S)\ (f_{u,min})$ characteristic flexural resistance of anchor

$\left(1 - \frac{N_{ua}}{\phi N_{sa}}\right)$ reduction for tensile force acting simultaneously with a shear force on the anchor

$S = \frac{\pi (d)^3}{32}$ elastic section modulus of anchor bolt at concrete surface

$L_b = z + (n)(d_0)$ internal lever arm adjusted for spalling of the surface concrete

$\phi\ V_s^M \geq V_{ua}$ ACI 318-11 Table D.4.1.1

Variables

α_M	$f_{u,min}$ [psi]	N_{ua} [lb]	ϕN_{sa} [lb]	z [in.]	n	d_0 [in.]
2.00	100000	119	14690	1.625	0.500	0.625

Calculations

M_s^0 [in.lb]	$\left(1 - \frac{N_{ua}}{\phi N_{sa}}\right)$	M_s [in.lb]	L_b [in.]
1817.227	0.992	1802.513	1.938

Results

V_s^M [lb]	ϕ steel	ϕ nonductile	$\phi\ V_s^M$ [lb]	V_{ua} [lb]
1861	0.600	1.000	1116	106

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4.3 Pryout Strength (Bond Strength controls)

$V_{cpg} = k_{cp}\left[\left(\frac{A_{Na}}{A_{Na0}}\right) \psi_{ec1,Na}\, \psi_{ec2,Na}\, \psi_{ed,Na}\, \psi_{cp,Na}\, N_{ba}\right]$ ACI 318-11 Eq. (D-41)

$\phi\ V_{cpg} \geq V_{ua}$ ACI 318-11 Table (D.4.1.1)

A_{Na} see ACI 318-11, Part D.5.5.1, Fig. RD.5.5.1(b)

$A_{Na0} = (2\ c_{Na})^2$ ACI 318-11 Eq. (D-20)

$c_{Na} = 10\ d_a \sqrt{\frac{\tau_{uncr}}{1100}}$ ACI 318-11 Eq. (D-21)

$\psi_{ec,Na} = \left(\frac{1}{1 + \frac{e'_N}{c_{Na}}}\right) \leq 1.0$ ACI 318-11 Eq. (D-23)

$\psi_{ed,Na} = 0.7 + 0.3\left(\frac{c_{a,min}}{c_{na}}\right) \leq 1.0$ ACI 318-11 Eq. (D-25)

$\psi_{cp,Na} = MAX\left(\frac{c_{a,min}}{c_{ac}}, \frac{c_{Na}}{c_{ac}}\right) \leq 1.0$ ACI 318-11 Eq. (D-27)

$N_{ba} = \lambda_a \cdot \tau_{k,c} \cdot \alpha_{N,seis} \cdot \pi \cdot d_a \cdot h_{ef}$ ACI 318-11 Eq. (D-22)

Variables

k_{cp}	$\tau_{k,c,uncr}$ [psi]	d_a [in.]	h_{ef} [in.]	$c_{a,min}$ [in.]	$\tau_{k,c}$ [psi]
2	2486	0.625	6.250	6.000	1352

$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	c_{ac} [in.]	λ_a	$\alpha_{N,seis}$
0.000	0.000	16.895	1.000	0.950

Calculations

c_{Na} [in.]	A_{Na} [in.^{2}]	A_{Na0} [in.^{2}]	$\psi_{ed,Na}$
9.353	829.04	349.88	0.892

$\psi_{ec1,Na}$	$\psi_{ec2,Na}$	$\psi_{cp,Na}$	N_{ba} [lb]
1.000	1.000	1.000	15762

Results

V_{cpg} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	$\phi\ V_{cpg}$ [lb]	V_{ua} [lb]
66665	0.700	1.000	1.000	46665	424

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4.4 Concrete edge failure in direction y+

$V_{cbg} = \left(\frac{A_{Vc}}{A_{Vc0}}\right) \psi_{ec,V} \psi_{ed,V} \psi_{c,V} \psi_{h,V} \psi_{parallel,V} V_b$ ACI 318-11 Eq. (D-31)

$\phi V_{cbg} \geq V_{ua}$ ACI 318-11 Table D.4.1.1

A_{Vc} see ACI 318-11, Part D.6.2.1, Fig. RD.6.2.1(b)

$A_{Vc0} = 4.5 c_{a1}^2$ ACI 318-11 Eq. (D-32)

$\psi_{ec,V} = \left(\frac{1}{1 + \frac{2e'_v}{3c_{a1}}}\right) \leq 1.0$ ACI 318-11 Eq. (D-36)

$\psi_{ed,V} = 0.7 + 0.3\left(\frac{c_{a2}}{1.5c_{a1}}\right) \leq 1.0$ ACI 318-11 Eq. (D-38)

$\psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0$ ACI 318-11 Eq. (D-39)

$V_b = \left(7\left(\frac{l_e}{d_a}\right)^{0.2}\sqrt{d_a}\right) \lambda_a \sqrt{f'_c}\, c_{a1}^{1.5}$ ACI 318-11 Eq. (D-33)

Variables

c_{a1} [in.]	c_{a2} [in.]	e_{cV} [in.]	$\psi_{c,V}$	h_a [in.]
6.000	6.000	0.000	1.000	8.000

l_e [in.]	λ_a	d_a [in.]	f'_c [psi]	$\psi_{parallel,V}$
5.000	1.000	0.625	4000	1.000

Calculations

A_{Vc} [in.^{2}]	A_{Vc0} [in.^{2}]	$\psi_{ec,V}$	$\psi_{ed,V}$	$\psi_{h,V}$	V_b [lb]
240.00	162.00	1.000	0.900	1.061	7797

Results

V_{cbg} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	ϕV_{cbg} [lb]	V_{ua} [lb]
11026	0.700	1.000	1.000	7718	424

5 Combined tension and shear loads

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.027	0.095	5/3	3	OK

$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} <= 1$

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6 Warnings

- Load re-distributions on the anchors due to elastic deformations of the anchor plate are not considered. The anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the loading! Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies when supplementary reinforcement is used. The Φ factor is increased for non-steel Design Strengths except Pullout Strength and Pryout strength. Condition B applies when supplementary reinforcement is not used and for Pullout Strength and Pryout Strength. Refer to your local standard.
- ACI 318 does not specifically address anchor bending when a stand-off condition exists. PROFIS Anchor calculates a shear load corresponding to anchor bending when stand-off exists and includes the results as a shear Design Strength!
- Design Strengths of adhesive anchor systems are influenced by the cleaning method. Refer to the INSTRUCTIONS FOR USE given in the Evaluation Service Report for cleaning and installation instructions
- Checking the transfer of loads into the base material and the shear resistance are required in accordance with ACI 318 or the relevant standard!
- An anchor design approach for structures assigned to Seismic Design Category C, D, E or F is given in ACI 318-11 Appendix D, Part D.3.3.4.3 (a) that requires the governing design strength of an anchor or group of anchors be limited by ductile steel failure. If this is NOT the case, the connection design (tension) shall satisfy the provisions of Part D.3.3.4.3 (b), Part D.3.3.4.3 (c), or Part D.3.3.4.3 (d). The connection design (shear) shall satisfy the provisions of Part D.3.3.5.3 (a), Part D.3.3.5.3 (b), or Part D.3.3.5.3 (c).
-
- Installation of Hilti adhesive anchor systems shall be performed by personnel trained to install Hilti adhesive anchors. Reference ACI 318-11, Part D.9.1

Fastening meets the design criteria!

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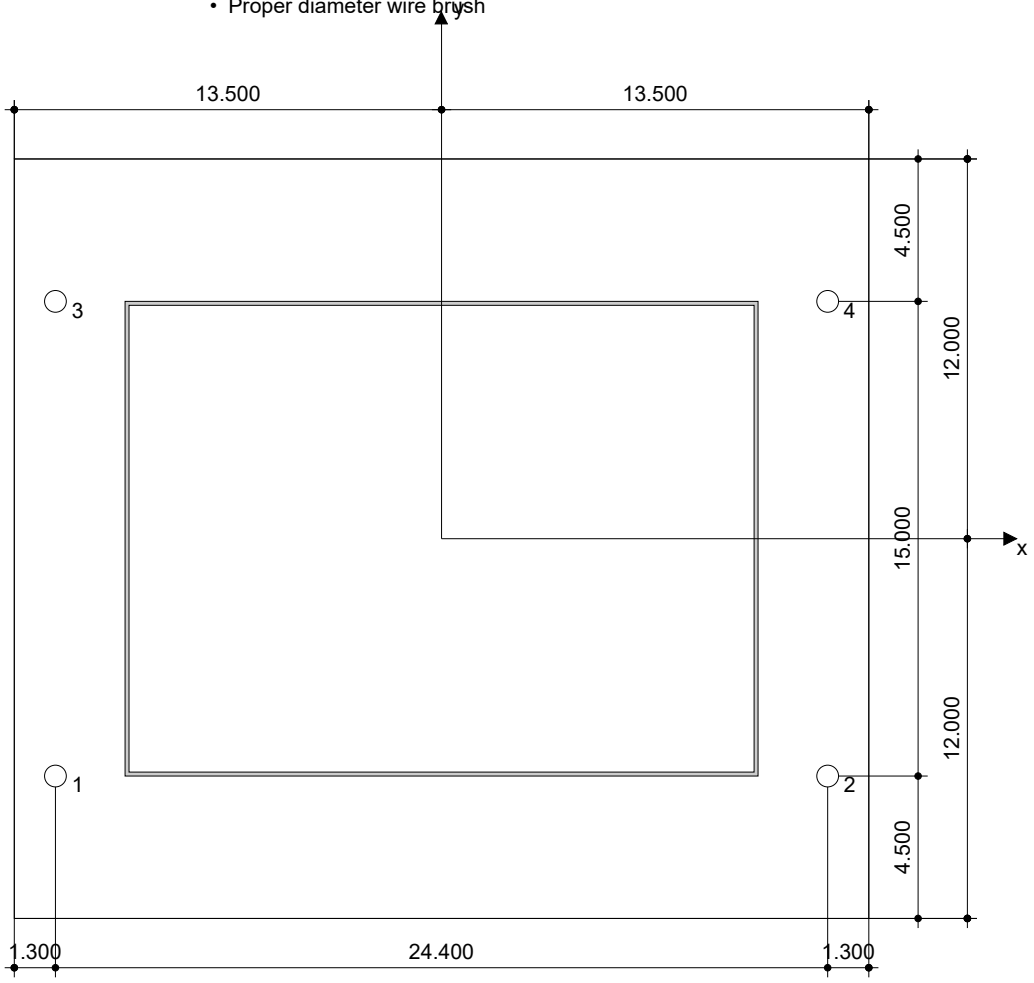
7 Installation data

Anchor plate, steel: -
Profile: Rectangular HSS (AISC); 20.000 x 15.000 x 0.125 in.
Hole diameter in the fixture: d_f = 0.688 in.
Plate thickness (input): 0.250 in.
Recommended plate thickness: not calculated
Drilling method: Hammer drilled
Cleaning: Compressed air cleaning of the drilled hole according to instructions for use is required

Anchor type and diameter: HIT-RE 500 V3 + HAS-R 316 5/8
Installation torque: 720.000 in.lb
Hole diameter in the base material: 0.750 in.
Hole depth in the base material: 6.250 in.
Minimum thickness of the base material: 7.750 in.

7.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• Compressed air with required accessories to blow from the bottom of the hole • Proper diameter wire brush	• Dispenser including cassette and mixer • Torque wrench



Coordinates Anchor in.

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-12.200	-7.500	6.000	30.400	6.000	21.000
2	12.200	-7.500	30.400	6.000	6.000	21.000
3	-12.200	7.500	6.000	30.400	21.000	6.000
4	12.200	7.500	30.400	6.000	21.000	6.000

Company:	SSC ENGINEERING INC.	Page:	10
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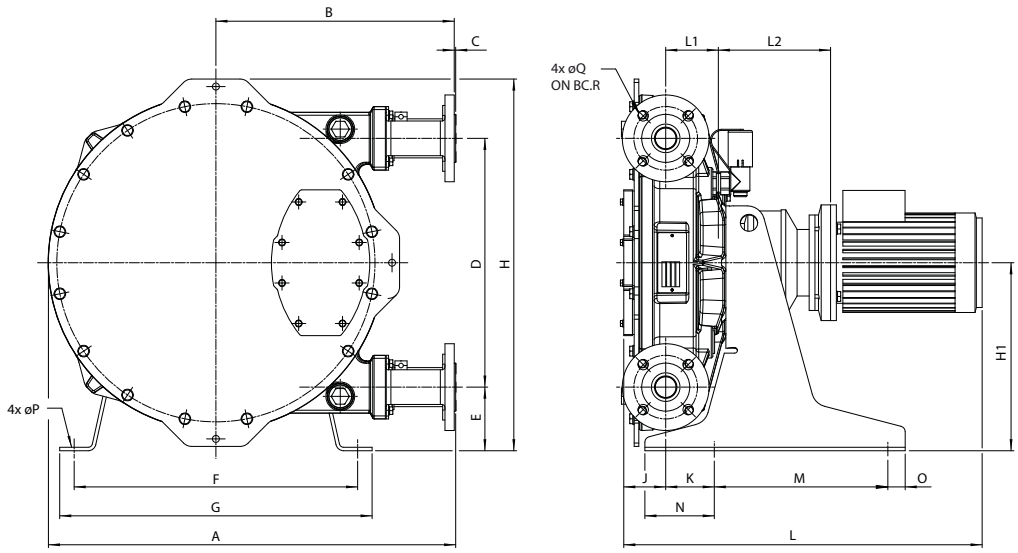
8 Remarks; Your Cooperation Duties

- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

DIMENSIONS



Connector sizes	ANSI 150#	EN DIN	JIS
Bredel 50	2”	50mm	50mm

Type	A	B	C	D	E	F	G	H	H1	J	K	Lmax	L1	L2max	M	N	O	ØP	ØQ	R
Bredel 50 (mm)	838	475	3	554	143	620	680	811	420	84	95	975	112	339	380	155	40	18	18	125
Bredel 50 (inches)	32.9	18.7	0.12	21.8	5.6	24.4	26.8	31.9	16.5	3.3	3.7	38.4	4.4	13.3	15	6.1	1.6	0.71	0.71	4.9

TECHNICAL SPECIFICATIONS

	Bredel 50
Flow range	up to 17,500 L/hr (4,623 USGPM)
Capacity	2.92 L/rev (0.77 G/rev)
Minimum starting torque	620Nm (5,487 inch-lbs)
Hose lubricant required	10 litres (2.64 USG)
Pumphead weight	227kg (500lbs)
Common features	
Max inlet pressure	2.5 bar abs (38 psia)
Suction pressure	0.05bar abs (0.73 psia)
Maximum discharge pressure	1,600 kPa (16 bar) (232psi)
Product temperature range*	-10C up to 80C (14F up to 176F)
Ambient temperature range**	-20C up to 45C (-4F up to 113F)

*Please consult your Bredel representative for lower or higher temperature operation.
**Allowable ambient temperature is based on pump capabilities and may be further limited by gearbox ambient capabilities

MATERIALS OF CONSTRUCTION

Components	Materials
Pump housing	Cast iron
Rotor	Cast iron
Pressing shoes	epoxy
Cover	Mild steel
Brackets	AISI 316
Flanges	AISI 316
Inserts	AISI 316
Support frame	AISI 316
Hose clamps	AISI 316
Shaft	Alloy steel
Seals	Neoprene or nitrile

Options	Features
Available hose materials	EPDM
Available flanges	ANSI
Available inserts	Bredel standard or with sanitary connectors
High level float switch	Max. 2A, 230 V AC/DC, max. 40VA
Low level float switch	ATEX: max. 50 mA, max. 28V AC/DC
Integrated FI for stand alone speed control	Factory programmable from 12-80 Hz
Revolution counter	For maintenance intervals and /or metering
Vacuum assist	For difficult suction conditions and high viscosity fluids
Cover lifting device	For one-man pump maintenance

Bredel Hose Pumps
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Design Maps Summary Report

PrintView Detailed Report

User–Specified Input

- **Report Title** Wastewater Quality Control Facility Digester Improvements Project Thu May 4, 2017 20:34:23 UTC
- **Building Code Reference Document** ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
- **Site Coordinates** 37.79°N, 121.26°W
- **Site Soil Classification** Site Class D – "Stiff Soil"
- **Risk Category** I/II/III

USGS–Provided Output

S_S =	1.051 g	S_{MS} =	1.135 g	S_{DS} =	0.757 g
S_1 =	0.369 g	S_{M1} =	0.613 g	S_{D1} =	0.409 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

SECTION 01612

SEISMIC DESIGN CRITERIA

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Seismic design criteria for the following:
   1. Seismic anchorage of mechanical equipment, electrical equipment and distributed systems (i.e. piping, conduit, ducting, other), shall be designed as called for below;
      a. Where the mechanical or electrical equipment has a weight of four hundred pounds (400 lbs) or more.
      b. Where the mechanical or electrical equipment has a weight of less than four hundred pounds (400 lbs) and a center of mass located four feet (4'-0") or more above the adjacent floor level.
      c. Where mechanical or electrical equipment has a weight of twenty pounds (20 lbs) or less or, in the case of a distributed system that has a weight of five pounds per feet (5 lbs/ft) or less, seismic anchorage need not be considered. Where multiple distributed systems are supported off of the same system their combined weight must be used in determining if design is required for the support system.
   2. Typical Details may have been provided for supporting mechanical equipment, electrical equipment and distributed systems (i.e. piping, conduit, ducting, other) as well as for stairs ladders and other miscellaneous items in the construction documents. These Typical Details are to be used for a minimum standard for style, size, and materials and shall be used as a guide for the contractor in designing the specific item or system utilized on the project Design for these systems shall be provided in the submittal. The design shall include details and calculations stamped and signed by a Civil or Structural engineer registered in the State of California.
   3. Seismic design of tanks and anchorage of tanks.
   4. Other structures or items as specified or indicated on the Drawings.

1.02 REFERENCES

A. International Code Council (ICC).

B. California Building Code (CBC).

C. American Society of Civil Engineers
   1. 7-10 Minimum Design Loads for Buildings and Other Structures (ASCE 7-10)

D. American Concrete Institute
   1. 318-11 Building Code Requirements for Structural Concrete (ACE 318-11)
      a. Appendix D-Anchoring to Concrete

1.03 SYSTEM DESCRIPTION

A. Design Requirements for Equipment provided by the Contractor:
   1. Design in accordance of the 2013 California Building Code.
      a. Risk Category, III
      b. Site Class, D

c. Spectral Acceleration Parameter, Ss:1.044
d. Spectral Acceleration Parameter, S1: 0.367
e. Design Spectral Acceleration at short period, S_{DS}: 0.753g
f. Design Spectral Acceleration at 1-Second Period, SD1: 0.407g
g. Component Amplification Factor, a_P: In accordance with ASCE 7-10, "Minimum Design Loadings for Buildings and Other Structures", Tables 13.5-1 and 13.6-1.
h. Component Response Modification Factor, R_P: In accordance with ASCE 7-10, Tables 13.5-1 and 13.6-1.
i. Overstrength Coefficients Ω: In accordance with ASCE 7-10, Tables 13.5-1 and 13.6-1 [Addendum No.1]
j. Component Importance Factor, I_P: In accordance with ASCE 7-10, Section 13.1.3 but not less than 1.25
k. Component Response Modification Factor, R: In accordance with ASCE 7-10, Tables 15.4-1 and 15.4-2
l. Overstrength Coefficients Ω: In accordance with ASCE 7-10, Tables 15.4-1 and 15.4-2 [Addendum No.1]
m. Deflection Amplification Factor, Cd: In accordance with ASCE 7-10, Tables 15.4-1 and 15.4-2
n. Importance Factor, Ie: In accordance with ASCE 7-10, Section 15.4.1.1 but no less than 1.25.
o. FOG-TNK-07-700 anchorage shall be designed in accordance with ACI 318 Appendix D Sections D.3.3.4.3 Option (a) and D.3.3.5.3 Option (a) in addition to the requirements a through f and k through n listed above.

2. Do not use friction to resist sliding due to seismic forces.
3. Do not use more than 60 percent of the weight of the mechanical and electrical equipment for designing anchors for resisting overturning due to seismic forces.
4. Do not use more than 60 percent of the weight of the tank for resisting overturning due to seismic forces. For FOG-TNK-07-700 for anchorage using strength design CBC prescribed load combinations may be used.
5. Use anchor bolts, bolts, or welded studs for anchors for resisting seismic forces. Anchor bolts used to resist seismic forces shall have a standard hex bolt head. Do not use anchor bolts fabricated from rod stock with an L or J shape.
6. Do not use concrete anchors, flush shells, chemical anchors, powder actuated fasteners, or other types of anchors unless **indicated on the Drawings** or accepted in writing by the ENGINEER.
7. Anchor design capacity is to be independent of reinforcing steel in the concrete providing ductility.
8. Seismic forces must be resisted by direct bearing on the fasteners used to resist seismic forces. Do not use connections which use friction to resist seismic forces.

1.04 SUBMITTALS

A. Shop Drawings and Calculations: Complete shop drawings and seismic calculations.

B. Calculations shall be signed and stamped by a civil or structural Professional. Engineer licensed to practice in the state where the Project is located. All calculations shall be done in English units.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

CODE:

2013 CALIFORNIA BUILDING CODE
CODE REQUIREMENTS FOR ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES (ACI 350-06) AND COMMENTARY (ACI 350R-06) PROVIDE SPECIAL INSPECTION IN ACCORDANCE WITH THE 2013 CALIFORNIA BUILDING CODE CHAPTER 17 AND THE PROJECT SPECIFICATIONS FOR THE FOLLOWING ITEMS:

1. REINFORCED CONCRETE.
2. HIGH STRENGTH BOLTS.
3. ANCHOR BOLTS INSTALLED IN CONCRETE.
4. STRUCTURAL WELDING.
5. MASONRY CONSTRUCTION.
6. POST - INSTALLED EPOXY ADHESIVE ALL-THREAD RODS AND REINFORCEMENT.
7. CONCRETE POST - INSTALLED EXPANSION ANCHORS.

CONCRETE REQUIREMENTS:

MINIMUM 28 DAY COMPRESSIVE STRENGTH - 4000 PSI

REINFORCING BAR REQUIREMENTS:

ALL REINFORCING SHALL CONFORM TO ASTM A615 GRADE 60

STEEL REQUIREMENTS:

1. STRUCTURAL STEEL
   PLATES, BARS, ROLLED SHAPES (EXCEPT W AND WT SHAPES), AND MISCELLANEOUS ITEMS USE ASTM A36. ROLLED W AND WT SHAPES USE ASTM A992 GRADE 50. HOLLOW STRUCTURAL SECTIONS (HSS): ROUND, SQUARE OR RECTANGULAR USE ASTM A500 GRADE B. STEEL PIPE USE ASTM A53 GRADE B.
2. ALL HIGH STRENGTH BOLTS SHALL CONFORM TO ASTM A325.
3. ANCHOR BOLTS, NUTS, AND WASHERS SHALL BE TYPE 316 STAINLESS STEEL OR HOT-DIP GALVANIZED CONFORMING TO ASTM A307 OR A36, AS INDICATED ON THE DRAWINGS.

SEISMIC DESIGN REQUIREMENTS:

SEISMIC COEFFICIENTS	S_S	= 1.04g
	S_1	= 0.367g
	F_a	= 1.08
	F_v	= 1.67
	S_{DS}	= 0.753g
	S_{D1}	= 0.41g
SITE CLASS		= D
SEISMIC DESIGN CATEGORY		= III
OCCUPANCY CATEGORY		= D
BUILDING STRUCTURAL SYSTEM		
RESPONSE MODIFICATION FACTOR	R	= 5.0
IMPORTANCE FACTOR	I	= 1.25
COMPONENT		
RESPONSE MODIFICATION FACTOR	R_P	= PER ASCE 7-10 CHAPTER 13, SECTION 13.1.3 AND TABLES 13.5-1 & 13.6-1
IMPORTANCE FACTOR	I_P	=
AMPLIFICATION FACTOR	a_P	=
OVERSTRENGTH FACTOR	Ω_0	=
C_s (EQUIVALENT LATERAL FORCE PROCEDURE)		= 0.19

S001 TYP STRUCTURAL NOTES FOR CBC
SHEET 1 OF 2

WIND DESIGN REQUIREMENTS:

BASIC WIND SPEED	= Vult=115 MPH Vasd=89 MPH
EXPOSURE CATEGORY	= C
RISK CATEGORY III	
SNOW LOAD	= N/A
FLOOD HAZARD AREA	= ZONE X

GEOTECHNICAL REPORT:

FOR GEOTECHNICAL DATA, REFER TO GEOTECHNICAL INVESTIGATION REPORT
MANTECA WATER QUALITY CONTROL FACILITY IMPROVEMENTS,
MANTECA, CALIFORNIA
BSK PROJECT No. G15-133-10L
DATED MAY 5TH, 2016

S001 TYP STRUCTURAL NOTES FOR CBC
SHEET 2 OF 2

1. CONCRETE CONSTRUCTION SHALL COMPLY WITH ACI "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE" (ACI 318) AND CODE REQUIREMENTS FOR ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES (ACI 350-06) AND COMMENTARY (ACI 350R-06).
2. UNLESS OTHERWISE INDICATED ON THE DRAWINGS, MINIMUM REINFORCEMENT OF CONCRETE WALLS OR SLABS SHALL BE:
   10" THICK OR LESS - USE #5 @ 12" EW
   MORE THAN 10" THICK - USE #5 @ 12" EWEF
3. WALL REINFORCEMENT AT CORNERS OR JUNCTIONS OF WALLS SHALL BE CONTINUOUS, APSPLICED, OR TERMINATED IN AN ACI STANDARD 90 DEGREE HOOK. LAP SPLICES SHALL CONFORM WITH NOTE 12.
4. UNLESS OTHERWISE INDICATED ON THE DRAWINGS, BARS SHALL BE DOWELED. DOWELS SHALL BE THE SAME SIZE AND SPACING AS THE REINFORCEMENT WHICH IS SPLICED TO THE DOWELS.
5. SLABS, BEAMS, AND COLUMN REINFORCING BARS SHALL HAVE A MINIMUM EXTENSION OR ANCHORAGE INTO SUPPORTS IN ACCORDANCE WITH ACI 318 AND ACI 350.
6. STIRRUP SUPPORT BARS SHALL BE PROVIDED TO SECURE TOP BARS AGAINST DISPLACEMENT AS REQUIRED.
7. UNLESS OTHERWISE INDICATED ON THE DRAWINGS, CONCRETE COVER OVER #11 AND SMALLER REINF BARS SHALL BE AS FOLLOWS:
   A. SLABS AND JOISTS:
      FORMED CONCRETE SURFACES AND UNFORMED TOP SURFACES FOR DRY CONDITIONS:
         #7 BARS AND SMALLER....................................1"
         #8 BARS AND LARGER.....................................1 1/2"
      FORMED CONCRETE SURFACES AND UNFORMED TOP SURFACES EXPOSED TO WEATHER, IN CONTACT WITH SOIL OR WATER, OR LOCATED OVER WATER..2"
   B. BEAMS AND COLUMNS:
      FORMED CONCRETE SURFACES FOR DRY CONDITIONS:
         STIRRUPS, SPIRALS, AND TIES...........................1 1/2"
         PRINCIPAL REINFORCEMENT...............................2"
      FORMED CONCRETE SURFACES EXPOSED TO WEATHER, IN CONTACT WITH SOIL OR WATER, OR BEAMS LOCATED OVER WATER:
         STIRRUPS AND TIES...2"
         PRINCIPAL REINFORCEMENT...............................2 1/2"
   C. WALLS:
      FORMED CONCRETE SURFACES FOR DRY CONDITIONS:
         #7 BARS AND SMALLER....................................1"
         #8 BARS AND LARGER.....................................1 1/2"
      FORMED CONCRETE SURFACES EXPOSED TO WEATHER, OR IN CONTACT WITH SOIL OR WATER..............................2

S002 TYP REINFORCED CONCRETE NOTES
SHEET 1 OF 3

   D. FOOTINGS AND BASE SLABS:
      FORMED VERTICAL CONCRETE SURFACES......................2"
      AT UNFORMED CONCRETE SURFACES CAST AGAINST THE SOIL OR CONCRETE WORK MATS...................................3"
      TOP SURFACE OF FOOTINGS AND BASE SLABS............SAME AS SLABS.
8. KEYWAYS AND WATERSTOP SHALL END 3" BELOW THE TOP OF WALLS, UNLESS THERE IS A SLAB ON TOP OF THE WALL, IN WHICH CASE IT SHALL END AT THE BOTTOM OF THE SLAB. IN JOINTS WHERE WATERSTOP TERMINATES AT ADJOINING SLAB OR WALL, WATERSTOP SHALL BE EMBEDDED IN ADJOINING SLAB OR WALL A MINIMUM OF 6".
9. CONCRETE CURING SHALL BE IN ACCORDANCE WITH THE CONTRACT DOCUMENTS. WHERE WATER CURING IS REQUIRED, MEMBRANE CURING IS NOT ALLOWED. THE CONTRACTOR IS WARNED THAT WATER CURING IS DIFFICULT AT TIMES DUE TO WIND AND DRY CONDITIONS THE CONTRACTOR SHALL STUDY REQUIREMENTS AND SHALL FURNISH ADEQUATE SYSTEMS TO PROVIDE WATER CURING WHERE REQUIRED. TOP OF WALLS SHALL BE KEPT VISIBLY MOIST AT ALL TIMES AND SHALL BE FLOODED NOT LESS THAN THREE TIMES DAILY.
10. WATERSTOP SHALL BE PLACED IN CONSTRUCTION, AND EXPANSION JOINTS IN WATERBEARING SLABS AND WALLS UNLESS OTHERWISE INDICATED ON THE DRAWINGS, AND IN WALLS AND SLABS SUBJECTED TO GROUNDWATER. WATERSTOP IN THE WALLS SHALL BE CARRIED INTO SLABS AND SHALL BE SPLICED WITH THE WATERSTOP IN THE SLABS.
11. NO BACKFILL SHALL BE PLACED AGAINST WALLS UNTIL:
    A. WALLS HAVE BEEN CAST FULL HEIGHT OF STRUCTURE AND CONCRETE HAS REACHED THE SPECIFIED STRENGTH.
    B. AND THE CONNECTING SLABS AND BEAMS HAVE BEEN CAST AND HAVE REACHED THE SPECIFIED STRENGTH.
12. LAP SPLICES:
    A. WHEN MULTIPLE BARS ARE SPLICED AT THE SAME SECTION, THE CLEAR BAR SPACING IS THE MINIMUM CLEAR DISTANCE BETWEEN THE BARS OUTSIDE THE SPLICE LENGTH LESS ONE BAR DIAMETER.
    B. UNLESS OTHERWISE INDICATED ON THE DRAWINGS, THE BARS AT A LAP SPLICE SHALL BE IN CONTACT WITH EACH OTHER.
    C. FOLLOWING TABULATED VALUES ARE CALCULATED FOR:
       FY = 60,000 PSI FOR REINFORCING BARS
       F'C = 4,000 PSI FOR CONCRETE
    D. TOP BARS ARE HORIZONTAL REINFORCEMENT SO PLACED THAT MORE THAN 12 INCHES OF FRESH CONCRETE IS CAST IN THE MEMBER BELOW THE BAR.
    E. HORIZONTAL BARS IN CIRCULAR WALLS OF HYDRAULIC STRUCTURES SHALL BE SPLICED WITH TOP BAR LAP SPLICES. ADJACENT LAP SPLICES SHALL BE STAGGERED HORIZONTALLY BY NOT LESS THAN ONE LAP LENGTH NOR 3 FEET FROM CENTER OF LAP BELOW TO ADJACENT CENTER OF LAP ABOVE, AND SHALL NOT COINCIDE IN VERTICAL ARRAYS MORE FREQUENTLY THAN EVERY THIRD BAR.

S002 TYP REINFORCED CONCRETE NOTES
SHEET 2 OF 3

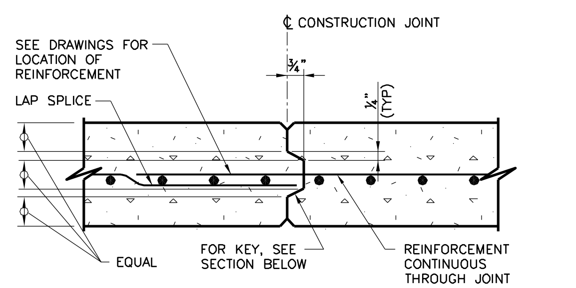
REINFORCING BAR LAP SPLICE

BAR SIZE	MINIMUM COVER (BAR DIA)	MINIMUM BAR SPACING (BAR DIA)	LAP SPLICE LENGTH (INCHES)	
			TOP BARS	OTHER BARS
#4	MORE THAN 1	MORE THAN 2	32 *	25 *
	MORE THAN 2	MORE THAN 4	20	15
#5	MORE THAN 1	MORE THAN 2	40 *	31 *
	MORE THAN 2	MORE THAN 4	26	20
#6	MORE THAN 1	MORE THAN 2	48 *	37 *
	MORE THAN 2	MORE THAN 4	30	24
#7	MORE THAN 1	MORE THAN 2	70 *	54 *
	MORE THAN 2	MORE THAN 4	43	33
#8	MORE THAN 1	MORE THAN 2	81 *	62 *
	MORE THAN 2	MORE THAN 4	50	38
#9	MORE THAN 1	MORE THAN 2	90 *	70 *
	MORE THAN 2	MORE THAN 4	56	42
#10	MORE THAN 1	MORE THAN 2	104 *	81 *
	MORE THAN 2	MORE THAN 4	62	48
#11	MORE THAN 1	MORE THAN 2	114 *	88 *
	MORE THAN 2	MORE THAN 4	69	54

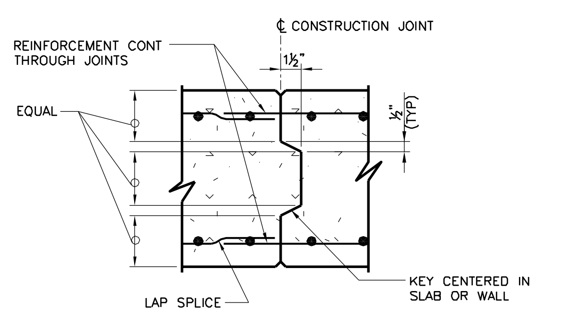
NOTES:

1. THE SPLICE LENGTH SHALL BE SELECTED ONLY WHEN BOTH REQUIREMENTS OF THE COVER AND BAR SPACING ARE SATISFIED.
2. * IF THE CLEAR SPACING IS LESS THAN OR EQUAL TO TWO BAR DIAMETERS OR THE CLEAR COVER IS LESS THAN OR EQUAL TO ONE BAR DIAMETER, THE LAP SPLICE LENGTH SHALL BE INCREASED BY 50 PERCENT.

S002 TYP REINFORCED CONCRETE NOTES
SHEET 3 OF 3

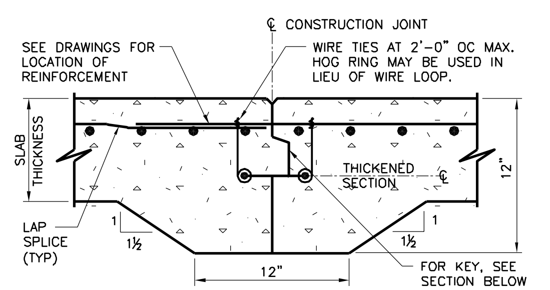


NON-WATER BEARING WALL OR SLAB

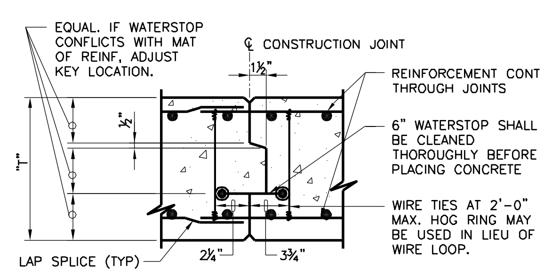


NON-WATER BEARING SLAB OR WALL

S010 TYP CONSTRUCTION JOINT
SHEET 1 OF 2



WATER BEARING SLAB LESS THAN 12" THICK

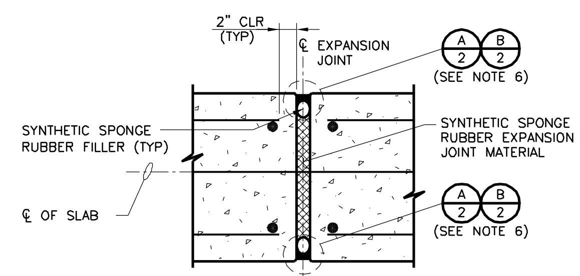


WATER BEARING SLAB OR WALL

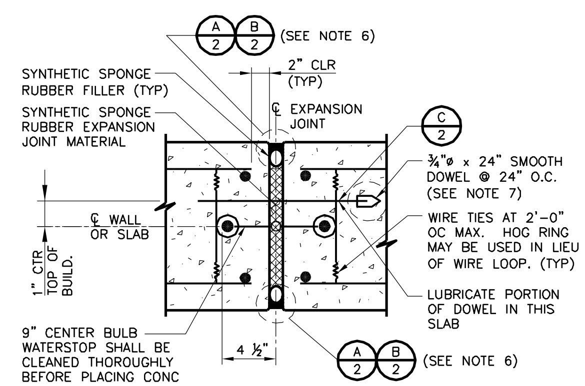
NOTES:

1. SANDBLAST OR WATERBLAST JOINT AND REINFORCEMENT PRIOR TO PLACING CONCRETE FOR NEXT SLAB OR WALL.
2. FOR WALLS, FORM ALL JOINT EDGES AT ¾" CHAMFER.
3. FOR SLABS, EDGE TOP OF EXPOSED SLAB JOINT EDGES AT ¼" RADIUS.
4. FOR UNDERSIDE OF EXPOSED SLABS, FORM JOINT EDGES AT ¾" CHAMFER.

S010 TYP CONSTRUCTION JOINT
SHEET 2 OF 2

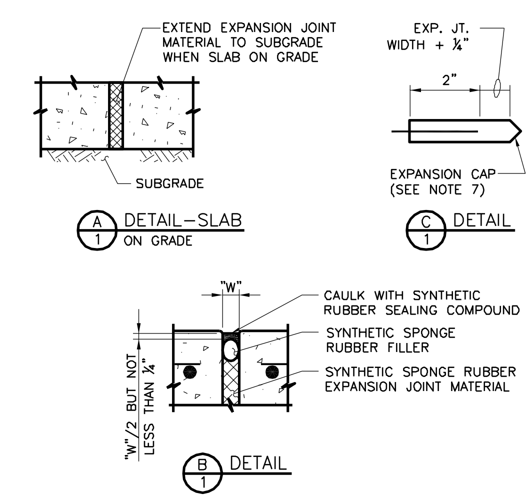


NON-WATER BEARING SLAB OR WALL



WATER BEARING SLAB OR WALL

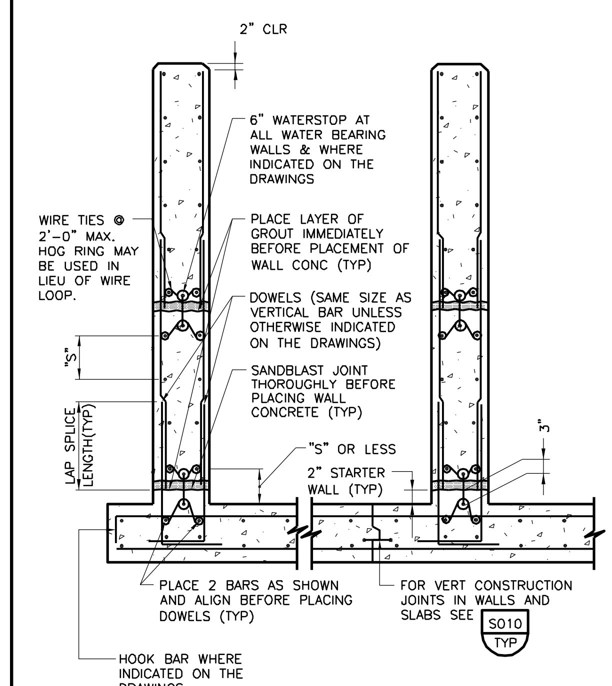
S030 TYP EXPANSION JOINT
SHEET 1 OF 2



NOTES:

1. SLABS ON GRADE SHALL BE THICKENED AT JOINT PER TYPICAL DETAIL S010.
2. FOR WALLS, FORM ALL JOINT EDGES AT ¾" CHAMFER.
3. FOR SLABS, EDGE TOP OF EXPOSED SLAB JOINT AT ¼" RADIUS
4. FOR UNDER SIDE OF EXPOSED SLABS, FORM BOTH JOINT EDGES AT ¾" CHAMFER.
5. "W" = 1" THICK UNLESS OTHERWISE INDICATED ON THE DRAWINGS. MIN JOINT WIDTH = ⅜".
6. USE (A/1) AT UNDERSIDE OF SLABS ON GRADE ONLY.
   USE (B/1) AT ALL OTHER LOCATIONS.
7. PROVIDE DOWELS ONLY WHEN INDICATED ON PLANS.

S030 TYP EXPANSION JOINT
SHEET 2 OF 2



NOTE:
1. "S" = BAR SPACING INDICATED ON THE DRAWINGS.

S042 TYP WALL AND SLAB JOINTS WITH WATERSTOP

REV.	DATE	BY	DESCRIPTION

FILENAME:

DESIGNED KAG
DRAWN IG
CHECKED GPH
DATE MAY 2016

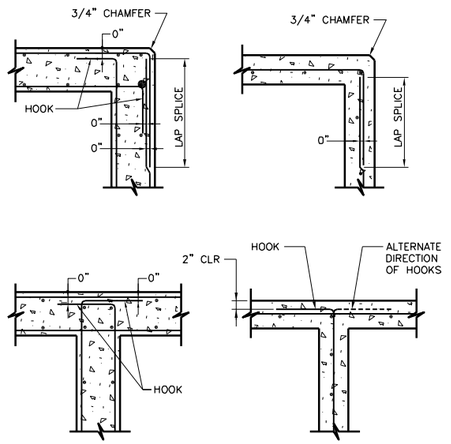
HERWIT ENGINEERING

CITY OF MANTECA

CITY OF MANTECA WASTEWATER QUALITY CONTROL FACILITY
DIGESTER IMPROVEMENTS PROJECT
TYPICAL
TYPICAL DETAILS

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

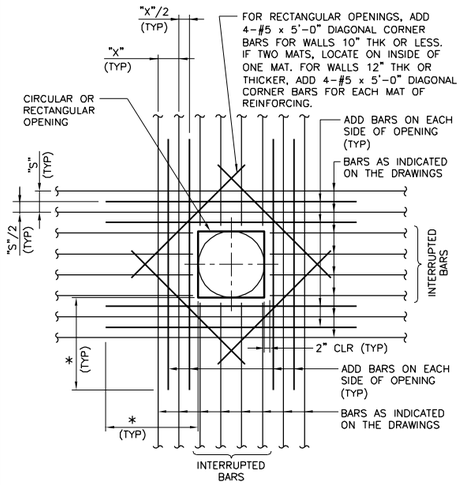
JOB NO. 2015-109 T01
DRAWING NO. T-13
SHEET NO. 16 OF 219



NOTE:

1. ALL HOOKS SHALL BE ACI STD 90 DEGREE HOOKS.

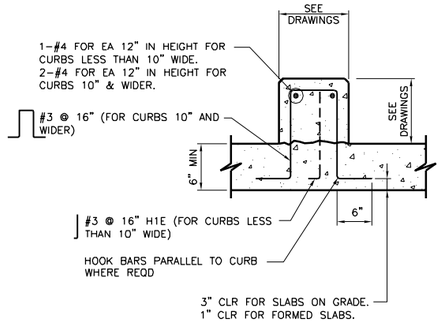
S044 TYP — REINFORCEMENT AT CORNERS AND JUNCTIONS



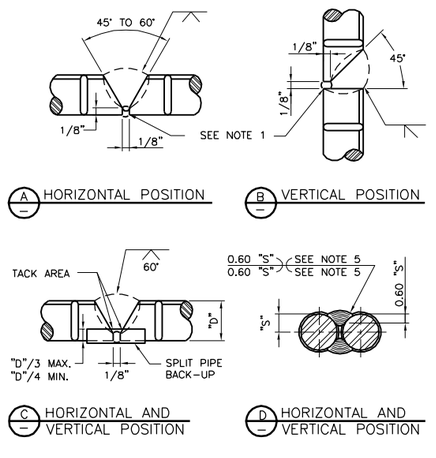
NOTES:

1. AREA OF ADD BARS AT EACH EDGE OF OPENING IN EACH DIRECTION SHALL MATCH ½ THE CROSS SECTIONAL AREA OF THE INTERRUPTED BARS.
2. PROVIDE STANDARD ACI HOOKS ON BARS IF STRAIGHT EXTENSION, PAST THE OPENING, CANNOT BE ACHIEVED.
3. PLACE ADD BARS IN SAME PLANES AS INTERRUPTED REINFORCING.
4. PLACE #5 DIAGONAL BARS UNDER INTERRUPTED REINFORCING.
5. * DIMENSION EQUALS OPENING DIMENSION MEASURED PERPENDICULAR TO ADD BARS PLUS LAP SPLICE LENGTH.

S080 TYP — ADDITIONAL REINFORCING AT OPENINGS IN CONCRETE SLABS OR WALLS



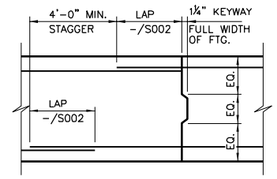
S084 TYP — CONCRETE CURB



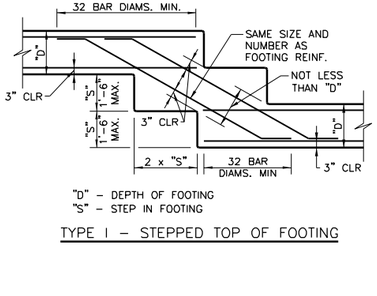
NOTES:

1. CHIP, GRIND, OR GOUGE TO SOUND METAL BEFORE WELDING OTHER SIDE.
2. USE DETAIL A & B FOR #9 & LARGER BARS. USE DETAIL C FOR #8 & SMALLER BARS. USE DETAIL D FOR #6 & SMALLER BARS.
3. E 70 ELECTRODE FOR GRADE 40; E 90 ELECTRODE FOR GRADE 60.
4. SEE AWS D1.4 FOR WELDING PROCESS, PREHEAT REQUIREMENTS, AND OTHER DETAILS. SUBMIT WELDING PROCEDURE PER AWS.
5. 1 1/2" FOR #3 AND #4 BARS; 2" FOR #5 BARS; AND 2 1/2" FOR #6 BARS.

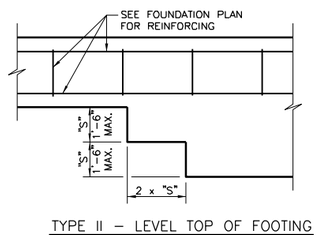
S090 TYP — WELDED SPLICE OF REINFORCING BARS



S210 TYP — FOOTING CONSTRUCTION JOINT

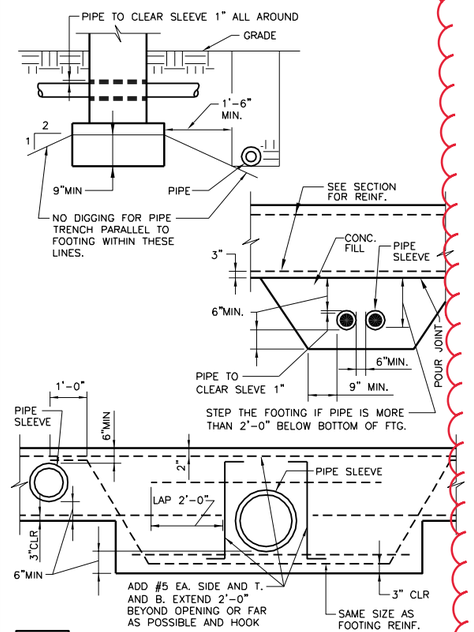


TYPE I – STEPPED TOP OF FOOTING

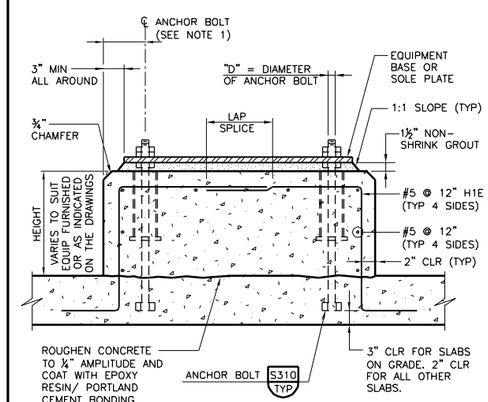


TYPE II – LEVEL TOP OF FOOTING

S212 TYP — TYPICAL STEP IN FOOTING WALL



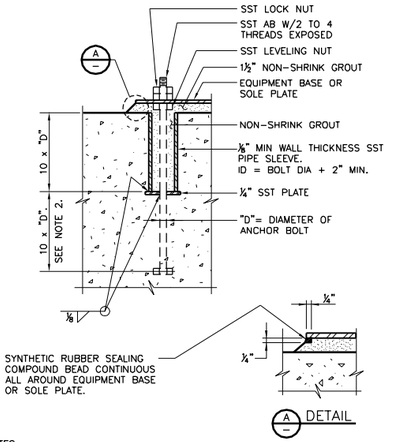
S218 TYP — TYPICAL LOCATION OF PIPE AT FOOTING



NOTES:

1. THE EDGE DISTANCE ON THE ANCHOR BOLTS SHALL NOT BE LESS THAN 6" OR 8 x "D".
2. WHERE CONCRETE SLAB OR BEAM THICKENESS WILL NOT ACCOMMODATE THE ANCHOR BOLT, PROVIDE EXTRA THICKENESS OR SLAB OR BEAM.

S302 TYP — EQUIPMENT BASE



NOTES:

1. ANCHOR BOLT DIAMETER AS INDICATED ON THE DRAWINGS. IF NOT INDICATED ON THE DRAWINGS, THE ANCHOR BOLT SIZE SHALL BE AS RECOMMENDED BY THE EQUIPMENT MANUFACTURER.
2. WHERE CONCRETE SLAB OR BEAM THICKNESS WILL NOT ACCOMMODATE THE ANCHOR BOLT, PROVIDE EXTRA THICKNESS OF SLAB OR BEAM.
3. PREFABRICATED PLASTIC ANCHOR BOLT SLEEVE OPTIONAL.
4. DO NOT USE ALL-THREAD RODS AS A SUBSTITUTE FOR BOLTS WITH A BOLT HEAD. SMOOTH RODS THREADED AT THE ENDS MAY BE USED IF ACCEPTABLE TO THE ENGINEER. DO NOT WELD NUTS TO THE THREADED RODS.

S310 TYP — ANCHOR BOLT

MASONRY:

1. F'm = 2000 PSI.
2. CONCRETE BLOCK UNITS SEE SPECIFICATIONS.
3. MORTAR SEE SPECIFICATIONS.
4. GROUT SEE SPECIFICATIONS.
5. REINFORCING STEEL SEE SPECIFICATIONS.
6. BEFORE BLOCK PLACED ON CONCRETE, THOROUGHLY CLEAN CONCRETE OF ALL LAITANCE AND ALL LOOSE MATERIAL. ROUGHEN PER S042/TYP.
7. CONCRETE BLOCK MASONRY SHALL BE BUILT TO PRESERVE THE UNOBSTRUCTED CONTINUITY OF THE VERTICAL CELLS, WALLS AND CROSS WEBS FORMING SUCH CELLS SHALL BE FULLY BEDDED IN MORTAR. ALL HEAD OR END JOINTS SHALL BE SOLIDLY FILLED WITH MORTAR FOR A DISTANCE IN FRONT OF THE WALL OR UNITS NOT LESS THAN THE THICKNESS OF THE LONGITUDINAL FACE SHELLS.
8. VERTICAL CELLS SHALL HAVE VERTICAL ALIGNMENT SUFFICIENT TO MAINTAIN A CLEAR UNOBSTRUCTED CONTINUOUS VERTICAL CELL MEASURING NOT LESS THAN 3" X 3".
9. VERTICAL REINFORCING SHALL BE HELD IN POSITION AT TOP AND BOTTOM AND AT INTERVALS NOT EXCEEDING 192 BAR DIAMETERS.
10. WHEN GROUTING STOPPED FOR ONE HOUR OR LONGER, HORIZONTAL CONSTRUCTION JOINTS SHALL BE FORMED STOPPING THE POUR 1-1/2 INCHES BELOW THE TOP OF THE UPPERMOST UNIT. HORIZONTAL CONSTRUCTION JOINTS ARE NOT ALLOWED IN UNITS CONTAINING REINFORCING.
11. PLACE ALL HORIZONTAL BARS IN BOND BEAM UNITS. WHEN 2 BARS ARE USED, STAGER LAPS 6'-0" MIN.
12. PROVIDE DOWEL TO FOUNDATION OF EQUAL DIAMETER AND 48 BAR DIAMETER LAP AT EACH VERTICAL BAR IN WALLS. DOWELS TO BE STRAIGHT AND PLUMED UNLESS OTHERWISE NOTED. LAP ALL OTHER BARS 72 BAR DIAMETER.
13. ALL WALLS SHALL HAVE ALL CELLS FILLED WITH GROUT.
14. ALL CONCRETE BLOCK UNITS SHALL BE OPEN END BOND BEAM UNITS AND CONSTRUCTED IN RUNNING BOND UNLESS NOTED OTHERWISE.

S402 TYP — MASONRY NOTES

REV.	DATE	BY	DESCRIPTION

FILENAME:

DESIGNED KAG
DRAWN IG
CHECKED GPH
DATE MAY 2016

DISCIPLINE ENGINEER — REGISTERED PROFESSIONAL ENGINEER GREGORY P. HERWIT M28326 Exp. 6/30/17 MECHANICAL STATE OF CALIFORNIA

PROJECT ENGINEER — REGISTERED PROFESSIONAL ENGINEER KURT A. GARDNER 45712 Exp. 12/31/16 CIVIL STATE OF CALIFORNIA

HERWIT ENGINEERING

CITY OF MANTECA, CALIFORNIA — Manteca, the family city — INCORPORATED MAY 28 1918

CITY OF MANTECA

CITY OF MANTECA WASTEWATER QUALITY CONTROL FACILITY

DIGESTER IMPROVEMENTS PROJECT

TYPICAL

TYPICAL DETAILS

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 — 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 2015-109 T01
DRAWING NO. T-14
SHEET NO. 17 OF 219

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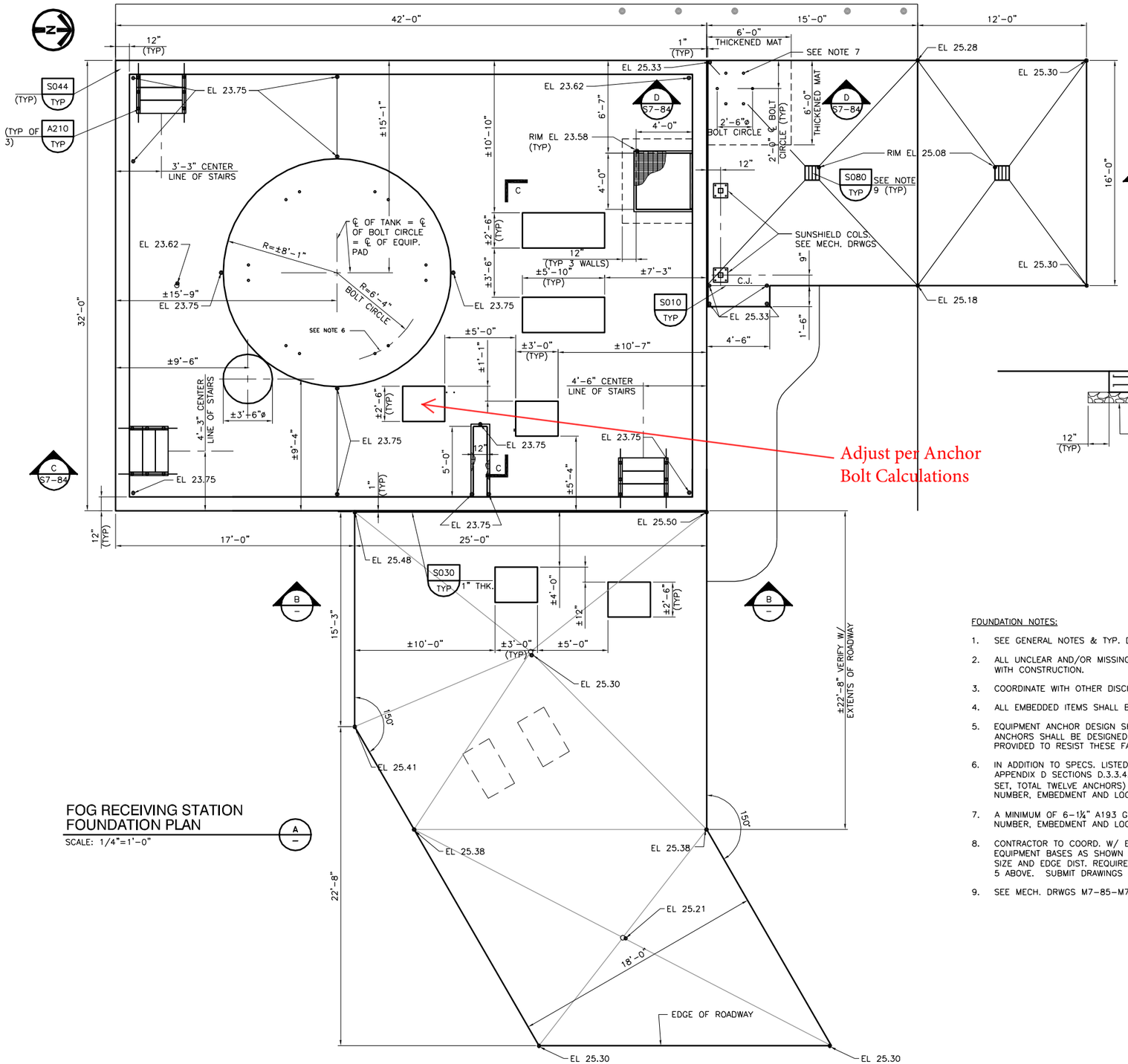
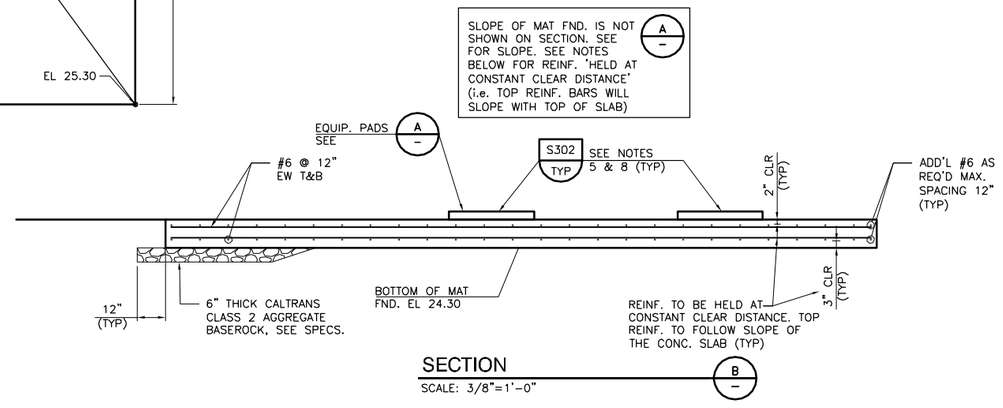


FOG RECEIVING STATION
FOUNDATION PLAN

SCALE: 1/4"=1'-0"



SECTION

SCALE: 3/8"=1'-0"

FOUNDATION NOTES:

1. SEE GENERAL NOTES & TYP. DETAILS.
2. ALL UNCLEAR AND/OR MISSING DETAILS SHALL BE BROUGHT TO THE ENGINEER'S ATTENTION BEFORE PROCEEDING WITH CONSTRUCTION.
3. COORDINATE WITH OTHER DISCIPLINES FOR ALL EMBEDDED ITEMS, CONDUITS, PIPES, ETC.
4. ALL EMBEDDED ITEMS SHALL BE SECURE AND IN PLACE PRIOR TO POURING OF CONCRETE.
5. EQUIPMENT ANCHOR DESIGN SHALL BE PER ACI 318 APPENDIX D, SEE SPECS. 01612 AND 01614 FOR ADD'N INFO. ANCHORS SHALL BE DESIGNED TO RESIST ALL CONCRETE BREAKOUT IN TENSION & SHEAR, REINF. HAS NOT BEEN PROVIDED TO RESIST THESE FAILURE MODES.
6. IN ADDITION TO SPECS. LISTED FOG-TNK-07-700 ANCHORAGE SHALL BE DESIGNED IN ACCORDANCE WITH ACI 318 APPENDIX D SECTIONS D.3.3.4.3 OPTION (a) AND D.3.3.5.3 OPTION (a). A MINIMUM OF 6 SETS (2 ANCHORS PER SET, TOTAL TWELVE ANCHORS) OF 1¼"ø F593 316 SST HEADED BOLTS SHALL BE PROVIDED AS SHOWN. ACTUAL NUMBER, EMBEDMENT AND LOCATION PER MANUFACTURER.
7. A MINIMUM OF 6-1¼" A193 GRADE B8M 316 SST HEADED BOLTS SHALL BE PROVIDED AS SHOWN. ACTUAL NUMBER, EMBEDMENT AND LOCATION PER MANUFACTURER.
8. CONTRACTOR TO COORD. W/ EQUIPMENT MFRS. SIZE, ELEVATIONS AND LOCATION OF EQUIPMENT BASES (TYP U.N.O.), EQUIPMENT BASES AS SHOWN ARE MINIMUM SIZES. SIZE OF EQUIPMENT BASES TO TAKE INTO ACCOUNT MINIMUM SIZE AND EDGE DIST. REQUIREMENTS FOR EQUIP. ANCHORAGE DESIGN (WHICHEVER IS GREATER GOVERNS), SEE NOTE 5 ABOVE. SUBMIT DRAWINGS AND CALCULATIONS FOR REVIEW PRIOR TO POURING EQUIPMENT BASES.
9. SEE MECH. DRWGS M7-85-M7-86 FOR SIZE & LOCATION OF ALL PIPE PENETRATIONS.

REV.	DATE	BY	DESCRIPTION

FILENAME:

DESIGNED SDS
DRAWN SDS
CHECKED SDS
DATE MAY 2016

DISCIPLINE ENGINEER: REGISTERED PROFESSIONAL ENGINEER, DEWON DAVID POLL, NO. 4431, Exp. 6-30-16, STRUCTURAL, STATE OF CALIFORNIA

PROJECT ENGINEER: REGISTERED PROFESSIONAL ENGINEER, KURT A. GALLAGHER, No. 53712, 12/31/16, CIVIL, STATE OF CALIFORNIA

HERWIT ENGINEERING

CITY OF MANTECA

CITY OF MANTECA WASTEWATER QUALITY CONTROL FACILITY

DIGESTER IMPROVEMENTS PROJECT

STRUCTURAL

FOG AND FOOD RECEIVING STATIONS FOUNDATION PLAN AND SECTION

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 2015-109 T01
DRAWING NO. S7-83
SHEET NO. 91 OF 219

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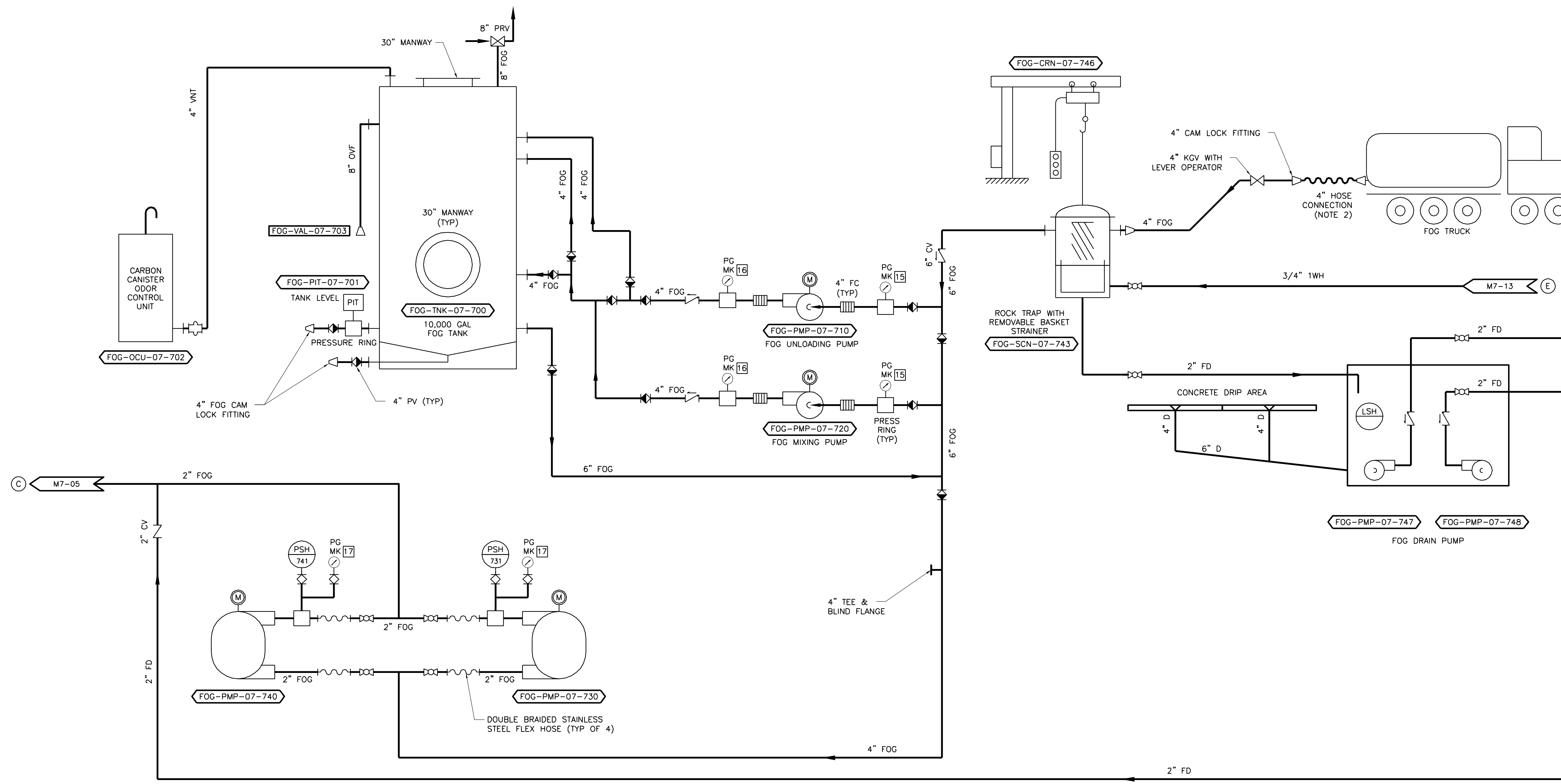

NOTES:

1. HEAT TRACE AND INSULATE ALL PIPING AND FOG TANK PER SPECIFICATIONS.
2. HOSE NOT BY CONTRACTOR.

REV.	DATE	BY	DESCRIPTION

FILENAME:

DESIGNED KAG
DRAWN IG
CHECKED GPH
DATE MAY 2016

DISCIPLINE ENGINEER
PROJECT ENGINEER

HERWIT ENGINEERING

CITY OF MANTECA

CITY OF MANTECA WASTEWATER QUALITY CONTROL FACILITY

DIGESTER IMPROVEMENTS PROJECT

MECHANICAL
FOG RECEIVING SYSTEM SCHEMATIC

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 2015-109 T01
DRAWING NO. M7-12
SHEET NO. 106 OF 219

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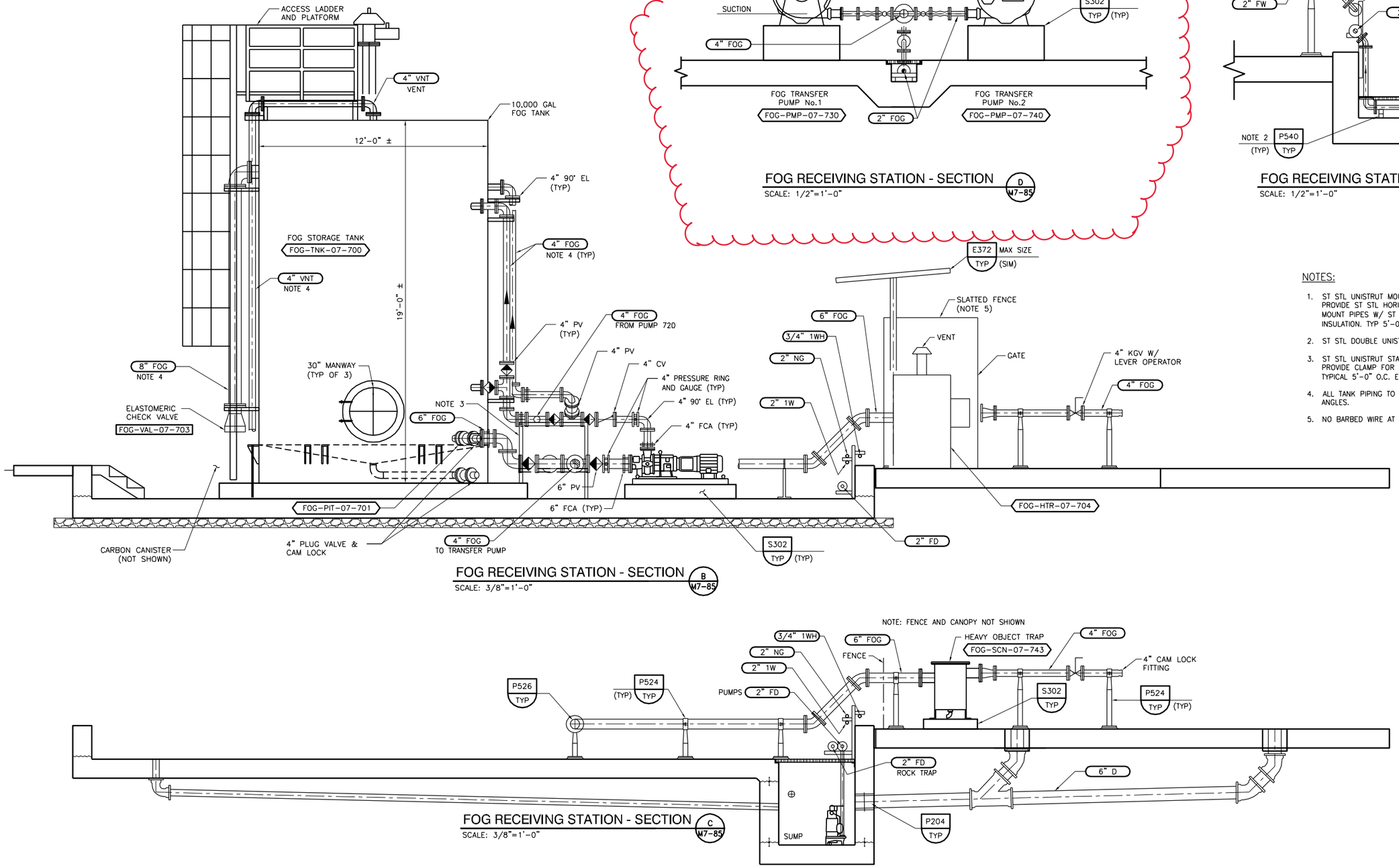
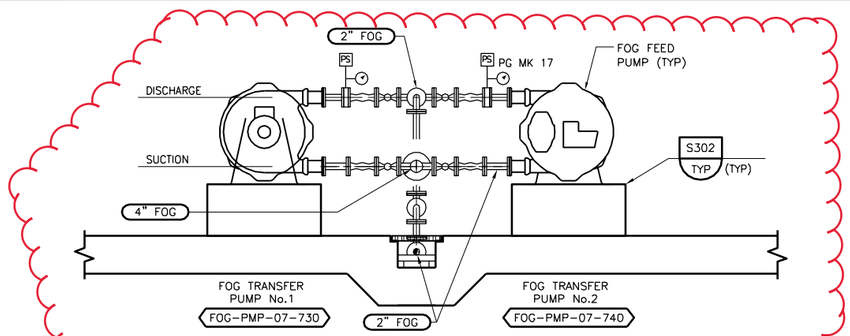


FOG RECEIVING STATION - SECTION (B / M7-85)
SCALE: 3/8"=1'-0"



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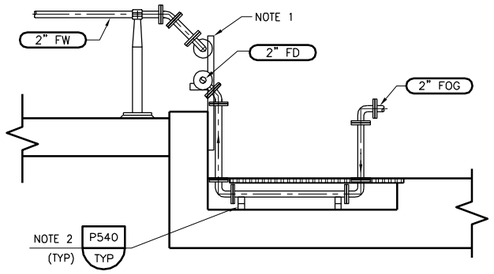

FOG RECEIVING STATION - SECTION (E / M7-85)
SCALE: 1/2"=1'-0"

FOG RECEIVING STATION - SECTION (C / M7-85)
SCALE: 3/8"=1'-0"

NOTES:

1. ST STL UNISTRUT MOUNT TO WALL AND EXTEND ABOVE WALL 24". PROVIDE ST STL HORIZONTAL UNISTRUT FOR PIPES AS REQUIRED. MOUNT PIPES W/ ST STL CLAMPS. PROVIDE CRUSH PROTECTION FOR INSULATION. TYP 5'-0" O.C.
2. ST STL DOUBLE UNISTRUTS.
3. ST STL UNISTRUT STAND SIMILAR TO P512/TYP EXCEPT FREE STANDING. PROVIDE CLAMP FOR PIPES. PROVIDE PROTECTION FOR INSULATION. TYPICAL 5'-0" O.C. ENSURE ACCESS TO ALL VALVES.
4. ALL TANK PIPING TO BE SUPPORTED FROM TANK WITH WELDED ST STL ANGLES.
5. NO BARBED WIRE AT FOUR SIDES OF ENCLOSURE OF HEATER UNITS.

REV.	DATE	BY	DESCRIPTION

FILENAME:

DESIGNED KAG
DRAWN IG
CHECKED GPH
DATE MAY 2016

DISCIPLINE ENGINEER — REGISTERED PROFESSIONAL ENGINEER — GREGORY P. HARRIS — M28326 6/30/17 — MECHANICAL — STATE OF CALIFORNIA

PROJECT ENGINEER — REGISTERED PROFESSIONAL ENGINEER — ALBERT A. GALLETTI — C45712 12/31/16 — CIVIL — STATE OF CALIFORNIA

HERWIT ENGINEERING

CITY OF MANTECA, CALIFORNIA — Manteca — the family city — INCORPORATED MAY 28, 1918

CITY OF MANTECA

CITY OF MANTECA WASTEWATER QUALITY CONTROL FACILITY
DIGESTER IMPROVEMENTS PROJECT
MECHANICAL
FOG RECEIVING STATION SECTIONS

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 — 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 2015-109 T01
DRAWING NO. M7-86
SHEET NO. 144 OF 219

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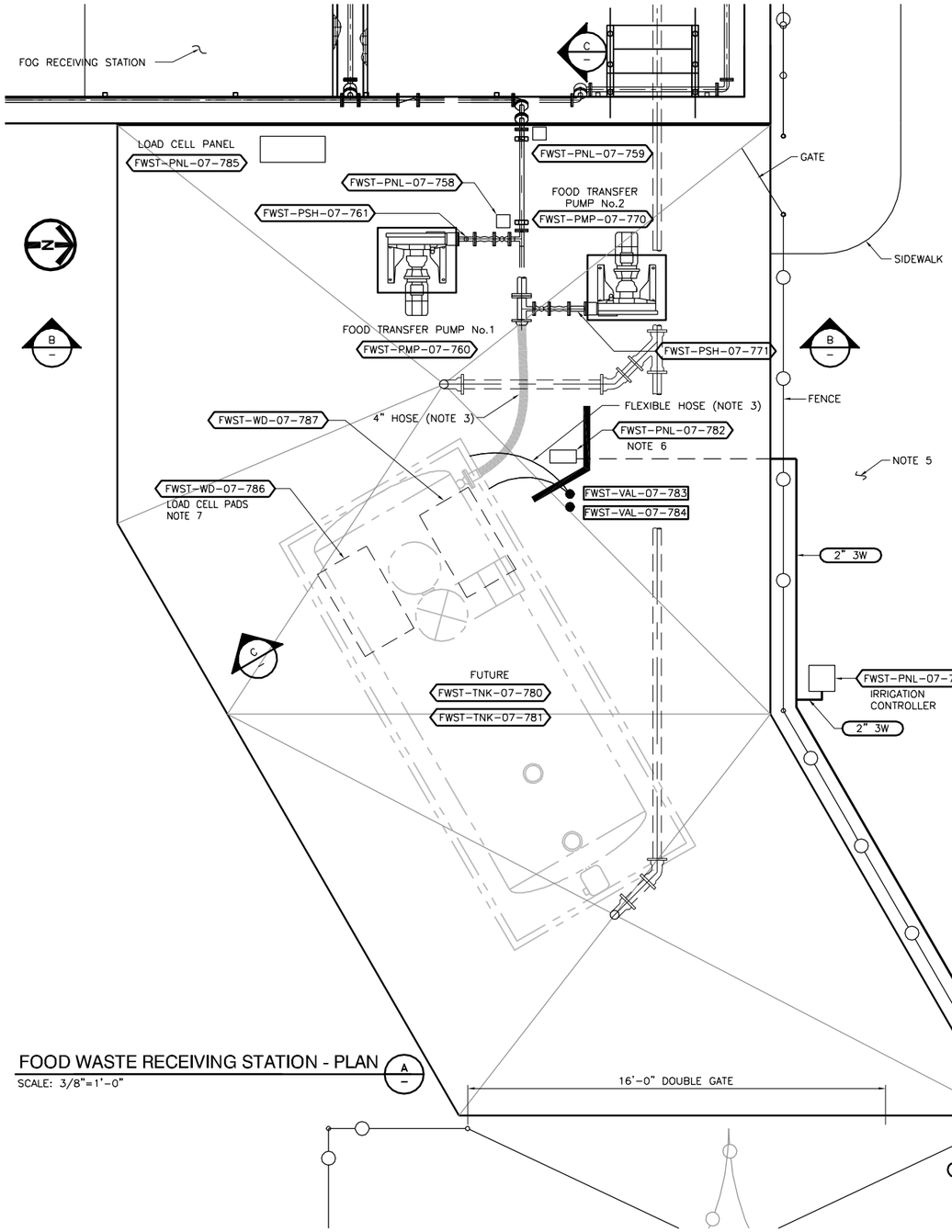
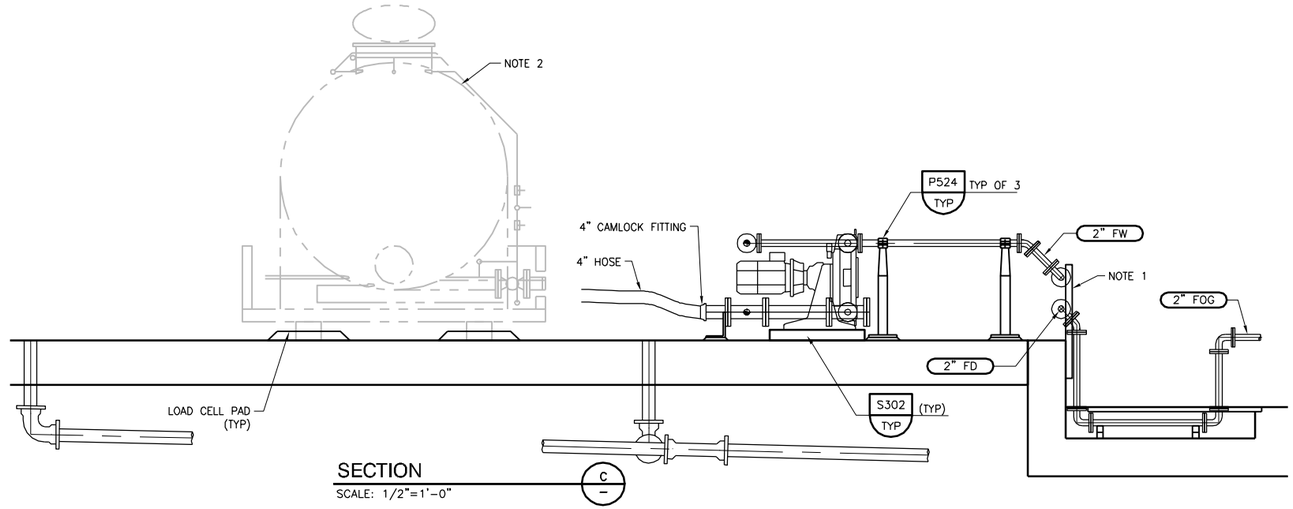


FOOD WASTE RECEIVING STATION - PLAN (A)
SCALE: 3/8"=1'-0"



SECTION (C)
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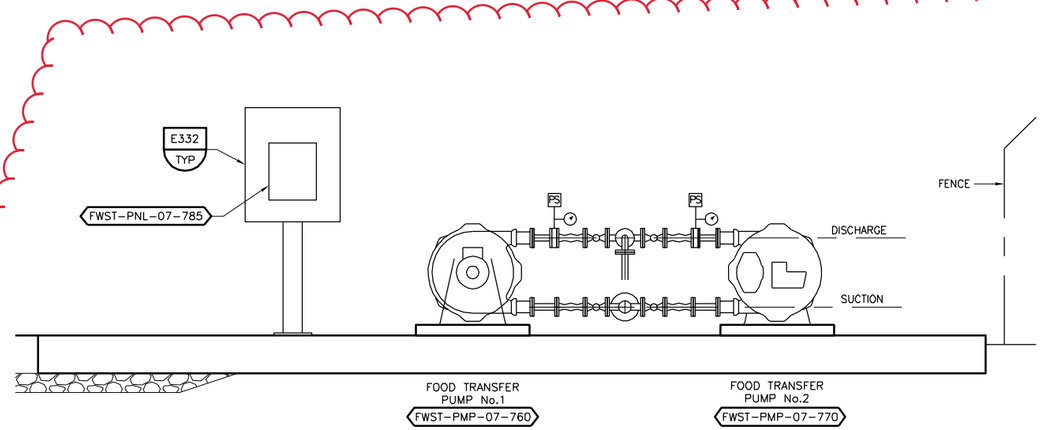

SECTION (B)
SCALE: 1/2"=1'-0"

NOTES:

1. SEE E/M786 FOR SUPPORT DETAILS.
2. FUTURE TANKER NOT BY CONTRACTOR.
3. HOSE NOT BY CONTRACTOR.
4. 316 ST STL BENT PLATE BOLT TO PIPE FLANGE SIMILAR TO P5226/TYP AND ANCHOR TO CONCRETE, LEVEL WITH NON-SHRINK GROUT TYP OF 3.
5. SEE LANDSCAPE PLAN.
6. BRING UP AND CONNECT SOLONOID VALVES AND HOSE CONNECTION PER SCHEMATIC.
7. COORDINATE WITH OWNER FOR FINAL LOCATION.

REV.	DATE	BY	DESCRIPTION

FILENAME:

DESIGNED KAG
DRAWN IG
CHECKED GPH
DATE MAY 2016

DISCIPLINE ENGINEER: REGISTERED PROFESSIONAL ENGINEER GREGORY P. HERWIT No. M28326 6/30/17 MECHANICAL STATE OF CALIFORNIA

PROJECT ENGINEER: REGISTERED PROFESSIONAL ENGINEER KURT A. GALLER No. 75712 12/31/16 CIVIL STATE OF CALIFORNIA

HERWIT ENGINEERING

CITY OF MANTECA

CITY OF MANTECA WASTEWATER QUALITY CONTROL FACILITY
DIGESTER IMPROVEMENTS PROJECT
MECHANICAL
FOOD WASTE RECEIVING STATION PLAN AND SECTIONS

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
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IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 2015-109 T01
DRAWING NO. M7-87
SHEET NO. 145 OF 219

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WATSON MARLOW
Fluid Technology Group

Part 2: Bredel 50 Peristaltic Pump Specification and Performance

Bredel 50 hose pumps

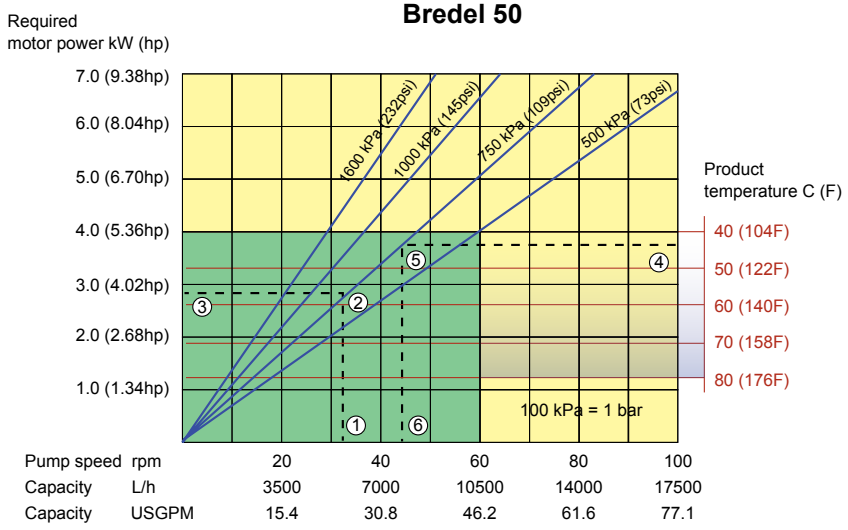
Bredel SERIES

Bredel Hose Pumps

FEATURES AND BENEFITS

- **Sealless, valveless pumping principle for reliable, low maintenance metering, dosing and transfer**
- **Flow rates up to 17,500 L/hr (77.1 USGPM) and pressures up to 16bar (232 psi)**
- **Dry running and self-priming, with up to 9.5 meters (30 foot) suction lift capability**
- **Robust design for aggressive chemicals or abrasives**
- **Compact direct coupled design to maximise gearbox life**
- **Simple hose change decreases cost of ownership, downtime and need for parts inventory**

PERFORMANCE



Continuous Duty

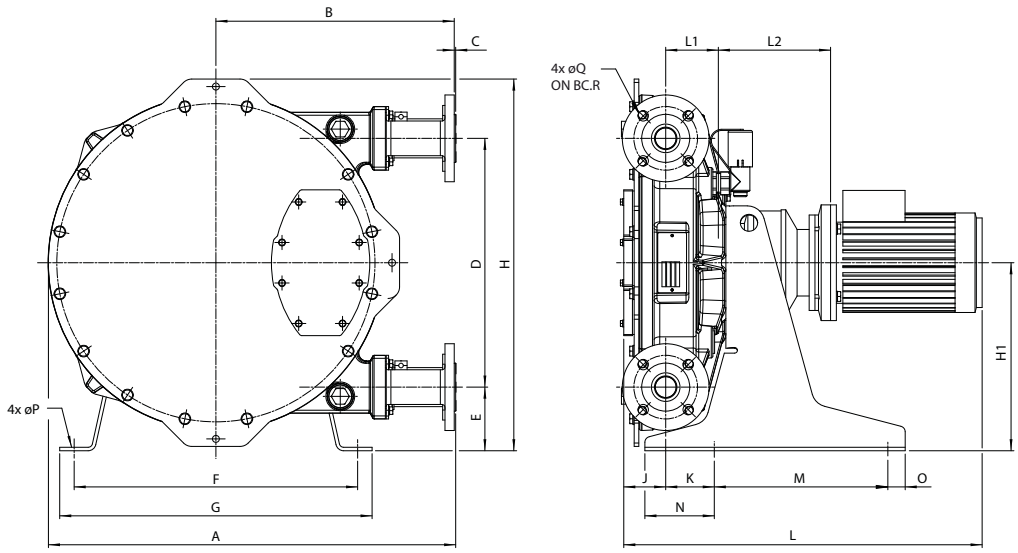
Intermittent Duty*

* Maximum 2 hours operation followed by minimum 1 hour stop

1. Flow required indicates pump speed
2. Calculated discharge pressure
3. Net motor power required
4. Product temperature
5. Calculated discharge pressure
6. Maximum recommended pump speed

Note: The area of continuous operation diminishes with increased product temperatures.
For product temperatures >40C (104F), the area of continuous operation is limited by the corresponding red temperature line.

DIMENSIONS



Connector sizes	ANSI 150#	EN DIN	JIS
Bredel 50	2”	50mm	50mm

Type	A	B	C	D	E	F	G	H	H1	J	K	Lmax	L1	L2max	M	N	O	ØP	ØQ	R
Bredel 50 (mm)	838	475	3	554	143	620	680	811	420	84	95	975	112	339	380	155	40	18	18	125
Bredel 50 (inches)	32.9	18.7	0.12	21.8	5.6	24.4	26.8	31.9	16.5	3.3	3.7	38.4	4.4	13.3	15	6.1	1.6	0.71	0.71	4.9

TECHNICAL SPECIFICATIONS

	Bredel 50
Flow range	up to 17,500 L/hr (4,623 USGPM)
Capacity	2.92 L/rev (0.77 G/rev)
Minimum starting torque	620Nm (5,487 inch-lbs)
Hose lubricant required	10 litres (2.64 USG)
Pumphead weight	227kg (500lbs)
Common features	
Max inlet pressure	2.5 bar abs (38 psia)
Suction pressure	0.05bar abs (0.73 psia)
Maximum discharge pressure	1,600 kPa (16 bar) (232psi)
Product temperature range*	-10C up to 80C (14F up to 176F)
Ambient temperature range**	-20C up to 45C (-4F up to 113F)

*Please consult your Bredel representative for lower or higher temperature operation.
**Allowable ambient temperature is based on pump capabilities and may be further limited by gearbox ambient capabilities

MATERIALS OF CONSTRUCTION

Components	Materials
Pump housing	Cast iron
Rotor	Cast iron
Pressing shoes	epoxy
Cover	Mild steel
Brackets	AISI 316
Flanges	AISI 316
Inserts	AISI 316
Support frame	AISI 316
Hose clamps	AISI 316
Shaft	Alloy steel
Seals	Neoprene or nitrile

Options	Features
Available hose materials	EPDM
Available flanges	ANSI
Available inserts	Bredel standard
High level float switch	Max. 2A, 230 V AC/DC, max. 40VA ATEX: max. 50 mA, max. 28V AC/DC
Revolution counter	For maintenance intervals and /or metering

Cover lifting device	For one-man pump maintenance

Bredel Hose Pumps
wmpg.com
+44 (0)1326 370 370
info@wmpg.com

PUMP POSITIONING

Situate the pump on a flat horizontal surface where there is free air to circulate around it. Secure the pump base to the mounting grout support base via anchor bolts mounted through the frame mounting holes as shown in the Drawings. The peristaltic pumphead may be rotated on its frame to accommodate four (4) different port positions:

Position 2: Ports facing right when facing the pump

Pumps supplied under contract will be factory mounted as requested and approved by the customer and as shown in the Drawings. If required once on site, most pumpheads can be rotated from the shipped configuration to another to accommodate different piping layouts than were expected prior to shipment. Consult Watson-Marlow/Bredel for instruction prior to changing pump configuration.

For normal hose changing maintenance, the pump hose must be inserted and removed through the pump ports. Care should be taken to insure maintenance personnel have sufficient working area to access and feed the pump hose through these ports. Although the hose is flexible, sufficient distance from walls or other rigid structures should be allowed to facilitate proper maintenance operation. The pump hose lengths are shown below:

Pump	Hose Length
Bredel 50	71.6”

In the event the pumphead, gearbox, or motor must be removed or accessed for service, sufficient space should be allowed to remove the units and for personnel and lifting equipment. Please see shop drawings or O&M’s for component sizes and weight.

ELECTRICAL CONNECTION

Pump motor and ancillary control equipment should be wired in accordance with the wiring schematics found with the appropriate vendor supplied information. A registered Electrician following all Industry Safety Standards and Local Electrical Codes should connect all electrical wiring. All power must be OFF and LOCKED OUT during installation. Ensure that the voltage and frequency of the electrical supply corresponds with the data on the motor nameplate. Pumps driven by fixed speed motors should be wired to an appropriate motor starter. Pumps powered by inverter driven motors should be wired to an appropriate VFD. Pumps supplied with either fixed speed or variable speed control panels or auxiliary control panels should be wired in accordance with the manufacturer's instruction. If supplied and listed as provided accessories, items such as discharge pressure switches, hose failure sensors, low lubricant sensors, motor thermal protectors should be wired to the pump controllers as recommended by the controller and accessory manufacturers to provide proper motor shutoff, alarms, or indicators as required by the installation.

DIRECTION OF OPERATION

SPX Series pumps are reversible and may be operated in either direction depending on motor wiring or the use of a reversing controller. Clockwise or counterclockwise operation will not affect pump performance. Either direction may be used to best suit the installation's piping layout.

SUCTION AND DISCHARGE CONNECTION AND PULSATION DAMPENING DEVICES

Pump suction and discharge lines should be of equal or greater inside diameter than the pump ports and sized to hold frictional losses to a minimum. If larger ID process piping is used, pipe size transitions to and from the pump should be made as cleanly and smoothly as possible to prevent product holdup and bridging. To minimize hammer, impulse, and frictional losses, suction and discharge lines should be as short as possible. Pipework to and from the pump should be straight, with a minimum length equal to the length of the corresponding hose prior to redirection. If piping redirection is required immediately at the pump, the use of flexible reinforced line, in lieu of rigid elbows and piping, is highly recommended. For overall piping layout, minimize the number of elbows, and use long sweeping elbows where redirection is required.

Watson-Marlow/Bredel recommends the installation of a pump isolation valve on both the suction and discharge lines of the pump. In the event process lines cannot be drained prior to hose changing maintenance, the isolation of the pump from the process lines will minimize product spillage and cleanup. If the main piping run to the pump is a rigid pipe work, there should be a drop out section or flexible pipe work to allow the pump hose to be installed and removed during maintenance.

Although required in conjunction with other pumping technologies, check valves are not required nor recommended for use with peristaltic hose pumps. Check valves operate in opposition to the occlusion and restitution of the pump hose and will both shorten hose life and create higher degrees of pulsation. All pump ancillary items should be utilized in accordance with the manufacturer’s recommendations.

INLET PULSATION ACCUMULATORS – IPA (NOT SUPPLIED UNDER THIS CONTRACT)

IPA's should be located as close to the pump inlet as possible and after any other in line equipment except pressure sensing equipment – with a maximum 3 foot piping distance from the pump inlet. Watson-Marlow/Bredel pumps are commonly utilized with two styles of IPA's:

- Bredel IPA: Manufactured by Watson-Marlow/Bredel, these IPA's are supplied with a flanged tee connection for direct flanged in-line mounting and are sized to mount directly to the pump suction flange. IPA's must be mounted vertically with a maximum angle of 45° from vertical. See IPA dimensional data for model and flange sizes. Bredel IPA's do not require an air source for operation.
- Blacoh IPA (also called suction accumulator): Blacoh style IPA's are supplied with a flanged or threaded inlet port and must be mounted as an appendage to the suction line through a pipe tee. Pipe tee is not supplied with the IPA. IPA's must be mounted vertically with a maximum angle of 45° from vertical. See IPA dimensional data for model and flange sizes. Blacoh style IPA's are fitted with an air charge valve. An air charge from a customer-supplied compressor may be required based on the process conditions. See Blacoh O&M data for details.

DISCHARGE PULSATION DAMPENERS - DPD (NOT SUPPLIED UNDER THIS CONTRACT)

DPD's should be located as close to the pump discharge and before any other in line equipment – with a maximum 3 foot piping distance from the pump discharge. Watson-Marlow/Bredel pumps are commonly utilized with two styles of DPD's.

- Bredel DPD: Manufactured by Watson-Marlow/Bredel, these DPD's are supplied for direct in line mounting, with a flanged inlet and outlet. Acting as a pulse-absorbing segment of piping, these dampeners may be mounted either vertically or horizontally. Bredel DPD's are recommended only for constant pressure applications with pressures in excess of 30 psi. The dampener must be charged with air to 95% of the process discharge pressure. See DPD data for models, dimensions, weight, and flange sizes. Care should be taken that these devices are properly supported upon installation such that their weight does not impact process piping with unnecessary vertical or horizontal force.
- Blacoh DPD: Blacoh style DPD's are supplied with a flanged or threaded inlet port and must be mounted as an appendage to the discharge line through a pipe tee. Pipe tee is not supplied with the DPD. DPD's must be mounted vertically with a maximum angle of 45° from vertical. See DPD dimensional data for model and flange sizes. Blacoh style DPD's are fitted with an air charge valve. An air charge from a customer-supplied compressor may be required based on the process conditions. See Blacoh O&M data for details.

SUCTION GAUGES AND PRESSURE SENSORS (NOT SUPPLIED UNDER THIS CONTRACT)

If selected to be installed, for maximum stability of pressure reading, suction gauges should be mounted between the inlet pulsation accumulator and the pump suction port, if an inlet pulsation accumulator is supplied.

DISCHARGE GAUGES AND PRESSURE SENSORS (NOT SUPPLIED UNDER THIS CONTRACT)

If selected to be installed, for maximum stability of pressure reading, discharge gauges should be mounted after the discharge pulsation dampener if a discharge pulsation dampener is supplied.

OUTLINED RECOMMENDED OPERATION INSTRUCTIONS

PRE-OPERATION CHECK

1. Confirm that pump hose material is chemically compatible with the product being pumped and inspect the hose for any damage that may have occurred through improper handling.
2. Shim pump shoes for the application based on speed, pressure, and temperature in accordance with the shimming table. If process conditions differ from original specifications, pump shims should be readjusted accordingly.
3. Load pump hose in accordance with the hose loading procedures. Fill the pumphead with the proper volume and type of lubricant. Only Watson-Marlow/Bredel lubricant must be used as it is specially formulated for compatibility with the hose and proper cooling. Alternate lubricants must NOT be used.
4. Inspect all pipe and clamp connections for tightness and inspect all valves for proper operational open position.
5. Gearboxes are shipped filled; however, upon service maintenance, check to insure proper filling of lubricating oil.
6. Prepare optional and ancillary equipment for startup in accordance with the vendor's recommendations.

OPERATION

1. Product temperature should not exceed 175° F and should be maintained below the maximum recommended temperature for the rated speed as shown on the performance curves.
2. Pumping pressure should not exceed the maximum torque capability of the drive as shown on the pump performance curves.
3. Pump casing temperature may be elevated during the first 48 hrs of operation with a newly installed hose and will lower itself after hose break in. As the hose is black with a machined outside diameter, it is normal for the pump lubricant to darken during operation.
4. The pump is self-priming and capable of running dry without damage. The pump may be used to evacuate the lines of product by isolating the pump from the source fluid and running the pump. With the pump running, lines may be flushed with water or a chemically compatible cleaning fluid.
5. In the event of a hose failure, pumphead should be stopped immediately and the hose removed. The pumphead should be thoroughly flushed with water to remove any contaminants. Housing may be flushed without removing cover, but care must be taken to remove all foreign matter. Running the pump with a failed hose may result in gearmotor failure and pumphead damage. Contaminated lubricant should NOT be reused and should be disposed of appropriately.
6. Hose loading and unloading should be done in accordance with the listed procedures.

STORAGE

Spare hoses should be stored in a cool area (ideally about 50F, 60% relative humidity). These items should be isolated from direct sunlight and the elements to prevent deterioration of the rubber. The pumphead cover should remain closed.

If the pump has been put into service but is expected to remain idle for a period of longer than one (1) continuous month as a result of process shutdown, etc., proper procedures should be performed to prevent a "compression set" in the hose. On an SPX pump, this can be done in one of three ways:

1. Ideally, the pump should be operated periodically to allow repositioning of the shoe on the hose. This should be done for approximately five minutes on a weekly basis. As the pump has the capability of running dry, it need not be connected to process lines to perform this procedure.
2. If periodic operation cannot be performed, drain the pump lubricant and remove one compressing shoe and shims. Replace the window and power the pump such that the other shoe is positioned in front of the window. Leave the pump in this position until next startup. With this positioning, the hose is not compressed. When ready for re-start, re-install the removed shoe/shims and replace the lubricant and window.
3. As a third option the pump hose may be removed and stored to insure the hose does not take a "compression set" in the event procedure 1 or 2 is not adopted.

Spare hose lubricant should be stored in a suitable environment (see MSDS) and has a shelf life of 5 years.

SHUT DOWN & EMERGENCY INSTRUCTIONS

Post-Shutdown Procedure

1. In the event the pump is shut down for service, isolate pump from process lines by closing suction and discharge valves. Isolate the pump from power mains. Bleed process fluid that is retained in the now isolated loop between these valves. Dispose of waste fluid properly.
2. When long-term shutdown is expected, as with a spare unit, it is recommended that the lubricant is drained and hose is removed.

Emergency Shutdown

1. In the event of an emergency, mains power should be immediately isolated from the pump.
2. Pump should be isolated from the process fluid by closing suction and discharge valves.

Hose Failure Shutdown

1. High liquid level sensor will automatically shut down the pump in the event of a hose failure if so wired.
2. Determine if the pump has stopped due to hose failure by verifying a flooded pumphead chamber through the cover viewport.
3. Drain pumphead chamber fluid and dispose of properly. Do not reuse contaminated lubricant. Be sure to isolate pump from mains power before draining pumphead.
4. Open pumphead cover to remove and replace ruptured hose being sure to wipe away ant residual fluid or debris.

TROUBLESHOOTING

Pump does not start

- Insure mains power to panel and pump is connected.
- Check panel for fault indication and check appropriate failure sensor.

Pump capacity does not meet expected calibration

- Insure rotor speed corresponds with gearbox nameplate.
- Insure suction and discharge lines are open and unobstructed. (i.e. valves, bypasses, etc. are properly positioned for normal operation).
- Insure peristaltic hose is properly loaded and occlusion is properly adjusted.
- Insure that the hose is new or within its projected operational lifetime.
- If pulsation dampeners are being used, insure they are properly charged and functional.

Discharge line shows excessive pulsation

- Insure discharge dampener air is charged to 5 psi below discharge line pressure.
- Insure discharge line is unobstructed such that line pressure corresponds with expected operational pressure.
- Check suction & discharge line for blockage.
- Insure any in line check valves are removed from the discharge line of the pump.

Pumphead lubricant leaks from pumphead chamber

- Insure pumphead cover seal is intact and cover is tightly secure.
- Insure hose was loaded with the cover on. As the cover is a structural member of the pump, loading a hose with the cover off will prevent proper sealing.
- Insure drain plug and fill port are secure.
- Insure connection at suction and discharge rubber bushings are tight.
- Insure flange connections are tightly secured.
- Insure level sensor housings are secure.

PROBLEMS ASSOCIATED WITH IMPROPER HOSE LOADING

IMPROPER PROCEDURE	RESULT
Hose loaded with cover off. Cover installed after hose loaded.	High pump temperature, leaking pump chamber, reduced hose life, bearing failure
Fittings not tightened in accordance with the torque tables	Pump leakage, premature hose failure

PROBLEMS ASSOCIATED WITH IMPROPER SHIMMING

IMPROPER OCCLUSION	RESULT
Overoccluded	Gap between shoes and track is reduced and causes overocclusion of hose - resulting in premature hose wear.
Underoccluded	Gap between shoes and track is greater than that recommended for the process parameters. Achievable pressure and flow rate is reduced. Due to slip (backflow), hose is damaged by fluid erosion thereby shortening expected hose life

HOSEPUMP PREVENTATIVE MAINTENANCE SCHEDULE

PUMP HEAD

PROCEDURE	TRADE	SKILL LEVEL	TIME REQUIRED	FREQUENCY	POWER LOCKOUT
Remove/replace hose, change lubricant	Mechanical	Apprentice (2)	Per A Below	Speed & duty dependent	Required (procedure dependent)
Shoe inspection/ replacement	Mechanical	Apprentice (2)	Per B Below	Visually inspect with each hose change/ replace as needed	Required

Typical Minimum Hose Replacement Time
A Bredel 50: 1.5 Hr

Typical Minimum Shoe Replacement Time
B Bredel 50: 1 Hr

Notes:

1. Frequency of hose change is dependent upon typical operational speed, typical discharge & suction pressures, fluids, and temperature. Watson-Marlow/Bredel recommends that the operator log the running hours of the pump and achieved life of the first hose and place all subsequent hoses on a PM schedule based on 100 hrs less than that duration.
2. In the event of hose failure where fluid has contaminated the pump chamber, the pump should be flushed prior to installation of a new hose. Shoes should be inspected for surface roughness or damage and replaced if necessary. Shoes need not be replaced unless damaged.

GEARBOX LUBRICATION (synthetic oil filled gearboxes only)

PROCEDURE	TRADE	SKILL LEVEL	TIME REQUIRED	FREQUENCY	POWER LOCKOUT
Drain and replace oil	Mechanical	Journeyman	2 hr	after 20,000 operating hours	Required

Motor Lubrication

Service Condition	NEMA Frame Size: 140-180, 1800 rpm
Standard	3 years
Severe	1 year
Seasonal	Lubricate at the beginning of the season. Then follow service schedule.
Amount	1 to 2 pumps

Seasonal Service: The motor remains idle for a period of six months or more.
Standard Service: Eight hours of operation per day, indoors, 100°F maximum ambient.
Severe Service: Continuous operation under high ambient temperatures (100°F to 150°F) and/or any of the following: dirty, moist locations, high vibration (above NEMA standards), heavy shock loading, or where shaft extension end is hot.

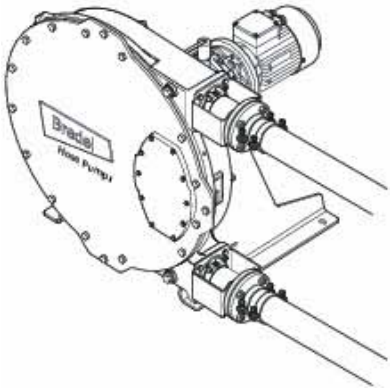
Gearbox Replacement

Procedure	Trade	Skill Level	Time Required	Power Lockout
Gearbox Replacement	Mechanical Electrical	Apprentice (2) Apprentice (1)	2 Hour	Required

Motor Replacement

Procedure	Trade	Skill Level	Time Required	Power Lockout
Motor Replacement	Mechanical Electrical	Apprentice (2) Apprentice (1)	1 Hour	Required

Hose pump series
Bredel 50
Manual



CONTENTS

1 GENERAL
1.1 How to use this manual 8
1.2 Original instructions 8
1.3 Other supplied documentation 8
1.4 Service and support 8
1.5 Environment and disposal of waste 9

2 SAFETY
2.1 Symbols 10
2.2 Intended use 10
2.3 Use in potentially explosive atmospheres 11
2.4 Responsibility 11
2.5 Qualification of the user 12
2.6 Regulations and instructions 12

3 WARRANTIES

4 DESCRIPTION
4.1 Identification of the product 14
4.1.1 Identification of the product 14
4.1.2 Identification of the pump 14
4.1.3 Identification of the gearbox 14
4.1.4 Identification of the electric motor 15
4.1.5 Identification of the pump hose 15
4.2 Construction of the pump 16
4.3 Operation of the pump 16
4.4 Pump hose 18
4.4.1 General 18
4.4.2 Hose compression force adjustment (shimming) 20
4.4.3 Lubrication and cooling 20
4.5 Gearbox 20
4.6 Electric motor 21
4.7 Available options 21

5 INSTALLATION
5.1 Unpacking 22
5.2 Inspection 22
5.3 Installation conditions 22

5.3.1 Ambient conditions 22
5.3.2 Set-up 22
5.3.3 Pipe work 23
5.4 Lifting and moving the pump 25
5.5 Placing the pump 25

6 COMMISSIONING
6.1 Preparations 26
6.2 Commissioning 27

7 MAINTENANCE
7.1 General 28
7.2 Maintenance and periodic inspections 28
7.3 Cleaning the pump hose 30
7.4 Changing lubricant 30
7.5 Changing oil in gearbox 31
7.6 Replacing pump hose 32
7.6.1 Removing pump hose 32
7.6.2 Cleaning the pumphead 35
7.6.3 Fitting the pump hose 36
7.7 Exchanging replacement parts 39
7.7.1 General 39
7.7.2 Replacing pressing shoes 39
7.7.3 Replacing seal and wear ring 41
7.7.4 Replacing bearings 44
7.8 Adjusting hose compression force (shimming) 45
7.9 Fitting options 48
7.9.1 Fitting a high-level float switch 48
7.9.2 Fitting a low level float switch 50
7.9.3 Fitting revolution counter 51

8 STORAGE
8.1 Hose pump 54
8.2 Pump hose 54

9 TROUBLESHOOTING

10 SPECIFICATIONS
10.1 Pump head 60
10.1.1 Performance 60

10.1.2 Materials 61
10.1.3 Surface treatment 62
10.1.4 Lubricant table pump 62
10.1.5 Weights 63
10.1.6 Torque figures 64
10.1.7 Shims specifications 65
10.2 Lubricant table gearbox 67
10.3 Electric motor 68
10.4 Parts list 68
10.4.1 Overview 68
10.4.2 Cover assembly 69
10.4.3 Rotor assembly 70
10.4.4 Pump housing assembly 71
10.4.5 Support assembly 73
10.4.6 Flange assembly 74
10.4.7 Revolution counter assembly 75
10.4.8 Lubricants 76

1 GENERAL

1.1 How to use this manual

This manual is intended as a reference book by means of which qualified users are able to install, commission and maintain the hose pumps mentioned on the front cover.

1.2 Original instructions

The original instructions for this manual have been written in English. Other language versions of this manual are a translation of the original instructions.

1.3 Other supplied documentation

Documentation of components such as electric motors, gearboxes, etc. is normally not included in this manual. But if additional documentation is supplied, you must follow the instructions in this additional documentation.

1.4 Service and support

For information with respect to specific adjustments, installation, maintenance or repair jobs which fall beyond the scope of this manual, contact your Bredel representative. Make sure you have the following data at hand:

- Serial number hose pump
- Article number pump hose
- Article number gearbox
- Article number electric motor
- Article number frequency controller

You will find these data on the identification plates or stickers of the pumphead, the pump hose, the gearbox and the electric motor. Refer to 4.1.1.

1.5 Environment and disposal of waste

	**CAUTION** Always observe the local rules and regulations with respect to processing (non reusable) parts of the hose pump.

Inquire within your local government about the possibilities for reuse or environment-friendly processing of packaging materials, (contaminated) lubricant and oil.

2 SAFETY

2.1 Symbols

In this manual the following symbols are used:

	**WARNING** Procedures which, if not carried out with the necessary care, may result in serious damage to the hose pump or in serious bodily harm.

	**CAUTION** Procedures which, if not carried out with the necessary care, may result in serious damage to the hose pump, the surrounding area or the environment.

	Remarks, suggestions and advice.

	**WARNING** Procedures, remarks, suggestions or advice which refer to use in potentially explosive atmospheres in accordance with the ATEX Directive 94/9/EC.

2.2 Intended use

The hose pump is exclusively designed for pumping suitable products. Every other or further use is not in conformance with the intended use.
The "Intended use" as laid down in EN 292-1 is "the use for which the technical product is intended in accordance with the specifications of the manufacturer, inclusive of his indications in the sales brochure". In case of doubt it is the use which appears to be its intended use judging from the construction, execution

and function of the product. Observing the instructions in the user's documentation also belongs to intended use.
Only use the pump in accordance with the intended use described above. The manufacturer cannot be held responsible for damage or harm resulting from misuse. If you want to change the application of your hose pump, contact your Bredel representative first.

2.3 Use in potentially explosive atmospheres

The *pump head* and *gearbox* mentioned in this manual are suitable for use in a potentially explosive atmosphere. Use in Potentially explosive atmospheres requires special configuration of the pump unit (See 4.7). The pumps mentioned meet the requirements as stated in the European Directive 94/9/EC (ATEX Directive).
The pumps belong to:

- Group II Appliances, category 2 G ck T4

2.4 Responsibility

The manufacturer does not accept any responsibility for damage or harm caused by not (strictly) observing the safety regulations and instructions in this manual and the also supplied documentation, or by negligence during installation, use, maintenance and repair of the hose pumps mentioned on the front cover. Depending on the specific working conditions or accessories used, additional safety instructions can be required.
Immediately contact your Bredel representative, if you noticed a potential danger while using your hose pump.

	**WARNING** The user of the hose pump is always fully responsible for observing the local valid safety regulations and directives. Observe these safety regulations and directives when using the hose pump.

2.5 Qualification of the user

The installation, use and maintenance of the hose pump should only be performed by well-trained and qualified users. Temporary staff and persons in training may use the hose pump only under the supervision and responsibility of trained and qualified users.

2.6 Regulations and instructions

- Everyone who works with the hose pump must be aware of the contents of this manual and observe the instructions with great care.
- Never change the order of the actions to be carried out.
- Always store the manual near the hose pump.

3 WARRANTIES

The manufacturer offers a two-year warranty on proper workmanship of all parts of the hose pump. Exclusion is made for normal wear and tear of consumables such as pump hoses, lubricant, hose clamps, pressing shoes, ball bearings, wear rings, seals and rubber bushes, or parts which have been misused or damaged through negligence.

This manufacturer's warranty is null and void for any user who has substituted the parts of an alternate manufacturer into a Watson-Marlow Bredel (hereafter called Bredel) hose pump.

Damaged parts may be returned to the manufacturer for warranty analysis. If failure was determined caused by faulty workmanship, the manufacturer will repair or replace the faulty component.
The parts must be accompanied by a fully completed and signed health and safety form, as present in the back of this manual. The form must be applied to the outside of the shipping carton.
Parts which have been contaminated or which have been corroded by chemicals or other substances that can pose a health risk must be cleaned before they are returned to the manufacturer. Furthermore, it should be indicated on the health and safety form, which specific cleaning procedure has been followed, and it should be indicated that the equipment has been decontaminated. The safety form is required at all items, even if the parts have not been used.

Warranties purporting to be on behalf of Bredel made by any person, including representatives of Bredel, its subsidiaries, or its distributors, which do not accord with the terms of this warranty shall not be binding upon Bredel. unless expressly approved in writing by a Director or Manager of Bredel.

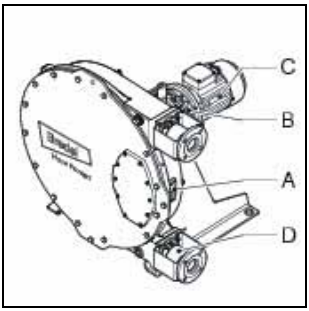
4 DESCRIPTION

4.1 Identification of the product

4.1.1 Identification of the product

The hose pump can be identified based on the identification plates or stickers on:

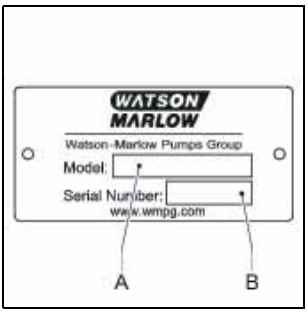
A: Pump head
B: Gearbox
C: Electric motor
D: Pump hose



4.1.2 Identification of the pump

The identification plate on the pump head contains the following data:

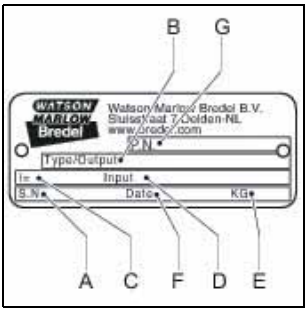
A: Pump model
B: Serial number



4.1.3 Identification of the gearbox

The identification plate on the gearbox contains the following data:

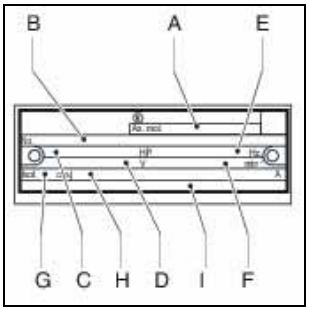
A: Serial number (S.N.)
B: Type number (Type/Output)
C: Reduction (i=)
D: Input (adaptation of the motor to the gearbox)
E: Mechanic code (MC)
F: Date
G: Bredel article or order number (PN)



4.1.4 Identification of the electric motor

The identification plate on the electric motor contains the following data:

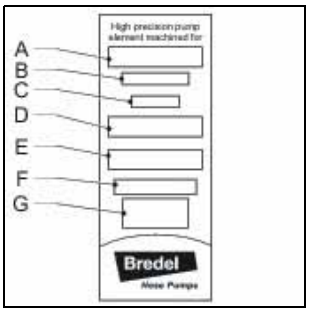
A: Serial number
B: Type number
C: Power
D: Voltage
E: Frequency
F: Pole no./Speed
G: Insulation class
H: Rise in temperature
I: Bredel article or order number



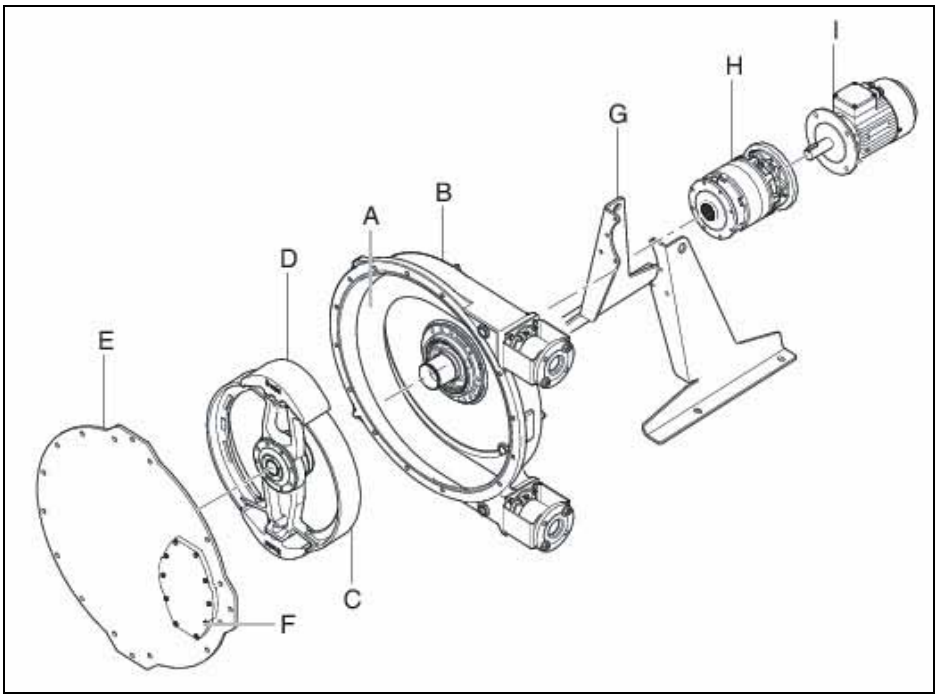
4.1.5 Identification of the pump hose

The identification sticker on the pump hose contains the following data:

A: Pump type
B: Reorder number
C: Internal diameter
D: Type of material of inner liner
E: Remarks, if applicable
F: Maximum permissible working pressure
G: Production code



4.2 Construction of the pump



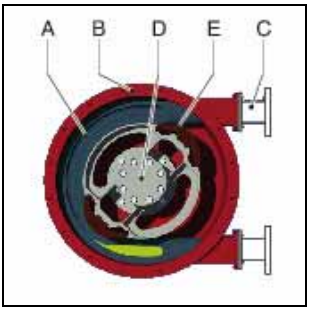
A: Pump hose
B: Pump housing
C: Rotor
D: Pressing shoes
E: Cover
F: Inspection window
G: Supports
H: Gearbox
I: Electric motor

4.3 Operation of the pump

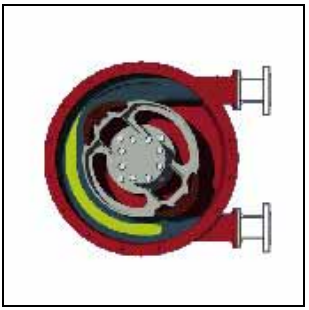
The heart of the pump head consists of a specially constructed pump hose (A) which lies contorted against the inside of the pump housing (B). Both ends of the hose are connected to the suction and discharge lines

by means of a flange construction (C). A bearing-mounted rotor (D) with two facing pressing shoes (E) is in the center of the pump head.

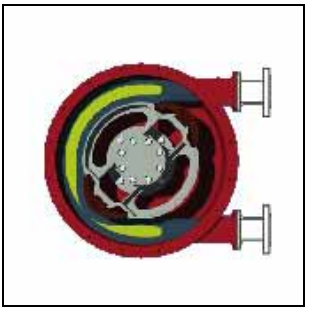
In phase 1 the lower pressing shoe compresses the pump hose by the rotational movement of the rotor, forcing the fluid through the hose. As soon as the pressing shoe has passed, the hose recovers to its original shape due to the mechanical properties of the material.



In phase 2 the product is drawn into the hose by the (continuous) turning motion of the rotor.



In phase 3, the second pressing shoe will subsequently compress the pump hose. Due to the continuous rotating movement of the rotor not only new product is sucked in, but also the already present product is pressed out by the pressing shoe. When the first pressing shoe runs from the pump hose, the second pressing shoe has already closed the pump hose and the product is prevented from flowing back. This method of liquid displacement is also known as the "positive displacement principle".

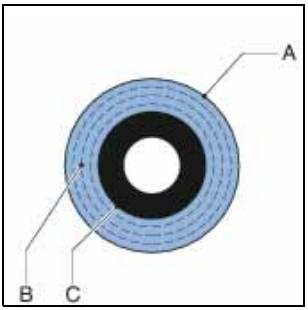


4.4 Pump hose

4.4.1 General

The pump hose is made of special rubbers, reinforced with nylon cords and is constructed as follows:

A: Outer extruded layer made of natural rubber
B: Four nylon reinforcement layers
C: Inner extruded liner



The pump hose liner material should be chemically resistant with the product to be pumped. Dependent on the specific requirements of your application a corresponding pump hose must be selected. For each pump model various hose types are available.
The material of the inner liner of the pump hose determines the hose type. Each hose type is marked by a unique color code.

Hose type	Material	Color code
NR	Natural rubber	Purple
NBR	Nitrile rubber	Yellow
EPDM	EPDM	Red
CSM	CSM	Blue

Natural Rubber*
Always the first choice hose. A highly dynamic material, which has excellent abrasion resistance and mechanical strength, and is generally resistant to diluted acids and alcohols.
Max. liquid temperature 80 °C (175 °F).
Min. temperature -20 °C (-5 °F).

Nitrile rubber*
A highly abrasion proof and wear resistant material that is generally resistant to oils, fats, alkaline, and detergents. Suitable for a wide range of food handling and meets FDA and 3A standards.
Max. liquid temperature 80 °C (175 °F).
Min. temperature -10 °C (15 °F).

EPDM*
Good chemical resistance especially to concentrated acids, ketones, and alcohols.
Max. liquid temperature 90 °C (195 °F).
Min. temperature -10 °C (15 °F).
Consult Bredel technical services for details on higher temperature operation, up to 90 °C (195 °F) with EPDM.

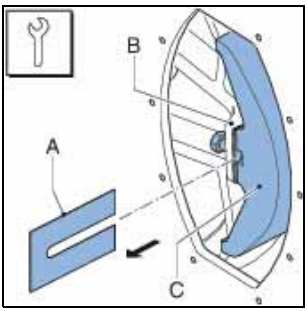
CSM*
Good chemical resistance for strong oxidizing products like concentrated acids and oxygen generating substances.
Max. liquid temperature 80 °C (175 °F).
Min. temperature -10 °C (15 °F)
Consult Bredel technical services for RPM limitations when using CSM.

	* Consult your Bredel representative for more detailed information about the chemical and temperature resistance of pump hoses.

The Bredel pump hoses have been carefully machined, therefore there are minimum tolerances in wall thickness. This is very important to guarantee the correct compression of the pump hose, because:

- When the compression is too high, it creates a load on the pump and pump hose that is too high, which may result in a reduction of the life of the pump hose and bearings.
- When the compression is too low this will result in high velocity backflow (slip). Backflow results in a reduction of pump performance, hydraulic efficiency, and negatively impact the life of the pump hose.

4.4.2 Hose compression force adjustment (shimming)



In order to achieve optimal life of the pump hose, the compression force of the pump hose can be adjusted by placing a number of shims under the pressing shoes. The shims (A) are fitted between the rotor (B) and the pressing shoe (C). The number of shims will vary for each discharge pressure situation.

The paragraph 7.8 describes how to select and install the shims.

4.4.3 Lubrication and cooling

The pump head, in which the rotor and pump hose can be found, is filled with Bredel Genuine Hose Lubricant. This lubricant lubricates the movement between the hose and the pressing shoes and dissipates the generated heat via the pump housing and the cover.

The lubricant is food grade. See 10.1.4 for the required quantity and NSF registration.

	Consult your Bredel representative for lubrication recommendations when operating the hose pump below 2 rpm.

4.5 Gearbox

The hose pump types described in this manual use planetary gearbox units. The gearbox units are characterized by their compact and modular construction.
This modular construction enables a wide range of reductions, torques and connection possibilities for the electric motor.

4.6 Electric motor

If the electric motor has been supplied, please consult the motor manual and nameplate for details on its specification. Most typically, AC squirrel cage induction motors drive hose pumps.

4.7 Available options

The following options are available for the hose pump:

- High (lubricant) level float switch
- Low (lubricant) level float switch
- Revolution counter

	The high level float switch is mandatory for use in potentially explosive atmospheres. If the pump is to be used in potentially explosive atmospheres, contact your Bredel representative.

5 INSTALLATION

5.1 Unpacking

When unpacking carefully follow the instructions as given on the packaging or on the hose pump.

5.2 Inspection

Check that your delivery is correct and check it for any transport damage. Refer to 4.1.1. Report any damage immediately to your Bredel representative.

5.3 Installation conditions

5.3.1 Ambient conditions

Make sure that the hose pump is in an area where the ambient temperature during operation is not lower than -20 °C (-4 °F) and not higher than +45 °C (+113 °F).

5.3.2 Set-up

- The pump materials and protective layers are suitable for indoor set-up and a protected outdoor set-up. Under certain conditions the pump is suitable for limited outdoor set-up or a salty or aggressive atmosphere. Consult your Bredel representative for more information.
- Make sure that the floor surface has a maximum slope of 10 mm per meter (0.12 inch per foot).
- Make sure that there is sufficient room around the pump to carry out the necessary maintenance.
- Make sure that the room is sufficiently ventilated, so that the heat developed by the pump and drive can be dissipated. Keep some distance between the ventilation cover of the electric motor and the wall to allow the supply of cooling air.

5.3.3 Pipe work

When determining and connecting suction and discharge lines consider the following points:

- **Do** keep delivery and suction lines as short and direct as possible.
- Keep the piping at a minimum equal to or greater than the bore size of the pump. Increase the bore size of the pipe work when the duty fluid has a high velocity or inertia. This will help keep friction and impulse losses to a minimum. Where critical velocities are a concern consult your Bredel representative.
- **Do** limit the presence of sharp bends in the process lines. Make sure that the radius of any bends is as large as possible (R=4d to 5d). It is recommended to use Y-connections instead of T-connections.
- Consult your Bredel representative for recommendations on mounting pulsation dampening devices. A pulsation dampener and/ or inlet pulse accumulator may be necessary if the relative density and pump speed is high and the line lengths are long.
- The self-priming and positive displacement nature of peristaltic pumps means that valves are not required. If for whatever reason, valves are fitted into the system, they must have a straight fluid path and cause minimum restriction to flow in the pumping circuit. Note that check valves directly in the process stream may increase pulsation and negatively impact hose life.
- For ease of hose changing and some pulsation suppression, it is recommended to use a segment of flexible hose between the pump flange and hard piping of the suction and/or discharge line. A segment of three quarters (3/ 4) of the pump hose length for the flexible pipe work is recommended. Bredel also recommends installing an isolation valve and

pipe-drain in the suction and discharge pipe work to allow fluid isolation and drainage from the pump during maintenance. Following these recommendations will help minimize process fluid exposure by maintenance personnel.

- For the flexible hoses select compatible materials and ensure the installation is suited for the design pressure of the system.
- Prevent any possibilities of exceeding the maximum working pressure of the hose pump. Refer to □ 10.1.1. If necessary install a pressure relief valve or shutdown switch. Consult your Bredel representative for more detailed information.

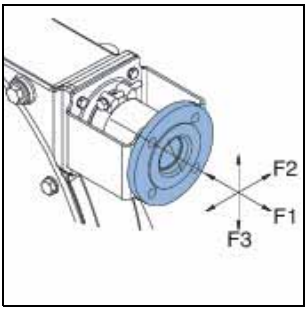
⚠	**CAUTION** Consider the maximum permissible working pressure on the discharge side. Exceeding the maximum working pressure may lead to serious damage to the pump.

- Make sure that the maximum forces on the flanges are not exceeded. The permissible loads are given in the following table.

Maximum permissible loads on the pump flange

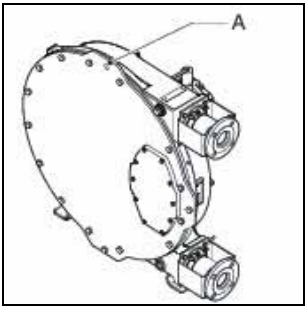
Force	Bredel 50
F1	1400
	315
F2	300
	67
F3	700
	157

	Newton [N]
	Pounds Force [lbf]



5.4 Lifting and moving the pump

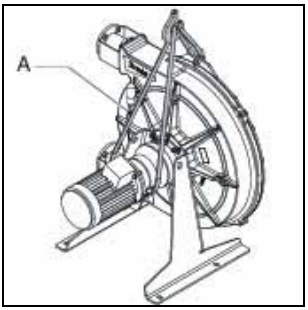
For lifting and moving the pump, it has been fitted with a lifting point. This lifting point (A) is fitted on the upper side of the cover. The maximum rating of the lifting point depends on the pump model. Make sure that the total of weight to be moved will not exceed this maximum rating.



For the weights, refer to 10.1.5.

Maximum rating of the lifting point of the pump head
Bredel 50
390 kg
860 lbs

The complete hose pump, i.e. pump head, gearbox and electric motor, must be lifted using the lifting point of the pump head plus additional support using suitably rated straps or slings (A). Never exceed the maximum rating of the lifting point of the pump head.



⚠	**WARNING** If the pump is to be lifted ensure that all standard lifting practices are adhered to and carried out by qualified personnel only.

⚠	**WARNING** Do not use the holes in the pump supports to lift the hose pump.

5.5 Placing the pump

Position the pump on a horizontal surface. Use suitable anchor bolts to attach the pump to the floor surface.

6 COMMISSIONING

6.1 Preparations

1. Connect the electric motor in conformance with the locally applicable rules and regulations. Ensure qualified personnel carry out the electrical installation work.

2. Check that the lubricant level is above the minimum level line in the inspection window. If necessary add Bredel Genuine Hose Lubricant via the breather/vent plug. See also □7.4.

3. Check the rotation of the rotor. The rotational direction of the rotor must match the configuration of suction and discharge piping.

4. Check that the correct number of shims corresponds with your application. Refer to □10.1.7.
   For adjusting the compression force of the hose, refer to □7.8.

5. Check that the breathers on the rear of the pump and on the gearbox are free from any obstruction.

6. Check to ensure the gearbox has been filled with the proper oil level.

6.2 Commissioning

1. Connect the pipework. Make sure that there are no obstructions such as closed valves.

2. Switch on the hose pump.

3. Check the rotation of the pump rotor.

4. Check the capacity of the hose pump. If the capacity differs from your specification, follow the instructions in chapter 9 or consult your Bredel representative.

5. Check the hose pump in accordance with points 1 to 4 of the maintenance table from □ 7.2.

7 MAINTENANCE

7.1 General

	**WARNING** Only use original Bredel parts when maintaining the hose pump. Bredel cannot guarantee a correct functioning and any consequential damage that occurs from the use of non-original Bredel components. See also chapters 2 and 3.

	**WARNING** If the cover is removed when the pump hose is still in the pump head, the compression forces on the pump hose may cause damage to the pump housing, rotor and pump hose. The pump hose needs to be safely removed before the cover can be replaced. Normally the compression forces are partially compensated by the cover.

7.2 Maintenance and periodic inspections

The following maintenance scheme shows the maintenance and periodic inspections that need to be carried out on the hose pump to guarantee an optimal safety, operation and life of the pump.

Point	Action	To be carried out	Remark
1	Check the lubricant level.	Before startup of the pump and on a scheduled interval during operation.	Make sure that the lubricant level is above the minimum level line in the inspection window. If necessary refill the lubricant. See also □7.4.
2	Check the pump head for any leakage of lubricant around the cover, the flanges and the rear of the pump head.	Before startup of the pump and on a scheduled interval during operation.	See □9.
3	Check the gearbox on any leakage.	Before startup of the pump and on a scheduled interval during operation.	In case of leakage consult your Bredel representative.
4	Check pump for deviating temperature or strange noises.	On a scheduled interval during operation.	See □9.
5	Check pressing shoes for excessive damage.	When replacing the pump hose.	See □7.6.
6	Internal cleaning of the pump hose.	Cleaning of the system or product change.	See □7.3.
7	Replacing pump hose.	Preventive, this means after 75% of the hose life of the first hose.	See □7.6.
8	Changing lubricant.	After every 2nd hose change or after 5,000 service hours, whichever comes first or after hose rupture.	See □7.4.
9	Changing oil in gearbox.	After the first 100 service hours and subsequently annually or every 2500 service hours.	See □7.5.
10	Replacing pump seal.	If necessary.	See □7.7.3.

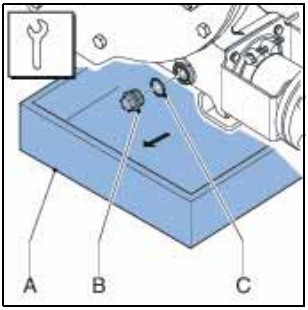
Point	Action	To be carried out	Remark
11	Replacing wear ring.	If necessary.	See □7.7.3.
12	Replacing pressing shoes.	Wear on the running surface.	See □7.7.2.
13	Replacing bearings.	If necessary.	See □7.7.4.
		In potentially explosive atmospheres preventive after 20,000 hrs. service or when damage is suspected.	See □7.7.2. Exclusively applicable in potentially explosive atmospheres (Group II Appliances, category 2 G ck T4).

7.3 Cleaning the pump hose

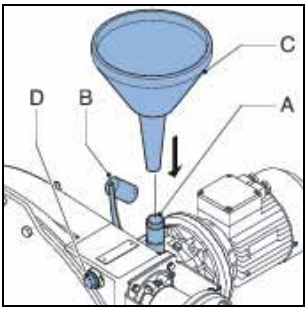
Running the pump with clean water can clean the inside of the pump hose. If a cleaning fluid is added to the water, attention must be given to its compatibility with the hose liner material, and also the temperature at which the cleaning procedure will be performed. Sometimes a cleaning sponge can be very helpful.
With many products, it is necessary to clean the pump hose immediately once the pump is stopped to avoid sedimentation and/or hardening of the product within the hose that can cause damage upon restart.

7.4 Changing lubricant

1. Place a tray (A) under the drain plug in the bottom of the pump. Remove the drain plug (B). Drain the lubricant from the pump housing into the tray. Check that the sealing ring (C) is not damaged and replace it if necessary. Position the drain plug and tighten it firmly.



2. The pump housing can be filled with lubricant via the breather/vent (A) on the rear of the pump housing. For this purpose remove the breather cap (B) and position a funnel (C) in the breather. In order to facilitate the filling with lubricant the plug (D) on the front of the pump housing can be removed. Pour the lubricant in the pump housing via the funnel. Continue until the lubricant level has reached above the minimum level line.



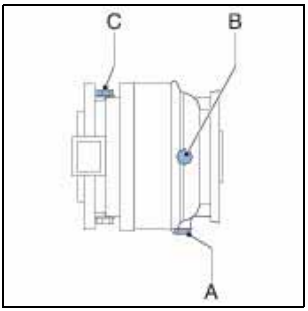
	For the required quantity of lubricant, refer to □ 10.1.4.

7.5 Changing oil in gearbox

1. Isolate the pump from the electrical supply.

2. Position a tray under the gearbox. Remove plug (A) and drain the gearbox.

3. The plug (A) is magnetically loaded. In this way metal particles in the oil are pulled to the plug. Clean the plug and remove any metal particles if necessary. Check that the sealing ring is not damaged and replace it if necessary. Place the plug back in the gearbox and tighten it firmly.



4. Remove level plug (B) and breather (C). Position a funnel in the hole of breather (C) and fill the gearbox with oil until the oil just comes out of the level plug hole (B). Place plug (B) and plug (C) back and tighten them firmly.

	For the required lubricant, refer to □ 10.2.

	**WARNING** To prevent damage to the gears, do not operate the pump unless proper volume of oil is filled into the gearbox.

5. Switch on the electrical supply to the pump.

7.6 Replacing pump hose

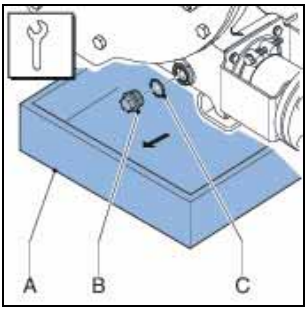
7.6.1 Removing pump hose

	**CAUTION** For all weight and torque adjustment, please refer to the technical information section at the rear of this manual.

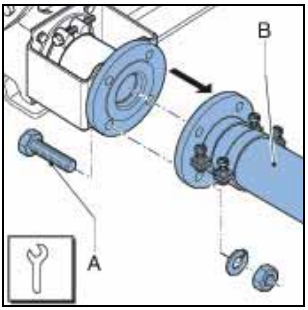
1. Isolate the pump from the electrical supply.

2. Close any shut-off valves in both the suction and discharge line to minimize product loss.

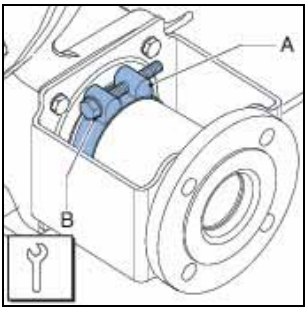
3. Place a tray (A) under the drain plug in the bottom of the pump head. The tray must be large enough to contain the lubricant, possibly contaminated with product fluid, from the pump head. Remove the drain plug (B). Catch the lubricant from the pump housing in the tray. Check that the breather vent mounted on the rear is not obscured. Check that the sealing ring (C) is not damaged and replace it if necessary. Position the drain plug and tighten it firmly.



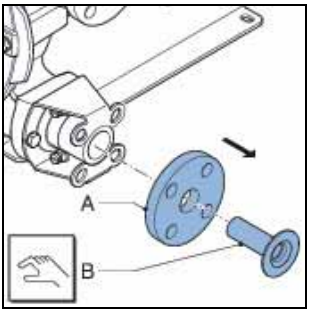
4. Loosen the retaining bolts (A) of both the suction and discharge line (B). Disconnect the suction and discharge lines.



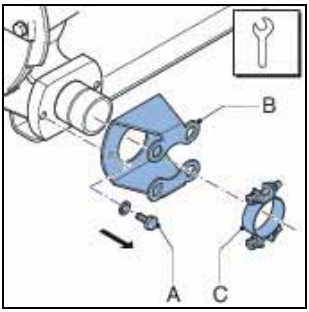
5. Loosen hose clamp (A) of both the inlet and outlet ports by loosening retaining bolt (B).



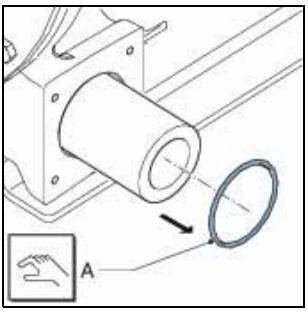
6. Pull the insert (B) from the hose and remove the flanges (A). Carry out this procedure both for the inlet and outlet ports.



7. Loosen the retaining bolts (A) of the flange bracket (B) and remove the bolts. Slide the flange bracket and the hose clip (C) off the hose. Carry out this procedure both for the inlet and outlet ports.



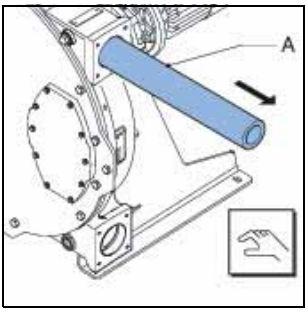
8. Slide off the sealing ring (A). Check that the sealing ring is not deformed or damaged and replace it if necessary. Carry out this procedure both for the inlet and outlet ports.



9. Connect the pump to the electrical supply.

⚠	**WARNING** Removal of the hose is a powered process and requires rotation of the pump. Ensure body and tools are clear from moving parts prior to proceeding with hose removal.

10. Power out the hose (A) from the pump chamber by jogging the drive motor.



7.6.2 Cleaning the pumphead

⚠	**WARNING** Never remove the cover when the pump hose is in the pumphead. The compression forces on the pump hose are partially compensated by the cover. By removing the cover with the hose installed, subsequent damage can occur.

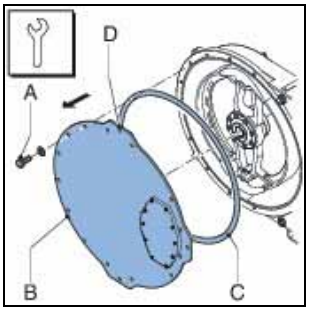
⚠	**WARNING** The cover is heavy. For all weight and torque adjustment, please refer to the technical information section at the rear of this manual.

1. Isolate the pump from the electrical supply.

2. Use lifting hole (D) to move the cover. Remove the cover (B) by loosening the retaining bolts (A).

3. Check the sealing ring (C) and replace it if necessary.

4. Rinse the pumphead with clean water and remove all residues. Make sure that no rinsing water remains in the pumphead.



5. Check the pressing shoes for wear or damage and replace them if necessary. Refer to □7.7.2. Also see the maintenance scheme in □7.2.

	**CAUTION** When the pressing shoes are worn the compression force of the hose decreases. If the compression force is too low, this results in a loss of capacity by the backflow of the liquid to be pumped. Backflow results in a reduction of the life of the pump hose.

6. Replace the cover and fasten the retaining bolts with the correct torque. Refer to □10.1.6.

7. Switch on the electrical supply to the pump.

7.6.3 Fitting the pump hose

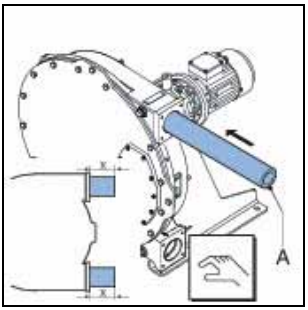
	**WARNING** Fitting the pump hose is a powered process and requires pump rotation. Ensure the pump cover is properly fitted and that body and tools are clear from moving parts.

	**WARNING** For all weight and torque adjustment, please refer to the technical information section at the rear of this manual.

1. Clean the (new) pump hose on the outside and fully lubricate it with Bredel Genuine Hose Lubricant.

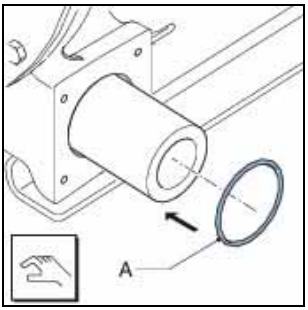
2. Turn on the pump and note the direction of the pump rotation.

3. Fit the pump hose (A) via one of the ports □ whichever is the suction based on rotation direction. Feed the hose into the port and allow the pressing shoe to draw the hose in the pump housing. The rotor will move the hose.

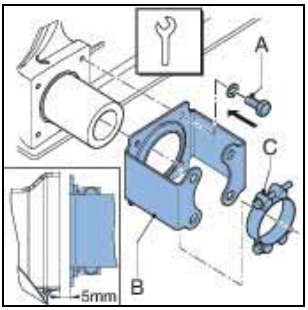


4. Stop the motor when the hose sticks out equally from both sides of the pump housing.

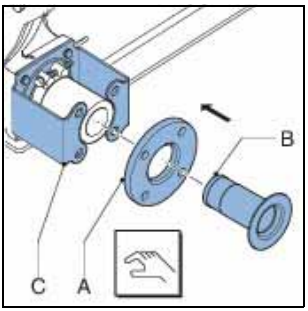
5. First fit the inlet port. Fit the sealing ring. Before mounting, check that the sealing ring (A) is not deformed or damaged and replace it if necessary.



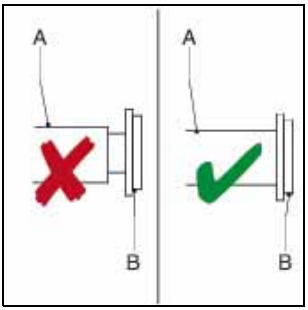
6. Before fitting check that the hose clamp is not damaged and replace it if necessary. Slide the flange bracket (B) and the hose clamp (C) over the hose together. Align the holes in the flange bracket with the ones at the front of the port. Position the four retaining bolts (A) and tighten them until they are approx. 5 mm (3/16□) from the port, so that the gap between the flange bracket and the port remains.



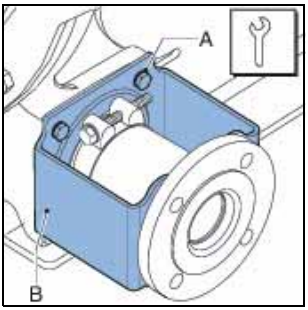
7. Slide insert (B) in the flange (A) and press the insert in the hose. If necessary lubricate the insert with Bredel Genuine Hose Lubricant in order to simplify mounting. Make sure that the holes in flange (A) are aligned with the holes in flange bracket (C). Check that the insert is in the correct place. If the insert is not positioned correctly the product to be pumped may leak or the lubricant may leak.



8. Turn the rotor in such a way that the hose (A) is pressed firmly against the flange surface (B).



9. Now fully tighten the retaining bolts (A) of the flange bracket (B). Make sure the bolts are tightened with the correct torque. Refer to 10.1.6.

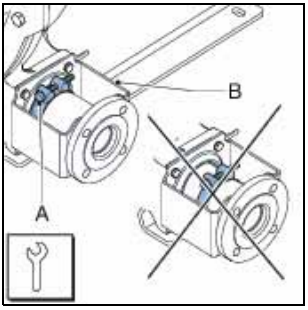


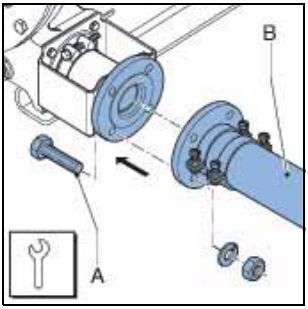
10. Position hose clamp (A) against O-ring chamber of the flange bracket (B) and fasten the retaining bolt. Make sure the bolts are tightened with the correct torque. Refer to 10.1.6.

11. Now fit the other port. For this port proceed in the same way as described above for the inlet port.

12. Fill the pump housing with Bredel Genuine Hose Lubricant. Refer to 7.4.

13. Fit the suction and discharge lines (B) and the retaining bolts (A). Tighten the retaining bolts with the correct torque. Refer to 10.1.6.





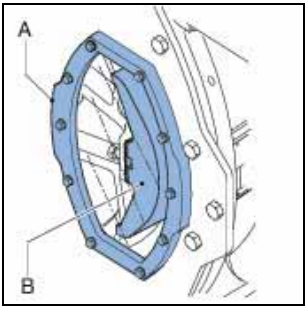
7.7 Exchanging replacement parts

7.7.1 General

⚠	**CAUTION** Items may be heavy. For all weight and torque adjustments for replacement procedures under this section, please refer to the technical information in chapter 10.

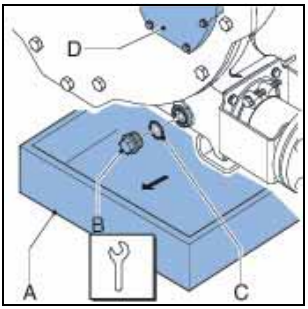
7.7.2 Replacing pressing shoes

1. Jog the motor until the pressing shoe (B) is positioned in view of the inspection window (A).

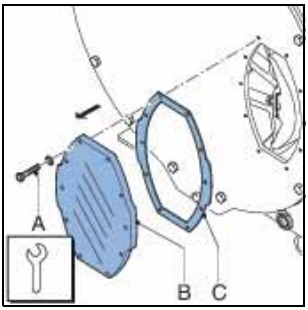


2. Isolate the pump from the electrical supply.

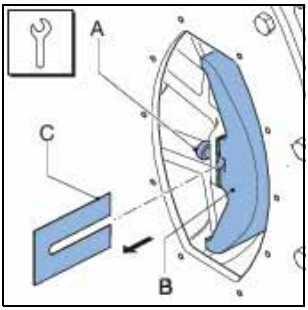
3. Place a tray (A) under the drain plug (B) in the bottom of the pumphead. Remove the drain plug. Drain as much Bredel Genuine Hose Lubricant until the level has lowered just below the inspection window (D). Check that the sealing ring (C) is not damaged and replace it if necessary. Position the drain plug and tighten it firmly



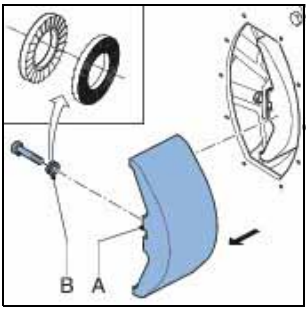
4. Loosen the retaining bolts (A) of the inspection window (B) and remove the bolts. Remove the inspection window. Care must be taken not to damage the gasket (C).



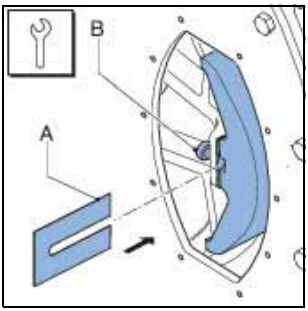
5. Loosen the retaining bolt(s) (A) of pressing shoe (B) a few turns. Remove the shims (C) if present. Loosen the retaining bolt(s) (A) of pressing shoe (B) completely and remove the pressing shoe.



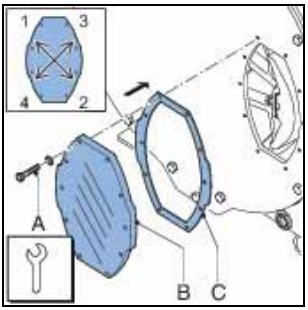
6. Position the (new) pressing shoe (A), check that the NordLock□-rings (B) have been positioned correctly and tighten the retaining bolt(s) a few turns.



7. Fit the removed shims (A) again. Tighten the retaining bolt(s) (B) with the correct torque. Refer to □ 10.1.6.



8. Refit the inspection window (B). Check the inspection window gasket (C) for damage and replace if necessary. Make sure that all bolts (A) are refitted and that they are tightened in the correct order, diagonally opposite each other.



9. Switch on the electrical supply.

10. Jog the motor until the second pressing shoe is positioned in front of the inspection window.

11. Isolate the pump from the electrical supply.

12. Repeat the procedure for removing and fitting this second pressing shoe by repeating steps 4 through 9.

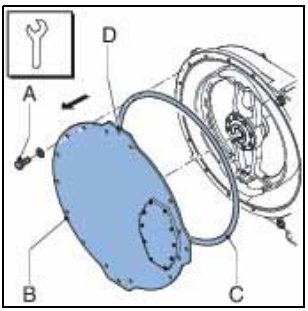
13. Refill the lubricant. Refer to 7.4.

7.7.3 Replacing seal and wear ring

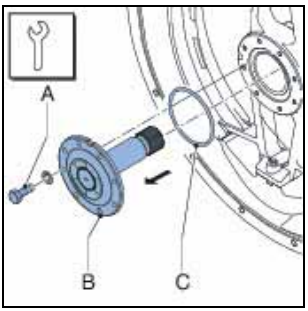
1. Remove the pump hose. Refer to 7.6.1.

2. Isolate the pump from the electrical supply.

3. Use lifting hole (D) to move the cover. Remove the cover (B) by loosening the retaining bolts (A). Check the sealing ring (C) of the pump cover for damage.

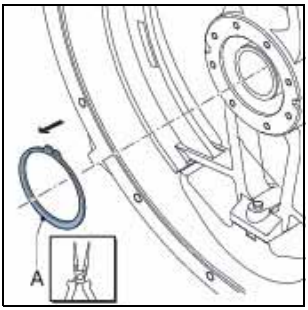


4. Remove the retaining bolts (A) of the drive shaft (B) and remove the drive shaft. Check the sealing ring (C) for damage.

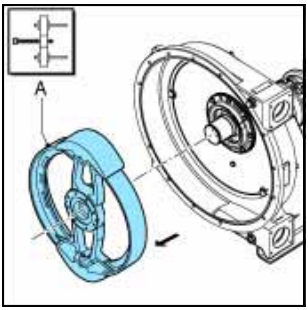


i	If the drive shaft cannot be removed manually, use a screwdriver in the slots in the rotor provided for this purpose.

5. Remove the rotor retaining circlip (A), which locks the rotor on the hub. Use the correct tools to do this.



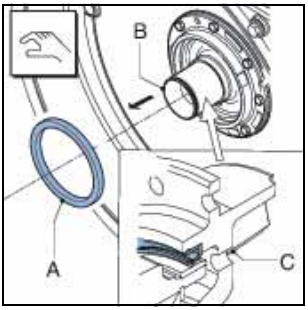
6. Fit the necessary lifting means before dismounting the rotor. Extract the rotor (A) from the hub. A suitable puller or similar extraction tool will be required during this stage of the disassembly.



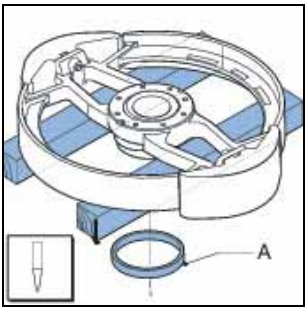
⚠	**WARNING** When removing the rotor a belt or similar lifting aid must carry the weight of the rotor. For the specific weight of the rotor, refer to 10.1.5.

7. Remove the seal (A) from the hub (B). Clean and degrease the bore.

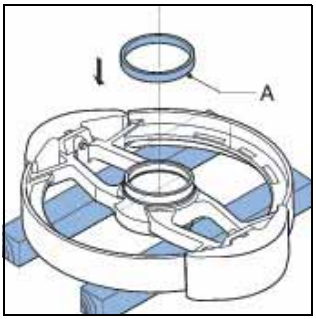
8. Fit a new seal using a wooden block and hammer. Carefully hit the seal crosswise and with equal strength in the bore until it touches the hub. The seal must be fitted in the correct orientation (C). Make sure that the open side points to the pump cover.



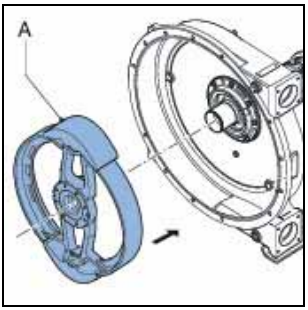
9. Support the rotor with wooden blocks at 90° to the spokes, with the ring (A) facing down. Position a suitable punch against the rear of the glued wear ring. Prevent damage to the wear ring seat or other parts.



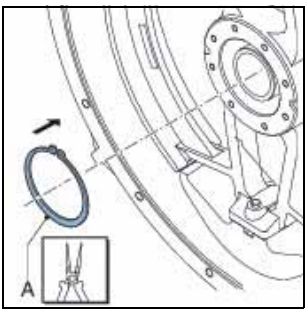
10. Turn the rotor over. Make sure that the seats of the new wear ring (A) and rotor are clean, dry and free of grease. Apply Loctite® type 641 or 603 both on the rotor and the wear ring. Position the new wear ring with the tapered edge facing up. Use a plastic hammer to fit the ring on the rotor until it touches the rotor completely.



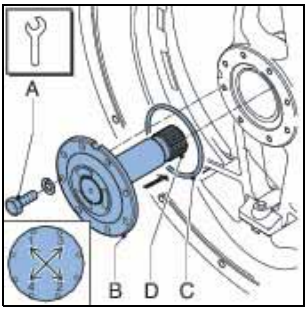
11. Check that the hub is clean and free of grease. Fit rotor (A). The bearings have been placed on the hub with a slight interference fit. Use a pressing tool to press the rotor on the hub.



12. Check rotor retaining circlip (A) for any signs of damage and replace if necessary. Refit the circlip. Use the correct tools for this purpose.



13. Heavily grease the spline (D) of the drive shaft (B) with a graphite-loaded grease. Ensure the mating faces of the drive shaft and rotor are clean, dry and free from lubricant. Check that the sealing ring (C) is not damaged and replace it if necessary. Fit the sealing ring in the groove of the shaft flange. Fit the drive shaft. Turn the rotor until the bolt holes in the drive shaft correspond with the threaded holes in the rotor. Mount the retaining bolts (A) of the drive shaft. Tighten the bolts finger-tight. Tighten them diagonally opposite to each other to the specified torque limits. Refer to □ 10.1.6.



14. Replace the cover and fasten the retaining bolts with the correct torque. Refer to □ 10.1.6.

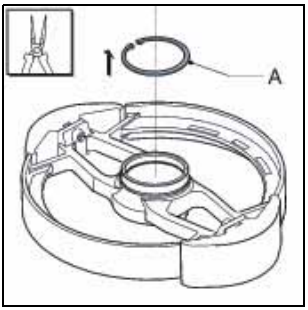
15. Switch on the electrical supply to the pump.

16. Fit the (new) pump hose. Refer to □ 7.6.3.

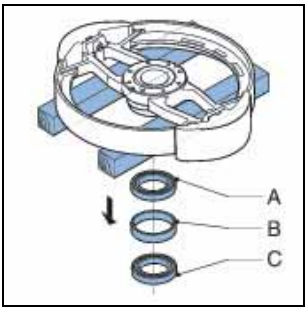
7.7.4 Replacing bearings

1. Dismount the pump hose, the cover and rotor by following steps 1 through 6 from □ 7.7.3.

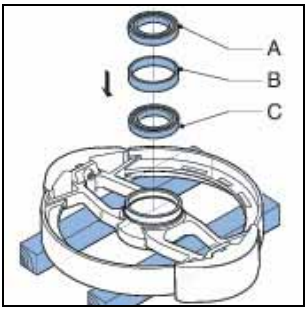
2. Lay the rotor on a flat surface with the wear ring face up. Remove retaining circlip (A) with the correct tools.



3. Turn the rotor over. Remove using the correct pressing tools, first the first bearing (C), the spacer ring (B) and the second bearing (A) from the rotor. Check the spacer ring for damage. Retain the spacer ring (B).

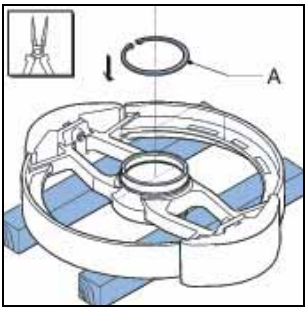


4. Turn the rotor over. Check that the hub is clean and dry. Press using the pressing tool the first bearing (C) in its place. Position the spacer ring (B). Subsequently press the second bearing (A) in its place.



5. Refit the retaining circlip (A) in the rotor. Use the correct tools for this purpose.

6. Fit the rotor, the cover and pump hose by following steps 11 through 16 from □7.7.3.



7.8 Adjusting hose compression force (shimming)

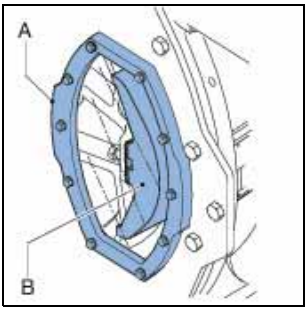
Fitting and removing shims is a simple action which can be carried out via the inspection window on the front of the pump housing. The pump hose or the pump cover

does not need to be removed. In order to determine the correct number of shims for your specific application refer to 10.1.7.

⚠	**CAUTION** Too many shims, this means a too high compression force on the pump hose, create a too high load on the pump head and pump hose, which results in a reduction of the life of the pump hose and bearings.

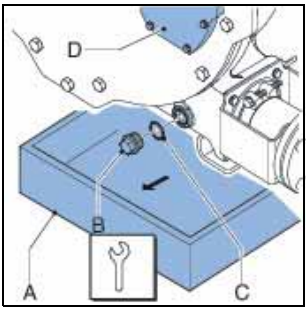
⚠	**CAUTION** Too few shims, this means a too low compression force on the pump hose, create a loss of yield and slip or backflow. Backflow results in a reduction of the life of the pump hose.

1. Jog the motor until the pressing shoe (B) is positioned in view of the inspection window (A).

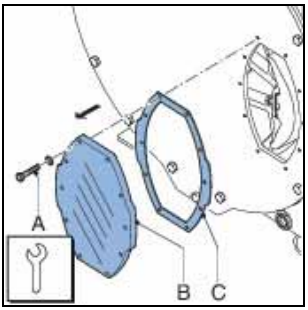


2. Isolate the pump from the electrical supply.

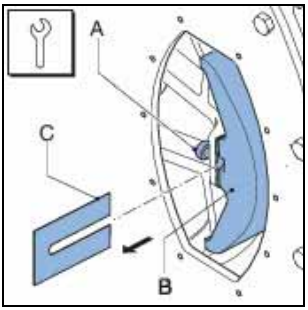
3. Place a tray (A) under the drain plug (B) in the bottom of the pump head. Remove the drain plug. Drain as much Bredel Genuine Hose Lubricant until the level has lowered just below the inspection window (D). Check that the sealing ring (C) is not damaged and replace it if necessary. Position the drain plug and tighten it firmly.



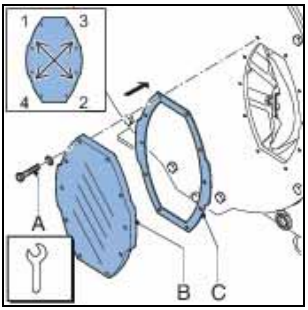
4. Loosen the retaining bolts (A) of the inspection window (B) and remove the bolts. Remove the inspection window. When doing this prevent the gasket (C) from damaging.



5. Loosen the retaining bolt(s) (A) of pressing shoe (B) a few turns. Fit the shims (C) or remove them, until the correct number of shims is present. Refer to □10.1.7. Tighten the retaining bolt(s) of the pressing shoe with the correct torque. Refer to □10.1.6.



6. Check the inspection window gasket for damage and replace if necessary. Refit the inspection window (B). Make sure that all bolts (A) are refitted and that they are tightened in the correct order, diagonally opposite each other, to the specified torque limits. Refer to □10.1.6.



7. Switch on the electrical supply.

8. □og the motor until the second pressing shoe is positioned in front of the inspection window.

9. Isolate the pump from the electrical supply.

10. Repeat the procedure for this pressing shoe by repeating steps 4, 5, 6 and 7.

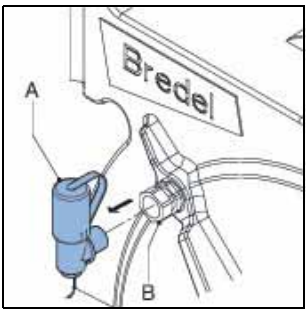
11. Refill the lubricant via the breather. Refer to □7.4.

7.9 Fitting options

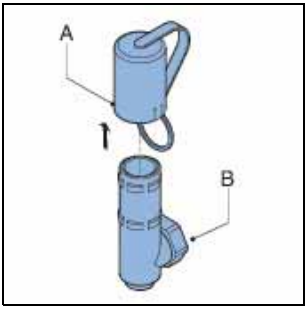
7.9.1 Fitting a high-level float switch

	For explosive environments, contact your Bredel representative.

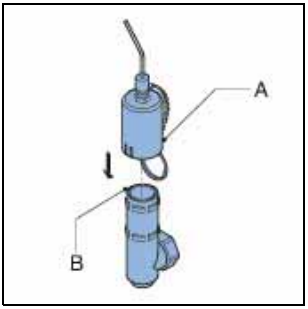
1. Remove the standard breather (A) on the rear of the pump, by removing it from crimp connector (B).



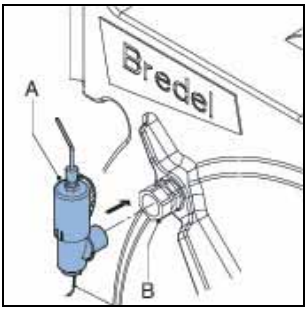
2. Slide the standard breather cap (A) from breather (B).



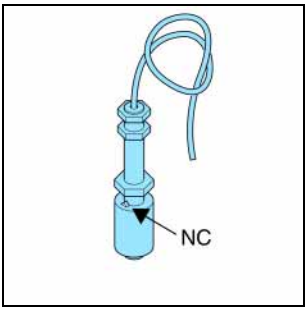
3. Replace the standard breather cap with the breather cap with high level float switch (A) and slide it over breather (B).



4. Fit the breather (A) on the rear of the pump, by mounting it to crimp connector (B).



5. Connect the high-level float switch to the auxiliary power circuit via the 2-meter (6.5-feet) long PVC cable (2 x 0.34 mm^2, 2 x 22 AWG). Bear in mind that the electrical contact of the float switch is normally closed (NC). The knob is upwards for normally closed operation. When the lubricant level is (too) high the contact will open.



Specifications*	
Voltage:	Max. 230 V AC/DC
Current:	Max. 2 A
Power:	Max. 40 VA

* For use in non-explosive atmospheres

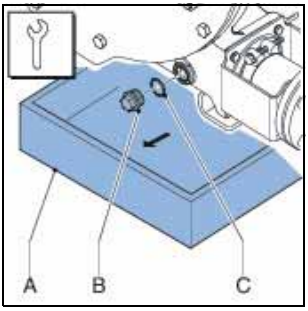
ℹ	Where the float switch is constructed to stop the equipment, operating has to be arranged so that the stop function locks-out, preventing the equipment from being re-started without re-setting. Check if the float switch is mounted with the NC sign at the top.

7.9.2 Fitting a low level float switch

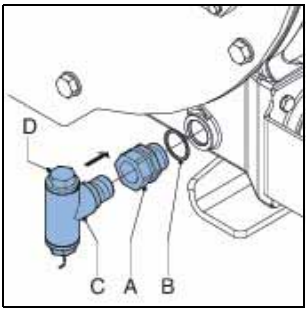
	For explosive environments, contact your Bredel representative.

	For specifications, refer to 7.9.1.

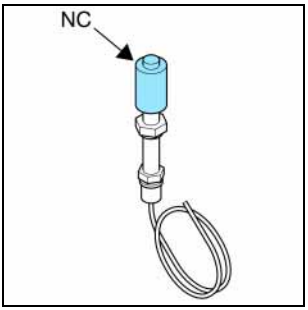
1. If the pump is filled with lubricant this must be removed first. Place a clean tray (A) under the drain plug in the bottom of the pump. Remove the drain plug (B). Drain the lubricant from the pump housing into the tray. Check the sealing ring (C) for damage.



2. Fit the crimp connector (A) together with the sealing ring (B) to the pump housing. Fit the low-level float switch (C) to the crimp connector (A).



3. Connect the high-level float switch to the electrical supply. Bear in mind that the electrical contact of the float switch is normally closed (NC). When the lubricant level is (too) low the contact will open.



	Where the floater is constructed to stop the equipment, operating has to be arranged so that the stop function locks-out, preventing the equipment from being re-started without re-setting. Check if the floater is mounted with the NC sign at the top.

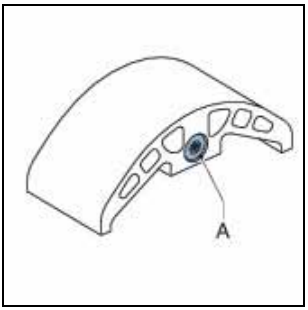
4. Refill the pump housing to the proper level with Bredel Genuine Hose Lubricant. Refer to □7.4.

5. Breath the float switch by carefully opening plug (D) until lubricant escapes. Subsequently close the plug again.

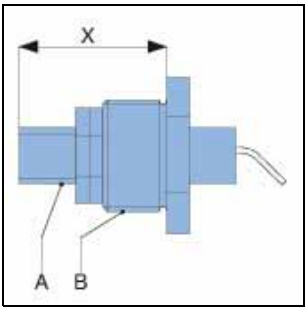
7.9.3 Fitting revolution counter

1. Remove one of the pressing shoes of the rotor by following steps 1 through 5 from □7.7.2.

2. Replace pressing shoe by the special pressing shoe with a magnet (A) by following the steps 6 through 8 from □7.7.2.

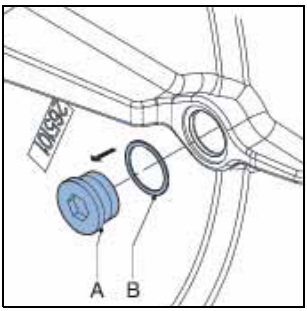


3. Fit the inductive sensor (A) in plug (B) and adjust it to dimension "X" as indicated in the table below.

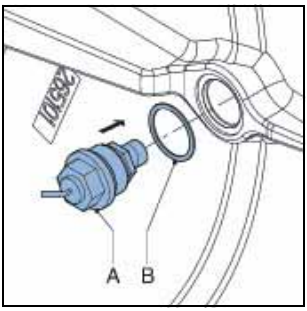


Pump type	Dimension "X"	
	mm	inch
Bredel 50	32 +0/-1	1.26 +0/-0.04

4. Tighten the adjusting nuts with a torque of 25 Nm (220 lbf in).
5. Remove a plug (A) and the sealing ring (B) on the back side of the pump housing. Check that the sealing ring (B) is not damage and replace it if necessary.

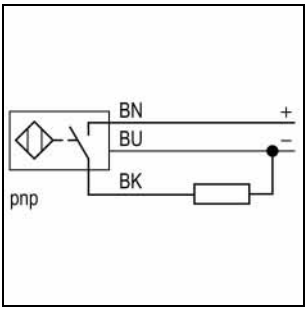


6. Fit the plug with the inductive sensor (A) together with sealing ring (B) on the pump housing.



7. Refill the pump housing to the proper level with Bredel Genuine Hose Lubricant. Refer to 7.4.

8. Connect the sensor via the 2-meter (6.5-feet) long PVC cable (3 x 0.34 mm^2, 3 x 22 AWG).



Specifications	
Voltage:	10...30 VDC
Current:	Max. 150 mA

WARNING
Contact your Bredel representative for proper connection of the sensor.

For explosive environments, contact your Bredel representative.

8 STORAGE

8.1 Hose pump

- Store the hose pump or pump parts in a dry area. Make sure that the hose pump or pump parts are not exposed to temperatures lower than -40 °C (-104 °F) or higher than +70 °C (158 °F).
- Cover the openings of the inlet and outlet ports.
- Prevent corrosion of untreated parts. For this purpose use the correct protection or packaging means.
- After a long period of standstill or storage (i.e. pump is idle for a period of longer than one continuous month), the static load on the pump hose may cause permanent deformation, which will reduce the life of the pump hose and may cause difficulty in starting.
  To prevent deformation of the hose, pump motor should be jogged on a monthly basis to allow repositioning of the shoe on the hose.
  If motor jogging is not possible and long term shutdown is expected, remove a pressing shoe and turn the rotor so far that the second pressing shoe is in front of the inspection window. In this way there is no load put on the pump hose. When startup is again expected, replace the pressing shoes, the proper number of shims, and the lubricant.

8.2 Pump hose

- Store the pump hose in a cool and dark room. After two years the hose material will age, which will reduce the life of the hose.

9 TROUBLESHOOTING

WARNING
Disconnect and lock the power supply to the pump drive before any work is carried out.
In case the motor is fitted with a frequency controller and has a single-phase power supply, wait two minutes to make sure that the capacitors have discharged.

If the hose pump does not function (correctly), consult the following checklist to see if you can remedy the error yourself. If this is not the case, contact your Bredel representative.

Problem	Possible cause	Correction
Failure to operate.	No voltage.	Check that the supply power switch is on.
		Check the electrical supply is available at the pump. Check current limit of electrical source to pump.
	Stalled rotor.	Check hose and lubricant was loaded properly and pressing shoes are shimmed properly.
	Lubricant level monitoring system has been activated.	Confirm that the lubricant level monitoring system has stopped the pump. Check the lubricant level and proper functioning of the level switch(es).

Problem	Possible cause	Correction
High pump temperature.	Non-standard hose lubricant used.	Consult the Bredel representative for the correct lubricant.
	Low lubricant level.	Add Bredel Genuine Hose Lubricant. For the required amount of lubricant refer to □ 10.1.4.
	Product temperature too high.	Consult the Bredel representative about the maximum temperature range of the product.
	Internal friction on the hose caused by blocked or poor suction characteristics.	Check pipe work/valves for blockages. Ensure that the suction pipe work is as short as possible and that the diameter is large enough.
	Over-shimming of the pump rotor shoes.	Consult the diagram. Refer to □ 10.1.7. Remove excess shims.
	High pump speed.	Reduce pump speed to a minimum. Consult with your Bredel pump representative for advice on optimum pump speeds.

Problem	Possible cause	Correction
Low capacity / pressure.	Shut-off valve in the suction line (partly) closed.	Fully open the shut-off valve.
	Under shimming of the pressing shoes.	Check shimming. Refer to specifications in □10.1.7. Fit the correct number of shims.
	Hose failure or badly worn hose.	Replace hose. Refer to □7.6.
	Partial blockage of the suction line or no product in suction vessel.	Ensure that the suction line is clear of blockages and that sufficient product is available.
	Connections and hose clamps not correctly mounted, which allows the pump to draw in air.	Tighten connections and hose clamps.
	You are starving the pump because the speed is too high for your suction pressure.	Consult your Bredel representative for a recommendation.
Vibration of the pump and pipe work.	Suction and discharge lines are not secured correctly.	Check and secure pipe work.
	High pump speed with long suction and discharge lines or high relative density or a combination of these factors.	Reduce pump speed. Reduce the line lengths on both suction and discharge where possible. Consult your Bredel representative for a recommendation.
	Too narrow diameter of suction and/or discharge line.	Increase the diameter of the suction/discharge lines.

Problem	Possible cause	Correction
Broken front cover bolts.	Pump cover removed with the hose in the pump.	Never remove the pump cover when the hose is still in the pump.
Short hose life.	Chemical attack of the hose.	Check the compatibility of the hose material with the product to be pumped. Consult your Bredel representative for correct hose selection.
	High pump speed.	Reduce pump speed.
	High discharge pressures.	It is recommended that the pressure on the discharge of the pump does not exceed 1600 kPa (230 psi). Check that the discharge line is not blocked, the shut-off valves are fully opened and the pressure relief valve functions properly (if present in the discharge line).
	High product temperature.	Consult your Bredel representative for correct hose selection.
	High pulsations.	Restructure the discharge and inlet conditions.
Hose pulled into the pump.	Insufficient or no hose lubricant in the pump head.	Add extra lubricant. Refer to 7.4.
	No Bredel Genuine Hose Lubricant used.	Consult the Bredel representative for the correct lubricant.
	Extremely high inlet pressure - larger than 300 kPa (43.5 psi).	Reduce the inlet pressure.

Problem	Possible cause	Correction
Lubricant leakage at flange bracket.	Hose blocked by an incompressible object in the hose. The hose cannot be compressed and will be pulled into the pump housing.	Remove hose, check for blockages and replace if necessary.
	Bolts of flange bracket loose.	Tighten to the specified torque settings. Refer to 10.1.6.
	Bolts of hose clamps loose.	Tighten to the specified torque settings. Refer to 10.1.6.
Leakage from the rear of the pump housing "Buffer zone".	Damaged wear or seal ring.	Replace wear or seal ring.
Motor running, but rotor not.	Pump shaft sheared at undercut from overload condition.	Follow installation procedure supplied with replacement shaft. Check process conditions to prevent reoccurrence of overload.

10 SPECIFICATIONS

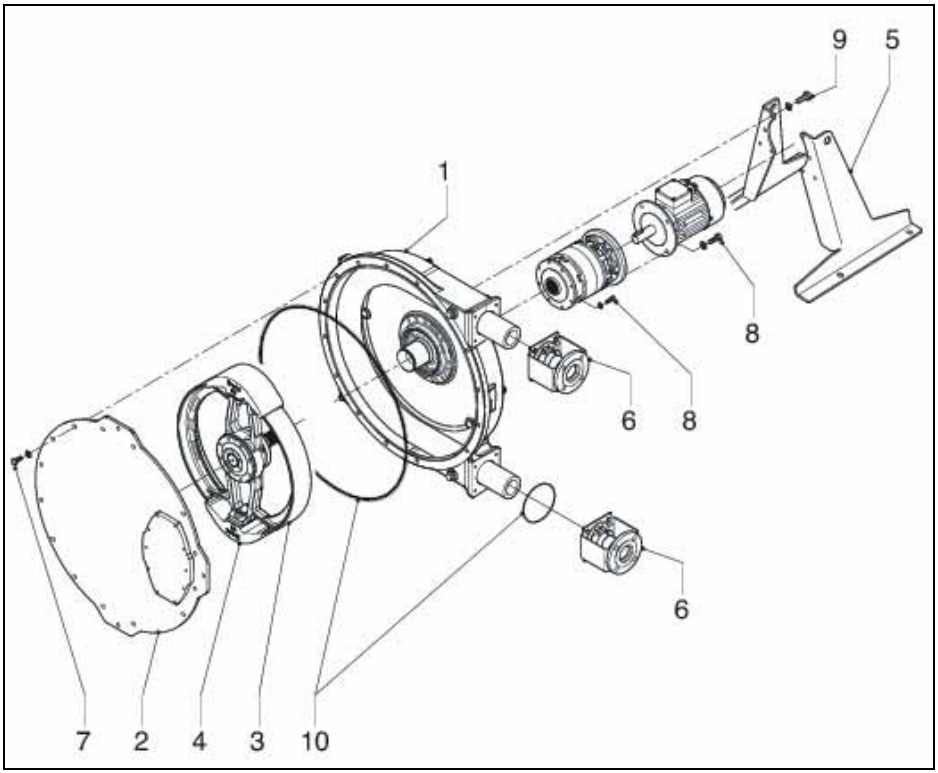
10.1 Pump head

10.1.1 Performance

Description	Unit	Bredel 50
Max. capacity, continuous	m3/h	10.5
	GPM	46.0
Max. capacity, intermittent*	m3/h	17.5
	GPM	77
Capacity per revolution	l/rev	2.9
	Gal/rev	0.766
Max. permissible working pressure	kPa	1600
	PSI	232
Permissible ambient temperature	°C	-20 to +45
	°F	-4 to 113
Permissible product temperature	°C	-10 to +80
	°F	14 to 176
Sound level on 1 m	dB(A)	70

* Intermittent duty: Let the pump stand still to cool down for at least 1 hour after 2 hours of operation.

10.1.2 Materials



Pos	Description	Material
1	Pump housing	Cast-iron
2	Cover	Commercial grade mild steel 37
3	Pump rotor	Cast-iron
4	Pressing shoes	Aluminium (Epoxy is optional)
5	Supports	Mild steel, galvanized*
6	Hose flange brackets	Mild steel, galvanized*
7	Cover fixings	Mild steel, galvanized*
8	Motor fixings	Mild steel, galvanized*
9	Mounting material of supports	Mild steel, galvanized*
10	Seals and glands	Neoprene or Nitrile

* Available in Stainless Steel upon request

10.1.3 Surface treatment

- After surface preparation, one layer of two-component acrylate is used for surface protection. Standard color is RAL 3011, however other colors are optional. Contact your Bredel representative for details on surface treatment.
- All galvanized parts, exclusive of mounting articles, have been provided with an electrolytic zinc layer of 15 - 20 microns (0.6 - 0.8 mil).

10.1.4 Lubricant table pump

	Unit	Bredel 50
Lubricant	-	Bredel*
Required quantity	liters	10
	gallons	2.6

* Bredel Genuine Hose Lubricant is registered at NSF: NSF Registration No 123204; Category Code H1. See also: www.NSF.org/USDA.

The relative density of Bredel Genuine Hose Lubricant is 1.245.

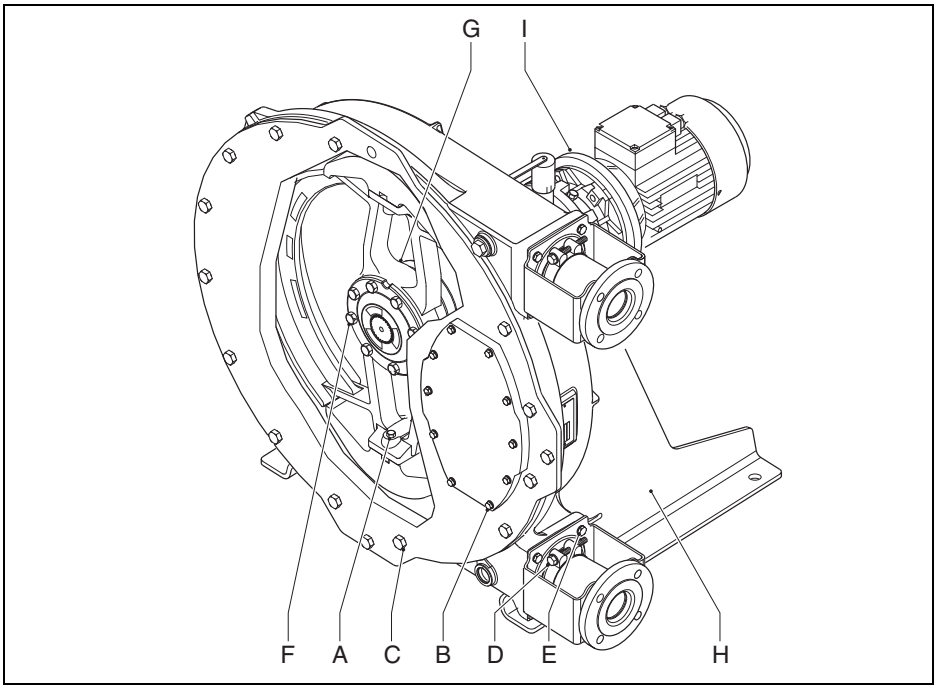
	Should you require additional information with respect to the safety data sheet, consult your Bredel representative.

10.1.5 Weights

Description	Unit	Bredel 50
Hose pump, maximum weight*	kg	325
	lbs	717
Pump head**	kg	227
	lbs	500
Rotor	kg	24
	lbs	53
Pressing shoe	kg	1.8
	lbs	4.0
Pump cover	kg	30
	lbs	66
Drive shaft	kg	5.9
	lbs	13
Hub	kg	16
	lbs	35.3
Hose	kg	6.4
	lbs	14.1
Hose dimensions IDxODxLength	mm	50 x 80.2 x 1820
	inch	1.97 x 3.16 x 71.6

* Maximum net weight of the hose pump with the heaviest gearbox and electric motor.
** Weight of a completely mounted pump head (inclusive of hose, lubricant and supports).

10.1.6 Torque figures



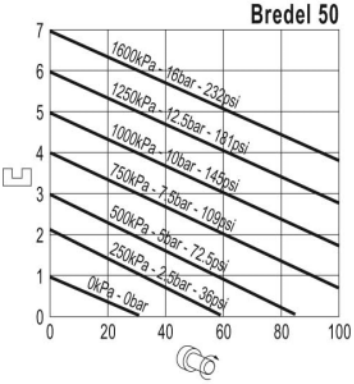
Pos	Description	Unit	Bredel 50
A	Pressing shoe bolt(s)	Nm	85
		lbf in	750
B	Inspection window bolts	Nm	8
		lbf in	70.8
C	Cover bolts	Nm	85
		lbf in	752.25
D	Hose clamp	Nm	40
		lbf in	354
E	Flange bracket bolts	Nm	50
		lbf in	442.5
F	Drive shaft bolts	Nm	50
		lbf in	442.5

Pos	Description	Unit	Bredel 50
G	Hub bolts	Nm	50
		lbf in	442.5
H	Support bolts	Nm	50
		lbf in	442.5
I	Gearbox bolts	Nm	85
		lbf in	752.25

Pos	Description	Thread, A/F
		Bredel 50
A	Pressing shoe bolt(s)	M12 19 mm
B	Inspection window bolts	M8 13 mm
C	Pump cover bolts	M12 19 mm
D	Hose clamp	M10 17 mm
E	Flange bracket bolts	M10 17 mm
F	Drive shaft bolts	M10 17 mm
G	Hub bolts	M10 17 mm
H	Support bolts	M10 17 mm
I	Gearbox bolts	M12 19 mm

10.1.7 Shims specifications

- When the product temperatures are above 60 °C (140 °F) always use one shim less than indicated in the diagrams.
- Always round up the number of shims.



10.2 Lubricant table gearbox

Below is an overview of some of the recommended lubricants for the planetary gearbox. In the majority of the cases a mineral oil ISO VG 150 or ISO VG 220 is recommended. In case of very low or ambient temperatures a mineral ISO VG 100 is advized. In case of high ambient temperatures or relatively wide range of ambient temperatures a synthetic oil is recommended. Also in case of very high loads, resulting in high operating temperatures a synthetic oil is to be preferred. Contact your Bredel representative for advice.

Recommended lubricants for the Bredel planetary gearboxes*				
	-20 °C to 5 °C -4 °F to 41 °F IV 95 min	5 °C to 30 °C 41 °F to 86 °F IV 95 min	5 °C to 50 °C 41 °F to 122 °F IV 95 min	-30 °C to 65 °C -22 °F to 149 °F IV 165 min
ISO 3448	VG 100	VG 150	VG 320	VG 150 - 220
AGIP	Blasia 100	Blasia 150	Blasia 320	Blasia SX 220
ARAL	Drgol BG 100	Drgol BG 150	Drgol BG 220	Drgol PAS 220
BP	Energol GR-XP 100	Energol GR-XP 150	Energol GR-XP 320	Enersyn EXP 22O
CASTROL	Alphamax 100	Alphamax 150	Alphamax 320	Alphasyn PG150
ESSO	Spartan EP 100	Spartan EP 150	Spartan EP 320	Spartan SEP 220
Q8	Goya NT 100	Goya NT 150	Goya NT 320	El Greco 220
I.P.	Mellana 100	Mellana 150	Mellana 320	Telesia Oil 150
MOBIL	Mobilgear XMP 100	Mobilgear XMP 150	Mobilgear XMP 320	Mobilgear SHC XMP 220
SHELL	Omala oil 100	Omala oil 150	Omala oil 320	Omala HD 220
TOTAL FINA ELF	Carter EP 100	Carter EP 150	Carter EP 320	Carter SH 220
KL□BER	Kluberoil GEM 1-150	Kluberoil GEM 1-150	Kluberoil GEM 1-320	Klubersynth EG 4-220
TEXACO	Meropa 100	Meropa 150	Meropa 320	Pinnacle EP

* For a complete overview of the recommended lubricants contact your Bredel representative.

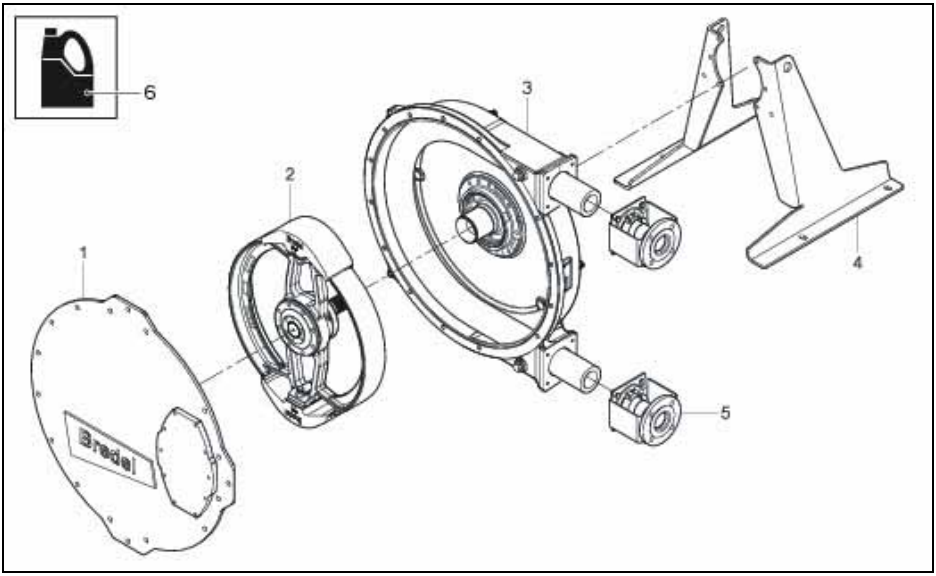
10.3 Electric motor

Protection class	IP55/IK08
Insulation class	F
Temperature rise	Within class B
Voltage/frequency*	230/460 V - 3 phases - 60 Hz

* unless specified otherwise

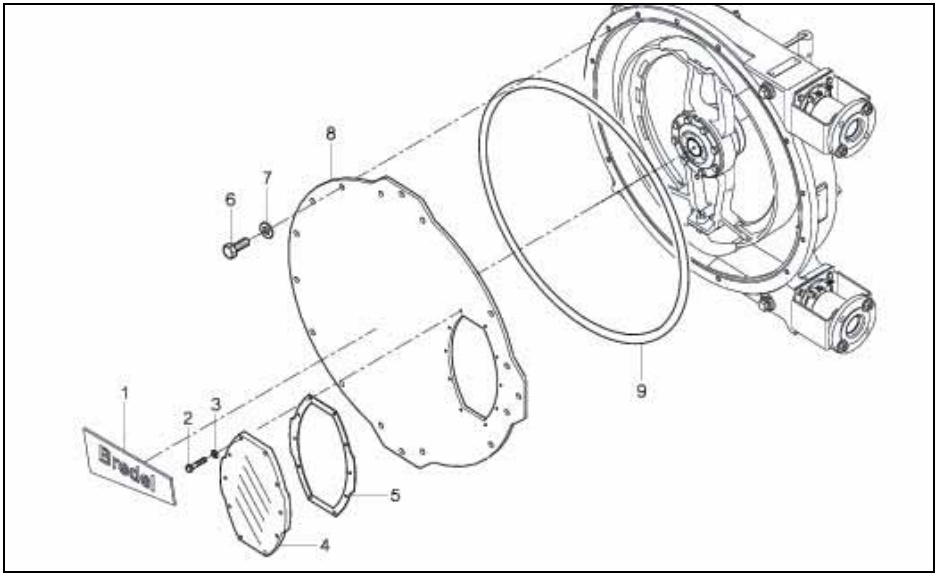
10.4 Parts list

10.4.1 Overview



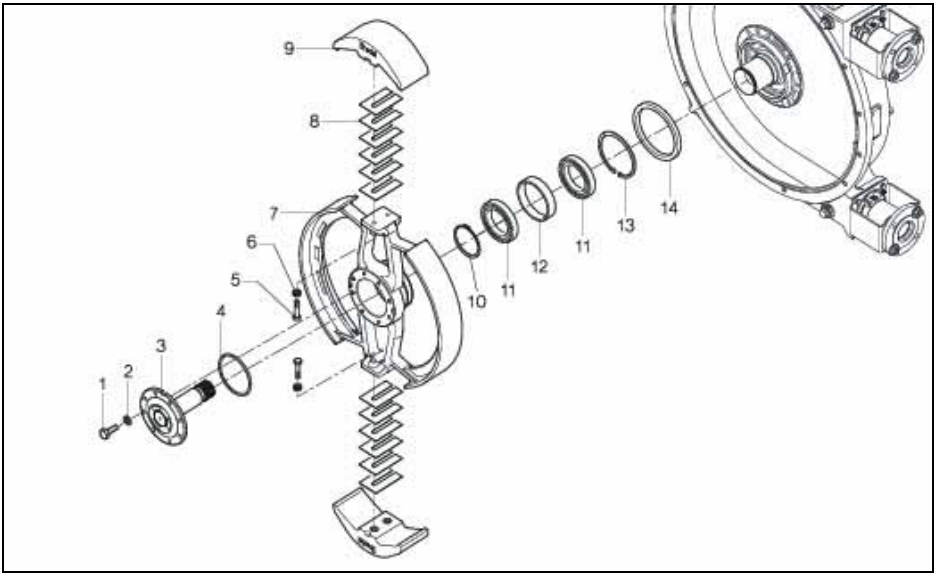
Pos.	Description
1	Cover assembly. Refer to □ 10.4.2.
2	Rotor assembly. Refer to □ 10.4.3.
3	Pump housing assembly. Refer to □ 10.4.4.
4	Pump support assembly. Refer to □ 10.4.5.
5	Flange assembly. Refer to □ 10.4.6.
6	Lubricant. Refer to □ 10.4.8.

10.4.2 Cover assembly



Pos.	Qty.	Description	Product codes for parts of pump type
			Bredel 50
1	1	Sticker	250238
2	8	Bolt, hex. head	F111074
3	8	Washer, plain	F322012
4	1	Inspection window	250155
5	1	Gasket	250156
6	14	Bolt, hex. head	F111130
7	14	Washer, plain	F322015
8	1	Pump cover	250102
9	1	Quad ring	250123

10.4.3 Rotor assembly



Pos.	Qty.	Description	Product codes for parts of pump type
			Bredel 50
1	8*	Bolt, hex. head	F111098
2	8*	Washer, spring Lock	F336012
3	1	Drive shaft**	250104
4	1	O-ring	S122541
5	2***	Bolt, hex. head	F101082
6	2***	NordLock® ring	F349007
7	1	Rotor	250103
8	12 ****	Shim	250107
9	2	Pressing shoe: aluminium	250110
	2	Epoxy, with stainless steel insert	250109A
10	1	Retaining ring	F343071
11	2	Bearing	B142060
12	1	Spacer outside	29150201
13	1	Retaining ring	F344087

Pos.	Qty.	Description	Product codes for parts of pump type
			Bredel 50
14	1	Wear ring	29180202

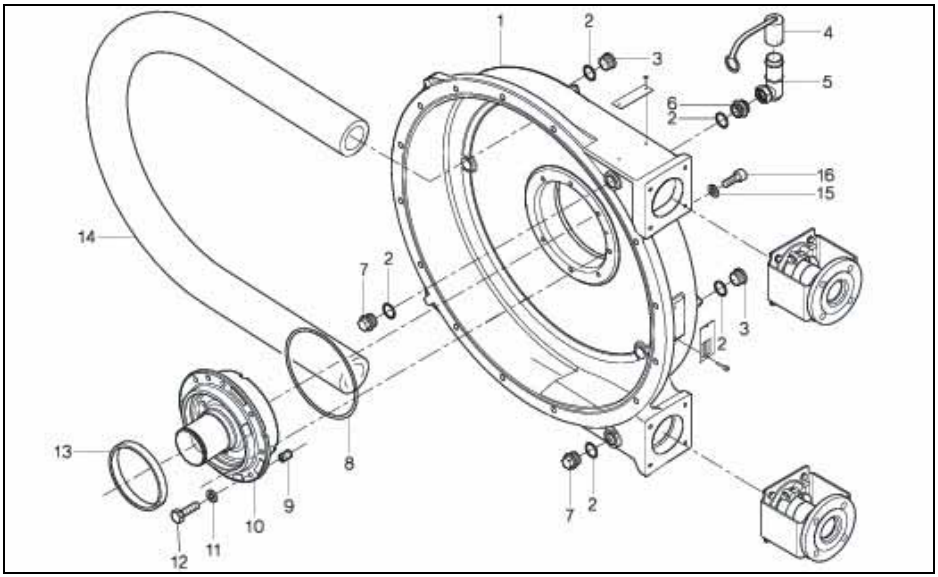
* Pos. 1 and 2: Bredel 65, Bredel 80, Bredel 100: 12 pieces

** Pos. 3: Standard drive shaft. For the drive shaft of the Bredel 65 heavy duty drive (gearboxes G0217□ and G0218□) and the Bredel 80 heavy duty drive (gearboxes G0224□ and G0225□), consult your Bredel representative.

*** Pos. 5 and 6: Bredel 65, Bredel 80, Bredel 100: 4 pieces

**** Pos. 8: Bredel 40: 12 pieces, Bredel 50 and Bredel 100: 14 pieces, Bredel 65 and Bredel 80: 20 pieces

10.4.4 Pump housing assembly

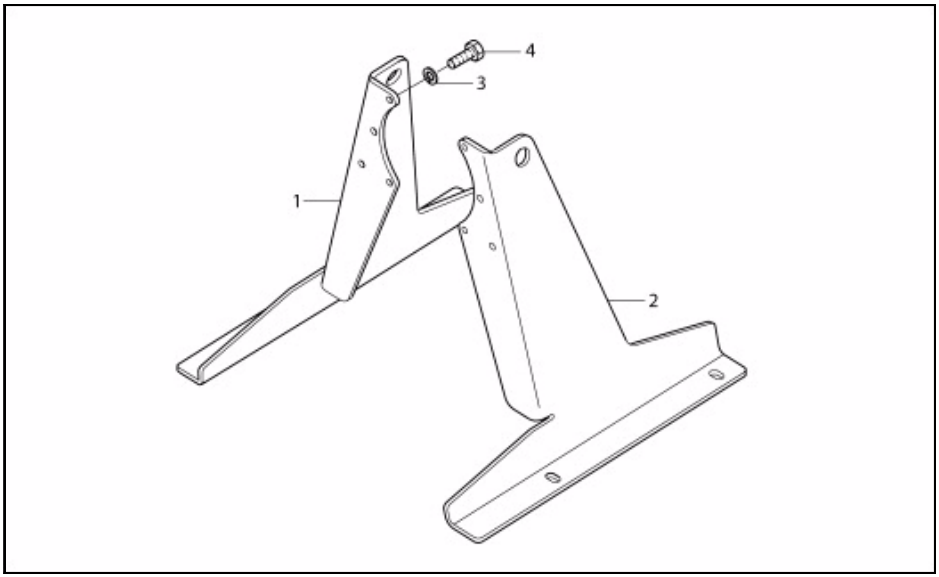


Pos.	Qty.	Description	Product codes for parts of pump type
			Bredel 50
1	1	Pump housing	250101
2	4	Packing ring	29040257
3	2	Plug, int. hex. hd	F901006
4	1	Breather cap	29065223
5	1	Breather	29110146
6	1	Coupling, straight	F602006

Pos.	Qty.	Description	Product codes for parts of pump type
			Bredel 50
7	2	Plug, ext. hex. hd.	F911006
8	1	O-ring	S122711
9	1	Dowel pin	F416082
10	1	Hub	250203
11	8	Washer, spring Lock	F336012
12	8	Bolt, hex. head	F115098
13	1	Seal	S213611
14	1	NR	050020
	1	NBR	050040
	1	EPDM	050075
	1	CSM	050070
15	8	Washer*	-
	10		F332007
	12		-
16	8	Bolt, hex. socket cap head*	-
	10		F201106
	12		-

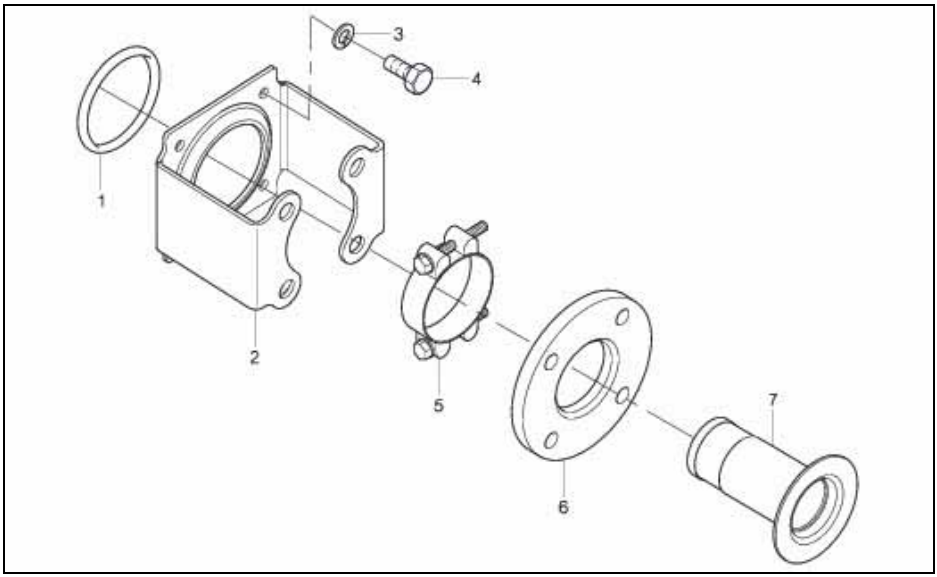
* For fixation of the standard drive. For fixation of the Bredel 65 heavy duty drive (gearboxes G0217... and G0218...) and the Bredel 80 heavy duty drive (gearboxes G0224... and G0225...), consult your Bredel representative.

10.4.5 Support assembly



Pos.	Qty.	Description	Product codes for parts of pump type
			Bredel 50
1	1	Support, right	250106B
2	1	Support, left	250106A
3	8	Washer, spring Lock	F336012
4	8	Bolt, hex. head	F111098

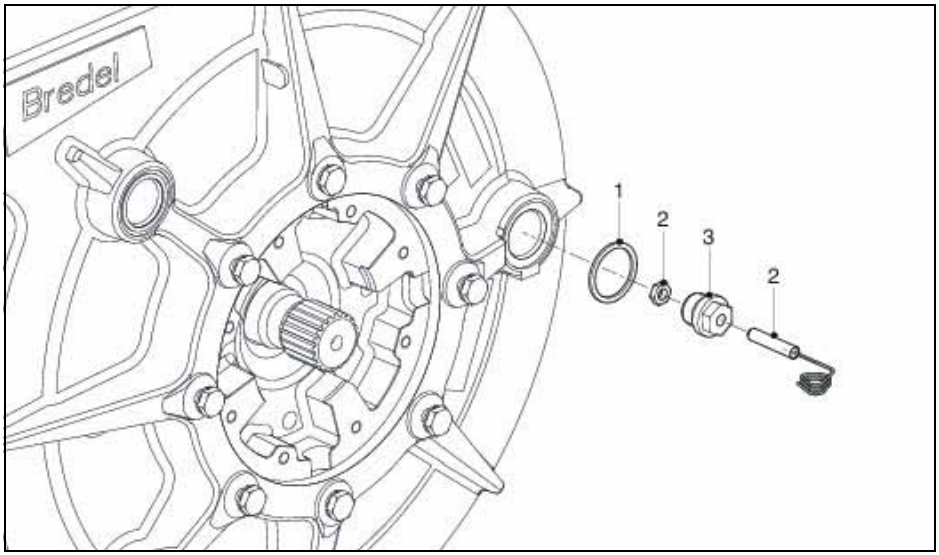
10.4.6 Flange assembly



Pos.	Qty.	Description	Product codes for parts of pump type
			Bredel 50
1	2	O-ring	S112371
2	2	Flange bracket, DIN Steel	250197
	2	Flange bracket, DIN SS	250197E
	2	Flange bracket, ANSI Steel	250197
	2	Flange bracket, ANSI SS	250197E
3	8	Washer, spring lock	F336012
4	8	Bolt, hex. head	F111096
5	2	Hose clamp	C101045
6	2	Flange, DIN Steel	050198
6	2	Flange, DIN SS	250199
6	2	Flange, ANSI Steel	050198A
6	2	Flange, ANSI SS	250199A

Pos.	Qty.	Description	Product codes for parts of pump type
			Bredel 50
7	1	Insert, AISI 316	050186
	1	Insert, PP	250189
	1	Insert, PVC	250187
	1	Insert, PVDF	250190

10.4.7 Revolution counter assembly



Pos.	Qty.	Description	Product codes for parts of pump type
			Bredel 50
1	1	Gasket	29040257
2	1	Revolution counter	29040462
3	1	Adapter	29039460

10.4.8 Lubricants

Pos.	Qty.	Description	Product codes for parts of pump type
			Bredel 50
1	1	5 l (1.3 gal) can Bredel Genuine Hose Lubricant	-
	1	10 l (2.6 gal) can Bredel Genuine Hose Lubricant	904143
	1	20 l (5.3 gal) can Bredel Genuine Hose Lubricant	-
	2		-
	3		-

SAFETY FORM

Product Use and Decontamination Declaration

In compliance with the **Health and Safety Regulations**, the user is required to declare those substances that have been in contact with the item(s) you are returning to Watson-Marlow Bredel B.V. or any of its subsidiaries or distributors. Failure to do so will cause delays in servicing the item or in issuing a response. Therefore, **please complete this form** to make sure we have the information before receipt of the item(s) being returned. A completed copy must be attached to **the outside of the packaging** containing the item(s). You, the user, are responsible for cleaning and decontaminating the item(s) before returning them.

Please complete a separate Decontamination Certificate for each item returned. **RGA/KBR no**.....

1 Company ....

Address ....

Postal code.....

Telephone ..... Fax number .....

2 Product .....

2.1 Serial Number .....

2.2 Has the Product been used□

YES ☐ NO ☐

If yes, please complete all the following paragraphs.

If no, please complete paragraph 5 only

3 Details of substances pumped

3.1 Chemical Names

a) .....

b) .....

c) .....

d) .....

3.2 Precautions to be taken in handling these substances:

a) .....

b) .....

c) .....

d) .....

3.3 Action to be taken in the event of human contact:

a) .....

b) .....

c) .....

d) .....

3.4 Cleaning fluid to be used if residue of chemical is found during servicing;

a) .....

b) .....

c) .....

d) .....

4 I hereby confirm that the only substances(s) that the equipment specified has pumped or come into contact with are those named, that the information given is correct, and the carrier has been informed if the consignment is of a hazardous nature.

5 Signed .....

Name .....

Position .....

Date .....

Note:

To assist us in our servicing please describe any fault condition you have witnessed.

.....

.....

.....

.....

.....

Watson-Marlow Pumps Group
37 Upton Technology Park
Wilmington, MA 01887
USA
Telephone: 800 - 282 - 8823
978 - 658 - 6168
Fax: 978 - 658 - 0041

Internet: www.wmpg.com
E-mail: support@wmpg.us

29210302 TS 02-013-E

Subject: **General paint specification**				Code: **TS07-004**	Rev. **E**
Designed:	ON	Datum:	12-9-07	Ref.:	
Checked:	DS	Datum:	12-9-07		

Paint specification for Bredel Hose Pumps: Bredel series

Surface preparation

1. Sandblasting, material conditions conform A Sa 2□
2. Impermeable coating, oxylane based

Housing outside and Cover

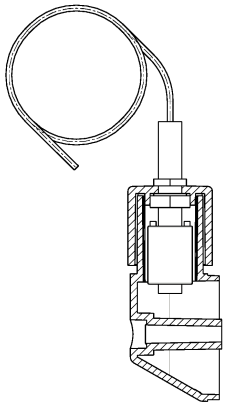
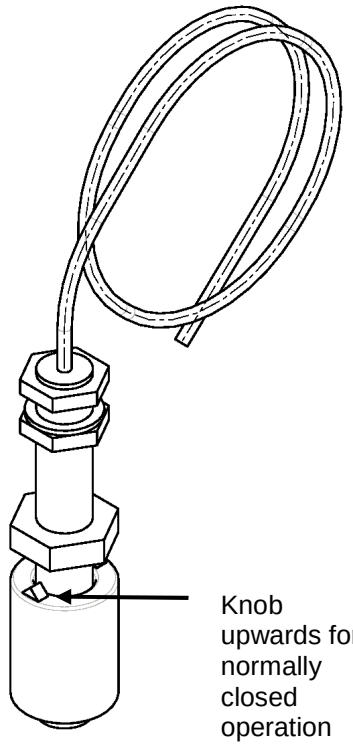
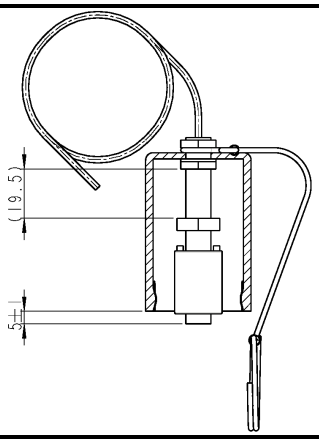
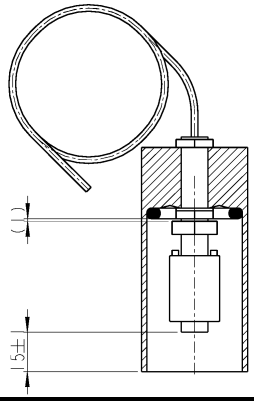
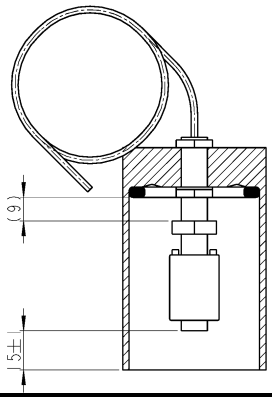
Coating:	1 layer of 2 component high solid polyurethancoating based on acrylate – isocyanate combination.
Dry film thickness:	DFT 60 – 80 micron
Colour:	RAL 3011, Red

Housing inside / Rotor / Hub

Coating:	1 layer of 2 component high solid polyurethancoating based on acrylate – isocyanate combination.
Dry film thickness:	DFT 30 – 40 micron
Colour:	RAL 3011, Red

WATSON-MARLOW BREDEL B.V. **TECHNICAL SPECIFICATION**

Description:				Code:	Rev.:
High Level Lubricant Switch				**TS05-011**	**C**
Created by:	AB	Date:	04-10-2005	Ref.:	
Checked by:	DS	Date:	04-10-2005		

Pump type	*Order code*	*Construction*	*Float switch (A230 002)*
APEX10 - 20	Composition: 300 001 610 Single floater: A230 002 Fitted on pump: 300 001 999		
Bredel 10 - 20	Composition: 29 107 610 Single floater: A230 002 Fitted on pump: 2*XX* 999N		
Bredel 25 – 65	Composition: 29 104 610 Single floater: A230 002 Fitted on pump: 2*XX* 999N		
Bredel 40 – 65 vacuüm	Composition: 29 106 610 Single floater : A230 002 Fitted on pump: 2*XX* 999N		
Bredel 80 – 100 (also for vacuum)	Composition: 29 124 610 Single floater : A230 002 Fitted on pump: 2*XX* 999N		

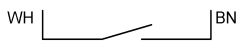
Barksdale
Type :
UNS-VA/G1/8-K2-PP19/1(2)-EXI

ATEX
II 1 GD EEx ia II B T6
IP65 T100^{0}C

T_{amb} : -40^{0}C …+75^{0}C
Ui = 28V
Ii = 50mA
Ci = 40pF
Li = 4 µH

Material :
Stem/nut: Stainless Steel
Float: PP
Cable: PVC/ 2x0.34 mm^2/ L = 2m.

Connection diagram :



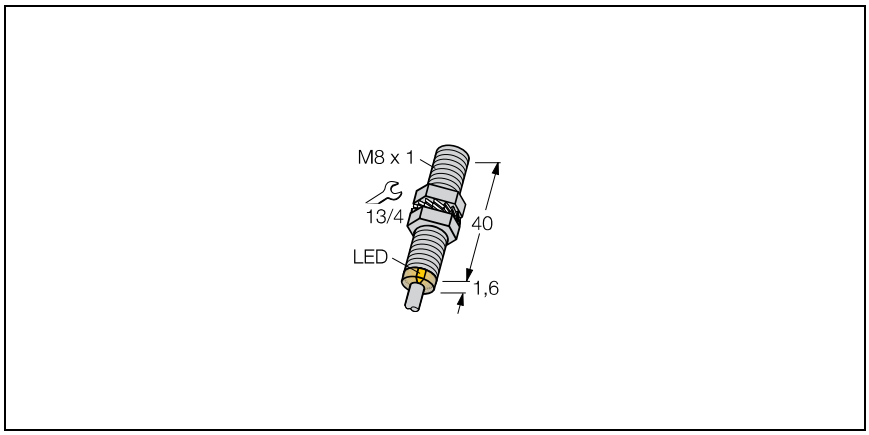
EXCEPTION:
Only if the switch is used in a non-ATEX zone you may use the following Max. Contact Rating: 230V AC/DC, 2 A, 40VA/W

**Remark : dimensions in mm.*

REVISIONS SUMMARY

Rev.	Description	By:	Date:	Remarks:
C	APEX data added	AK	24-04-2014	

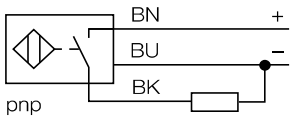
Magnetic field sensor
magnet-inductive proximity sensor
BIM-EG08-AP6X



Type	BIM-EG08-AP6X
Ident-No.	4621310
Rated operating distance Sn	78 mm
Hysteresis (switching distance)	1... 10 %
Temperature drift	≤ ± 10 %
Min. repeat accuracy	≤ 0,3 %
Operating temperature	-25 ...+ 70 °C
Rated operational voltage (DC) U_B	10... 30 VDC
Max. ripple	≤ 10 % U_{pp}
Rated operational current (DC) I_e	≤ 150 mA
No-load current I_0	≤ 15 mA
Max. OFF-state current	≤ 0,1 mA
Max. switching frequency	≤ 1 kHz
Rated insulation voltage	≤ 0,5 kV
Output function	3-wire, normally open, PNP
Short-circuit protection	yes, cyclic
Max. voltage drop at I_e	≤ 1,8 V
Wire breakage / reverse polarity protection	yes / complete
Housing style	threaded barrel; M8 x 1
Dimensions	40 mm
Housing material	metal, A2 1.4301 (AISI 304)
Active face	plastic, PA12-GF30
Wiring	cable
Cable	Ø 4, LifYY-11Y, PUR, 2 m
Cable cross section	3 x 0,25 mm^2
Vibration resistance	55 Hz (1 mm)
Shock resistance	30 x g (11 ms)
Degree of protection	IP67
Switching status indication	LED yellow

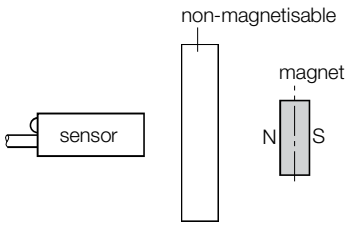
- **threaded barrel, M8 x 1**
- **stainless steel, 1.4301**
- **nominal switching distance 78 mm, in conjunction with magnet DMR31-15-5**
- **3-wire DC, 10...30 VDC**
- **normally open pnp output**
- **cable connection**

Wiring diagram



Function principles

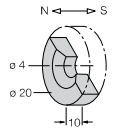
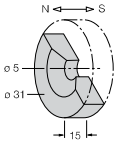
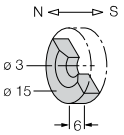
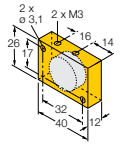
Magnet-inductive proximity sensors are actuated by magnetic fields and are thus capable of detecting permanent magnets through ferro-magnetic materials (e.g. wood, plastic, non-ferrous metals, aluminium, stainless steel).
Thus it is possible to achieve large switching distances even with smaller housing styles. In combination with the actuation magnet DMR31-15-5, TURCK's M8style sensors feature a nominal switching distance of 78 mm. Thus there are manifold detection possibilities, particularly if mounting space is limited or other difficult sensing conditions prevail.



Hans Turck GmbH & Co.KG • Postfach • D-45466 Mülheim an der Ruhr • Telefon 02 08/49 52-0 • Telefax 02 08/49 52-264

Magnetic field sensor
magnet-inductive proximity sensor
BIM-EG08-AP6X

Accessories

Typ	Ident-No.	Description	Dimension drawing
DMR20-10-4	6900214	actuation magnet; Ø 20 mm (Ø 4 mm), h: 10 mm	
DMR31-15-5	6900215	actuation magnet, Ø 31 mm (Ø 5 mm), h: 15 mm	
DMR15-6-3	6900216	actuation magnet, Ø 15 mm (Ø 3 mm), h: 6 mm	
DM-Q12	6900367	actuation magnet; rectangular, plastic	

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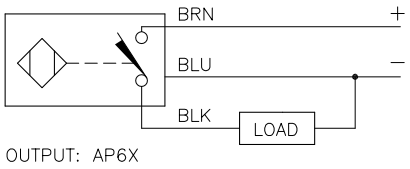
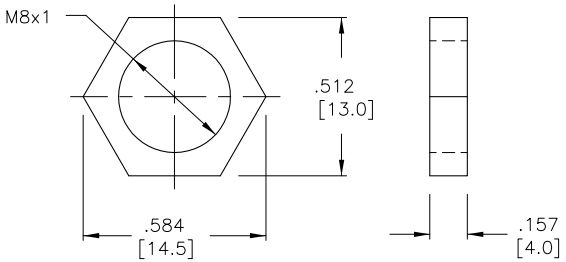
WIRING DIAGRAM



OUTPUT: AP6X

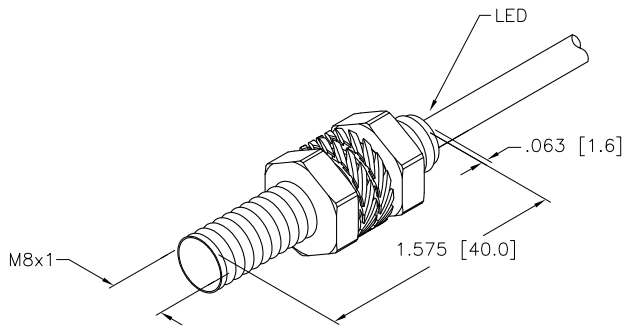
SHORT–CIRCUIT AND OVERLOAD PROTECTED

LOCKNUT LN–M8



SPECIFICATIONS

MIN. REPEAT ACCURACY	≤ 0.3%
TEMPERATURE DRIFT	≤ ±10%
HYSTERESIS	1–10%
OPERATING TEMPERATURE	–25°C to +70°C (–13°F to +158°F)
RATED OPERATIONAL VOLTAGE	10–30 VDC
RESIDUAL RIPPLE	≤ 10%
DC RATED OPERATIONAL CURRENT	≤ 150 mA
NO–LOAD CURRENT	≤ 15 mA
RESIDUAL CURRENT	≤ 0.1 mA
RATED INSULATION VOLTAGE	≤ 0.5 kV
SHORT–CIRCUIT PROTECTION	YES
MAX. VOLTAGE DROP	≤ 1.8 V
WIRE BREAKAGE PROTECTION	INCORPORATED
REVERSE POLARITY PROTECTION	INCORPORATED
OUTPUT FUNCTION	3–WIRE, NORMALLY OPEN, PNP
MAX. SWITCHING FREQUENCY	≤ 1.0 kHz
HOUSING MATERIAL	METAL, A2 1.4301 (AISI 304)
ACTIVE FACE MATERIAL	PLASTIC, PA12–GF30
END CAP MATERIAL	PLASTIC, PP
CABLE	ø4.0, LifYY–11Y, TPU, 2.0 METERS
VIBRATION RESISTANCE	55 Hz (IN ALL 3 PLANES)
SHOCK RESISTANCE	30 g, 11 ms
DEGREE OF PROTECTION	IP 67
SWITCHING STATUS INDICATION	LED, YELLOW



CABLE LENGTH	TOLERANCE
ALL LENGTHS	+ 4% (OR 50mm) OF LENGTH – 0% (OR 0mm) OF LENGTH WHICHEVER IS GREATER
STRIP LENGTH	**TOLERANCE**
0–7mm	±0.5mm
8–29mm	±1.0mm
30–49mm	±2.0mm
50–69mm	±3.0mm
70–100mm	±4.0mm
OVER 100mm	±5.0mm

RELATED DOCUMENTS
1.
2.
3.
4.

3RD ANGLE PROJECTION

TURCK INC
High Technology Sensors and Automation Controls
3000 CAMPUS DRIVE
MINNEAPOLIS, MN 55441
1–800–544–7769
(763) 553–7300
(763) 553–0708 fax
turck.com

MATERIAL: SEE SPECIFICATIONS

FINISH: SEE SPECIFICATIONS

ALL DIMENSIONS DISPLAYED ON THIS DRAWING ARE FOR REFERENCE ONLY

CONTACT TURCK FOR MORE INFORMATION

DRFT: RDS | DATE: 10/30/02

DSGN: – | SCALE: 1=1.0

UNIT OF MEASUREMENT
INCH [MILLIMETER]
DO NOT SCALE THIS DRAWING

DESCRIPTION: BIM–EG08–AP6X

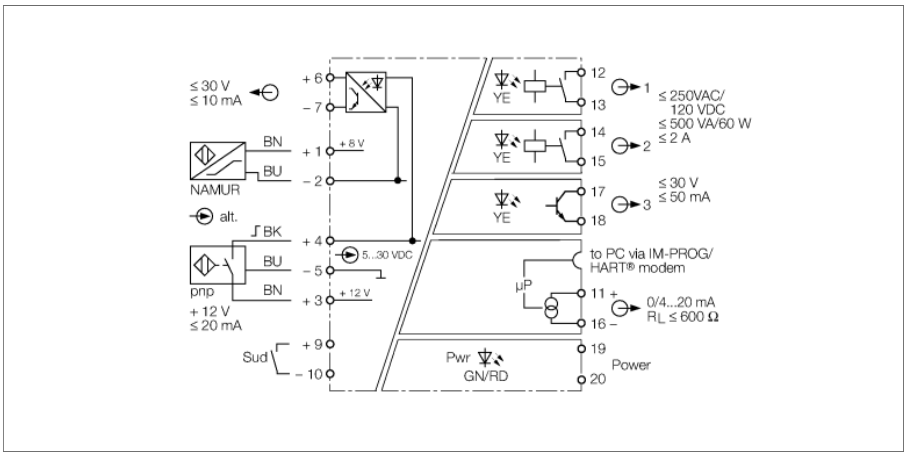
IDENTIFICATION NO.: S4621310 | REV: C

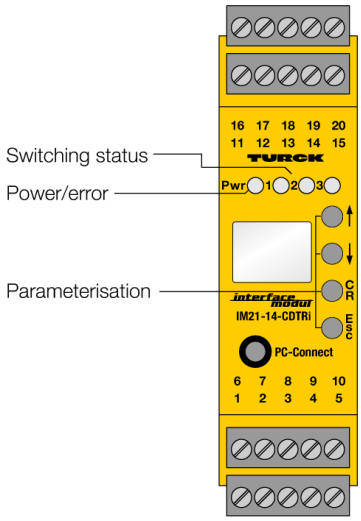
FILE: S4621310 | SHEET 1 OF 1

REV	DESCRIPTION	BY	DATE	ECO NO.
C	DRAWING PROCESSED AS PART OF ECO 33971	CBM	04/06/11	33971

interface modul

Rotation speed monitor
1-channel
IM21-14-CDTRI





The rotation speed monitor IM21-14-CDTRI analyzes pulse frequencies, rotation speeds and pulse trains of rotating motor parts, gears or turbines and monitors them for overrange resp. underrange of adjusted limit values. A display integrated in the front cover indicates the current value.

The switching status of the corresponding output relay or transistor is indicated by a yellow LED and operational readiness by a green LED. Input pulses are shown on the display. For signal detection, connect sensors acc. to EN 60947-5-6 (NAMUR), 3-wire PNP sensors or external signal sources with pulse levels of 5…30 VDC. If NAMUR sensors are connected, the line is monitored according to wire-break and/or short-circuit. In case of input circuit error the relays are de-energized, the transistor is inhibited and the Power-LED (Pwr) changes to red.

PNP 3-wire sensors can be supplied with 12 V (20 mA) from the rotation speed monitor. External signal sources must have a signal level of 5…30 VDC. The input pulse signal is transferred to the potential-free pulse output and from there to further processing units.

In order to achieve short response times for all applications, low frequencies are monitored according to the principle of period duration measurement and high frequencies are monitored with a time window. In case of low frequencies, the response time depends only on the period duration of the signal. The device is parameterized via four pushbuttons. The parameters are shown on the display.

At each of the three outputs a predefined setpoint value can be monitored according to overshoot/undershoot. In addition, the two relays monitor overshoot/undershoot of window limits which are defined as a tolerance around the setpoint value. The transistor output can also be used as a pulse divider. The measured value is permanently written to a ring memory with space for 8000 values. The writing process is stopped with a predefined trigger event, like for example "excess of limit value". After that, the stored signal sequence can be read out.

The switching hysteresis is defined by programming the switch-on and switch-off point. Additionally, output cut-off due to suddend frequency changes can be avoided if a switch-off delay is programmed for each output. A locking function prevents the output relay of being switched on again. The outputs are operated in NO mode; in "good-condition" the corresponding output is in switched state.

- **Rotation speed monitor**
- **Line monitored for wire-break/short-circuit**
- **Monitoring of over and underrange of value and window limits**
- **Operating range 0.06…600000 min^{-1}**
- **Connection of sensors acc. to EN 60947-5-6 (NAMUR), 3-wire sensors and external power supplies 5…30 VDC**
- **Two relay outputs and one transistor output**
- **Current output 0/4…20 mA, reversible**
- **Pulse output**
- **Analog output adjustable in the event of input circuit errors**
- **Parametrized via PC (FDT/DTM); with diagnostic messaging function**
- **HART®**
- **Ring memory for up to 8000 measured values**
- **Universal operating voltage**
- **Removable terminal blocks**
- **Galvanic separation of input circuits, output circuits and power supply**

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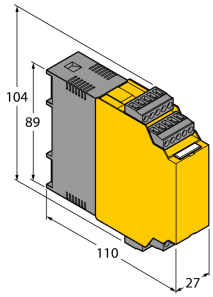
Rotation speed monitor
1-channel
IM21-14-CDTRI

Dimensions



Type	IM21-14-CDTRI
Ident-No.	7505650
Ident-No (TUSA)	M7505650
Nominal voltage	Universal voltage supply unit
Operating voltage	20…250 VAC
Frequency	40…70 Hz
Operating voltage range	20…250 VDC
Power consumption	≤ 3 W
Monitoring range / setting range:	≤ 0.06…600000 min^{-1}
Input frequency	600000 min^{-1}
Pulse time	≥ 0.02 ms
Pulse stop	≥ 0.02 ms
NAMUR	EN 60947-5-6
No-load voltage	8.2 VDC
Short-circuit current	8.2 mA
Input resistance	1 kΩ
Cable resistance	≤ 50 Ω
Switch-on threshold:	1.55 mA
Switch-off threshold:	1.75 mA
Wire breakage threshold	≤ 0.1 mA
Short-circuit threshold	≥ 6 mA
3-wire input	
No-load voltage	12 VDC
Current	≤ 20 mA
Input resistance	600 Ω
0-signal	0...3VDC
1-signal	5...30 VDC
External signal source	
0-signal	0…3 VDC
1-signal	5…30 VDC
Input resistance	26000 Ω
Output current	0/4...20 mA
Load resistance current output	≤ 0.6 kΩ
Fault current	0 / 22 mA adjustable
Output circuits (digital)	2 x relays (NO)
Relay switching voltage	≤ 250 VAC/120 VDC
Switching current per output	≤ 2 A
Switching capacity per output	≤ 500 VA/60 W
Switching frequency	≤ 10 Hz
Voltage drop	≤ 2.5 V
Contact quality	AgNi, 3µ Au
Semicondutor output circuit(s)	
Output circuits (digital)	1 x transistor (potential-free, short-circuit protected)
Switching voltage	≤ 30 VDC
Switching current per output	≤ 50 mA
Switching frequency	≤ 10000 Hz
Pulse output	
Voltage	≤ 30 V
Current	≤ 10 mA
Measuring accuracy	≤ 0.1 % of full scale
Galvanic separation	
Test voltage	2.5 kV
Rated voltage	250 V
Indication	
Operational readiness	green
Switching state	yellow
Error indication	red

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Rotation speed monitor
1-channel
IM21-14-CDTRI

Protection class	IP20
Ambient temperature	-25…+70 °C
Storage temperature	-40…80°C
Dimensions	104 x 27 x 110 mm
Weight	243 g
Mounting instruction	For mounting on DIN rail or mounting panel
Housing material	Polycarbonate/ABS
Electrical connection	4 x 5-pole removable terminal blocks, reverse polarity protected, screw connection
Terminal cross-section	1 x 2.5 mm^2 / 2 x 1.5 mm^2

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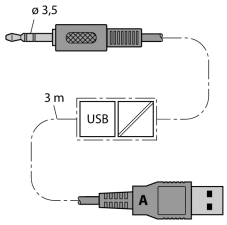
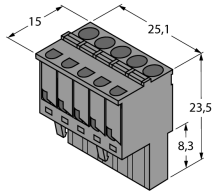
Rotation speed monitor
1-channel
IM21-14-CDTRI

Accessories

Type code	Ident-No.	Short text	Dimension drawing
IM-PROG III	7525111	The programming adapter IM-PROG III is used for parametrization of TURCK IM and IMB devices via FDT/DTM and for galvanic separation.	
IM-CC-5X2BK/2BK	7541219	Cage clamps for IM modules (non-Ex devices, width 27 mm): 4 black, 5-pin, included in delivery	

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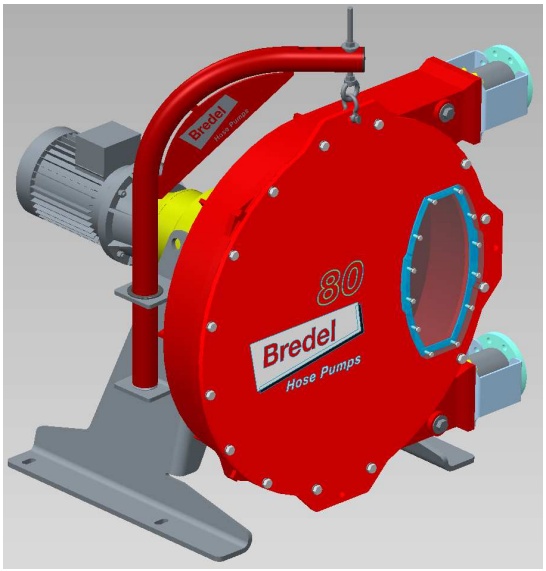
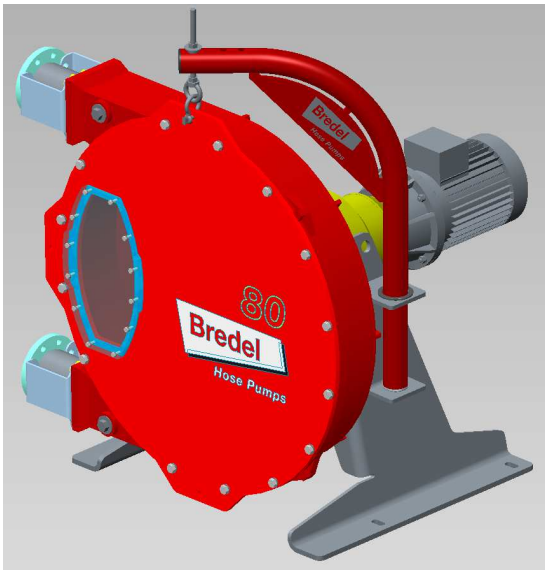
Description: **Mounting instruction cover lifting device**				Code: **TS08-005E**	Rev. **C**
Created by:	ON	Date:	14-11-07	Reference:	
Checked by:	VM	Date:	14-11-07	29999000	

1 Position definition.

The cover lifting device must be mounted on the opposite position of the piping side, as illustrated below.



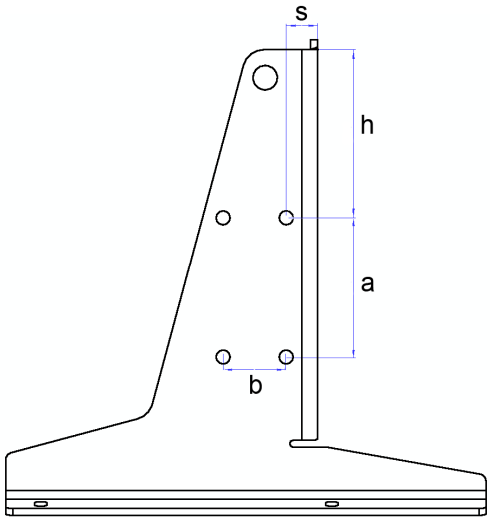


2 Modification of the pump support (if necessary).

The dimensions for the modification are figured in the table below

	Bredel 50
s	35
h	275
a	200
b	90

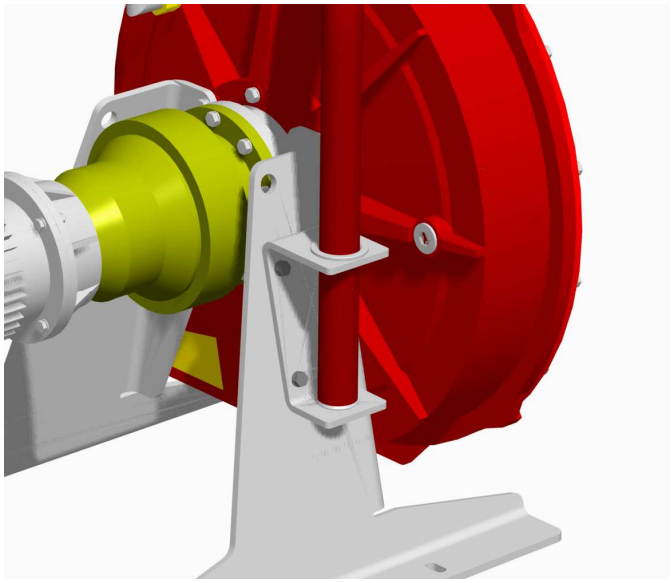
Remark: Protect the holes against corrosion. Distance 'h' is measured from the top of the surface. Hole diameters are 20 mm.



Description: **Mounting instruction cover lifting device**				Code: **TS08-005E**	Rev. **C**
Created by:	ON	Date:	14-11-07	Reference:	
Checked by:	VM	Date:	14-11-07	29999000	

3 Mounting the bracket.

Mount the bracket to the pump support with M16 bolts.



MODIFICATIONS				
Rev.	**Description**	**By:**	**Date:**	**Remarks:**
0	FIRST ISSUE	ON	14-11-07	
A	STICKER DESIGN CHANGED	DH	23-11-11	
B	Rebranding	AK	14-10-2013	
C	Rebranding pictures	AK	27-11-2013	

Safety Data Sheet
[According to ISO/DIS 11014]

printing date: 18.08.2015 revision date: 18-08-2015

Section 1 – Identification of the substance / preparation and of the company

Product identifier / product name:	LUBRICANT/COOLANT for BREDEL HOSEPUMP “Genuine Hose Lubricant”, 'FOOD GRADE' NSF Registration No123204, Category Code H1
Relevant identified use:	Lubricant, Coolant
Details of the supplier of the SDS:	Watson-Marlow Bredel B.V. Sluisstraat 7, 7491 GA tel.: +31 74 3770000 P.O.Box 47, 7490 AA fax.: +31 74 3761175 DELDEN, the Netherlands
Information provided by:	Tel.: +31 (0)74 3770000 E-mail: hosepumps@wmpg.com
Emergency information::	Tel.: +31 (0)74 3770000

Section 2 – Hazards identification

Classification of the substance/mixture:

According to Directive 67/548/EEC or 199/45/EC: not classified

According to regulation (EC) No 1272/2008 (CLP): not classified

Information concerning particular hazards for human and the environment: not applicable

NFPA-Ratings for USA: Health = 0; Fire = 1; Reactivity = 0

The product does not have to be labelled due to the calculation procedure of the □General Classification guideline for preparations of the EU□in the latest valid version.

Section 3 – Composition / information on ingredients

Chemical Characterization: Mixture of substances

Ingredient Name	CAS No.	EINECS No.	% w/w	REACH registration number
Glycerol	56-81-5	200-289-5	50-100	Not applicable
1,2-Propylene Glycol	57-55-6	200-338-0	2.5-10	01-2119456809

Remark Glycerol: REACH not applicable according to Annex V of the REACH regulation EC 1907/2006

Section 4 – First aid measures

General	No special measures required.
Inhalation	Remove victim into fresh air.
Skin contact	Remove contaminated clothing. Rinse skin immediately with plenty of water. (shower if necessary).
Eye contact	Remove contact lenses, if present. Rinse immediately thoroughly and long (at least 15 min.) with plenty of water.
Ingestion	Rinse mouth with water. Seek medical attention.

Section 5 – Fire fighting measures

Suitable extinguishing media	Powder, water spray, foam, carbon dioxide.
Special procedures	Apply water spray or fog to cool nearby equipment. Avoid fire-fighting water to enter environment.
Special exposure hazards	Fire may liberate carbon monoxide (CO) and smoke.
Special protective equipment	Wear fully protective suit.

Section 6 – Accidental release measures

Personal precautions	Not required.
Environmental precautions	Dilute with plenty of water.
Methods for cleaning up	Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust). Dispose of the material collected according to regulations.

Section 7 – Handling and storage

Handling:

Information for safe handling	No special measures required.
Information about protection against explosions and fires	No special measures required.

Storage:

Requirements to be met by storerooms and receptacles	Suitable material for receptacles: stainless and carbon steel and plastics.
Information about storage in one common storage facility	Not required.
Further information about storage conditions	This product is hygroscopic. Protect product from humidity and water.

Section 8 – Exposure controls / personal protection

Component ***Glycerol*** with limit values that require monitoring at the workplace	Indicative limit: Long-term value: 10 mg/m□(mist particulates).
Component **1,2-*Propylene Glycol*** with limit values that require monitoring at the workplace:	Indicative limit: Long-term value: 50 mg/m□(mist particulates).
REACH DNEL (derived no effect level)	For Glycerol no DNEL valid. For 1,2-Propylene Glycol Systemic effects: Long-term value: 168 mg/m□ Local effects: Long-term value: 10 mg/m□ Remark: The product does not contain any relevant quantities of materials with respect to values that should be monitored at the workplace.
Additional information	The lists valid during the making were used as basis.
General protective measures	The usual precautionary measures are to be adhered to when handling chemicals.
Breathing equipment	Not required.
Protection of hands	Safety gloves recommended: Neoprene Nitrile rubber, NBR Fluorocarbon rubber (Viton)
Penetration time of glove material	The determined penetration times according to EN 374 part III are not performed under practical conditions. Therefore a maximum wearing time, which corresponds to 50% of the penetration time, is recommended.
For the permanent contact of a maximum of 15 minutes gloves made of the following materials are suitable	Butyl rubber.
Eye protection	Goggles recommended.
Hygiene measures	When using, do not eat, drink or smoke.

Section 9 – Physical and chemical properties

Form	Fluid.
Colour	Clear green.
Odor	Odorless.
Boiling point/Boiling range	260 °C (500°F).
Solidification point	-30 °C (-22 °F).
Flash point	□100 °C (□212 °F) (ASTM D6450).
Ignition temperature	□ 370 °C (□698 °F).
Danger of explosion	Product is not explosive. However, formation of explosive air/vapor mixtures are possible.
Explosion limits: lower	2.6 Vol %.
Explosion limits: high	11.3 Vol %.
Vapour pressure at 20°C	1.3 hPa (130 Pa; 1 mm Hg).
Density at 20°C	□ 1.245 g/cm□(ISO 2811-2).
Water solubility	Fully miscible.
Ethanol solubility	Fully miscible.
pH	Neutral.
Viscosity (20°C)	600-700 mPa·s (ASTM D2196).

Section 10 – Stability and reactivity

Thermal decomposition / Conditions to avoid	No decomposition if used according to specifications.
Materials to avoid	Oxidizing agents.
Hazardous decomposition products	Fire may liberate carbon monoxide (CO) and smoke.

Section 11 – Toxicological information

Acute toxicity:

Oral (LD50)	Glycerol (100%): □12000mg/kg (rat, literature). 1,2 Propylene Glycol (100%): 20000mg/kg (rat, literature).
Primary irritant effect: skin Skin (LD50)	No irritant effect. Glycerol (100%) □10000mg/kg (rabbit, literature). 1,2-Propylene Glycol (100%):□20000mg/kg (rabbit,literature).
Primary irritant effect: skin	No irritant effect.
Primary irritant effect: eyes	No irritating effect.
Sensitization:	No sensitizing effects known.
Additional toxicological information:	The product is not subject to classification according to the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version. When used and handled according to specifications, the product does not have any harmful effects to our experience and the information provided to us.

Section 12 – Ecological information

Information about elimination (persistence and degradability)	Easily biodegradable Biodegradability: □ 85%.
Aquatic toxicity: fish toxicity:	LC50: □ 5000 mg/l, literature.
Behaviour in sewage processing plants	In case of judicious use the product does not cause disturbances in water purification plants, according to experiences made so far.
General notes	Water hazard class 1 (German Regulation) (Self-assessment): slightly hazardous for water. Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system. Classification according VwVwS dated May 1999. (German legislation)

Safety Data Sheet
[According to ISO/DIS 11014]

printing date: 18.08.2015 revision date: 18-08-2015

Section 13 – Disposal considerations

Product:

Recommendation	Must not be disposed together with household garbage. Do not allow product to reach sewage system.

Uncleaned packaging

Recommendation	With due observance of local regulations, for instance transport to refuse incinerator.
Recommended cleansing agent	Water, if necessary together with cleansing agents.

Section 14 – Transport information

Transport/Additional information	Not dangerous according to the ADR/RID, IMDG and ICAO/IATA and DOT specifications.

Section 15 –- Regulatory information

Cancerogenity categories:

EPA (Environmental Protection Agency)	None of the ingredients is listed.
IARC (International Agency for Research on Cancer)	None of the ingredients is listed.
NTP (National Toxicology Program)	None of the ingredients is listed.
TLV (Threshold Limit Values established by ACGIH)	None of the ingredients is listed.
MAK (German Maximum Workplace Concentration)	None of the ingredients is listed.
NIOSH-Ca (National Institute for Occupational Safety Health)	None of the ingredients is listed.
OSHA-Ca (Occupational Safety Health Administration)	None of the ingredients is listed.

Product related hazard information	Observe the general safety regulations when handling chemicals. The product is not subject to identification regulations according to directives on hazardous materials.
Water hazard class	Water hazard class 1 (Self-assessment): slightly hazardous for water.

Section 16 – Other information

Disclaimer

Disclaimer of liability: the information in this SDS was obtained from sources which we believe are reliable.
However, the information is provided without any warranty, express or implied, regarding its correctness.
The conditions or methods of handling, storage, use or disposal of the product are beyond our control and may be beyond our knowledge.
For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of the product.
This SDS was prepared and is to be used only for this product.
If the product is used as a component in another product, this SDS information may not be applicable.

WATSON MARLOW
Fluid Technology Group

Part 3: Gear Reducer

Bredel 50 Planetary Gearboxes

All gearboxes are rated for continuous duty with a minimum 1.4 service factor applied to the torque values shown. Gearboxes are suitable for applications with peak discharge pressures up to those shown in the table below. Output speeds are based on 1750 rpm motor input.

2-Stage Planetary Gearboxes

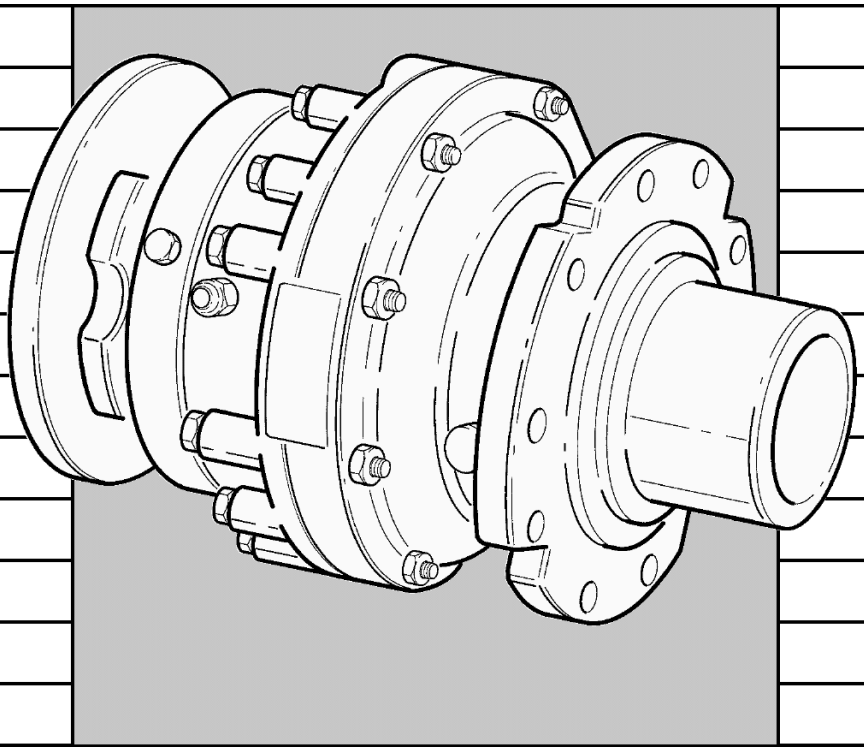
	Peak Discharge Pressure							
RPM	72.5 psi	109 psi	150 psi	232 psi	Nominal Ratio	Actual Ratio	T(max) In-lbs	Part Number
28	•	•			63	63	12435	GRD2020-63-B3

NEMA Motor Adapters (specify when ordering)

NEMA Size	Part Number
180TC	61130800070

*Normally stocked

βχδ	**DESCRIPTION:** **INSTALLATION AND MAINTENANCE MANUAL** **TYPE:** **GEAR UNITS STANDARD SERIES** **FOR SPX PRODUCTS**



1. Introduction
1.1 How to Consult the Manual
1.2 Scope of the Manual
1.3 General Warning
1.4 Reproduction and Copyright Restrictions
1.5 Revisions

2. Technical Data
2.1 Code Description
2.2 Configurations

3. Supply Conditions

4. Packing Handling, Receiving, Storage
4.1 Packing
4.2 Handling
4.3 Receiving
4.4 Handling the Gear Unit After Shipping
4.5 Storage

5. Installation
5.1 General Instructions
5.2 Installation Instructions for Flange-Mounted Gear Unit
5.3 Accessory Installation Instructions

6. Brake Start up
6.1 Negative Multi-Disc Brake
6.2 Disc Brake

7. Lubrication
7.1 Gear Unit Lubrication
7.2 Brake Lubrication
7.3 Grease Features
7.4 Lubricant Table
7.5 Expansion Tank
7.6 Lubrication Volume Required by Gearbox

8. Checks
8.1 First Start-Up Checks
8.2 No-Load Tests

9. Maintenance
9.1 Routine Maintenance
9.2 Oil Change
9.3 Unscheduled Maintenance

10. Brake Maintenance
10.1 Procedure to Replace Discs or Seals for Multi-Disc Brakes
10.2 Procedure to Replace Pads for Disc Brakes

11. Scrap Disposal
11.1 Machine Demolition
11.2 Ecology Information

12. Problems and Relative Solutions

1. INTRODUCTION

Thanks for selecting a planetary gear unit. We are pleased to include you among our preferred customers and trust that you will be satisfied with the performance of your gear unit.

1.1 How to Consult the Manual

Begin by turning to the table of contents which is organized by subject. Each chapter is organized into a hierarchical structure that makes it easier to find information.

1.2 Scope of the Manual

This manual contains all of the information necessary to correctly install, maintain and use the gear unit in compliance with current safety standards. Please take time to understand the following terms so that you will better understand the manual:

HAZARDOUS AREA: the area within, or around, the machine where an exposed person is at risk for health or safety.

EXPOSED PERSON: any person who is inside all or part of a hazardous area.

OPERATOR: a person assigned to install, operate, adjust, perform routine maintenance and clean the machine.

SKILLED TECHNICIAN: a specialized person who performs unscheduled maintenance or repairs requiring special knowledge of the machine, its operation, safety devices and relative operating methods.

The following symbols are used to draw your attention to special situations:

ATTENTION: Operator accident-prevention standards

WARNING: The machine and/or its parts may be damaged

CAUTION: Additional information regarding the operation being carried out

NOTE: Provides useful information If you have any questions or concerns about the information appearing in this manual, please contact Watson-Marlow Bredel.

1.3 General Warning

Please inform all personnel regarding machine operating safety including:

-Accident risks.

-D.P.I. devices designed to ensure operator safety (individual protection devices: goggles, gloves, hard-hat, etc.).

-General accident-prevention rules or those set forth by international directives and by the laws of the country where the machine will be used.

When delivered, check that the gear unit has not been damaged during transport and that all accessories are present.

-Before using the machine, the operator must be familiar with machine features and must have read this entire manual.

-The gear unit must be used in an environment and for applications that comply with its intended use.

-Any improper use of the gear unit is prohibited.

-Any change or replacement of machine parts, which has not been authorized by Watson-Marlow Bredel, may represent an accident risk and releases the manufacturer from any civil or criminal liabilities, and will always invalidate the warranty.

1.4 Reproduction and Copyright Restrictions

1.5 Revisions

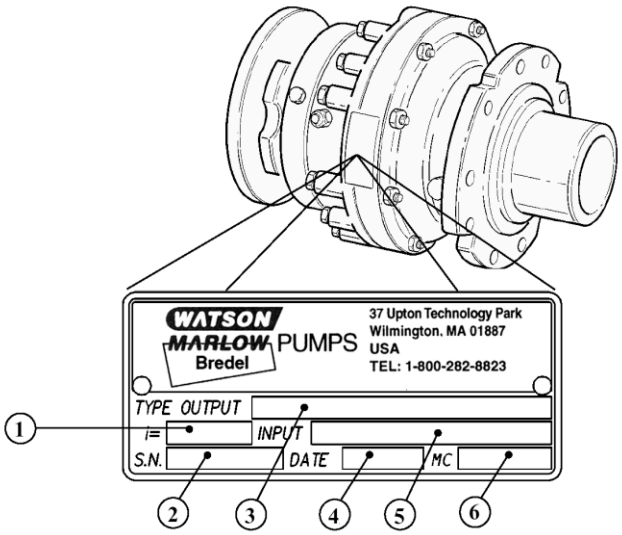
Subsequent revisions of the manual will be issued as a result of machine functional changes or replacements.

2. TECHNICAL DATA

Each gear unit is supplied with an identification nameplate and a manufacturer's declaration (as per the enclosure II B) which have been prepared according to EEC directive 392 and subsequent amendments. The identification nameplate contains the main technical data regarding the functional and construction features of the gear unit. Therefore, it must always be visible and undamaged.

1) Reduction Ratio
2) Serial Number
3) Type of gear unit/Gear unit output
4) Year built
5) Gear unit input
6) Quality Code

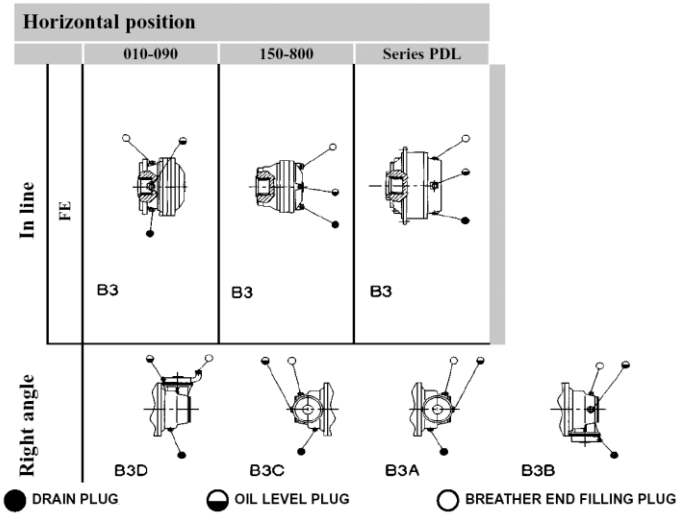
Watson-Marlow Bredel supplies manufacturer's declaration upon request.



2.1 Code Description

GRD	2090	20	B3
Gear unit family	Reduction size	Reduction ratio	Construction form

2.2 Configurations



3. SUPPLY CONDITION

The exterior of the gear units are painted with a red synthetic epoxy paint, unless otherwise indicated in the contract. Such protection can withstand normal industrial environments, including outdoor sites, while additional synthetic top coats can also be applied. If the machine will be used under particularly aggressive environmental conditions, special types of paints can also be applied.

The machined external parts of the gear unit, such as the ends of the hollow and non-hollow shafts, support surfaces, spigots, etc., are protected with rust-inhibitor oil (tectyl). The internal parts of the gear unit casings and drives are also protected with rust-inhibitor oil. All the gear units mounted to Watson-Marlow Bredel SPX pumps are supplied with lubricant. Unless otherwise indicated in the contract, independently supplied gearboxes, as for spares, are supplied without lubrication and must be lubricated by the customer prior to startup.

4. PACKING, HANDLING, RECEIVING, STORAGE

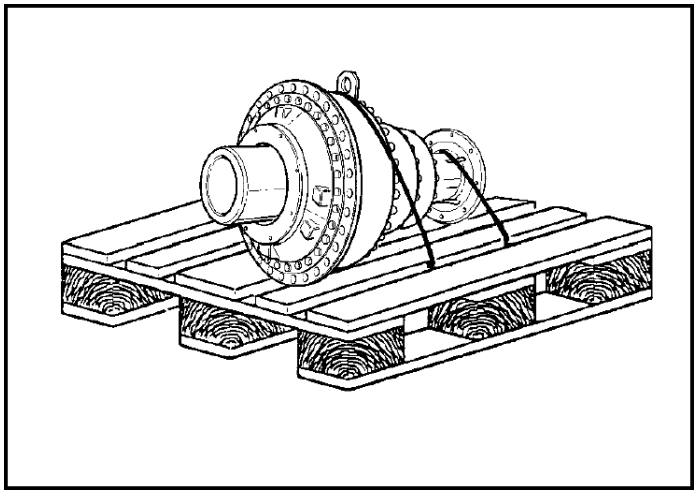
4.1 Packing

Watson-Marlow Bredel products are packed and shipped in crates or on pallets.

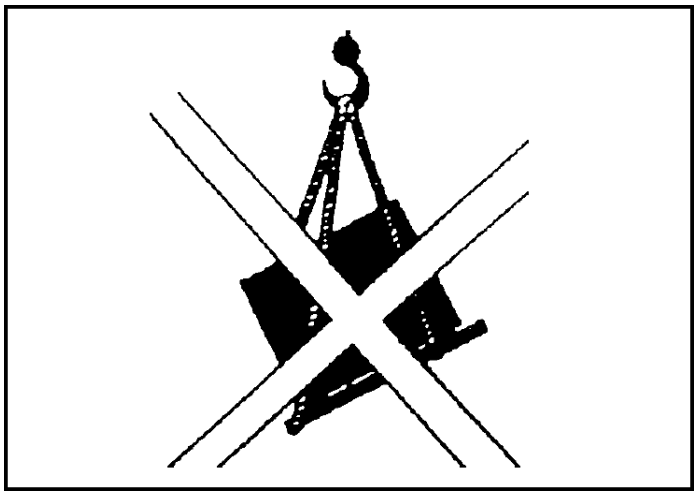
-All Watson-Marlow Bredel products, unless otherwise indicated in the contract, are packed with wrapping that can withstand normal industrial environments.

4.2 Handling

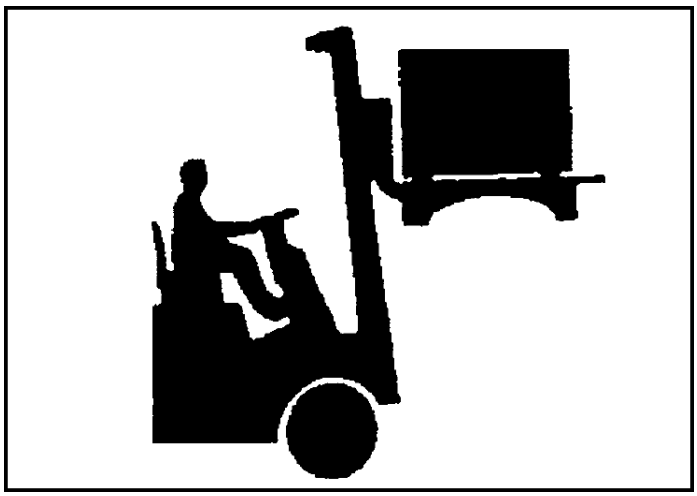
Note: the weight shown in our catalogs does not include any accessories such as brakes, motor flanges, wheel flanges, etc.; consequently, to obtain the gear unit + accessories total weight, please add, depending on the gear unit size, a maximum approximate extra weight of 88 lbs for input accessories.



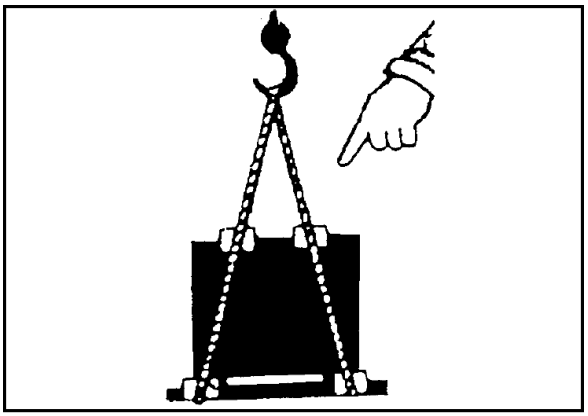
To move the unit, use lifting equipment that is suitable for the type of packing an the capacity is indicated.



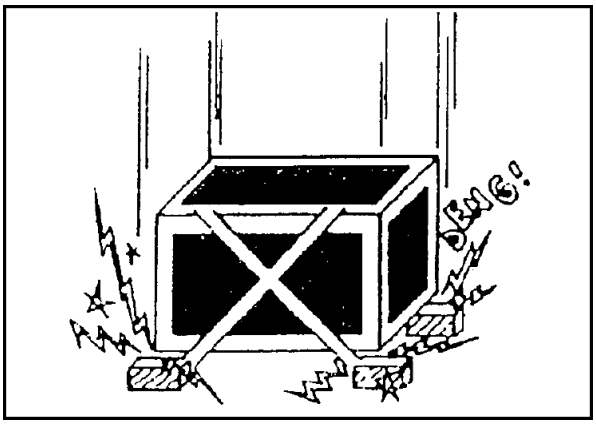
Do not tilt or turn the unit upside down while lifting or during transport.



If using a fork-lift to unload the unit, make sure the weight is balanced on the forks.

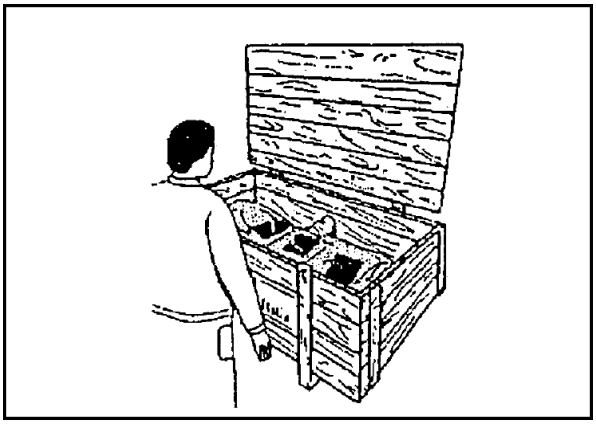


If the unit is unloaded with a hoist or a hook, make sure that the load is balanced, and for slinging, use lifting accessories that are legally certified. For units shipped on pallets, make sure that the lifting accessories do not damage the machine.

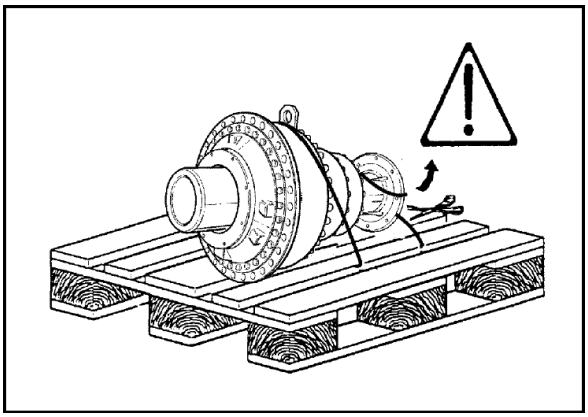


Do not drop or bump the unit while lifting and positioning it.

4.3 Receiving

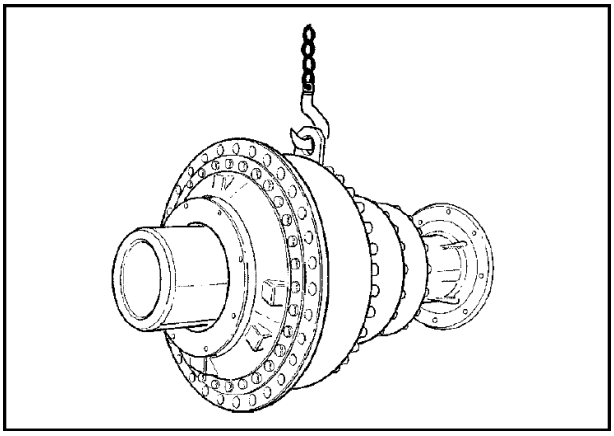


Make sure the unit you receive corresponds to what is specified in the order. Also check that the package and its contents have not been damaged during transport.



Depending on size and quantity, spare units may be strapped to the pallet using a metal strap. Be careful since it may spring back and hit the operator while the product is being opened.
Unpack the unit as follows:
-Use a pair of shears to cut the straps (**warning: the ends may spring back and hit the operator**)
-Cut or remove the external packing materials
-Cut the internal strap (**warning: the ends may spring back and hit the operator**)
-Remove the unit from the pallet.
If the unit has been damaged or if there are any defects or missing parts, immediately notify Watson-Marlow Bredel.

4.4 Handling the Gear Unit After Unpacking



Before lifting the unit off the pallet, make sure it is solidly attached to the lifting accessories so that it cannot slide or flip over. Before handling the unit, remove the wood blocks inserted in the packing to keep it stable during shipment. Make sure the load is balanced before lifting the unit.

4.5 Storage

Use the following procedure if the unit will be stored for more than 2 months:
-Protect the shafts and the spigots with a film of grease and/or rust-inhibitor liquids
-Completely fill the gear unit with suitable oil as shown in the lubrication tables.
-Store the unit in a cool place at a temperature ranging from -5°C to +30°C
-Protect the unit against dirt, dust and moisture.
-Do not stack units on top of each other.
-Do not walk on or place objects on top of the unit.

NOTE: For extended storage of more than 6 months, the rotating seals will no longer be efficient. Check them periodically by turning the internal gears and rotating the input shaft.
Replace the gaskets before starting the unit.

5. INSTALLATION

5.1 General Instructions

Use the following steps to carefully install the unit:
-Make sure the oil, breather, level and drain plugs are in the correct position. Their position will vary according to the assembly position (see paragraph 2.2 Configurations).
-When installing RPR or MDU series gear units, be careful not to damage any grease pipes or those used to empty the oil in the gear unit (located on the side of the gear unit support). They should be positioned for easy access with a grease fitting and oil expansion tank (during installation protect the pipes and the tank).
-The gear unit is normally supplied with a flange for coupling the electric, hydraulic and air motors.

5.2 Installation Instructions for Flange- Mounted Gear Unit
-Attach the unit to a rigid structure with a clean support surface that is perpendicular to the drive axis.
-The spigots and the coupling surfaces of the gear unit must be clean and without any dents. The checks described above are particularly important to ensure perfect alignment between the drive shaft and the output shaft of the gear unit. This is even more important for gear units with a splined female output shaft which cannot bear any radial or axial loads.
-Lubricate all the spigots of the gear unit and the housing seat with grease or oil.
-After having inserted the gear unit into its housing and having placed it in the correct position, fit the reference pins in their seats, then tighten the attachment bolts (recommended minimum class 8.8), applying torque as indicated in the table "torque setting" paragraph 8.1, making sure that such torque settings are compatible with the other parts (nuts and/or structure).

NOTE: Use class 10.9 or 12.9 bolts where the application involves severe impacts, frequent stops, starts, reversals or when the application exceeds 70% of the maximum tolerated torque.

NOTE: If the input axis on the right angle gear unit is not in the ideal position during installation, make the following correction:

5.3 Accessory Installation Instructions Motor Assembly:
While assembling the gear unit on the motor, lubricate the coupling with a thin layer of grease or with a no-grip lubricant. Carefully insert the motor shaft into the coupling and make sure that the motor spigot perfectly matches the gear unit spigot. After checking that the motor is properly centered, tighten all the attachment bolts, applying the torque indicated in the table "torque setting."

6. LUBRICATION

6.1 Gear Unit Lubrication

Filling and level
-The gear units are equipped with oil level, breather, filler and drain plugs and their position changes according to the installation configuration.
-Check the exact position of the plugs using the diagrams on paragraph 2.2 "configuration".
-Unscrew the level-filler plugs, put oil into the gear unit, and when this oil flows out of the level hole, replace the plugs.
-In the RPR or MDU series, one of the support bearings must be lubricated with grease, using the grease gun located above the gear unit attachment flange, and using a generic type of grease with the features indicated in paragraph 6.2.
-Turn the gear unit a few times to eliminate any air pockets and then check the various levels.

6.2 Grease Features

Type of soap:	stearate hydroxide lithium 12 or equivalent
Consistency:	NLGI No. 2
Base Oil:	Mineral oil with viscosity from 100 to 320 cST at 40°C
Additives:	Rust inhibitors
Pour point:	-10° C maximum

6.3 Lubricant Table

Lubricant	-20 C +5 C IV 95 min	+5 C +30 C IV 95 min	+30 C +50 C IV 95 min	-30 C +65 C IV 95 min
ESSO	Spartan EP 100	Spartan EP 150	Spartan EP 320	Compressor oil LG 150
AGIP	Blasia 100	Blasia 150	Blasia 320	Blasia S 220
ARAL	Degol BG 100	Degol BG 150	Degol BG 320	Degol BS 220
BP MACH	GR XP 100	GR XP 150	GR XP 320	SGR XP 220
CASTROL	Alpha SP 100	Alpha SP 150	Alpha SP 320	Alpha SN 6
ELF	Reductelf SP 100	Reductelf SP 150	Reductelf SP 320	Oritis 125 MS Syntherma P30
CHEVRON	non leaded gear compound 100	non leaded gear compound 150	non leaded gear compound 320	
GULF		EP lubricant HD 150	EP lubricant HD 320	
I.P.	Mellana 100	Mellana 150	Mellana 320	Telesia oil 150
MOBIL		Mobilgear 629	Mobilgear 632	Glycoyle 22/30 SHC 630
SHELL	Omala oil 100	Omala oil 150	Omala oil 320	Tivela oil SA
TOTAL	Carter EP 100N	Carter EP 150	Carter EP 320N	
KLUBER	Lamora 100	Lamora 150	Lamora 320	
ISO 3448	VG100	VG150	VG320	VG150-200

Mobil SHC 630 is Watson-Marlow Bredel Standard

6.5 Lubrication Volume Required by Gearbox

Model	Oil Quantity		
	Liters	Quarts	Gallons
GRD2020	1.5	1.6	0.40

7. CHECKS

7.1 First Start-Up Checks

Before starting the machine check the following:

-Check that all oil plugs are in the correct position (see paragraph 2.2 “configuration”).

-Check that all oil levels are correct.

-Check that all the fittings are full of grease.

-Check that all the bolts with isometric threads are correctly tightened (see table “torque setting values”).

Values Table Torque Setting Bolts

d x p mm	4.8		5.8		8.8		10.9		12.9	
	kN	Nm	kN	Nm	kN	Nm	kN	Nm	kN	Nm
3x0,5	1.2	0.9	1.5	1.1	2.3	1.8	3.4	2.6	4.0	3
4x0.7	2.1	1.6	2.7	2	4.1	3.1	6.0	4.5	7.0	5.3
5x0.8	3.5	3.2	4.4	4	6.7	6.1	9.8	8.9	11.5	10.4
6x1	4.9	5.5	6.1	6.8	9.4	10.4	13.8	15.3	16.1	17.9
7x1	7.3	9.3	9.0	11.5	13.7	17.2	20.2	25	23.6	30
9x1.25	9.3	13.6	11.5	16.8	17.2	25	25	37	30	44
8x1	9.9	14.5	12.2	18	18.9	27	28	40	32	47
10x1.5	14.5	26.6	18	33	27	50	40	73	47	86
10x1.25	15.8	28	19.5	35	30	53	43	78	51	91
12x1.75	21.3	46	26	56	40	86	50	127	69	148
12x1.25	23.8	50	29	62	45	95	65	139	77	163
14x2	29	73	36	90	55	137	80	201	94	235
14x1.5	32	79	40	96	61	150	90	220	105	257
16x2	40	113	50	141	76	214	111	314	130	369
16x1.5	43	121	54	150	82	229	121	336	141	393
10x2.5	49	157	60	194	95	306	135	435	158	509
18x1.5	57	178	70	220	110	345	157	491	184	575
20x2.5	63	222	77	275	122	432	173	615	203	719
20x1.5	72	248	89	307	140	482	199	687	233	804
22x2.5	78	305	97	376	152	502	216	843	253	987
22x1.5	88	337	109	416	172	654	245	932	266	1090
24x3	90	383	112	474	175	744	250	1080	292	1240
24x2	101	420	125	519	196	814	280	1160	327	1360
27x3	119	568	147	703	230	1100	328	1570	384	1840
27x2	131	615	162	760	225	1200	363	1700	425	1990
30x3.5	144	772	178	955	280	1500	300	2130	467	2500
30x2	165	850	204	1060	321	1670	457	2370	535	2380

d= bolt diameter p= bolt pitch

kN = axial pre-loading Nm= torque setting bolts

7.2 No-Load Tests
-After a brief period of operation (5-10 minutes), check the oil levels under no-load conditions, topping off those levels which have gone down.
-Check that nuts and bolts of the various attachments are properly tightened.

8. MAINTENANCE

Introduction
Maintenance can be "routine or unscheduled".

ATTENTION: All maintenance activities must be carried out under safety conditions.

8.1 Routine Maintenance
The operator is responsible for routine maintenance and must carry out the following activities:
-After a brief operating period of about 100 hours (breaking-in), change the oil in the gear unit and the multi-disc brake (if installed) and wash the interior of the unit with cleaning liquid.
-Check that there are no metallic parts with unusual dimension in the magnetic plug of the gear unit and in any multi-disc brake.
-Change the oil in the gear unit while it is hot so that it is easier to drain.
-Subsequent oil changes should be made every 2000-2500 hours of operation or, in any case, each year.
-Do not mix different types of oil.
-Periodically check the levels (about once a month) and top off if necessary.

ATTENTION: When checking the oil levels in gear units equipped with a hydraulic motor, if the levels have risen, this means that oil is penetrating either from the brake seals or from the motor rotary seal. Contact Watson-Marlow Bredel.
-Keep a chart for each and update it each time maintenance is performed.

8.2 Oil Change
-Use the diagrams on paragraph 2.2 "configuration" to identify the oil plug according to the gear unit configuration and paragraph 2.2 for the multi-disc brake configuration.
-Unscrew the drain plug and the filler plug to help drain the oil from the gear unit. Once the oil has been emptied, replace the drain plug.
-Wash the interior of the gear unit with a suitable cleaning liquid as recommended by the lubricant manufacturer.
-Put cleaning liquid into the gear unit, then replace the filler plugs; run the device for a few minutes under no load, then remove the cleaning liquid again from the gear unit.
-See Lubrication, Section 6, for filling instructions.

8.3 Unscheduled Maintenance
Do not open the gear unit to carry out any operation that is not included in routine maintenance procedures. Watson-Marlow Bredel does not undertake any liability for any operations outside of routine maintenance and which may cause damage to people or things.
When the need arises, contact Watson-Marlow Bredel.

10. SCRAP DISPOSAL

10.1 Machine Demolition
If the machine must be scrapped, it should be made inoperative:
-Drain all oil from the gear unit.
-Disassemble the various parts.
-Disconnect any motor unit.

10.2 Ecology Information
The disposal of gear unit packaging materials, replaced parts, components or the gear unit and lubricants must comply with environmental restrictions, without polluting the soil, water or air. The party receiving the materials is responsible for carrying out the operation in conformity with the current standards in force in the country in which the machine is used.

Instructions for suitable waste treatment
-Iron, aluminum, copper materials: these are recyclable materials which must be sent to a special authorized collection center.
-Plastic and rubber materials: these materials must be delivered to a dump or to special recycling center.
-Used oil: Check local regulations for proper disposal instructions.

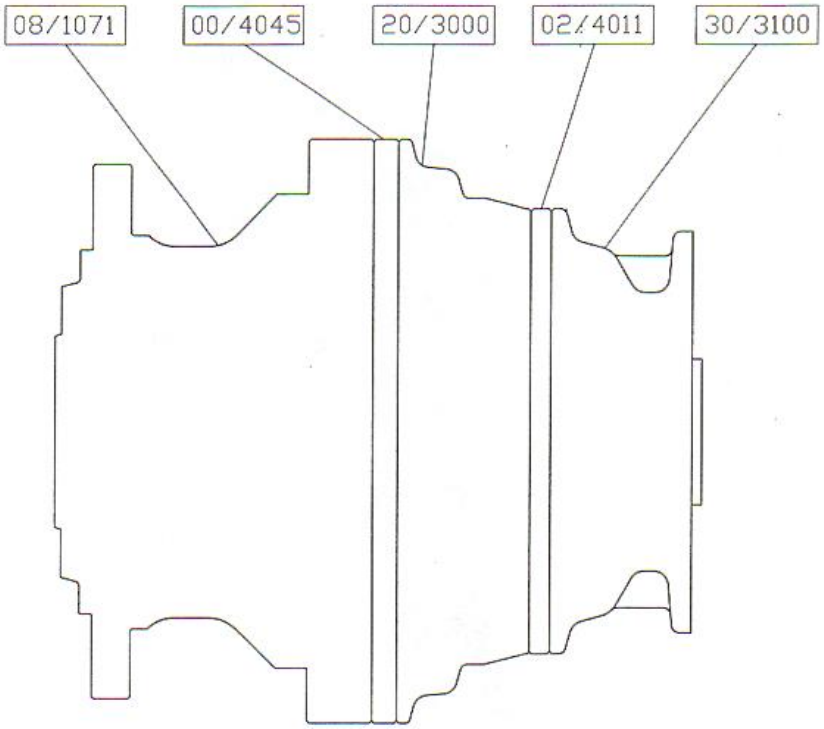
11. PROBLEMS AND RELATIVE SOLUTIONS
If malfunctions occur, consult the following table. If the problems continue, contact Watson-Marlow Bredel (WMB).

PROBLEM	POSSIBLE CAUSE	SOLUTION
With moor running the output shaft doesn't run	1)Incorrect motor assembly 2)Internal Malfunction	1) Check coupling between motor and gear unit 2) Contact WMB
Oil leak from breather during operation	1) Level too high 2) Incorrect Breather Position	1) Lower oil level 2) Check breather position
Oil leak from seals	1) Clogged breather plug 2) Stiffening of seals due to prolonged storage after a few days 3) Damaged or worn seals	1) Unscrew and thoroughly clean plug 2) Clean the area and check for leakage again
Excessive noise	1) Internal malfunction	1) Contact WMB
Excessive vibration	1) Gear unit incorrectly installed 2) Coupling not properly installed 3) Internal malfunction	1) Check the connection to driven equipment and in-line configuration 2) Check motor coupling installation 3) Contact WMB
Excessive heating	1) Improper lubrication 2) Process overloading gearbox	1) Check lubrication level 2) Consult WMB on application detail

βχδ	DESCRIPTION: PLANETARY GEAR REDUCER TYPE: GRD2020 2-STAGE VERSION:	DRAWING NO.

GRD2020-63-B3

OUTPUT SIDE



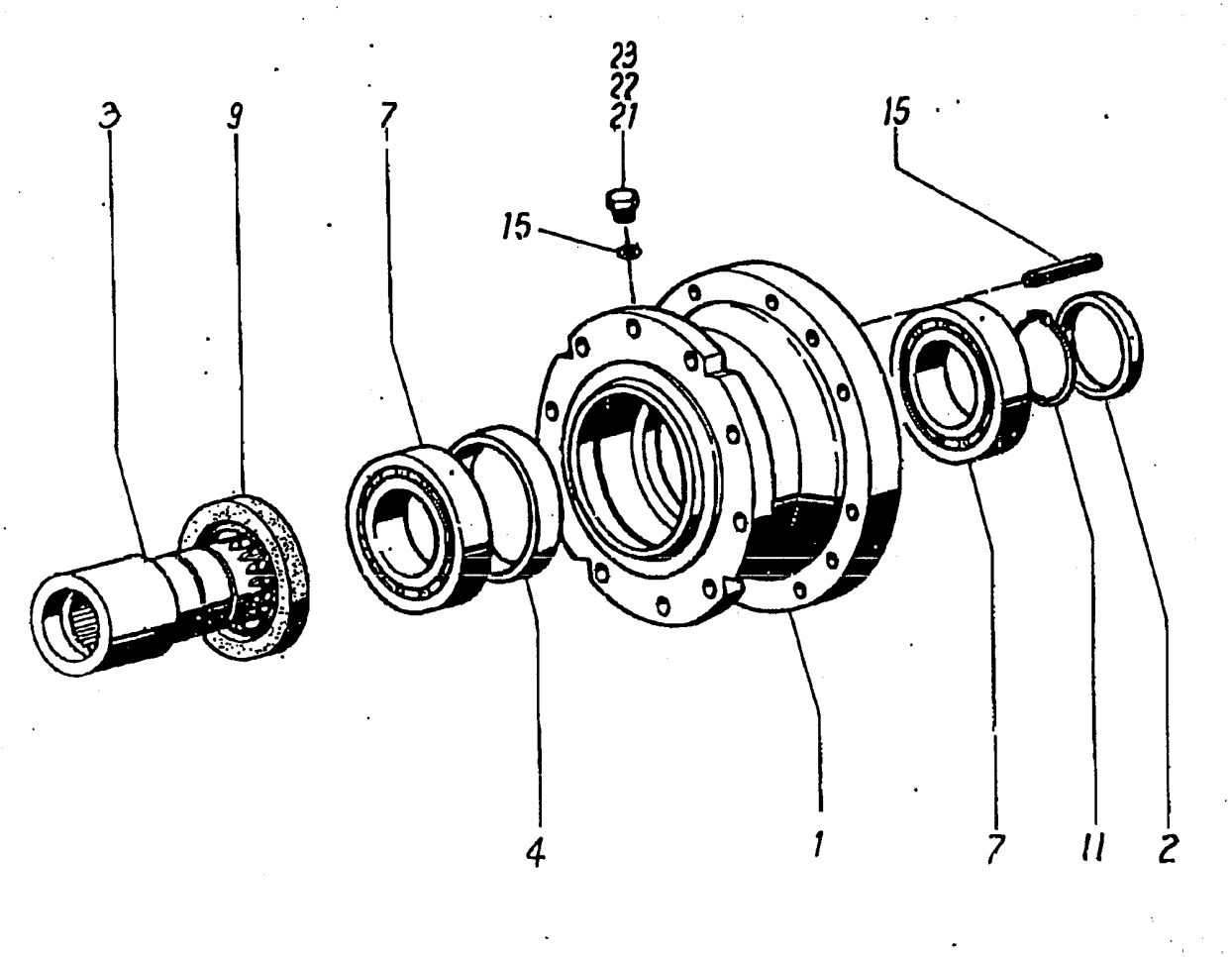
INPUT SIDE
(MOTOR KIT)

βχδ	**DESCRIPTION:** **GEAR RATIO CHART** **TYPE:** **GRD2020**	

SPX50	Output Speed at 1750 RPM	Nominal Ratio	Actual Ratio	Part No.	Stage 1 Ratio (Item #'s) IN	Stage 2 Ratio (Item #'s) OUT
Drawing Number					**02/4011**	**00/4045**
	28	63	63.00	GRD2020-63-B3	10.50 (7, 13)	6.00 (7, 14)

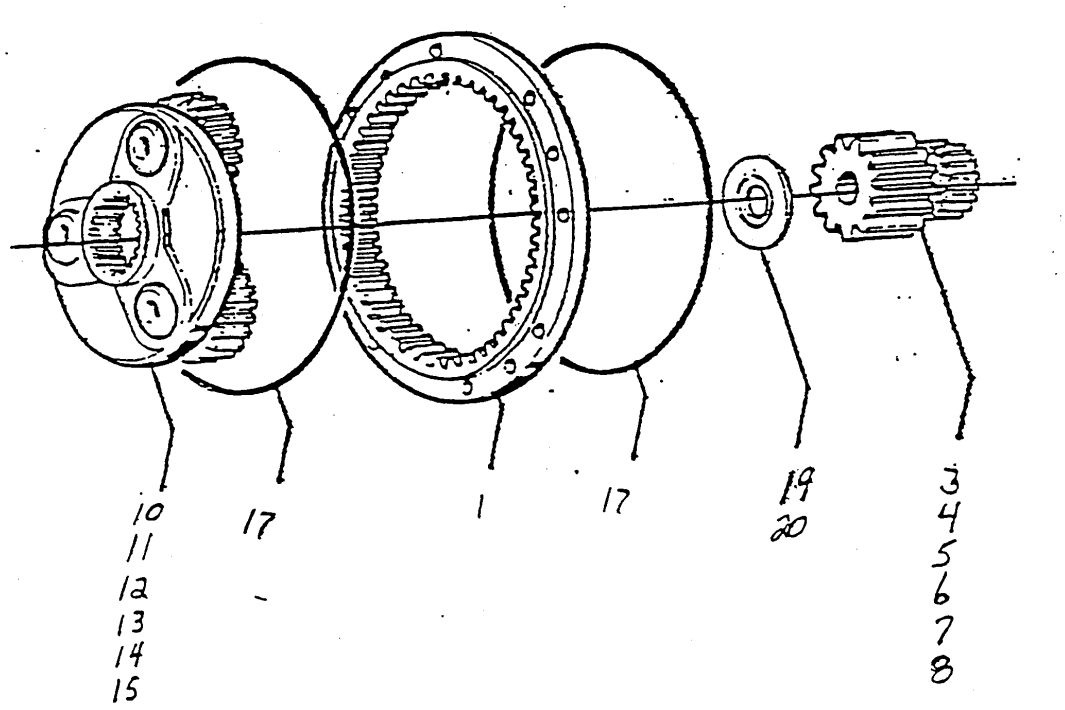
βχδ	DESCRIPTION: SUPPORT TYPE: EM1020/FET VERSION:	DRAWING NO. 08/1071

ITEM	PART NUMBER	DESCRIPTION	QTY.
1	352-1621-4000	020/045 MR HOUSING	1
2	363-4944-6300	8mm SPACER	1
3	313-0972-000K	045 FET SHAFT	1
4	363-7854-6300	SPACER	1
7	421-2140-0000	16014 BEARING	2
9	411-3320-0000	80x110x10 DOUBLE LIP SEAL	1
11	431-0700-0500	12mm "E" SNAP RING	1
15	438-3964-0100	M10x60 SPIRAL ROLL PIN	4
21	451-0640-0000	3/8" BREATHER	1
22	451-1040-0000	3/8" OIL PLUG	1
23	451-2040-0000	3/8" MAGNETIC PLUG	1
25	417-0030-0100	3/8" GASKET	3



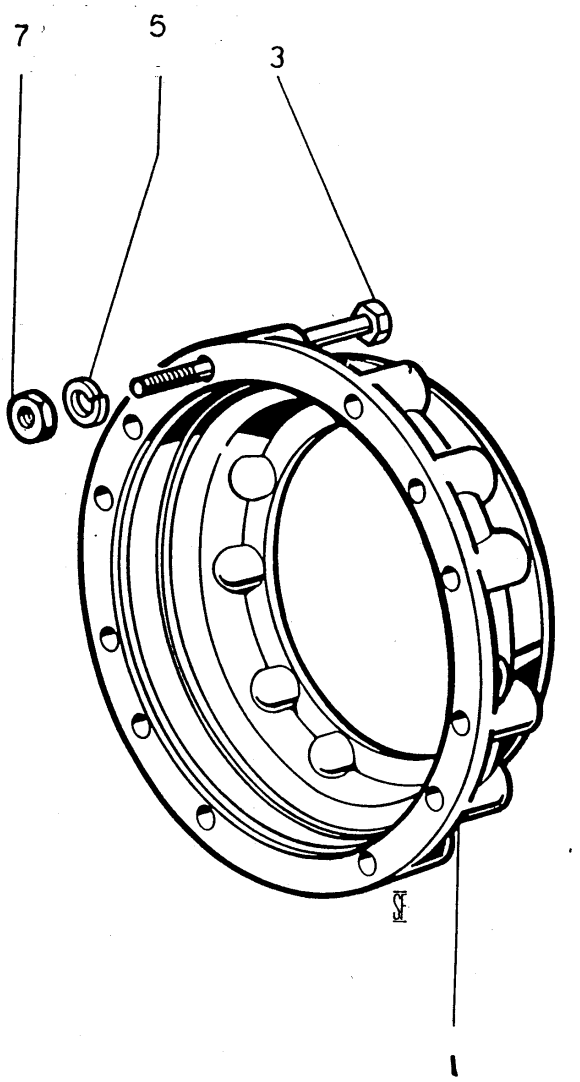
βχδ	DESCRIPTION: INTERNAL GEAR ASSEMBLY TYPE: GRM 020 VERSION:	DRAWING NO. 00/4045

ITEM	PART NUMBER	DESCRIPTION	QTY.
1	320-0102-1100	020 RING GEAR	1
7	327-3043-0300	CENTRAL PINION - RATIO=6.00	1
14	211-B827-0000	PLANETARY SUBASSEMBLY-RATIO=6.00	1
17	412-2090-0000	O-RING, 2-170	2
19	361-0583-6400	THRUST PLATE (NOT FOR 7.25 RATIO)	1
20	361-0563-6400	THRUST PLATE FOR 7.25 RATIO	1
21	431-0400-0000	SNAP RING, 36MM "E"	1



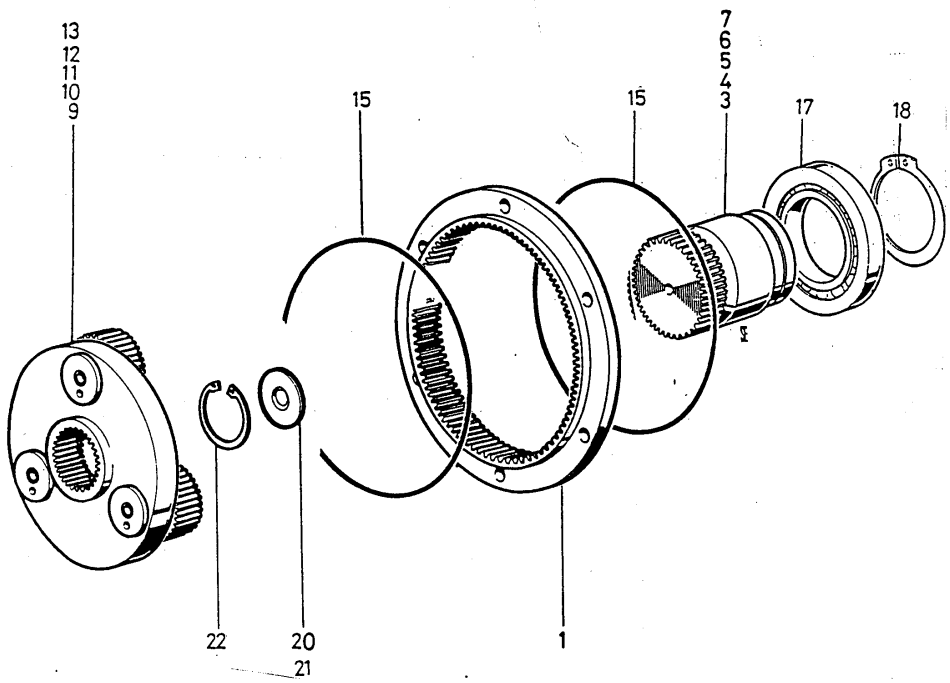
βχδ	**DESCRIPTION:** **INTERMEDIATE FLANGE** **TYPE:** **GRD2020 TO GRT3020** **VERSION:**	**DRAWING NO.** **20/3000**

ITEM	PART NUMBER	DESCRIPTION	QTY.
2	342-0732-4000	INTERMEDIATE FLANGE	1
3	461-1290-0000	M10x85 SCREW	8
6	466-0080-0100	M10 NUT	8
8	467-0110-0101	10.5x18x2 WASHER	8
11	417-0020-0100	13.3x19x1.5 WASHER	3
13	451-0430-0000	1/4" PLUG	3



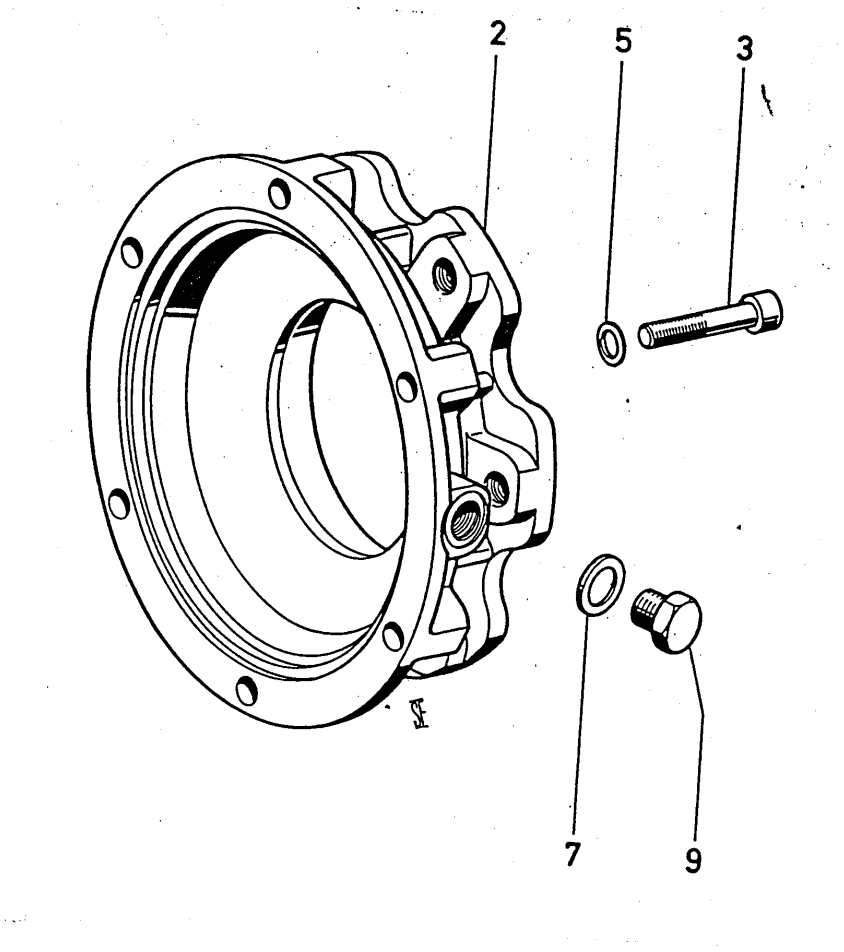
βχδ	DESCRIPTION: INTERNAL GEAR ASSEMBLY TYPE: EM 1010 VERSION:	DRAWING NO. 02/4011

ITEM	PART NUMBER	DESCRIPTION	QTY.
1	320-0053-8300	RING GEAR	1
7	326-0343-1900	UNIVERSAL PINION - RATIO = 10.5	1
13	211-B434-0000	PLANETARY ASSEMBLY - RATIO = 10.5	1
15	366-1034-0000	010 O-RING	2
17	421-1930-0000	16012 BEARING	1
18	431-0630-0000	60mm "E" SNAP RING	1
20	361-0524-6400	THRUST PLATE	1
21	361-1214-6400	THRUST PLATE 10.5:1 ONLY	1
22	432-0370-0000	32mm "I" SNAP RING	1



βχδ	**DESCRIPTION:** UNIVERSAL INPUT HOUSING **TYPE:** 010 **VERSION:**	**DRAWING NO.** 30/3100

ITEM	PART NUMBER	DESCRIPTION	QTY.
2	346-0312-4000	UNIVERSAL INPUT HOUSING	1
3	462-0830-0000	BOLT, M8x50 S.H.	6
5	469-0350-0000	M8.4 SCHNOOR WASHER	6
7	417-0020-0100	1/4" ALUMINUM GASKET	2
9	451-0430-0000	1/4" PLAIN PLUG	2



WATSON MARLOW
Fluid Technology Group

Part 4: Motor

BALDOR
A MEMBER OF THE ABB GROUP

BALDOR • RELIANCE

Product Information Packet

VEM3615T

5HP,1750RPM,3PH,60HZ,184TC,3642M,TEFC,F1

Part Detail							
Revision:	E	**Status:**	PRD/A	**Change #:**		**Proprietary:**	No
Type:	AC	**Prod. Type:**	3642M	**Elec. Spec:**	36WGS268	**CD Diagram:**	CD0005
Enclosure:	TEFC	**Mfg Plant:**		**Mech. Spec:**	36A003	**Layout:**	36LYA003
Frame:	184TC	**Mounting:**	F1	**Poles:**	04	**Created Date:**	08-04-2010
Base:	N	**Rotation:**	R	**Insulation:**	F	**Eff. Date:**	03-31-2015
Leads:	9#16					**Replaced By:**	
Literature:		**Elec. Diagram:**					

Nameplate NP1259L							
CAT.NO.	VEM3615T						
SPEC.	36A003S268G2						
HP	5						
VOLTS	208-230/460						
AMP	13.9-13.4/6.7						
RPM	1750						
FRAME	184TC	HZ	60	PH	3		
SER.F.	1.15	CODE	J	DES	B	CL	F
NEMA-NOM-EFF	89.5	PF	78				
RATING	40C AMB-CONT						
CC	010A	USABLE AT 208V	13.9				
DE	6206	ODE	6205				
ENCL	TEFC	SN					

Parts List

Part Number	Description	Quantity
SA201005	SA 36A003S268G2	1.000 EA
RA188310	RA 36A003S268G2	1.000 EA
36FN3000C01SP	EXFN, PLASTIC, 5.25 OD, .912 ID	1.000 EA
S/P107-000-001	SUPER E PROC'S-FS, WS & CK PLTS	1.000 EA
36CB3004	36 CB CASTING W/1.09 DIA LEAD HOLE @ 6:0	1.000 EA
36GS1000SP	GASKET-CONDUIT BOX, .06 THICK #SV-330 LE	1.000 EA
51XB1016A08	10-16X 1/2HXWSSLD SERTYB	2.000 EA
11XW1032G06	10-32 X .38, TAPTITE II, HEX WSHR SLTD U	1.000 EA
HW3001B01	003SS CUP WASHER, FOR #8 SCREW	1.000 EA
36EP3104A01	FREP MACH W/GRSR, RAISED FH PADS	1.000 EA
HW4500A01	1641B(ALEMITE)400 UNIV, GREASE FITT	1.000 EA
HW5100A05	WVY WSHR F/205 & 304 BRGS	1.000 EA
36EP3301A23	PU ENDPLATE, ENCL. 182-4TC 206 BRG. W/GR	1.000 EA
HW4500A01	1641B(ALEMITE)400 UNIV, GREASE FITT	1.000 EA
10XN2520A28	1/4-20X 1 3/4 HEX HD	4.000 EA
HW1001A25	LOCKWASHER 1/4, ZINC PLT .493 OD, .255 I	4.000 EA
51XB1214A16	12-14X1.00 HXWSSLD SERTYB	1.000 EA
36FH4009A102	IEC FH GREASER W/AUTOPHERETIC PRIMER	1.000 EA
51XW1032A06	10-32 X .38, TAPTITE II, HEX WSHR SLTD S	3.000 EA
36CB4516	36 LIPPED CB LID	1.000 EA
37GS1001	GASKET, CONDUIT BOX LID, .06 THICK LEXID	1.000 EA
51XW0832A07	8-32 X .44, TAPTITE II, HEX WSHR SLTD SE	4.000 EA
HW2501E16	3KEY, 1/4 SQ X 1.750	1.000 EA
HA7000A02	KEY RETAINER RING, 1 1/8 DIA, 1 3/8 DIA	1.000 EA

Parts List (continued)

Part Number	Description	Quantity
85XU0407S04	4X1/4 U DRIVE PIN STAINLESS	2.000 EA
HW3200A01	3/8-16X3/4 I-BLT WELDED F/S	1.000 EA
MJ1000A75	GREASE, POLYREX EM EXXON (USe 4824-15A)	0.050 LB
LB1115N	LABEL,LIFTING DEVICE (ON ROLLS)	1.000 EA
HA3101A28	THRUBOLT 1/4-20 X 12.500 OHIO ROD	4.000 EA
MG1000Y03	MUNSELL 2.53Y 6.70/ 4.60, GLOSS 20,	0.022 GA
LC0005E01	CONN.DIA./WARNING LABEL (LC0005/LB1119N)	1.000 EA
NP1259L	ALUM SUPER-E UL CSA-EEV CC NEMA PREMIUM	1.000 EA
36PA1001	PKG GRP, PRINT PK1017A06	1.000 EA
PK3082	STYROFOAM CRADLE	1.000 EA
MN416A01	TAG-INSTAL-MAINT no wire (1200/bx) 10/13	1.000 EA

AC Induction Motor Performance Data

Record □31668 - Typical performance - not guaranteed values

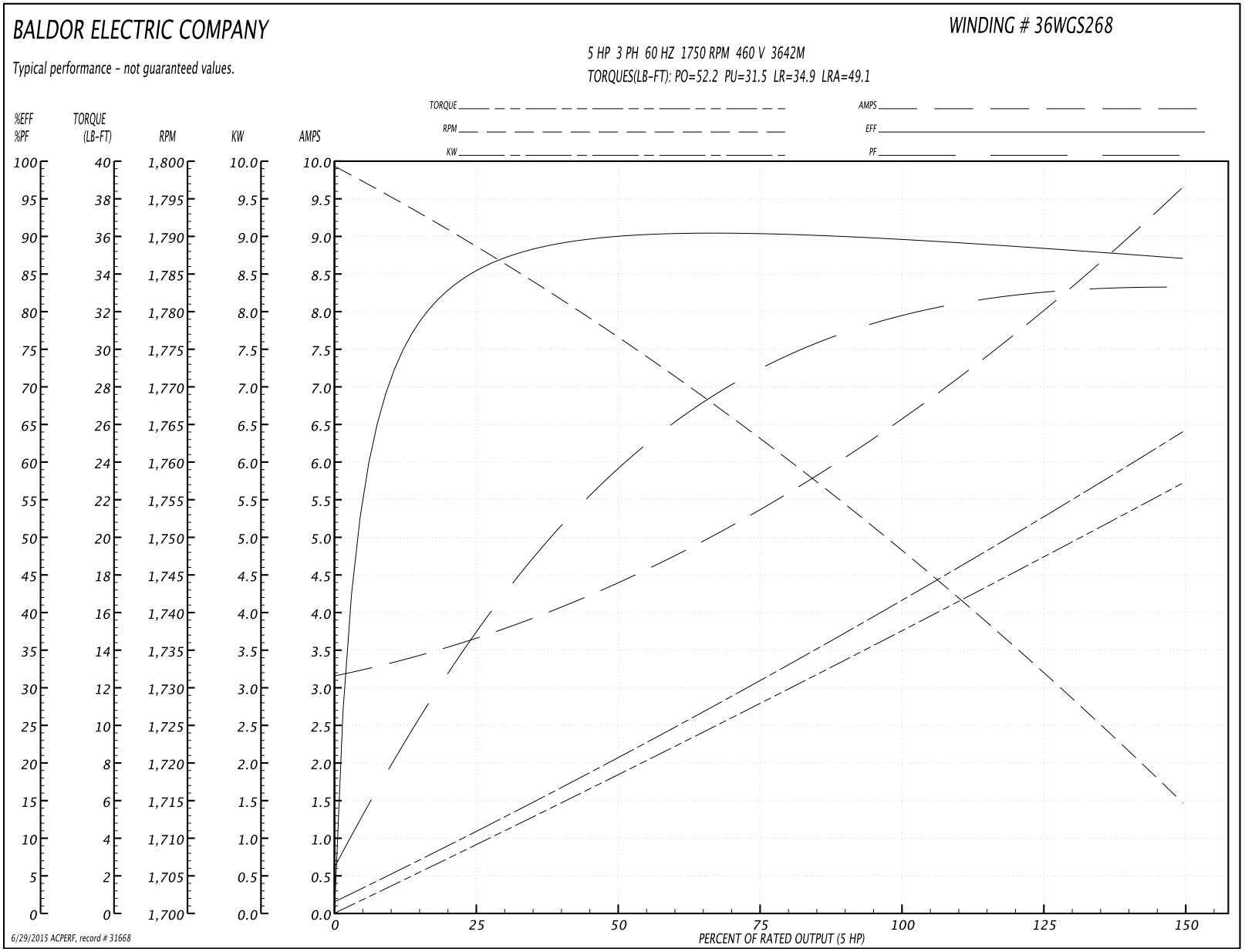
Winding: 36WGS268-R001	**Type:** 3642M	**Enclosure:** TEFC

Nameplate Data				460 V, 60 Hz: High Voltage Connection	
Rated Output (HP)	5			Full Load Torque	14.9 LB-FT
Volts	208-230/460			Start Configuration	direct on line
Full Load Amps	13.9-13.4/6.7			Breakdown Torque	52.2 LB-FT
R.P.M.	1750			Pull-up Torque	31.5 LB-FT
Hz	60	Phase	3	Locked-rotor Torque	34.9 LB-FT
NEMA Design Code	B	KVA Code	□	Starting Current	49.1 A
Service Factor (S.F.)	1.15			No-load Current	3.24 A
NEMA Nom. Eff.	89.5	Power Factor	78	Line-line Res. @ 25ºC	2.31 Ω
Rating - Duty	40C AMB-CONT			Temp. Rise @ Rated Load	71°C
S.F. Amps				Temp. Rise @ S.F. Load	87°C
				Rotor inertia	0.391 LB-FT2

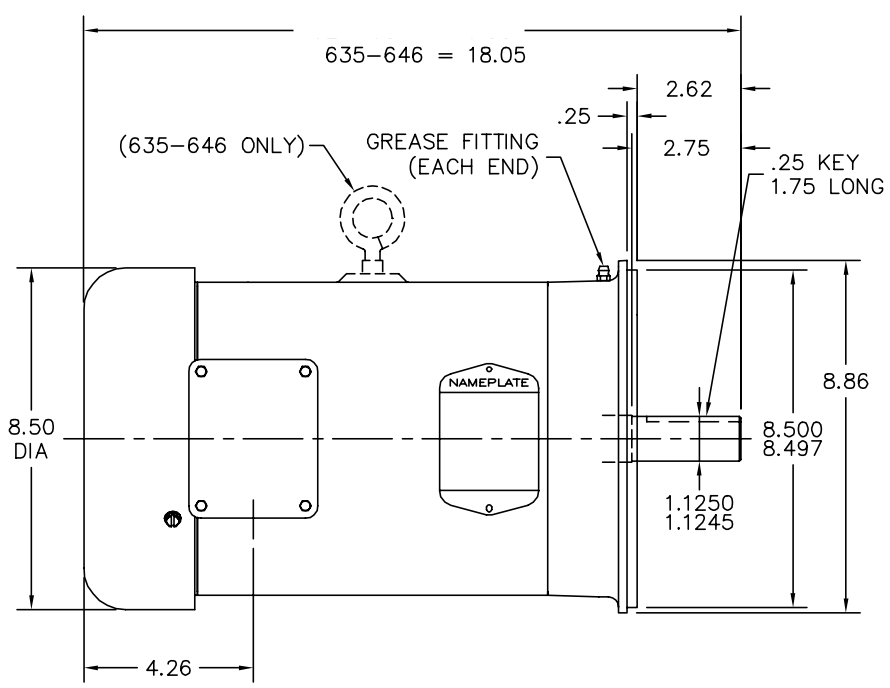
Load Characteristics 460 V, 60 Hz, 5 HP

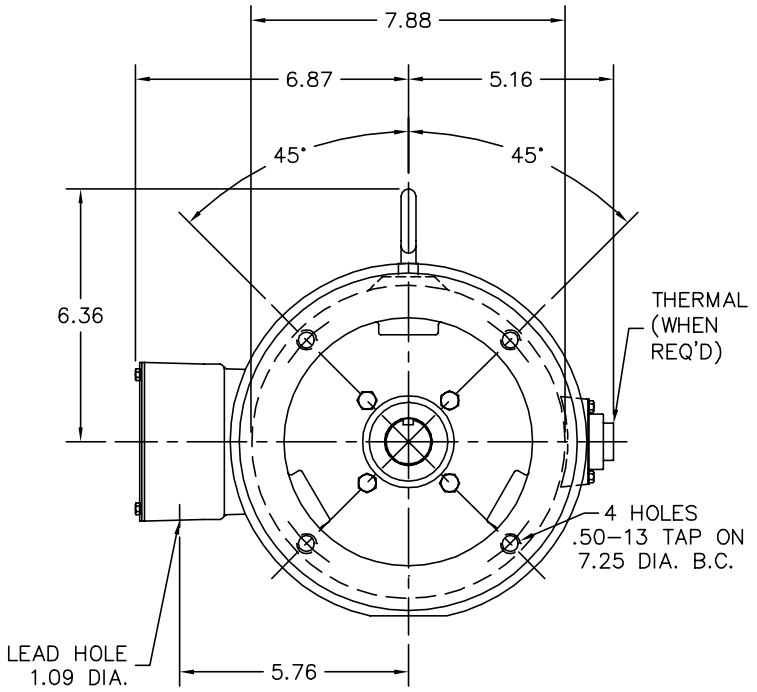
% of Rated Load	25	50	75	100	125	150	S.F.
Power Factor	39	60	72	78	83	83	81
Efficiency	84.9	89.7	90.3	89.8	88.8	87	89.2
Speed	1789.1	1776.2	1762.3	1749.7	1732.5	1714.3	1739
Line amperes	3.55	4.31	5.43	6.65	7.94	9.64	7.42

Performance Graph at 460V, 60Hz, 5.0HP Typical performance - Not guaranteed values



36LYA003



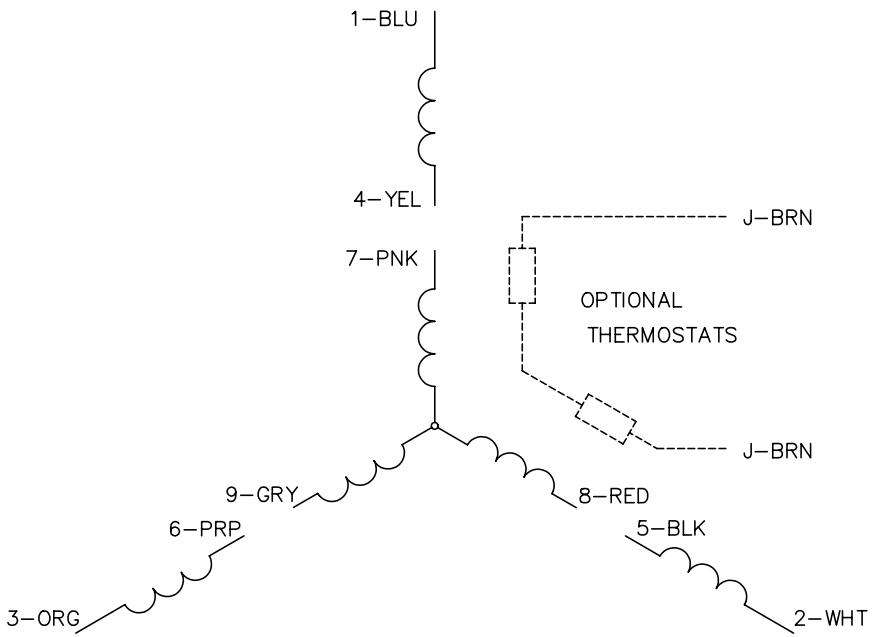


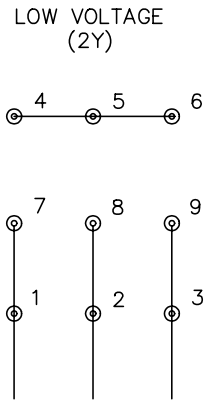
CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT MOTOR PERFORMANCE IS SUITABLE IN THE APPLICATION.

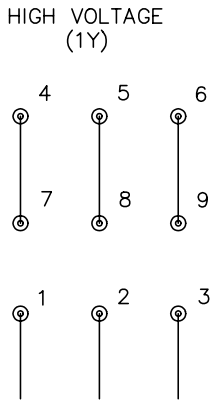
REV. DESC: FREEZE LINES SHOWING THROUGH CAPACITOR/KO BOX			BALDOR ELECTRIC Co.
REV. LTR: L	VERSION: 04	TDR: 000000384004	
36LYA003	FILE: \AAA\00003\207	REVISED: 13:08:34 12/22/2005	STD VERT FACE MTD 182–4TC TEFC 36M
	MTL: –	BY: ENCHRCO	

36LYA003

CD0005







NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. OPTIONAL THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

CD0005

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			BALDOR ELECTRIC Co.
REV. LTR: E	BY: JLP	REVISED: 01/19/99 10:15	TDR: 0171435
CD0005		FILE: AAA00005140	MDL: –
		MTL: –	3PH, DV, 9 LEADS

BALDOR • RELIANCE

Integral Horsepower
AC Induction Motors

Installation & Operating Manual

2/09 MN400

Table of Contents

Section 1
General Information 1-1
Overview 1-1
Limited Warranty 1-1
Safety Notice 1-1
Receiving 1-2
Handling 1-2
Storage 1-3
Removal From Storage 1-4
Section 2
Installation & Operation 2-1
Overview 2-1
Location 2-1
Mounting 2-1
Alignment 2-1
Doweling & Bolting 2-2
Guarding 2-2
Power Connection 2-2
Conduit Box 2-2
AC Power 2-2
Rotation 2-3
First Time Start Up 2-4
Coupled Start Up 2-4
Jogging and Repeated Starts 2-4
Section 3
Maintenance & Troubleshooting 3-1
General Inspection 3-1
Relubrication & Bearings 3-1
Type of Grease 3-1
Relubrication Intervals 3-1
Relubrication Procedure 3-3
Troubleshooting Chart 3-4
Suggested bearing and winding RTD setting guidelines 3-5

Section 1
General Information

Overview This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements.
A Warning statement indicates a possible unsafe condition that can cause harm to personnel.
A Caution statement indicates a condition that can cause damage to equipment.

Important: **This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.**

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- The National Electrical Code
- Local codes and Practices

Limited Warranty

www.baldor.com/support/warranty_standard.asp

Safety Notice: This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment.

Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: **Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.**

WARNING: **Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.**

WARNING: **Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.**

WARNING: **Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.**

WARNING: **Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. When installing, protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.**

WARNING: **This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.**

WARNING: **Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.**

WARNING: **Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.**

WARNING: **Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.**

WARNING: **Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.**

WARNING: **Thermostat contacts automatically reset when the motor has slightly cooled down. To prevent injury or damage, the control circuit should be designed so that automatic starting of the motor is not possible when the thermostat resets.**

Safety Notice Continued

WARNING: **UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.**

WARNING: **Pacemaker danger – Magnetic and electromagnetic fields in the vicinity of current carrying carrying conductors and permanent magnet motors can result result in a serious health hazard to persons with cardiac pacemakers, metal implants, and hearing aids. To avoid risk, stay way from the area surrounding a permanent magnet motor.**

WARNING: **Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.**

WARNING: **Use only UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust.**

WARNING: **Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo. Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.**

WARNING: **Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

Caution: **To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.**

Caution: **Do not over–lubricate motor as this may cause premature bearing failure.**

Caution: **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

Caution: **If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.**

Caution: **To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.**

Caution: **If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.**

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.

Receiving

Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

Handling

The motor should be lifted using the lifting lugs or eye bolts provided.

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft or the hood of a WPII motor.
2. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.
3. When lifting a WPII (Weather Proof Type 2) motor, do not lift the motor by inserting lifting lugs into holes on top of the cooling hood. These lugs are to be used for hood removal only. A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame.

4. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation.

   Do not lift the assembly using the motor lugs or eye bolts provided. Lugs or eye bolts are designed to lift motor only. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

Storage

Storage requirements for motors and generators that will not be placed in service for at least six months from date of shipment.

Improper motor storage will result in seriously reduced reliability and failure. An electric motor that does not experience regular usage while being exposed to normally humid atmospheric conditions is likely to develop rust in the bearings or rust particles from surrounding surfaces may contaminate the bearings. The electrical insulation may absorb an excessive amount of moisture leading to the motor winding failure.

A wooden crate “shell” should be constructed to secure the motor during storage. This is similar to an export box but the sides & top must be secured to the wooden base with lag bolts (not nailed as export boxes are) to allow opening and reclosing many times without damage to the “shell”.

Minimum resistance of motor winding insulation is 5 Meg ohms or the calculated minimum, which ever is greater. Minimum resistance is calculated as follows: **Rm = kV + 1**

where: (Rm is minimum resistance to ground in Meg−Ohms and
kV is rated nameplate voltage defined as Kilo−Volts.)

Example: For a 480VAC rated motor Rm =1.48 meg−ohms (use 5 MΩ).
For a 4160VAC rated motor Rm = 5.16 meg−ohms.

Preparation for Storage

1. Some motors have a shipping brace attached to the shaft to prevent damage during transportation. The shipping brace, if provided, must be removed and stored for future use. The brace must be reinstalled to hold the shaft firmly in place against the bearing before the motor is moved.
2. Store in a clean, dry, protected warehouse where control is maintained as follows:
   a. Shock or vibration must not exceed 2 mils maximum at 60 hertz, to prevent the bearings from brinelling. If shock or vibration exceeds this limit vibration isolation pads must be used.
   b. Storage temperatures of 10°C (50°F) to 49°C (120°F) must be maintained.
   c. Relative humidity must not exceed 60%.
   d. Motor space heaters (when present) are to be connected and energized whenever there is a possibility that the storage ambient conditions will reach the dew point. Space heaters are optional.

   Note: Remove motor from containers when heaters are energized, reprotect if necessary.
3. Measure and record the resistance of the winding insulation (dielectric withstand) every 30 days of storage.
   a. If motor insulation resistance decreases below the minimum resistance, contact your Baldor District office.
   b. Place new desiccant inside the vapor bag and re−seal by taping it closed.
   c. If a zipper−closing type bag is used instead of the heat−sealed type bag, zip the bag closed instead of taping it. Be sure to place new desiccant inside bag after each monthly inspection.
   d. Place the shell over the motor and secure with lag bolts.
4. Where motors are mounted to machinery, the mounting must be such that the drains and breathers are fully operable and are at the lowest point of the motor. Vertical motors must be stored in the vertical position. Storage environment must be maintained as stated in step 2.

5. Motors with anti−friction bearings are to be greased at the time of going into extended storage with periodic service as follows:
   a. Motors marked “Do Not Lubricate” on the nameplate do not need to be greased before or during storage.
   b. Ball and roller bearing (anti−friction) motor shafts are to be rotated manually every 3 months and greased every 6 months in accordance with the Maintenance section of this manual.
   c. Sleeve bearing (oil lube) motors are drained of oil prior to shipment. The oil reservoirs must be refilled to the indicated level with the specified lubricant, (see Maintenance). The shaft should be rotated monthly by hand at least 10 to 15 revolutions to distribute oil to bearing surfaces.
   d. “Provisions for oil mist lubrication” − These motors are packed with grease. Storage procedures are the same as paragraph 5b.
   e. “Oil Mist Lubricated” − These bearings are protected for temporary storage by a corrosion inhibitor. If stored for greater than 3 months or outdoor storage is anticipated, connected to the oil mist system while in storage. If this is not possible, add the amount of grease indicated under “Standard Condition” in Section 3, then rotate the shaft 15 times by hand.
6. All breather drains are to be fully operable while in storage (drain plugs removed). The motors must be stored so that the drain is at the lowest point. All breathers and automatic “T” drains must be operable to allow breathing and draining at points other than through the bearings around the shaft. Vertical motors should be stored in a safe stable vertical position.
7. Coat all external machined surfaces with a rust preventing material. An acceptable product for this purpose is Exxon Rust Ban # 392.

Non−Regreaseable Motors

Non−regreasable motors with “Do Not Lubricate” on the nameplate should have the motor shaft rotated 15 times to redistribute the grease within the bearing every 3 months or more often.

All Other Motor Types

Before storage, the following procedure must be performed.

1. Remove the grease drain plug, if supplied, (opposite the grease fitting) on the bottom of each bracket prior to lubricating the motor.
2. The motor with regreasable bearing must be greased as instructed in Section 3 of this manual.
3. Replace the grease drain plug after greasing.
4. The motor shaft must be rotated a minimum of 15 times after greasing.
5. Motor Shafts are to be rotated at least 15 revolutions manually every 3 months and additional grease added every nine months (see Section 3) to each bearing.
6. Bearings are to be greased at the time of removal from storage.

Removal From Storage

1. Remove all packing material.
2. Measure and record the electrical resistance of the winding insulation resistance meter at the time of removal from storage. The insulation resistance must not be less than 50% from the initial reading recorded when the motor was placed into storage. A decrease in resistance indicates moisture in the windings and necessitates electrical or mechanical drying before the motor can be placed into service. If resistance is low, contact your Baldor District office.
3. Regrease the bearings as instructed in Section 3 of this manual.
4. Reinstall the original shipping brace if motor is to be moved. This will hold the shaft firmly against the bearing and prevent damage during movement.

Section 2
Installation & Operation

Overview Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

Location It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

1. **Open Drip−Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non−corrosive.
2. **Totally Enclosed and WPII** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service.

Hazardous Locations are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers, or flyings. Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code.

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

Mounting The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

After installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

Alignment Accurate alignment of the motor with the driven equipment is extremely important. The pulley, sprocket, or gear used in the drive should be located on the shaft as close to the shaft shoulder as possible. It is recommended to heat the pulley, sprocket, or gear before installing on the motor shaft. Forcibly driving a unit on the motor shaft will damage the bearings.

1. **Direct Coupling**
   For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.
2. **End-Play Adjustment**
   The axial position of the motor frame with respect to its load is also extremely important. The motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.
3. **Pulley Ratio**
   The pulley ratio should not exceed 8:1.

Caution: **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

4. **Belt Drive**
   Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.
5. Sleeve bearing motors are only suitable for coupled loads.

Doweling & Bolting After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor motors are designed for doweling.)

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment. Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure. Flanged nuts or bolts may be used as an alternative to washers.

WARNING: Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.

Guarding Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions. This is particularly important where the parts have surface irregularities such as keys, key ways or set screws. Some satisfactory methods of guarding are:

1. Covering the machine and associated rotating parts with structural or decorative parts of the driven equipment.
2. Providing covers for the rotating parts. Covers should be sufficiently rigid to maintain adequate guarding during normal service.

Power Connection Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices. Flying leads must be insulated with two full wraps of electrical grade insulating tape or heat shrink tubing.

Conduit Box For ease of making connections, an oversize conduit box is provided.
The box can be rotated 360° in 90° increments.
Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

AC Power Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

1. AC power is within ±10% of rated voltage with rated frequency. (See motor name plate for ratings).
   OR
2. AC power is within ±5% of rated frequency with rated voltage.
   OR
3. A combined variation in voltage and frequency of ±10% (sum of absolute values) of rated values, provided the frequency variation does not exceed ±5% of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-2.

Figure 2-1 Accessory Connections

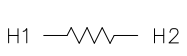
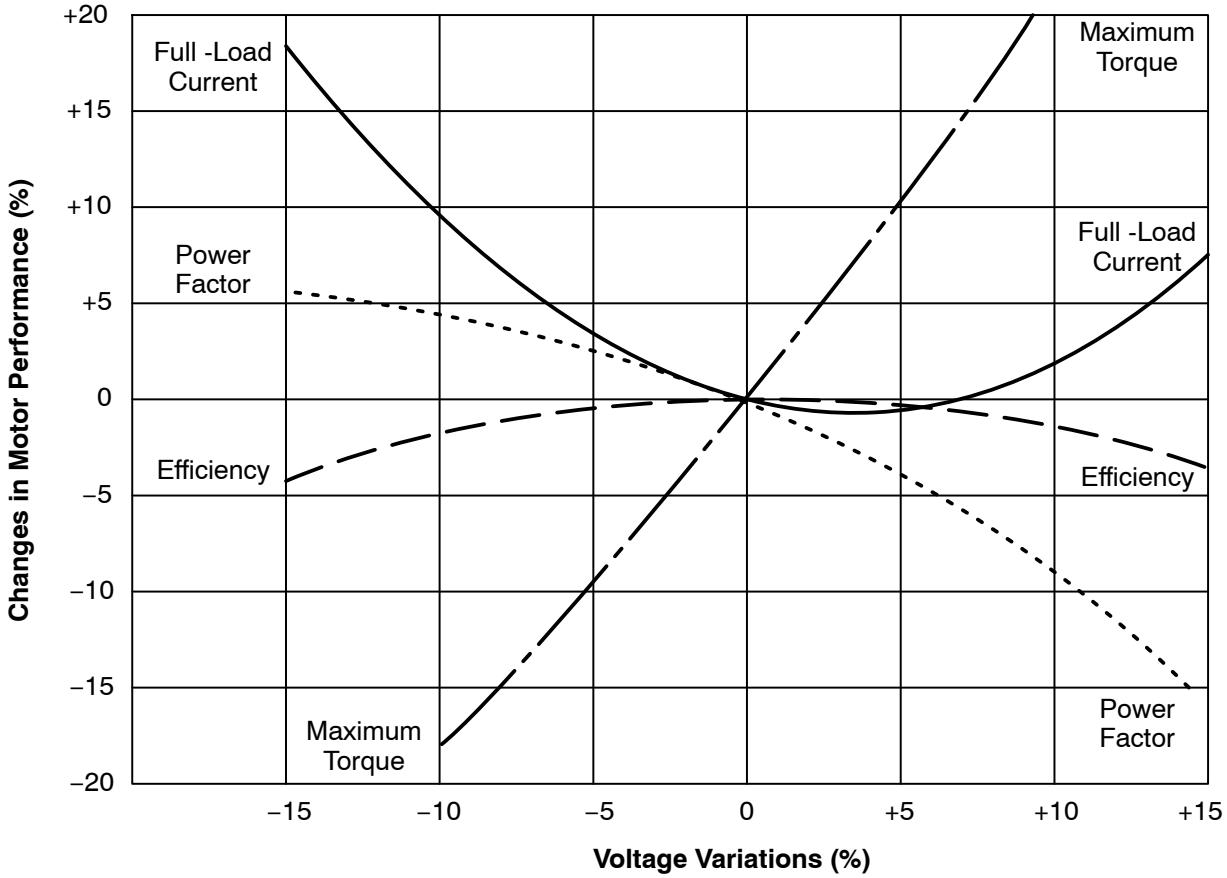
HEATERS 	One heater is installed in each end of motor. Leads for each heater are labeled H1 & H2. (Like numbers should be tied together).
THERMISTORS 	Three thermistors are installed in windings and tied in series. Leads are labeled T1 & T2.
WINDING RTDS 	Winding RTDs are installed in windings (2) per phase. Each set of leads is labeled W1, W2, W3, W4, W5, & W6.
BEARING RTD 	* One bearing RTD is installed in Drive endplate (PUEP), leads are labeled RTDDE. * One bearing RTD is installed in Opposite Drive endplate (FREP), leads are labeled RTDODE. * Note RTD may have 2–Red/1–White leads; or 2–White/1–Red Lead.

Figure 2-2 Typical Motor Performance VS Voltage Variations



Rotation All three phase motors are reversible. To reverse the direction of rotation, disconnect and lock out power and interchange any two of the three line leads for three phase motors. For single phase motors, check the connection diagram to determine if the motor is reversible and follow the connection instructions for lead numbers to be interchanged. Not all single phase motors are reversible.

Adjustable Frequency Power Inverters used to supply adjustable frequency power to induction motors produce wave forms with lower order harmonics with voltage spikes superimposed. Turn−to−turn, phase−to−phase, and ground insulation of stator windings are subject to the resulting dielectric stresses. Suitable precautions should be taken in the design of these drive systems to minimize the magnitude of these voltage spikes. Consult the drive instructions for maximum acceptable motor lead lengths, and proper grounding.

First Time Start Up Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.

Coupled Start Up This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor though the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor District Office or Baldor Service Center.

Section 3
Maintenance & Troubleshooting

WARNING: UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

General Inspection Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Use a “Megger” periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

Relubrication & Bearings Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

Type of Grease A high grade ball or roller bearing grease should be used. Recommended grease for standard service conditions is **Polyrex EM (Mobil)**. Do not mix greases unless compatibility has been checked and verified.

Equivalent and compatible greases include:
Texaco Polystar, Rykon Premium #2, Pennzoil Pen 2 Lube and Chevron SRI.

Relubrication Intervals Recommended relubrication intervals are shown in Table 3-1. It is important to realize that the recommended intervals of Table 3-1 are based on average use.

Refer to additional information contained in Tables 3-2, 3-3 and 3-4.

Table 3-1 Relubrication Intervals *

NEMA / (IEC) Frame Size	Rated Speed - RPM					
	10000	6000	3600	1800	1200	900
Up to 210 incl. (132)	**	2700 Hrs.	5500 Hrs.	12000 Hrs.	18000 Hrs.	22000 Hrs.
Over 210 to 280 incl. (180)		**	3600 Hrs.	9500 Hrs.	15000 Hrs.	18000 Hrs.
Over 280 to 360 incl. (225)		**	* 2200 Hrs.	7400 Hrs.	12000 Hrs.	15000 Hrs.
Over 360 to 5800 incl. (300)		**	*2200 Hrs.	3500 Hrs.	7400 Hrs.	10500 Hrs.

* Relubrication intervals are for ball bearings.
For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

Table 3-2 Service Conditions

Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination
Standard	8	40° C	Clean, Little Corrosion
Severe	16 Plus	50° C	Moderate dirt, Corrosion
Extreme	16 Plus	>50° C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration
Low Temperature		<–29° C **	

* Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

Table 3-3 Relubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

Table 3-4 Bearings Sizes and Types

Frame Size NEMA (IEC)	Bearing Description (These are the "Large" bearings (Shaft End) in each frame size)			
	Bearing	Weight of Grease to add * oz (Grams)	Volume of grease to be added	
			in^3	teaspoon
56 to 140 (90)	6203	0.08 (2.4)	0.15	0.5
140 (90)	6205	0.15 (3.9)	0.2	0.8
180 (100–112)	6206	0.19 (5.0)	0.3	1.0
210 (132)	6307	0.30 (8.4)	0.6	2.0
250 (160)	6309	0.47 (12.5)	0.7	2.5
280 (180)	6311	0.61 (17)	1.2	3.9
320 (200)	6312	0.76 (20.1)	1.2	4.0
360 (225)	6313	0.81 (23)	1.5	5.2
400 (250)	6316	1.25 (33)	2.0	6.6
440 (280)	6319	2.12 (60)	4.1	13.4
5000 to 5800 (315–450)	6328	4.70 (130)	9.2	30.0
5000 to 5800 (315–450)	NU328	4.70 (130)	9.2	30.0
360 to 449 (225–280)	NU319	2.12 (60)	4.1	13.4
AC Induction Servo				
76 Frame 180 (112)	6207	0.22 (6.1)	0.44	1.4
77 Frame 210 (132)	6210	0.32 (9.0)	0.64	2.1
80 Frame 250(160)	6213	0.49 (14.0)	0.99	3.3

* Weight in grams = .005 DB of grease to be added

Note: Not all bearing sizes are listed. For intermediate bearing sizes, use the grease volume for the next larger size bearing.

Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.

Relubrication Procedure Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

Caution: Do not over−lubricate motor as this may cause premature bearing failure.

With Grease Outlet Plug

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.

Caution: Over−lubricating can cause excessive bearing temperatures, premature lubrication breakdown and bearing failure.

3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed. This allows excess grease to purge.
5. Re-install grease outlet plug.

Without Grease Provisions

Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed explosion proof motor to maintain it's UL/CSA listing.

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.

Sample Relubrication Determination

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

1. Table 3-1 list 9500 hours for standard conditions.
2. Table 3-2 classifies severity of service as "Severe".
3. Table 3-4 shows that 1.2 in^3 or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

Table 3-5 Troubleshooting Chart

Symptom	Possible Causes	Possible Solutions
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter.	Check source of power. Check overloads, fuses, controls, etc.
Excessive humming	High Voltage.	Check input line connections.
	Eccentric air gap.	Have motor serviced at local Baldor service center.
Motor Over Heating	Overload. Compare actual amps (measured) with nameplate rating.	Locate and remove source of excessive friction in motor or load. Reduce load or replace with motor of greater capacity.
	Single Phasing.	Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation.	Check external cooling fan to be sure air is moving properly across cooling fins. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage.	Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator.	Check air gap clearance and bearings.
		Tighten “Thru Bolts”.
	Over voltage or under voltage.	Check input voltage at each phase to motor.
	Open stator winding.	Check stator resistance at all three phases for balance.
	Grounded winding.	Perform dielectric test and repair as required.
	Improper connections.	Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram.
Bearing Over Heating	Misalignment.	Check and align motor and driven equipment.
	Excessive belt tension.	Reduce belt tension to proper point for load.
	Excessive end thrust.	Reduce the end thrust from driven machine.
	Excessive grease in bearing.	Remove grease until cavity is approximately $^3/_4$ filled.
	Insufficient grease in bearing.	Add grease until cavity is approximately $^3/_4$ filled.
	Dirt in bearing.	Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled.
Vibration	Misalignment.	Check and align motor and driven equipment.
	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Rotor out of balance.	Have rotor balance checked are repaired at your Baldor Service Center.
	Resonance.	Tune system or contact your Baldor Service Center for assistance.
Noise	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.
Growling or whining	Bad bearing.	Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled.

Suggested bearing and winding RTD setting guidelines

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80°C) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

Winding RTDs – Temperature Limit In °C (40°C Maximum Ambient)

Motor Load	Class B Temp Rise ≤ 80°C (Typical Design)		Class F Temp Rise ≤ 105°C		Class H Temp Rise ≤ 125°C	
	Alarm	Trip	Alarm	Trip	Alarm	Trip
≤ Rated Load	130	140	155	165	175	185
Rated Load to 1.15 S.F.	140	150	160	165	180	185

Note: • Winding RTDs are factory production installed, not from Mod–Express.
• When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

Bearing RTDs – Temperature Limit In °C (40°C Maximum Ambient)

Bearing Type Oil or Grease	Anti–Friction		Sleeve	
	Alarm	Trip	Alarm	Trip
Standard*	95	100	85	95
High Temperature**	110	115	105	110

Note: * Bearing temperature limits are for standard design motors operating at Class B temperature rise.
** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as “standard” lubricants) include the following:

- Texaco Polystar
- Mobilith SHC–100
- Darmex 707
- Rykon Premium #2
- Pennzoil Pennzlube EM–2
- Darmex 711
- Chevron SRI #2
- Chevron Black Pearl
- Petro–Canada Peerless LLG

See the motor nameplate for replacement grease or oil recommendation.
Contact Baldor application engineering for special lubricants or further clarifications.

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