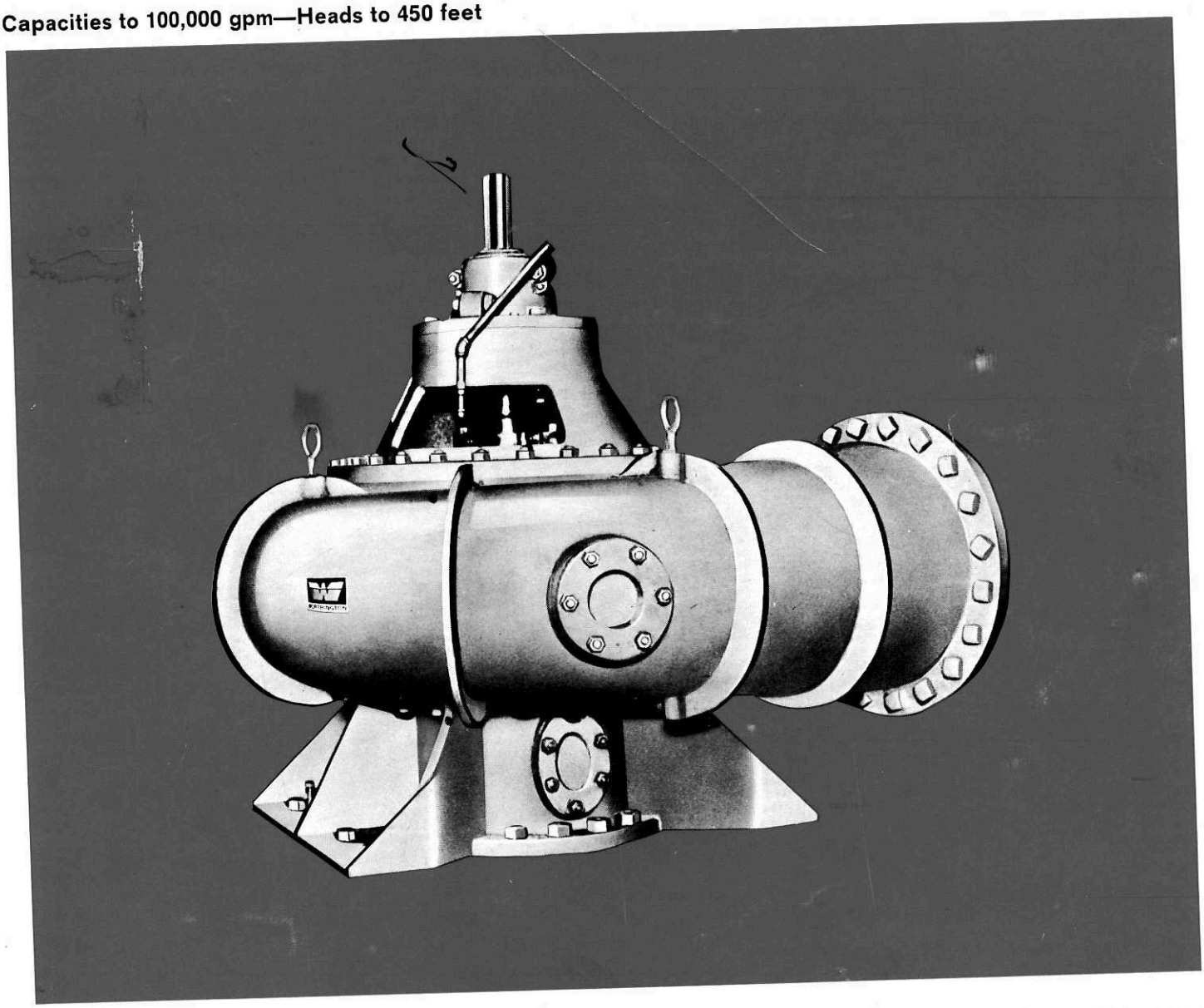
Existing Pump 2 Data Package

Worthington

Volute Centrifugal Pumps

Type FA-FC-NA

Capacities to 100,000 gpm—Heads to 450 feet



MEMBER HYDRAULIC INSTITUTE USA

A rugged, economical
Single stage, end suction pump

WORTHINGTON

CERTIFIED CORRECT FOR CUST. ORDER: 49571

CUSTOMER: THE CITY OF WINNIPEG

D.O. ORDER: S 1-75 CONTRACT: B0754021

CERTIFIED BY: [signature] DATE: 9 JUNE 1975

DIMENSIONS ARE FROM DRAWINGS, CASTINGS MAY VARY SLIGHTLY. FOUNDATION BOLTS MUST NOT BE FIXED RIGIDLY UNTIL MACHINE IS IN PLACE. THIS PRINT SUBJECT TO RETURN ON DEMAND AND UNDER CONDITION IT IS NOT USED IN ANY WAY DETRIMENTAL TO OUR INTEREST.

SYM.	REVISION	ZONE	DATE	BY
04	LENGTH 133·96 WAS 129·04	C4	MAR 2 1976	RC
03	SUCTION HEIGHT WAS 43·83		2/5/76	
02	SHAFT LENGTH CHG.		1/29/76	
01	ADDED DRIVE DETAILS & INFORMATION; FOUND. BOLT SLEEVES WERE ...	GENERAL DE-1	27 NOV 1975	RC

QTY. | REF. | NAME OF PART | PART NO. | MAT'L | SIZE / PATT. NO.

DATE: 9 JUN '75 DWN.: RC CK'D.: SCALE: — STD'S. CK'D.

WORTHINGTON (CANADA) LTD. BRANTFORD, ONTARIO

ORDER NO. B0754021 REVISION 04

DESCRIPTION: COMPOSITE ELEVATION 16 CFG-1

2111331

JUN 17 1975 JUN 2 1976

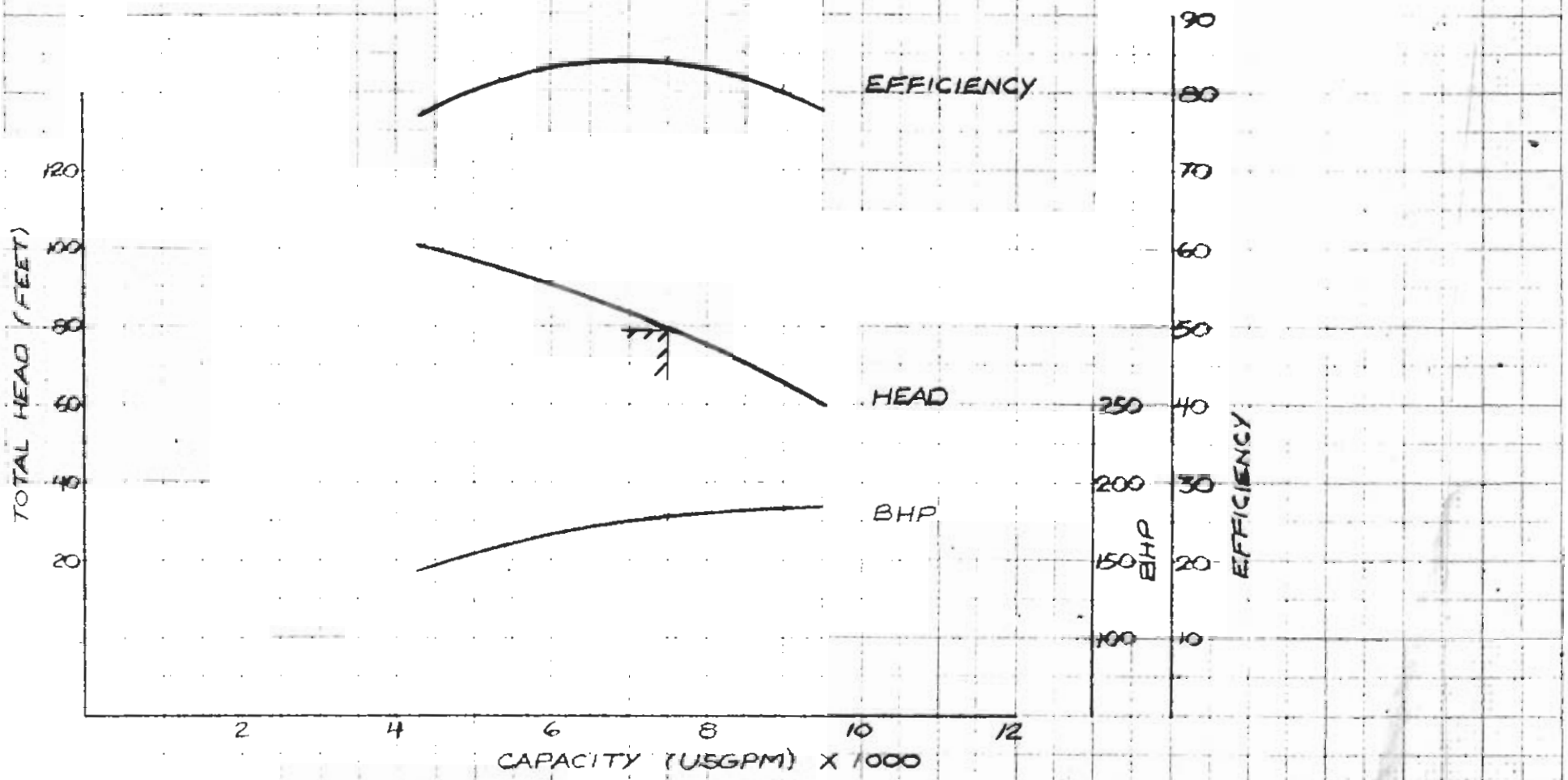
FOR 16CFC PUMP, S/N .....

TESTED ON ...MAY 6/76.....

Pembina Rd. Pump Sta.

PRPS M200

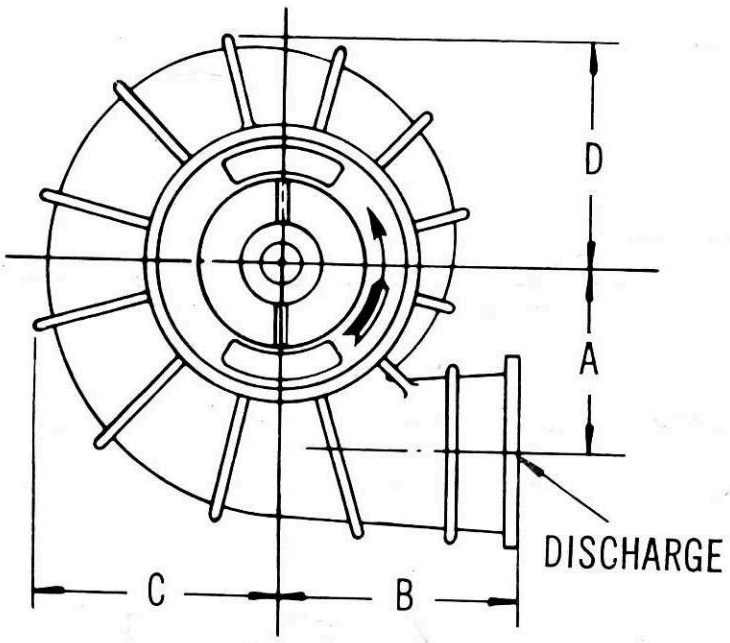
THIS CURVE SHOWS IN ADDITION, THE EXPECTED HEADS AND EFFICIENCIES AT OTHER CAPACITIES BUT ONLY THE CONDITION POINT IS GUARANTEED.

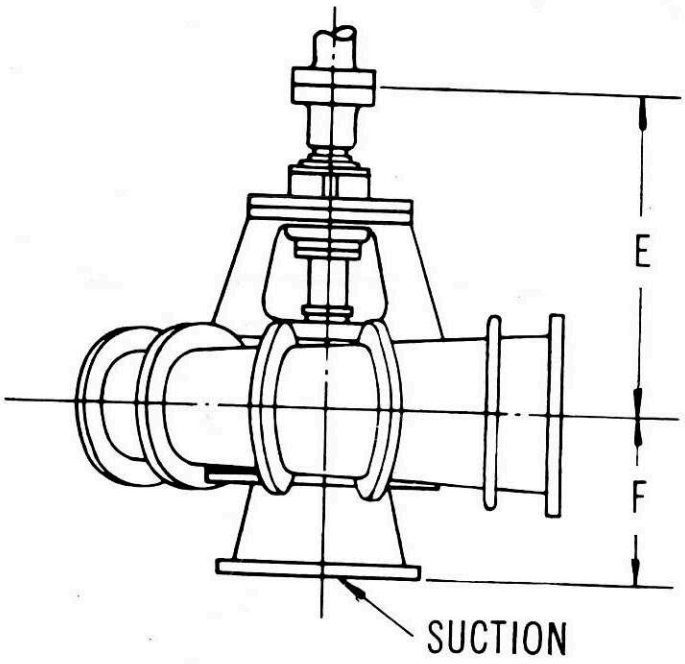


SPEC. CONDITIONS OF SERVICE		WORTHINGTON (CANADA) LTD.	CUSTOMER CITY OF WINNIPEG
USGPM 7500	BHP 181		CUSTOMER REF: 49571
TDH 79	SP. GR. 1.0	DESCRIPTION 16 CFC PERFORMANCE TEST CURVE	OUR REF: B0754021
RPM 854	EFF'CY 82.5		9810835
DATE MAY 4/76	DRAWN RH		

WC-242-1

TYPES FA-FC-NA Dimensions





Note: All dimensions are in inches (not to be used for construction purposes).

RX-128436

LINE NO.	SIZE OF PUMP	DISCHARGE DIA.	SUCTION DIA.*	A	B	C	D	E*	F*
1	10 FA-2	10	12	17¾	27	21¾	20⅝	44½	17¼
2	12 FA-2	12	14	17¾	30	23	21¾	32	21
3	16 FC-1	16	16	18	19	20¾	18¾	46	21¼
4	18 NA-25	18	20	16	42	26½	24¾	54	30½
5	18 NA-33	18	20	21	47	30½	28½	54	31½
6	18 NA-37	18	20	23	40	32	30¼	56	32½
7	20 NA-30	20	24	23	27	31	29½	40	24
8	20 NA-37	24	24	23	49	34¾	32¾	54	30½
9	24 NA-30	24	30	23	42	32	28¾	42	24
10	24 NA-37	24	24	23	49	34¾	32¾	54	30½
11	24 NA-38	24	24	23	52	34¾	32¾	57	36
12	26 NA-43	26	30	33½	42	44	39¼	57	29½
13	30 NA-40	30	30	25	64	38½	35½	54	39¾
14	30 NA-44	30	42	33½	66	44	39	59	53¾
15	36 NA-43	36	36	32½	72	44	39	45	35½
16	36 NA-57	36	36	45½	60	63¼	57¼	45	29½
17	42 NA-57	42	42	45½	78	62¾	57	57¼	34
18	42 NA-85	42	42	58⅛	102	70	63	108	54
19	54 NA-80	60	60	57½	63	78¼	69½	73	60
20	60 NA-75	60	72	64	63	83½	73	108	60
21	60 NA-68	60	72	64	63	83½	73	108	60

*These dimensions are typical.

DATA ON FLANGES 125# STANDARD					
DIA. OF OPENING	DIA. OF FLANGE	FLANGE THICKNESS	SIZE OF BOLT	BOLT CIRCLE	NO. OF BOLTS
10	16	1 3/16	⅞	14¼	12
12	19	1¼	⅞	17	12
14	21	1⅜	1	18¾	12
16	23½	1 7/16	1	21¼	16
18	25	1 5/16	1⅛	22¾	16
20	27½	1 11/16	1⅛	25	20
24	32	1⅞	1¼	29½	20
26	34¼	2	1¼	31¾	24
28	36½	2 1/16	1¼	34	28
30	38¾	2⅛	1¼	36	28
36	46	2⅜	1½	42¾	32
42	53	2⅝	1½	49½	36
54	66¼	3	1¾	62¾	44
60	73	3⅛	1¾	69¼	52
72	86½	3½	1¾	82½	60

Worthington Pump International
Harrison, New Jersey 07029
a division of Worthington Corporation

WORTHINGTON

Supersedes 2122-B1
2122-B1A 7110 Bar. P.

Litho in U.S.A.

Bearing Supply (Canada) Ltd.

DISTRIBUTORS OF:
Power Transmission Equipment • Hose & Fittings • Automation Technology
Fluid Power Products • Material Handling Systems • Mechanical Sealing Devices
Bearings, Oil Seals & O-Rings • Specialty Lubricants & Adhesives

#2 PUMP

IMP 23.5" ø

R.P.M 954.

PUMP 16 CFL.

S/N 3.07540211.

9864232

CNRIS 694 9300

~~VERNAT. 403 ~~

APPLIED ENG LTD. = POWER & MINE

10 WEEKS. 8 WEEKS

impeller

2017910-004 L.H. IMP

COST $4657.00

+ TAXES

wear Rings

2017970-001 S.S. WR RINGS

SET $2114.00

+ TAXES

FOR BRANTFORD ONT

THE CITY OF WINNEPEG

16 CFC INSTRUCTION BOOK

CUSTOMER ORDER NO. 49571
WORTHINGTON ORDER NO. B 0754021

INDEX

WORTHINGTON

Worthington Canada Inc.
A McGraw-Edison Company
4180 Dundas Street West
Toronto, Ontario, Canada
M8X 1Y1

Tel: 416 239 4881
Telex: 06 967556

City of Winnipeg
360 McPhillip St.
Winnipeg, Manitoba
R3E 2L1

August 24, 1982

Attention: Mr. Leo Picciano

c.c. Mr. Ray Gagnon - Power & Mine, Winnipeg
Mr. Jim Valerianos - Worthington, Calgary

Subject: Worthington 16CFC Pumps

Gentlemen:

Enclosed are two copies of the FC Instruction Manual and the FC bulletin. The CFC name on your pump indicates that it is a Canadian built FC pump. Both parts and pump are still available.

I understand that you are having trouble getting bearing seals for this pump. I have requested by telex that our Calgary office quote to you on these seals. The Calgary office is located at:

Worthington Canada Inc.
4030-7th St. S.E.
Calgary, Alberta
T2G 2Y8
Tele - (403) 243-6046
Telex- 038-22682

Contact - ~~Jim Valerianos~~ - units Charles Dean.
- Dawn Wells - parts

For these pumps you would normally deal with our Calgary office, but since your need is urgent, I have sent these manuals from here.

Yours very truly,
WORTHINGTON CANADA INC.

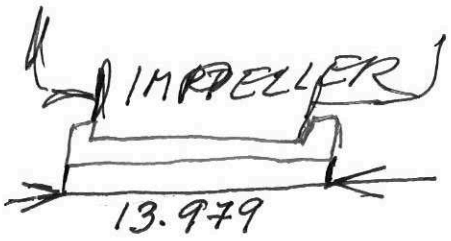
P. G. Williams

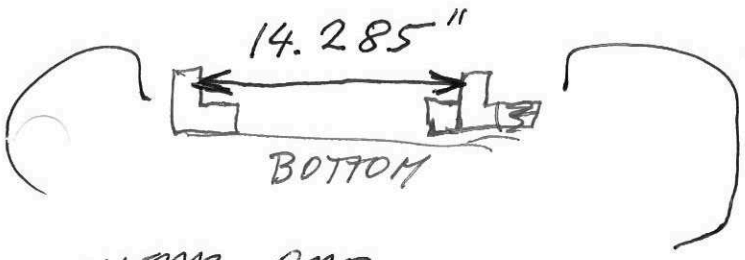
Peter Williams
Sales Engineer per

PW/ms
Enclosures

PRPS

MP 2





WEAR CAP

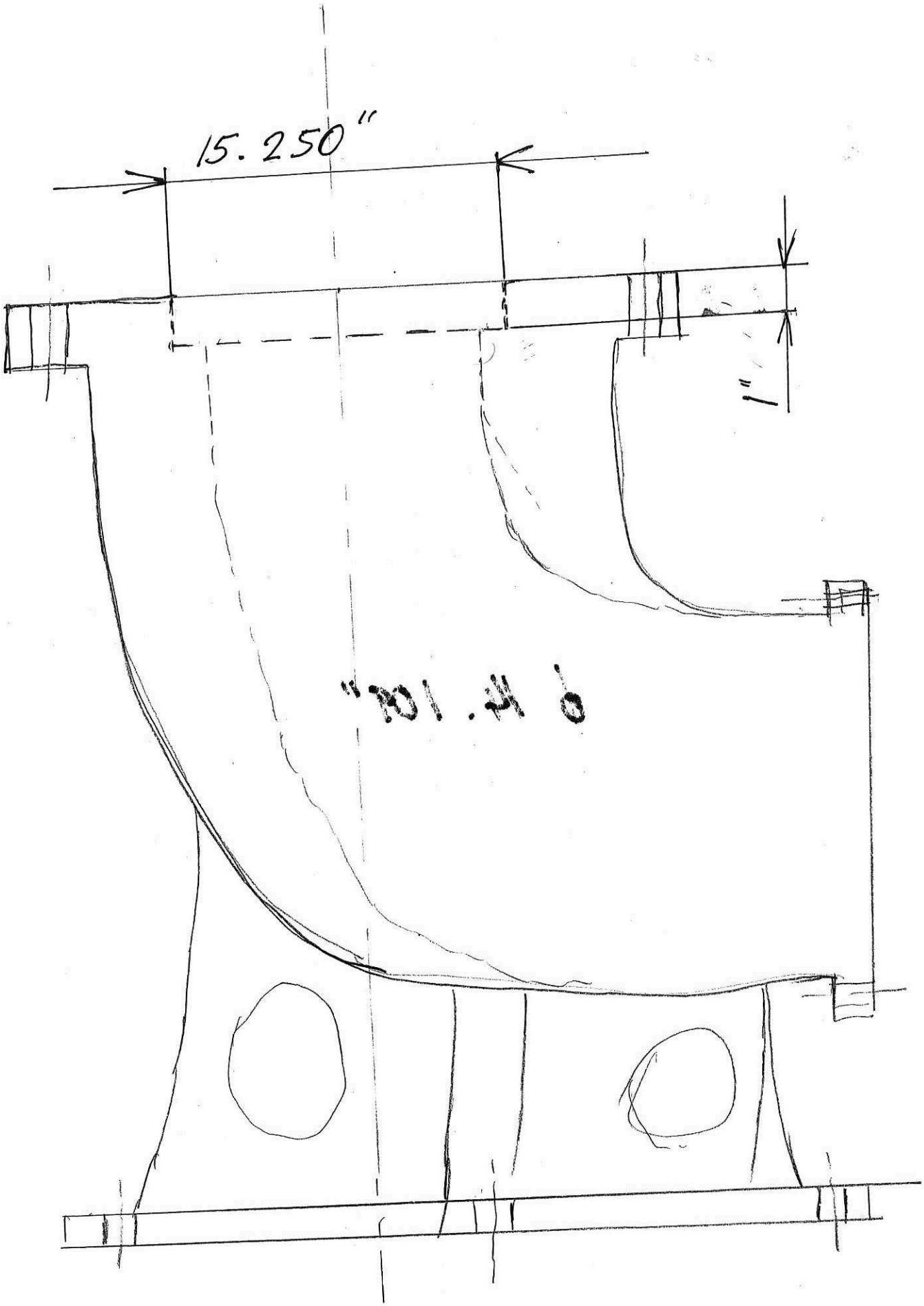
0.306"

MAY. 30. 2012

14.285"
− 0.045
14.240

PUMP # 200 PRPS

NOV. 2009



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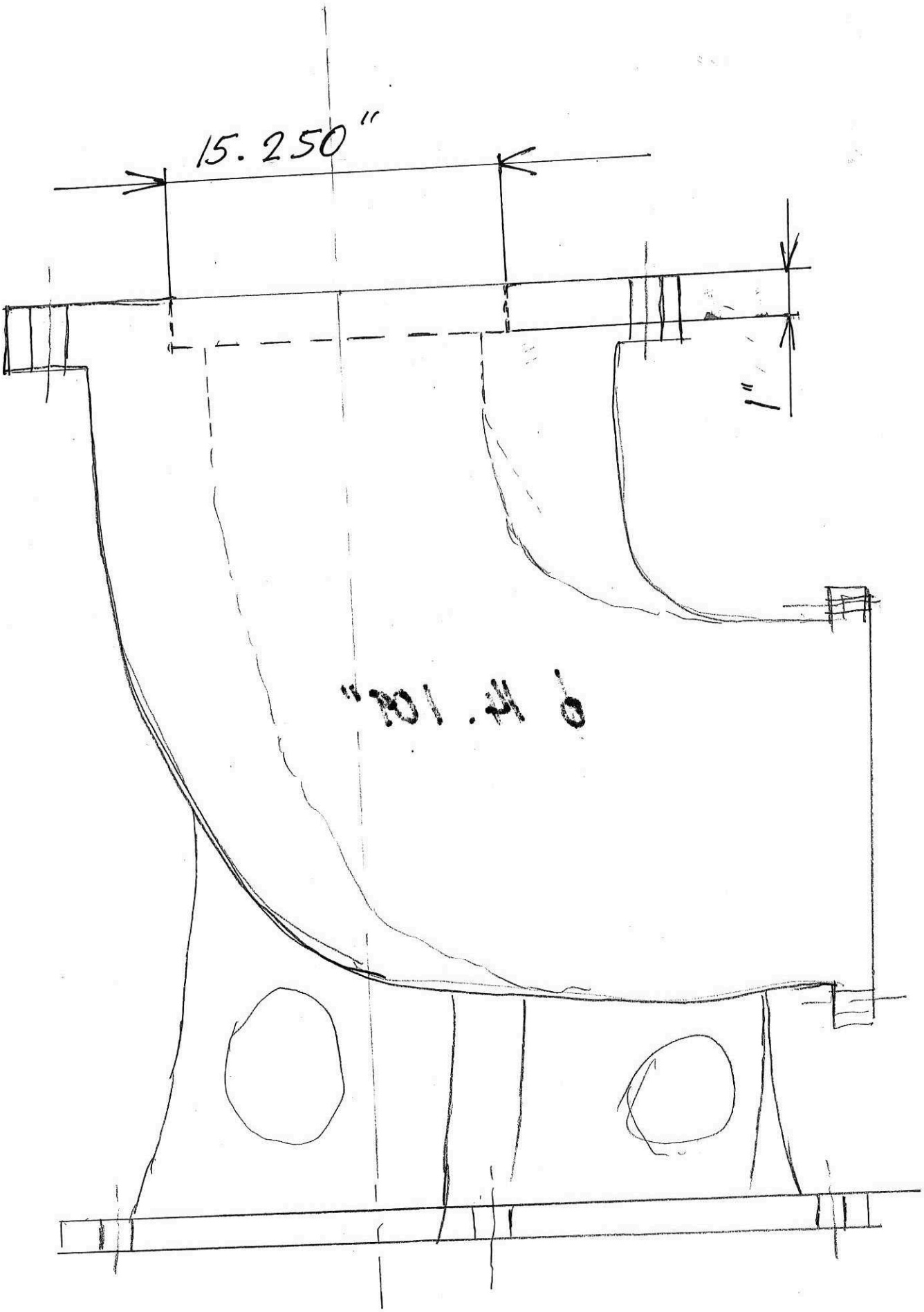
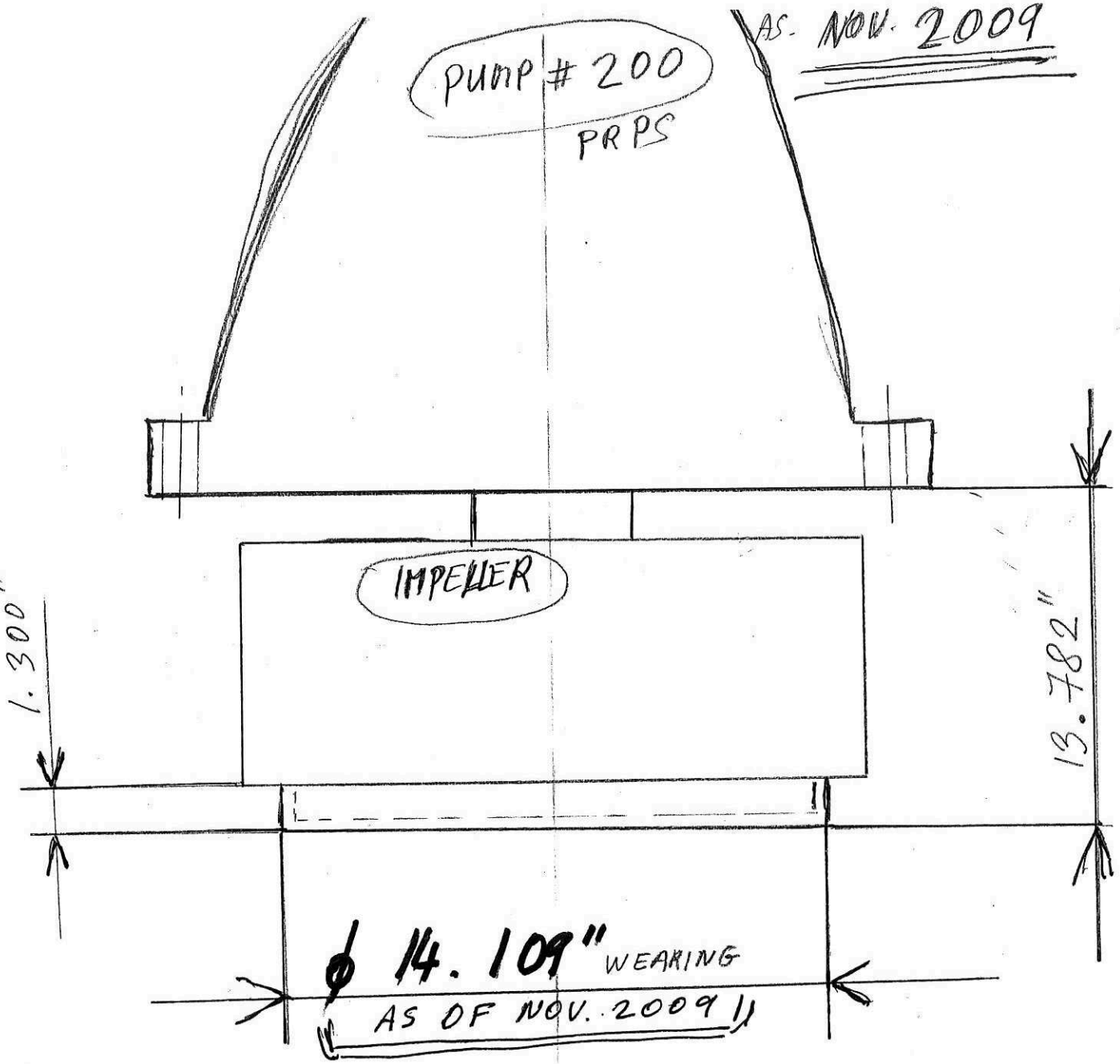
NOV. 2009



PUMP # 200

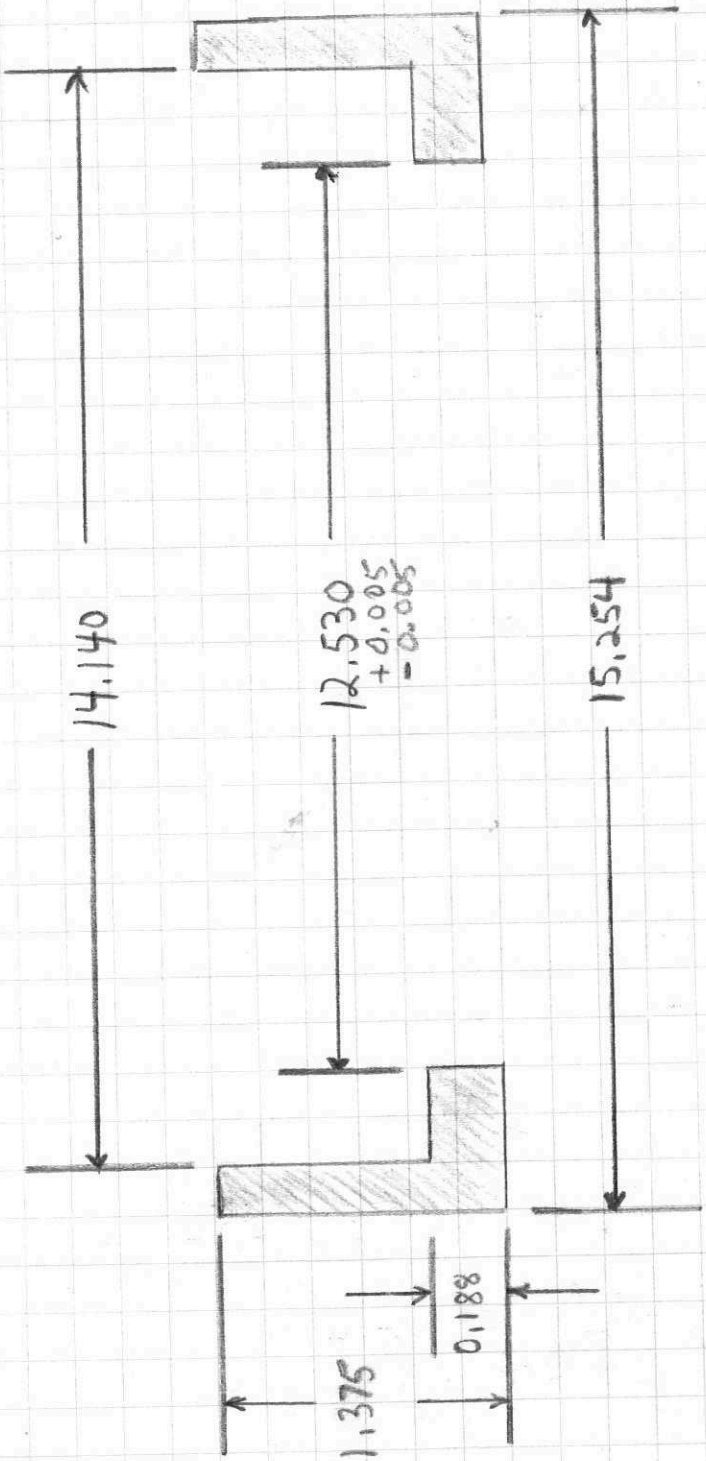
PRPS

AS. NOV. 2009

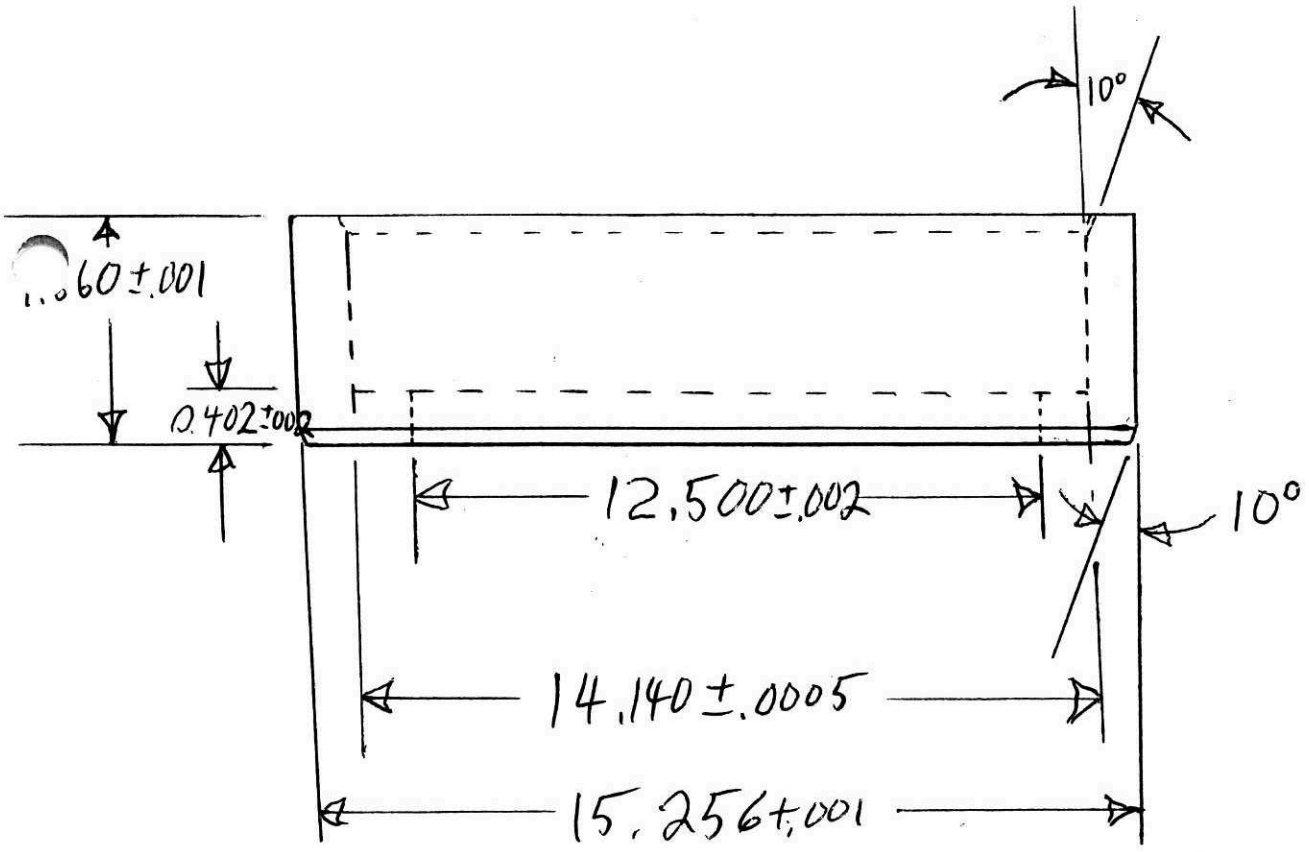


West Evo Pump Wear Ring

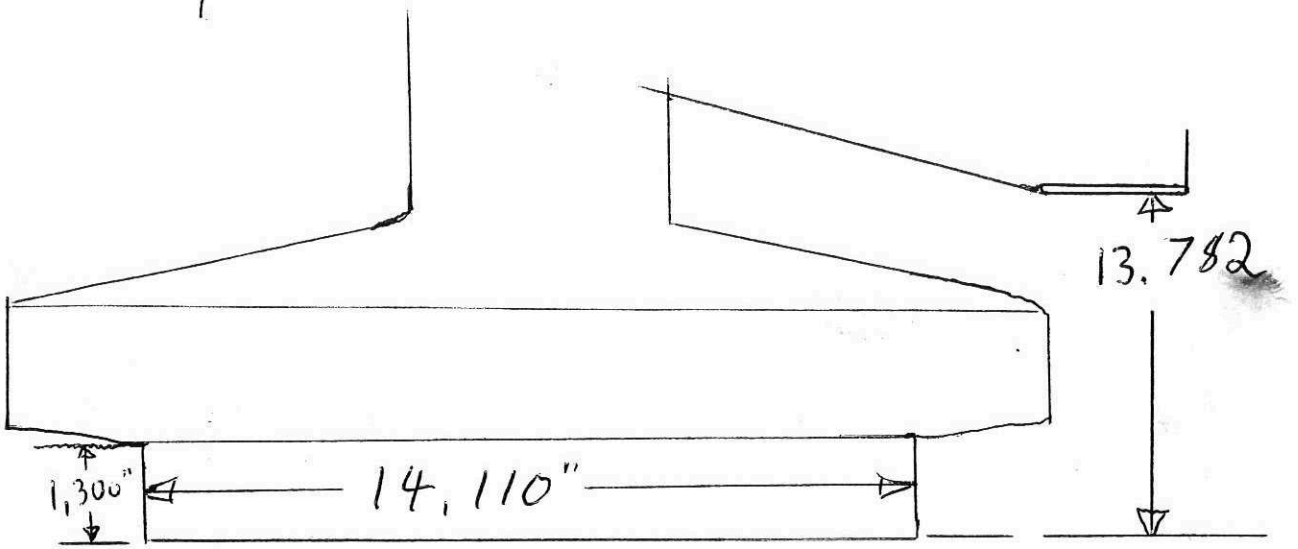
BOWL

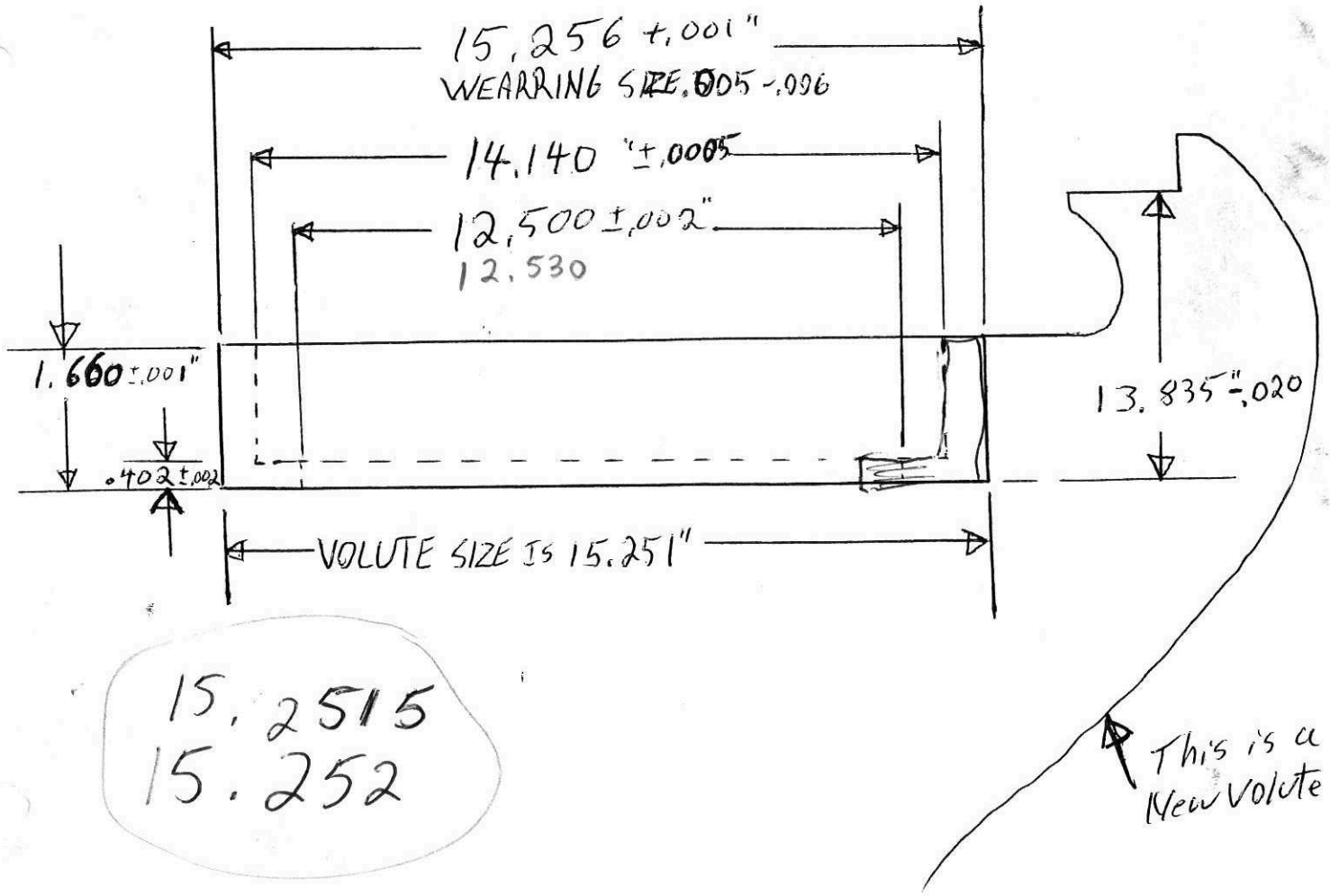


Wearing rings Dec 9/09



Nov 4/09
West END w/o 0907646/02
phone # 470 9694

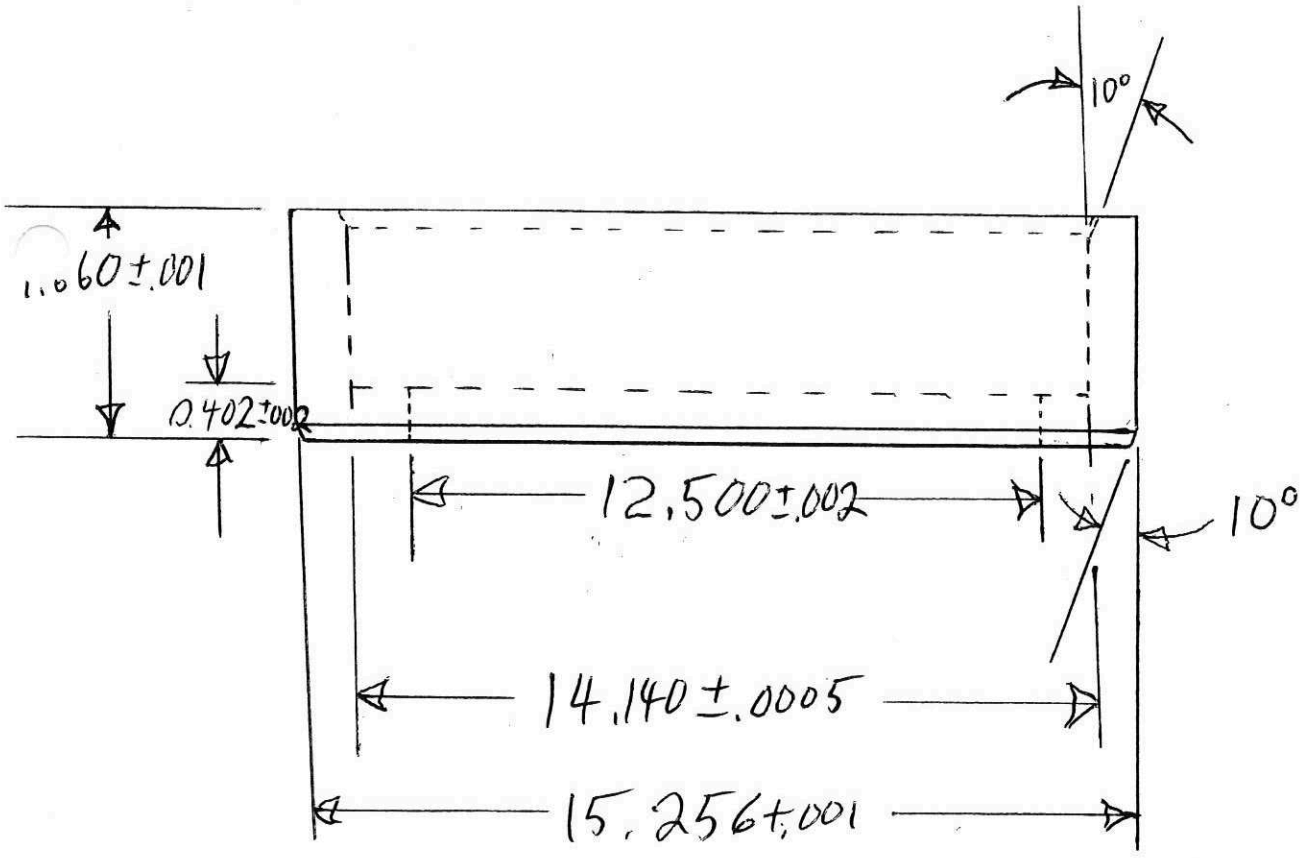




15.2515
15.252

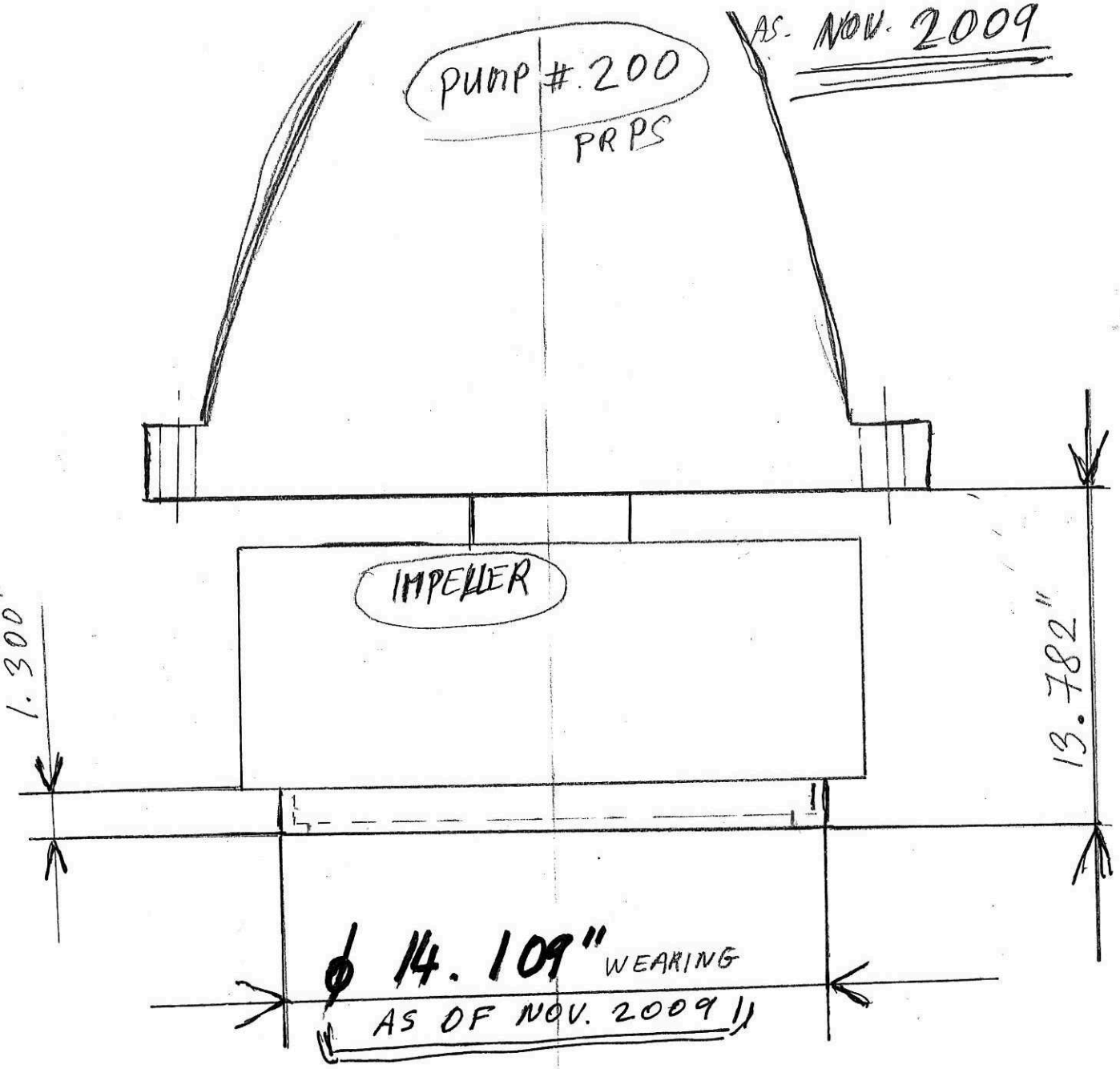
This is a New Volute

Wearing rings Dec 9/09

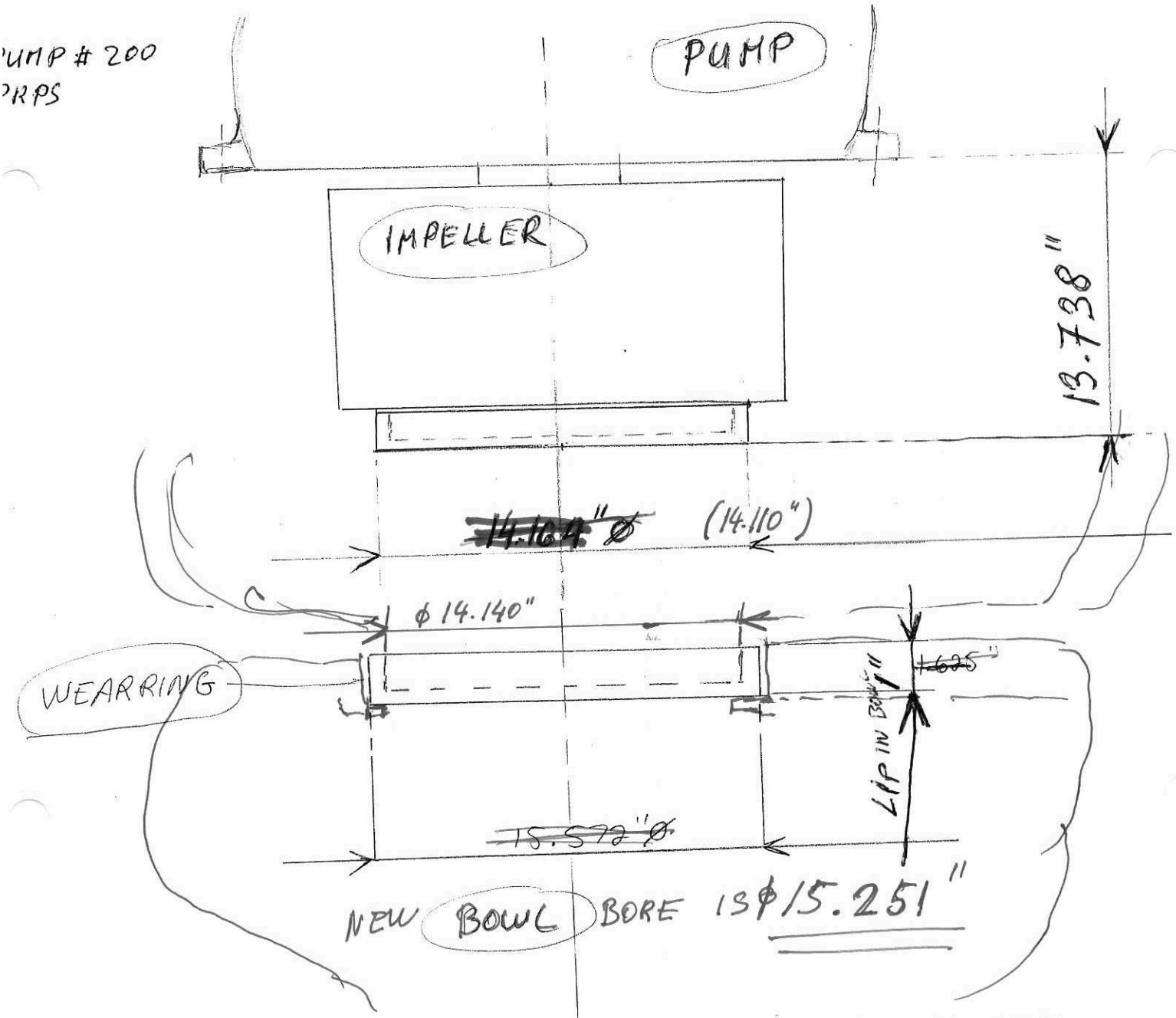


PUMP #.200
PRPS

AS. NOV. 2009



UMP # 200
RPS



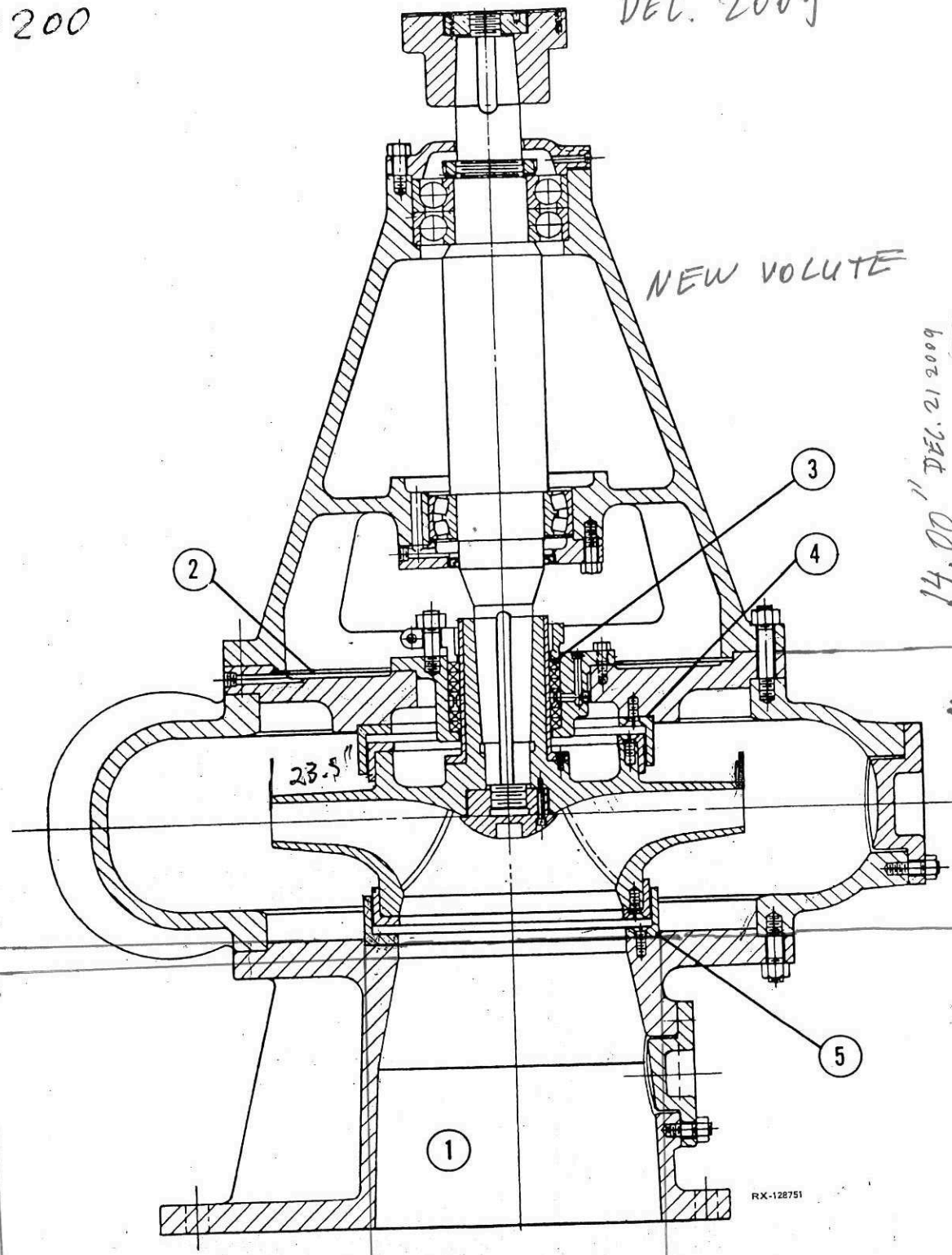
THE STATIONARY WEARRING FOR NEW BOWL SHOULD HAVE 0.030" GAP (THE NEW BORE SHOULD BE 14.140")

[14.109" + 0.030" = 14.139"] NOV. 2009

PUMP # 200

PRPS

DEC. 2009



TYPES FA-FC Typical Section

Section Elevation showing typical construction of the type FA and FC pump. Refer to Harrison for specific construction of any given pump.

1 Bottom suction with two winged feet rigidly supporting the pump.

2 Stuffing box head permits easy drainage.

3 Easily accessible stuffing box.

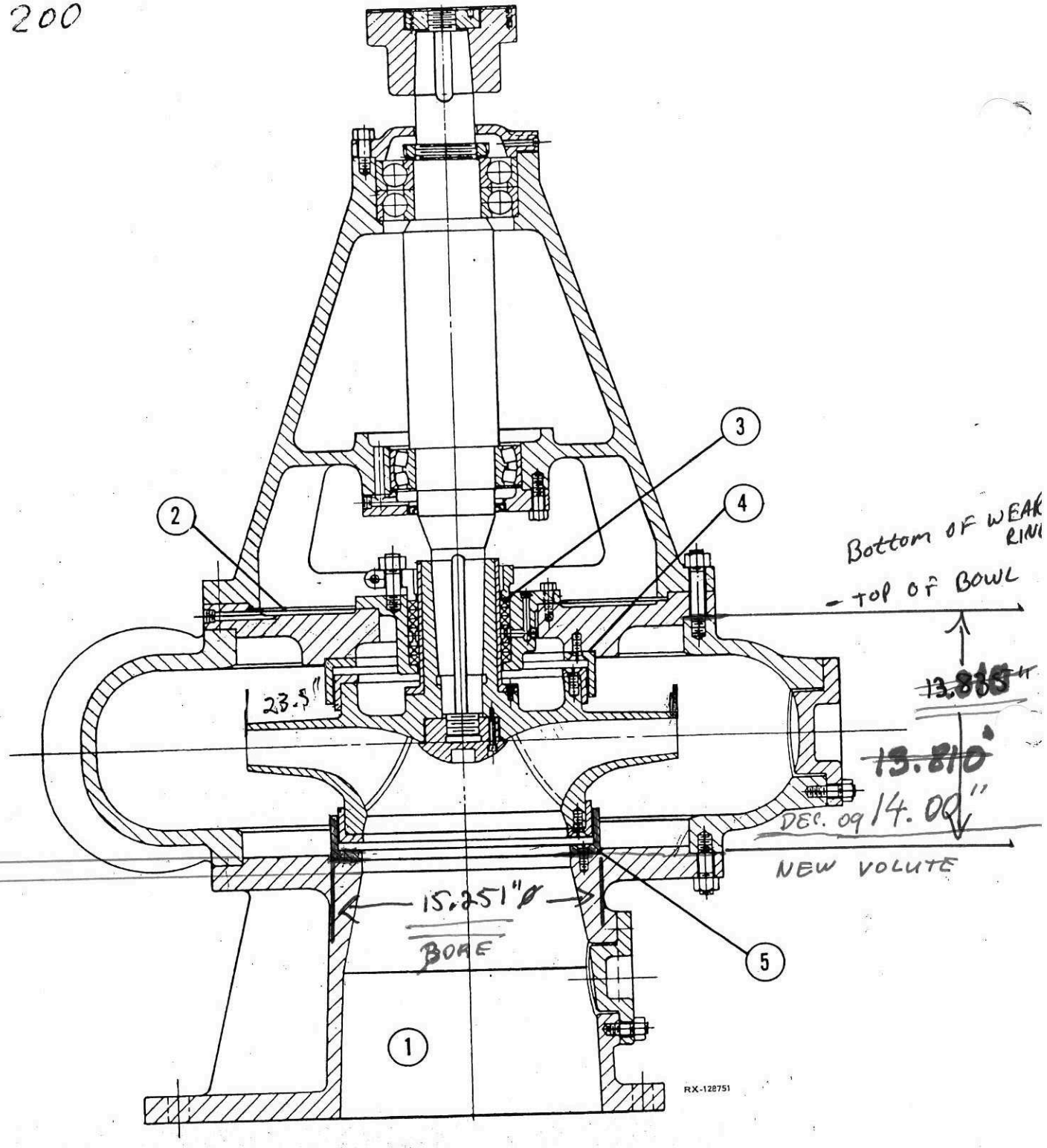
4 Back rings may be furnished to minimize hydraulic thrust.

5 Generous renewable double wearing rings.

WEIGHT OF PEDESTAL AND VOLUTE 290016 NEW 2009

ϕ 15.251" NEW VOLUTE BORE FOR STATIONARY WEARING

PUMP # 200
PRPS



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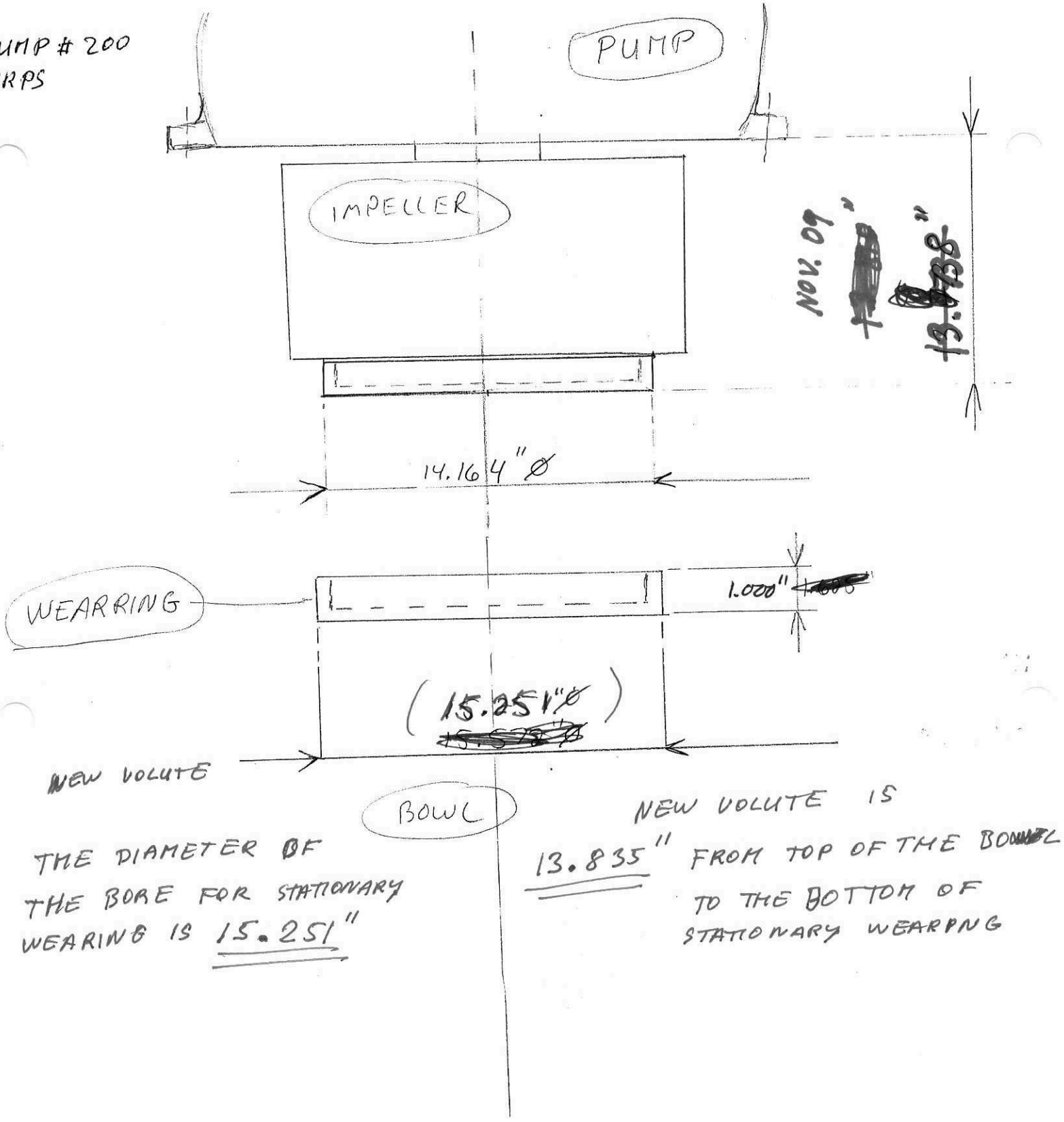
BOTTOM WEARING IS SHARING PIT

NEW PEDESTAL AND VOLUTE 2009 THE VOLUTE WEIGHT IS 1000 lbs

WEIGHT OF BOTH TOGETHER IS 2400 LB

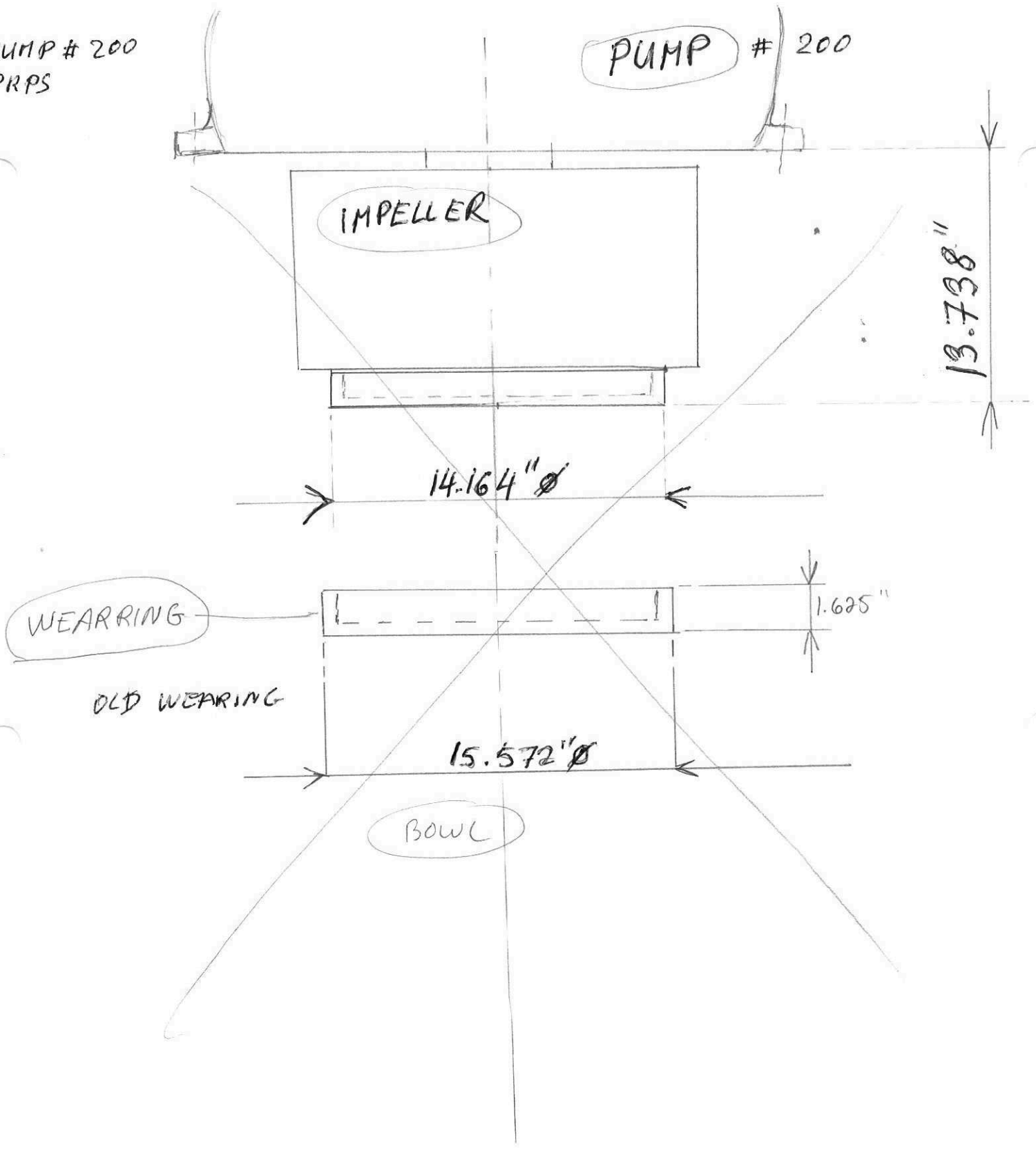
PUMP # 200
ORPS



THE DIAMETER OF THE BORE FOR STATIONARY WEARING IS 15.251"

NEW VOLUTE IS 13.835" FROM TOP OF THE BOWL TO THE BOTTOM OF STATIONARY WEARING

PUMP # 200
PRPS



M200 PUMP

Krocil, Emil

PRPS

From: Barbara.Pugh@motioncanada.com
Sent: Friday, December 13, 2013 10:50 AM
To: Krocil, Emil
Cc: Barbara.Pugh@motioncanada.com
Subject: Order Acknowledgement Customer PO#: EMILE NEED PO OCN# 273287

E-mail Address: Barbara.Pugh@motioncanada.com

MOTION CANADA
UNIT 1 75 MERIDIAN DRIVE
WINNIPEG, MB R2R 2V9

Ship To:
CITY OF WINNIPEG
WATER AND WASTE
WASTEWATER SERVICES
7740 WILKES AVE
WINNIPEG, MB R4H 1B8

Phone: 2046940050
Fax: 2046941066

Order Information

Customer PO#: EMILE NEED PO OCN: 273287
Release No: Date: 12/13/2013
F.O.B: FOB ORG,FRT PP&ALLOW
Terms: . NET 30
Delivery: STOCK UNLESS NOTED

Qty	Description	Requested Date
1.0	FAG 22220-E1-C3 BEARING Item No.....: 00063448 Cust Stk No .....: Price.....: 201.420 201.42	12/16/2013
2.0	SKF 7319 BECBM BRG Item No.....: 00060911 Cust Stk No .....: Price.....: 951.830 1903.66	12/16/2013
3.0	NATIONAL S 417210 OIL SEAL Item No.....: 01315653 Cust Stk No .....: Price.....: 26.620 79.86	12/16/2013

3.0	NATIONAL S 415303 OIL SEAL		12/16/2013
	Item No.....: 00612042		
	Cust Stk No .....:		
	Price.....: 19.640	58.92	

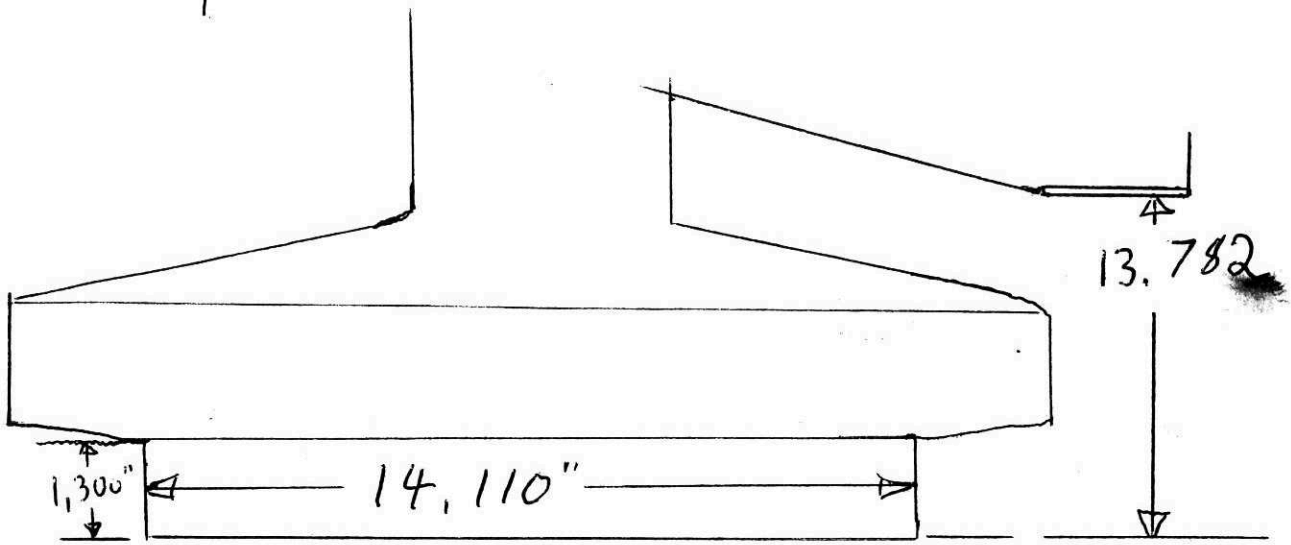
SUBTOTAL	2243.86
FREIGHT*	0.00
TAX	291.70
TOTAL**	2535.56

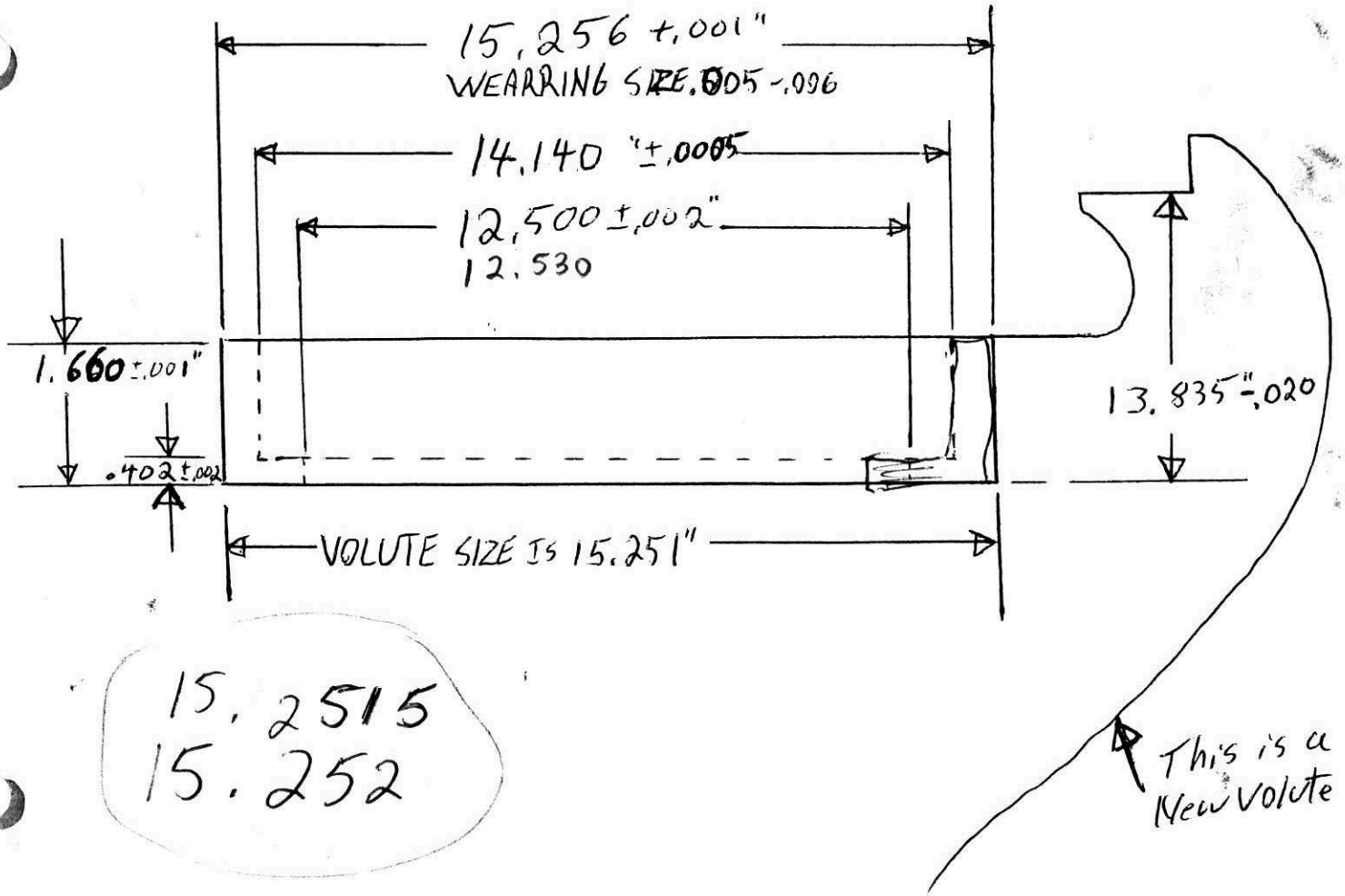
---

* Freight amounts are subject to change based on package weight.
** Total excludes applicable taxes and special freight charges.

You may review all of your present and past orders or quotes online at http://www.MotionIndustries.com.

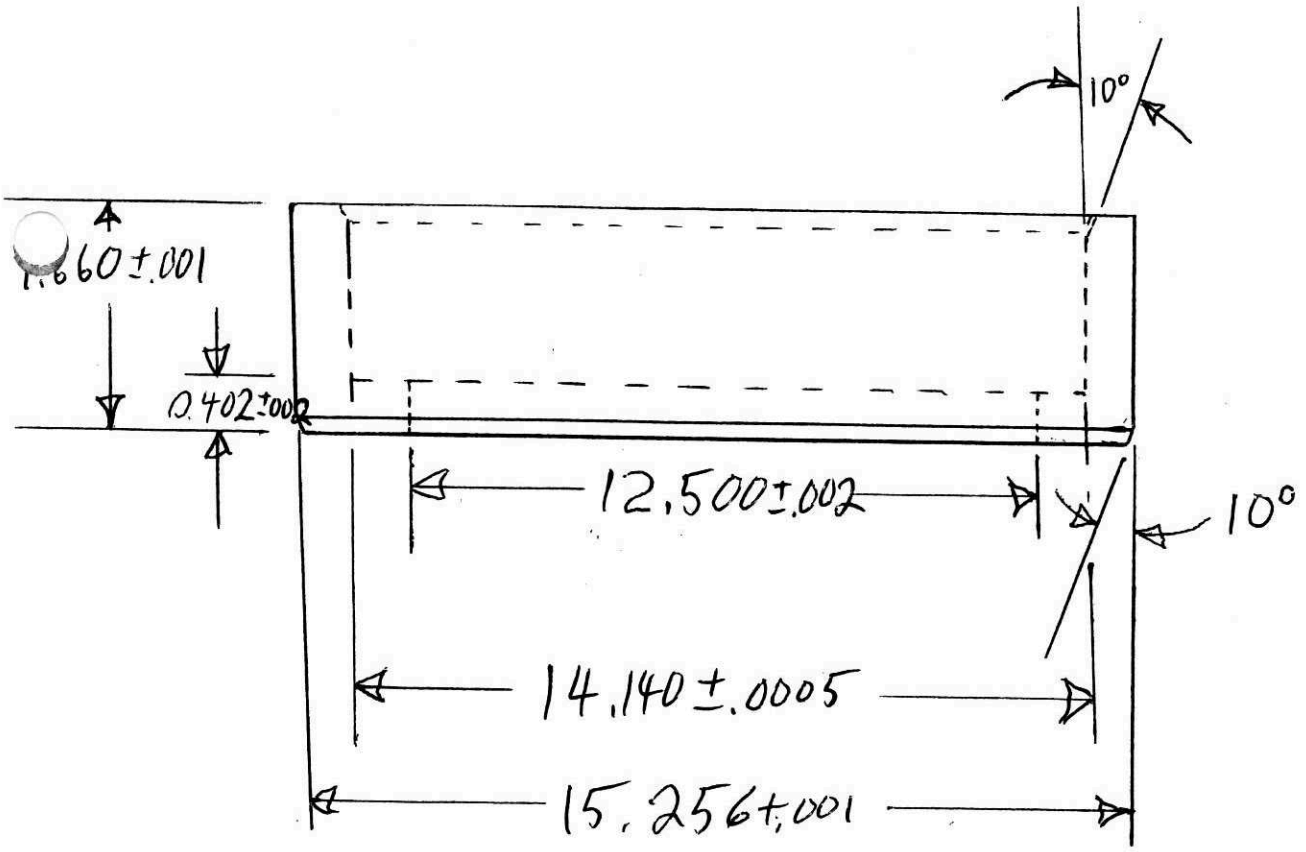
Nov 4/09
West END w/o 0907646/02
phone # 470 9694





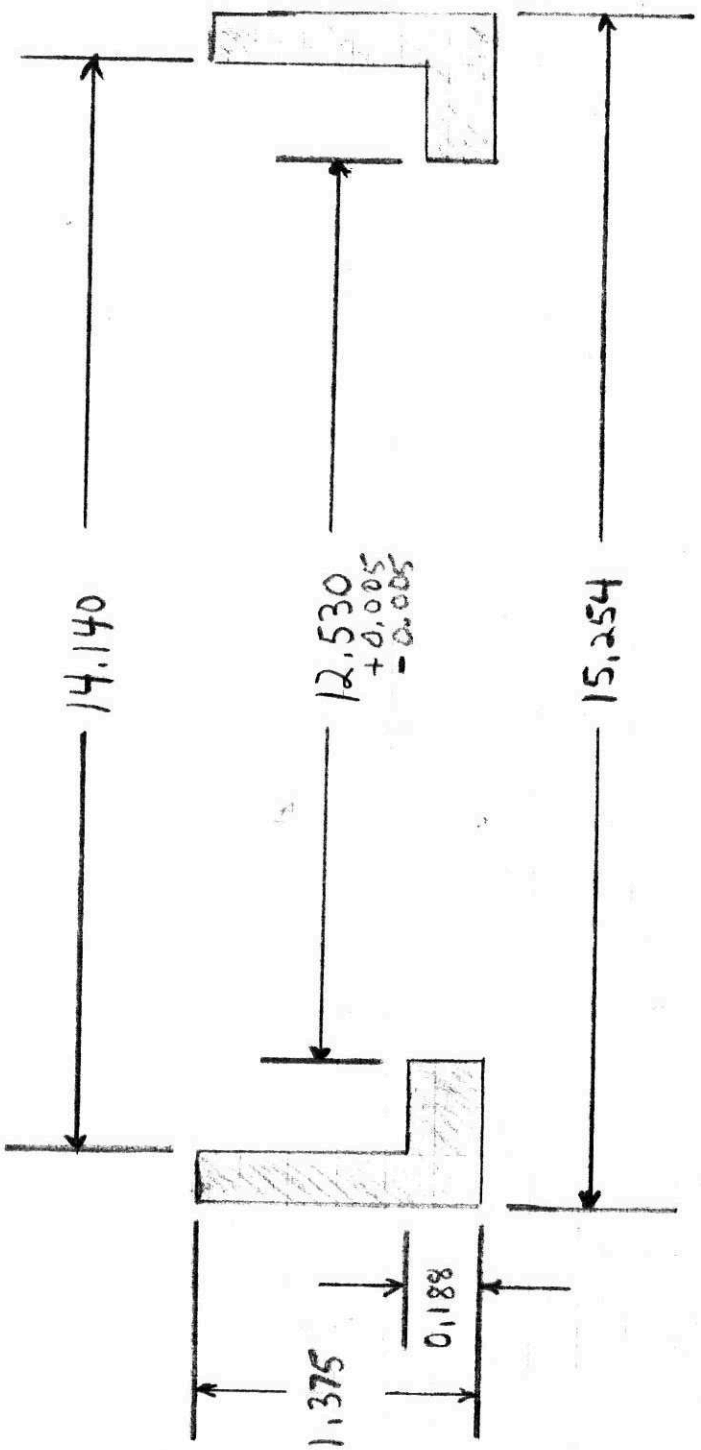
15.2515
15.252

Wearing rings Dec 9/09



West End Pump Wear Ring

BOWL



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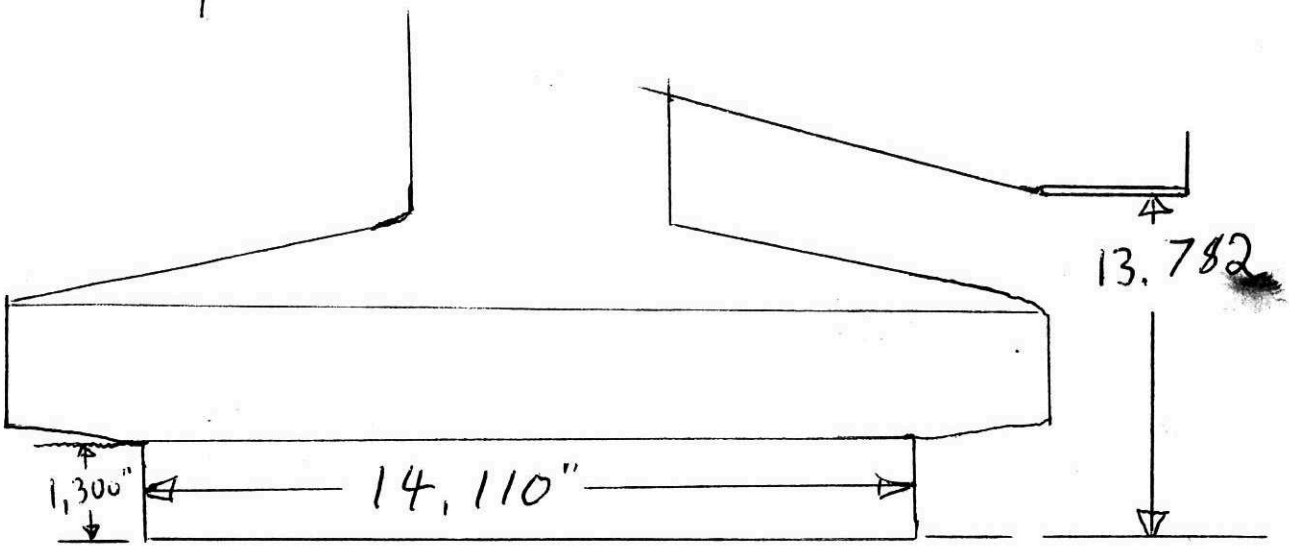

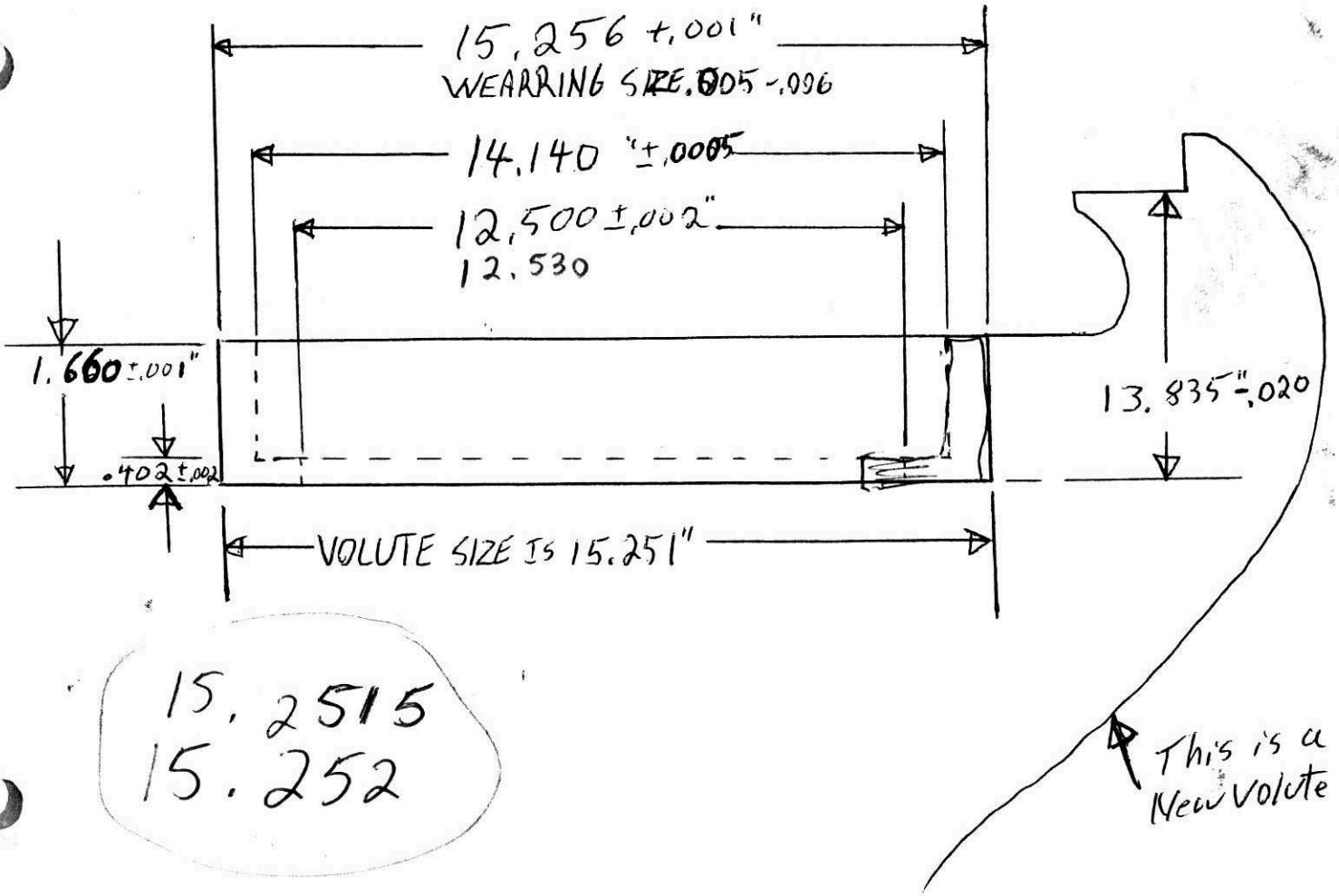

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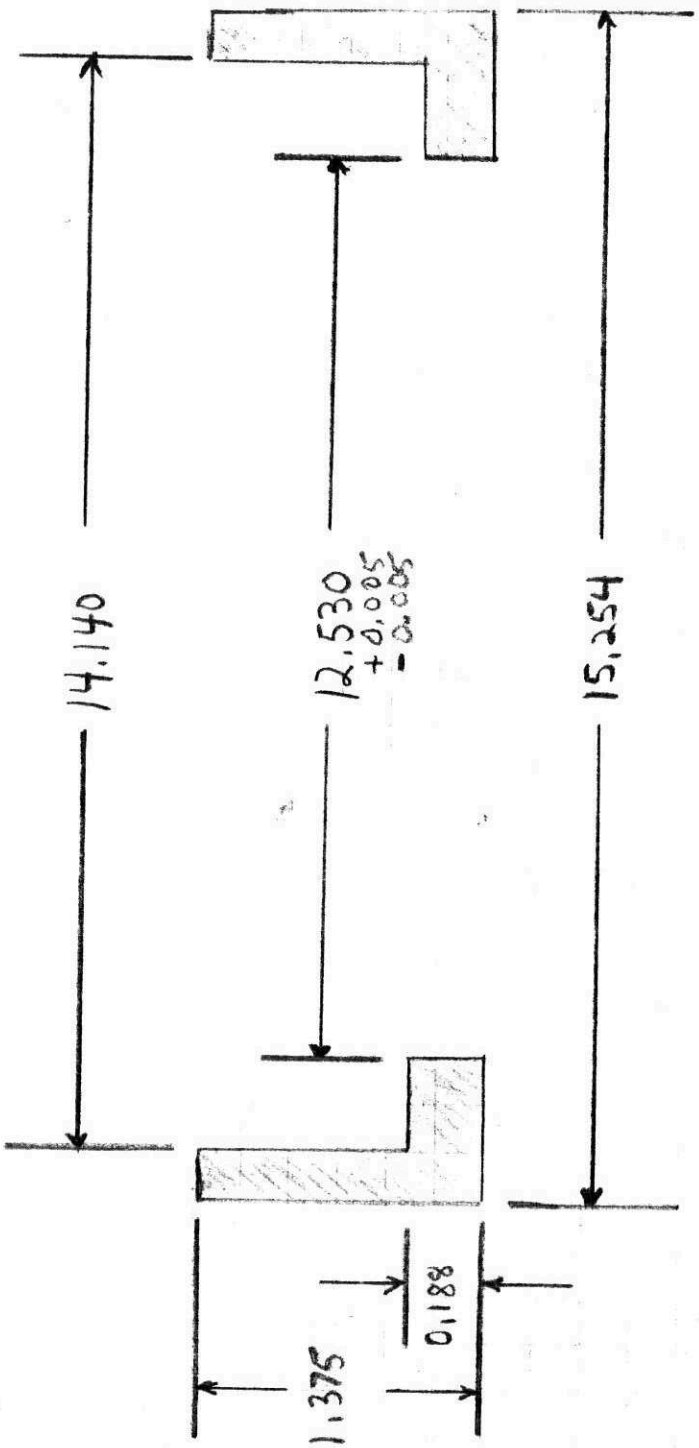

ASA
ALLOYS DIV. OF CSM ULC
"...KEEPING OUR CUSTOMERS #1"
Paramount Road, Winnipeg, Manitoba R2X 2W6 • Tel: (204) 953-1910 • Toll Free: 1-888-671-0960 • Fax: (204) 489-8542

PRPS # 2 MP 200

WORTHINGTON 16 CFC # B07540211

BEARINGS:

INBOARD — 22220-W33

OUTBOARD — 2x 7319 BECBM.

MECH SEAL - DURAMETALLIC (FLOWSERVE) 379634

LIP SEALS — NATIONAL - 417210
415303

SERIAL # B07540211

ASA
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MP 200

PRPS # 2

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OUTBOARD — 2x 7319 BECBM.

MECH SEAL - DURAMETALLIC (FLOWSERVE) 379634

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MP 200.

PRPS # 2

S/N

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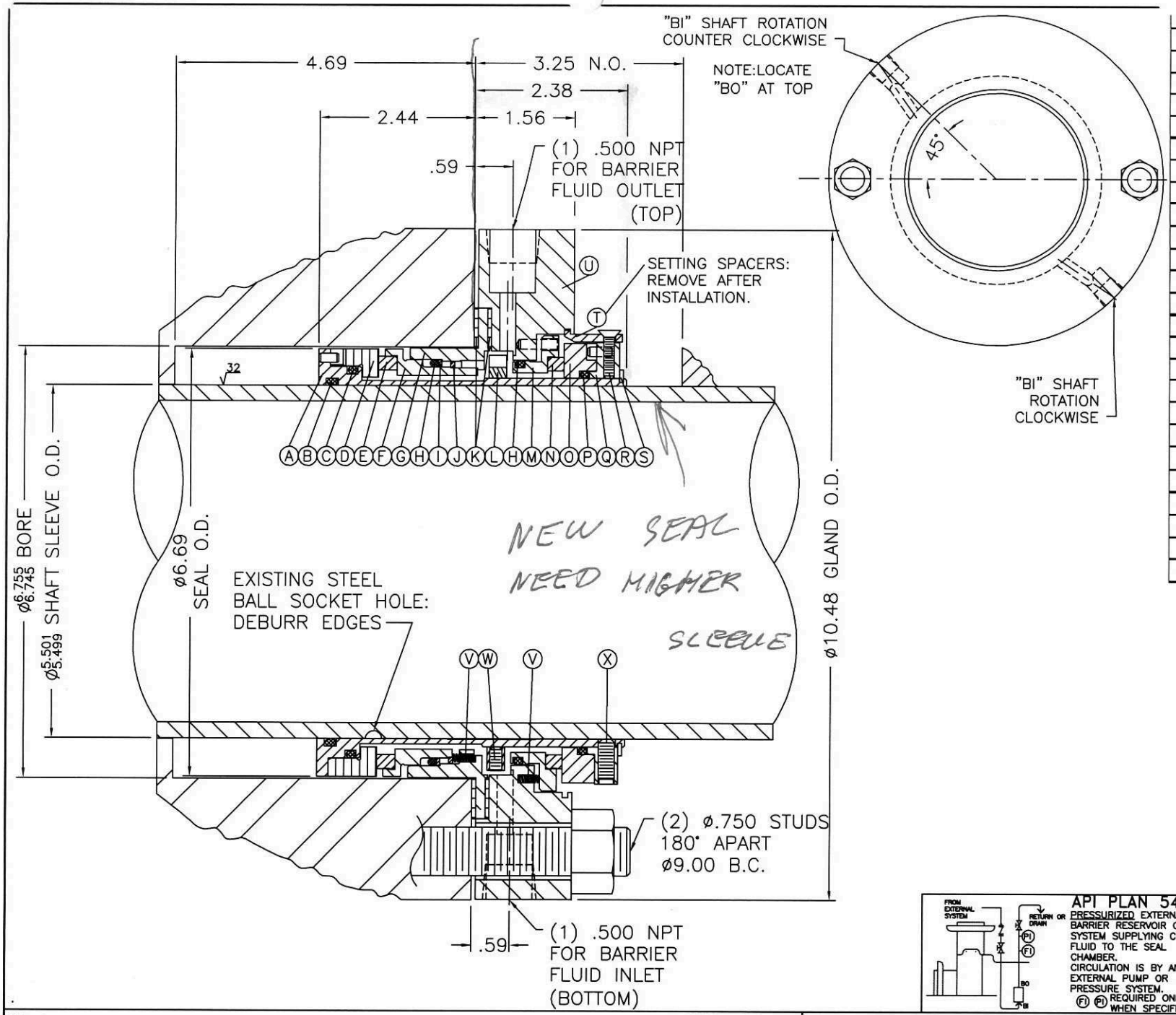

ITEM	DESCI
A	SLEEVE
B	O-RING
C	O-RING
D	I.B. ROTARY FACE
E	I.B. STATIONARY IN
F	I.B. STATIONARY IN
G	GLAND ADAPTER
H	O-RING
I	BACK UP RING
J	SPRING DISC
K	GASKETS
L	PUMPING RING
M	O.B. STATIONARY I
N	O.B. STATIONARY I
O	O.B. ROTARY FACE
P	O-RING
Q	COLLAR
R	FLAT HEAD SCREWS
S	RETAINING RING
T	SETTING SPACERS
U	GLAND
V	SPRINGS
W	SET SCREWS
X	SET SCREWS

* ITEMS NO

MFG: WOR
MODEL: 16
SIZE:
SERIAL NO:

CUSTOMER: INDU
END USER:
LOCATION: WINI
STOCK NO: BA-
USER TAG: Q12

PRODUCT:
NOTES:
BARRIER FLUID:
PLAN:

TEMP: AMBIENT
SP GR: 1.0
V P:
VISC:

DESC: POWERPUMP
SIZE: 5.500

COMPUTER AIDED DESIGN | SC | D

PPC ME
BATON

API PLAN 54
PRESSURIZED EXTERNAL BARRIER RESERVOIR OR SYSTEM SUPPLYING CLEAN FLUID TO THE SEAL CHAMBER.
CIRCULATION IS BY AN EXTERNAL PUMP OR PRESSURE SYSTEM.
(FI) (PI) REQUIRED ONLY WHEN SPECIFIED

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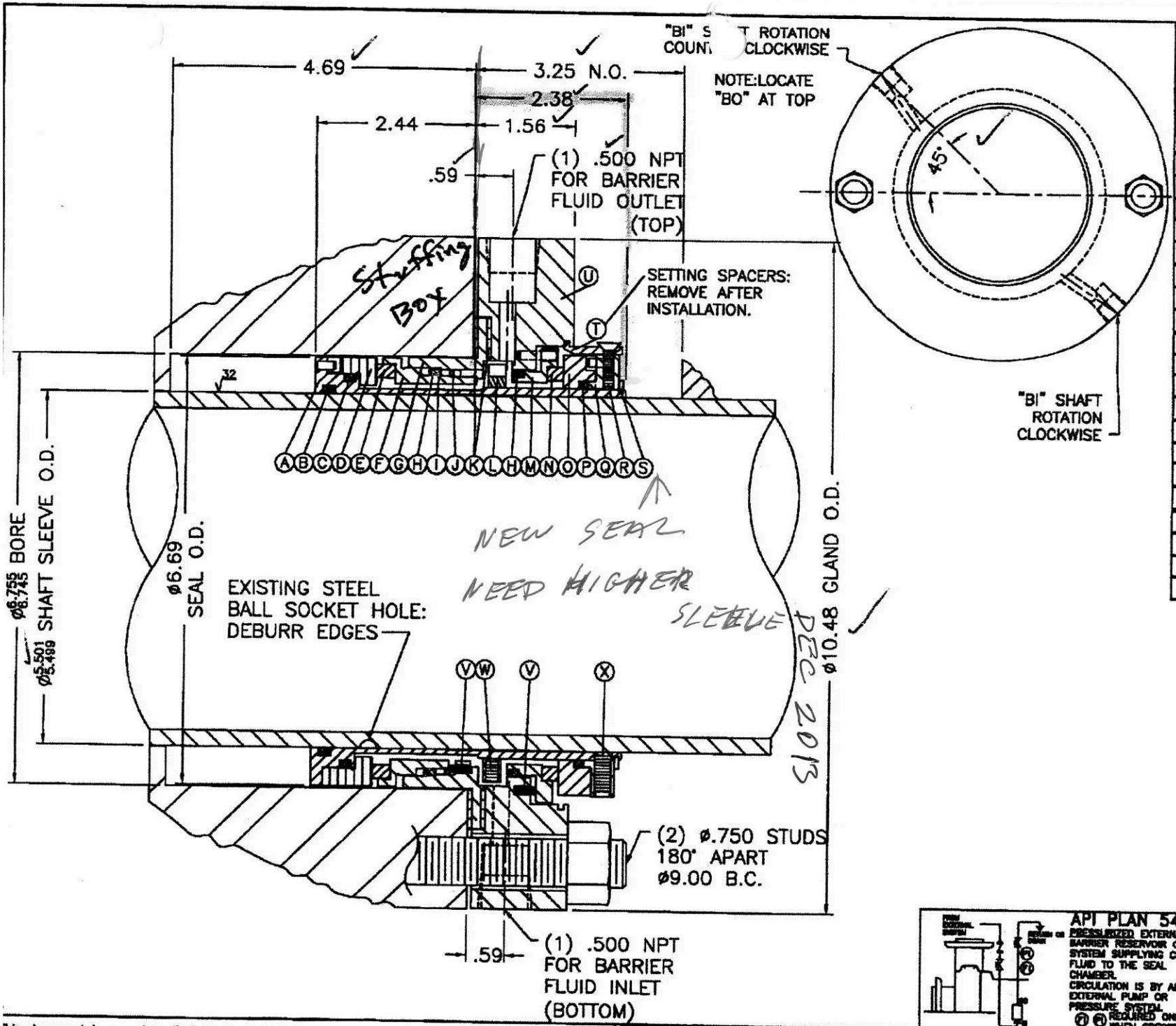


ITEM	
A	SLEEV
B	O-RIN
C	O-RING
D	I.B. ROT
E	I.B. STAT
F	I.B. STAT
G	GLAND A
H	O-RING
I	BACK UP RI
J	SPRING DIS
K	GASKETS
L	PUMPING RI
M	O.B. STATIONA
N	O.B. STATIONA
O	O.B. ROTARY FA
P	O-RING
Q	COLLAR
R	FLAT HEAD SCR
S	RETAINING RIN
T	SETTING SPACE
U	GLAND
V	SPRINGS
W	SET SCREWS
X	SET SCREWS

* ITEMS

MFG: W
MODEL: 1
SIZE:
SERIAL NO:

CUSTOMER: I
END USER:
LOCATION: W
STOCK NO: B
USER TAG: Q

PRODUCT:
NOTES:
BARRIER FLU
PLAN:

TEMP: AMBIE
SP GR: 1.0
V P:
VISC:

DESC:POWERPU
SIZE: 5.500

COMPUTER AIDED DESIGN

PPC M
RA

API PLAN 54
PRESSURIZED EXTERNAL BARRIER RESERVOIR OR SYSTEM SUPPLYING CLEAN FLUID TO THE SEAL CHAMBER. CIRCULATION IS BY AN EXTERNAL PUMP OR PRESSURE SYSTEM.
(71) (81) REQUIRED ONLY WHEN SPECIFIED

FILENAME: C:\CAD-DWG\INSTALL\00004327.DWG

ASA
ALLOYS DIV. OF CSM ULC
"...KEEPING OUR CUSTOMERS #1"
Paramount Road, Winnipeg, Manitoba R2X 2W6 • Tel: (204) 953-1910 • Toll Free: 1-888-671-0960 • Fax: (204) 489-8542

MP 200

PRPS # 2

WORTHINGTON 16 CFC # B07540211

BEARINGS:

INBOARD — 22220-W33

OUTBOARD — 2x 7319 BECBM.

MECH SEAL - DURAMETALLIC (FLOWSERVE) 379634

LIP SEALS - NATIONAL - 417210
415303

SERIAL # B07540211

2013 NEW SEAL PUMP 17200 PAPS

POWERPUMPER
DOUBLE/TANDEM CARTRIDGE SEAL
INSTALLATION INSTRUCTIONS

PREPARE PUMP

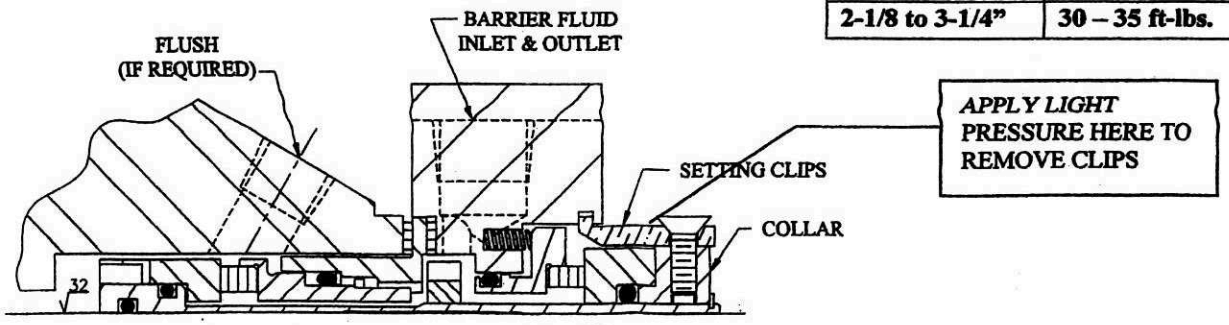
1. Clean and inspect pump parts.
2. Replace shaft or shaft sleeve if worn in secondary sealing areas under o-rings.
3. Check for good starting bevel and remove all burrs that would cut secondary seal o-rings or cause misalignment.
4. Check shaft run out (to be within .001" TIR per inch of shaft dia.), shaft end play (not to exceed .005"), stuffing box face alignment (must be square to shaft within .003" TIR and have good sealing surface, 125 RMS min.), and condition of the pump bearings: Replace if necessary.

INSTALLING SEAL

1. Lubricate shaft or sleeve.
2. Insert seal into stuffing box with barrier fluid ports facing desired location.
3. Loosely thread gland bolts into back plate. **IMPORTANT:** Do not tighten gland bolts at this time. Also, do not remove any setting clips at this time. **NOTE:** For larger pumps with heavy back plates, install the seal on the shaft or sleeve, then slip on the back plate and loosely thread the gland bolts.
4. Install and bolt back plate to pump frame.
5. Install and tighten impeller.
6. Make all necessary impeller adjustments as required. The impeller can be reset at any time, as long as the setting clips are in place and the seal set screws are loosened while the shaft is being moved.
7. Tighten gland bolts evenly.
8. Tighten set screws in collar.
9. Remove setting clips and flat head screws. **NOTE:** Apply pressure to clip at the gland face, as shown, with a screwdriver or flat edge then lift rear of clip to remove. (The setting clips must be removed entirely)
10. Turn shaft by hand to make sure there is no rubbing between rotating and stationary parts.
11. Make all necessary pump connections and alignments.
12. Clean out barrier fluid lines and seal pot.
13. Connect and open barrier fluid lines to seal.
14. If a seal pot is used, fill seal pot with barrier fluid and bleed out air in lines. For API Plan 53 pressurize to 20-30 PSI above stuffing box pressure.
15. Run pump according to normal start up and operating procedures.

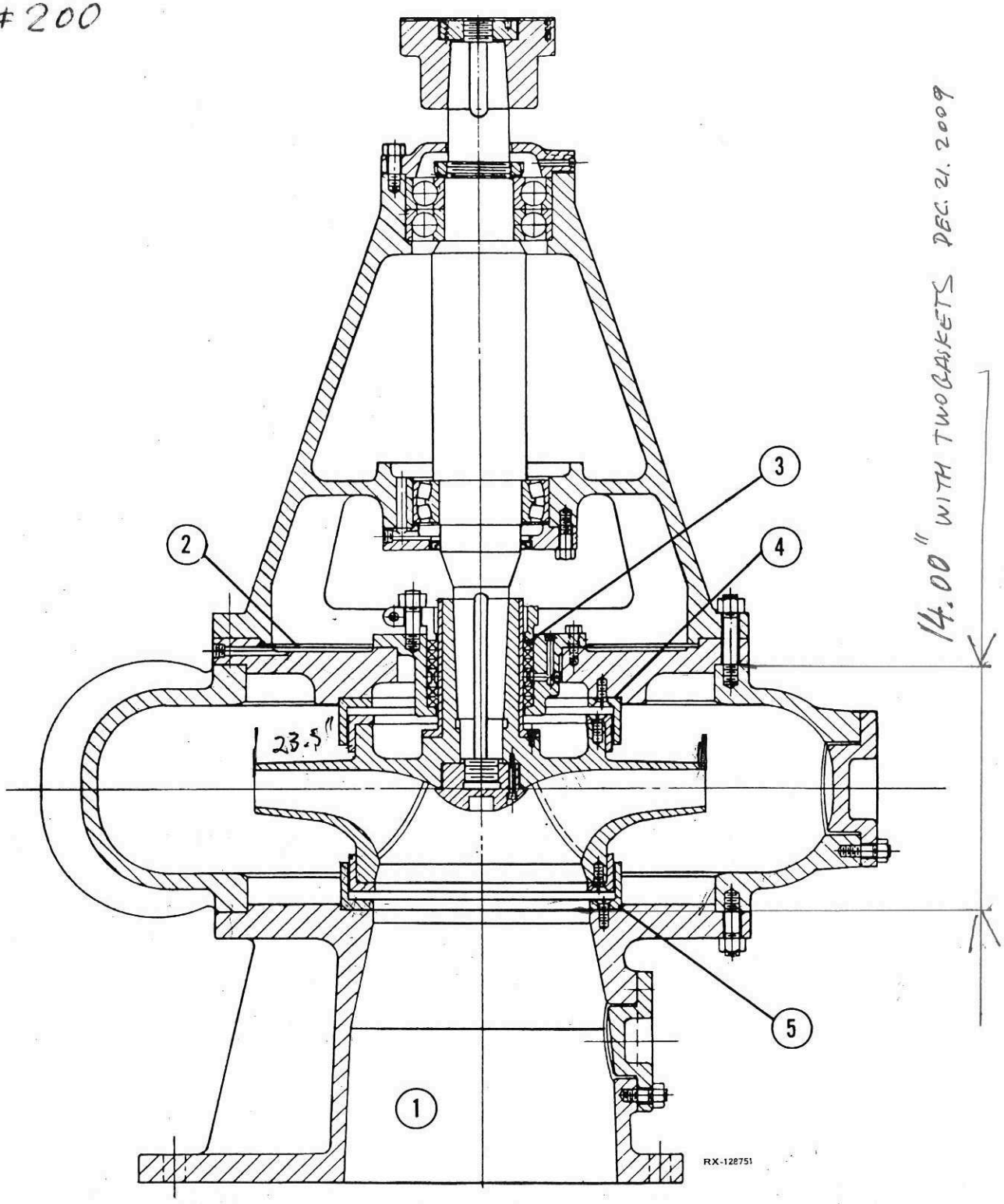
GLAND BOLT TORQUE

Seal Size	Torque Value
1 to 1-3/8"	15 – 20 ft-lbs.
1-1/2 to 2"	25 – 30 ft-lbs.
2-1/8 to 3-1/4"	30 – 35 ft-lbs.



SLEEVE HAS TO BE LONGER

PUMP # 200
PRPS



TYPES FA-FC Typical Section

Section Elevation showing typical construction of the type FA and FC pump. Refer to Harrison for specific construction of any given pump.

1 Bottom suction with two winged feet rigidly supporting the pump.

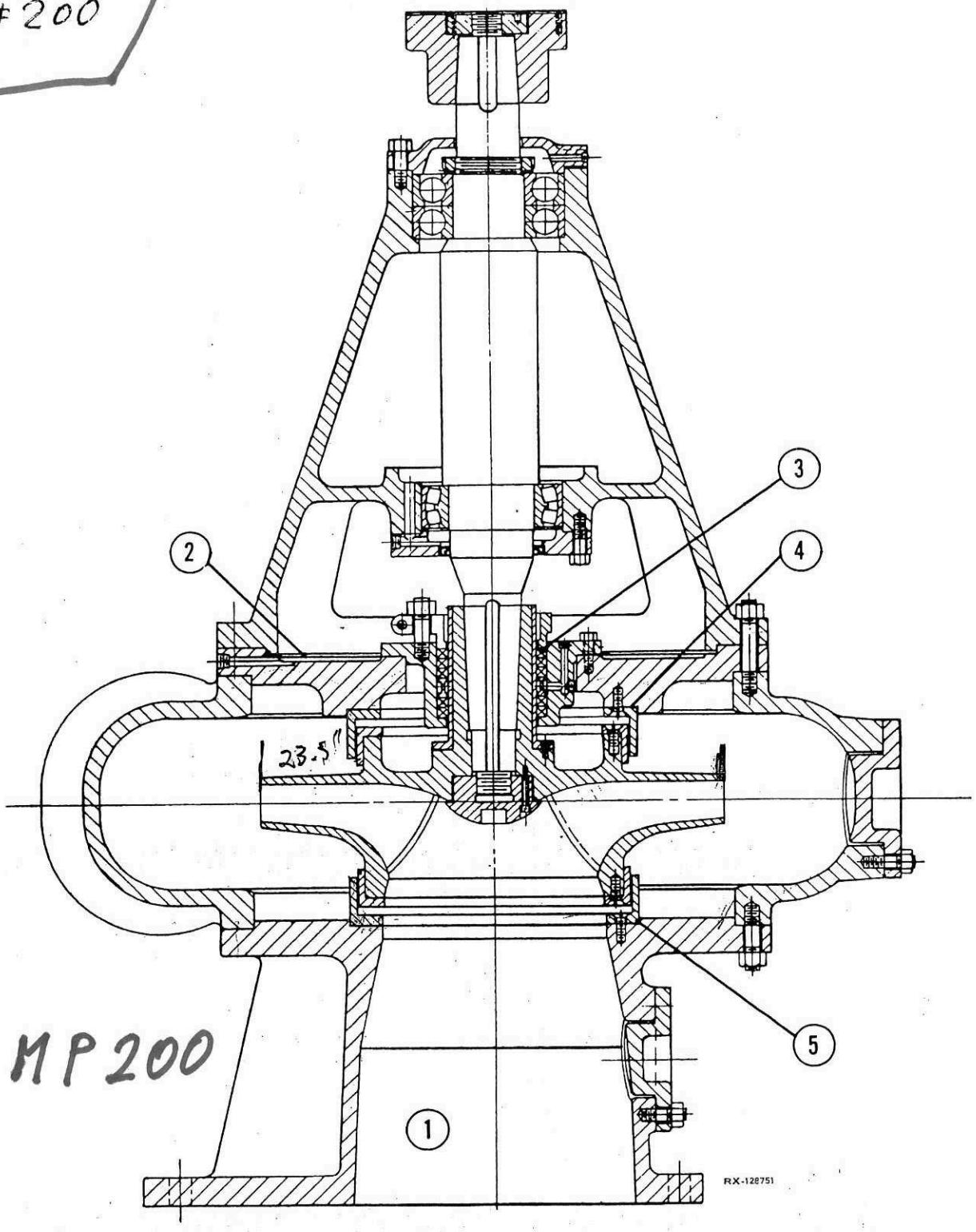
2 Stuffing box head permits easy drainage.

3 Easily accessible stuffing box.

4 Back rings may be furnished to minimize hydraulic thrust.

5 Generous renewable double wearing rings.

PUMP # 200
PRPS



MP200

TYPES FA-FC Typical Section

Section Elevation showing typical construction of the type FA and FC pump. Refer to Harrison for specific construction of any given pump.

1 Bottom suction with two winged feet rigidly supporting the pump.

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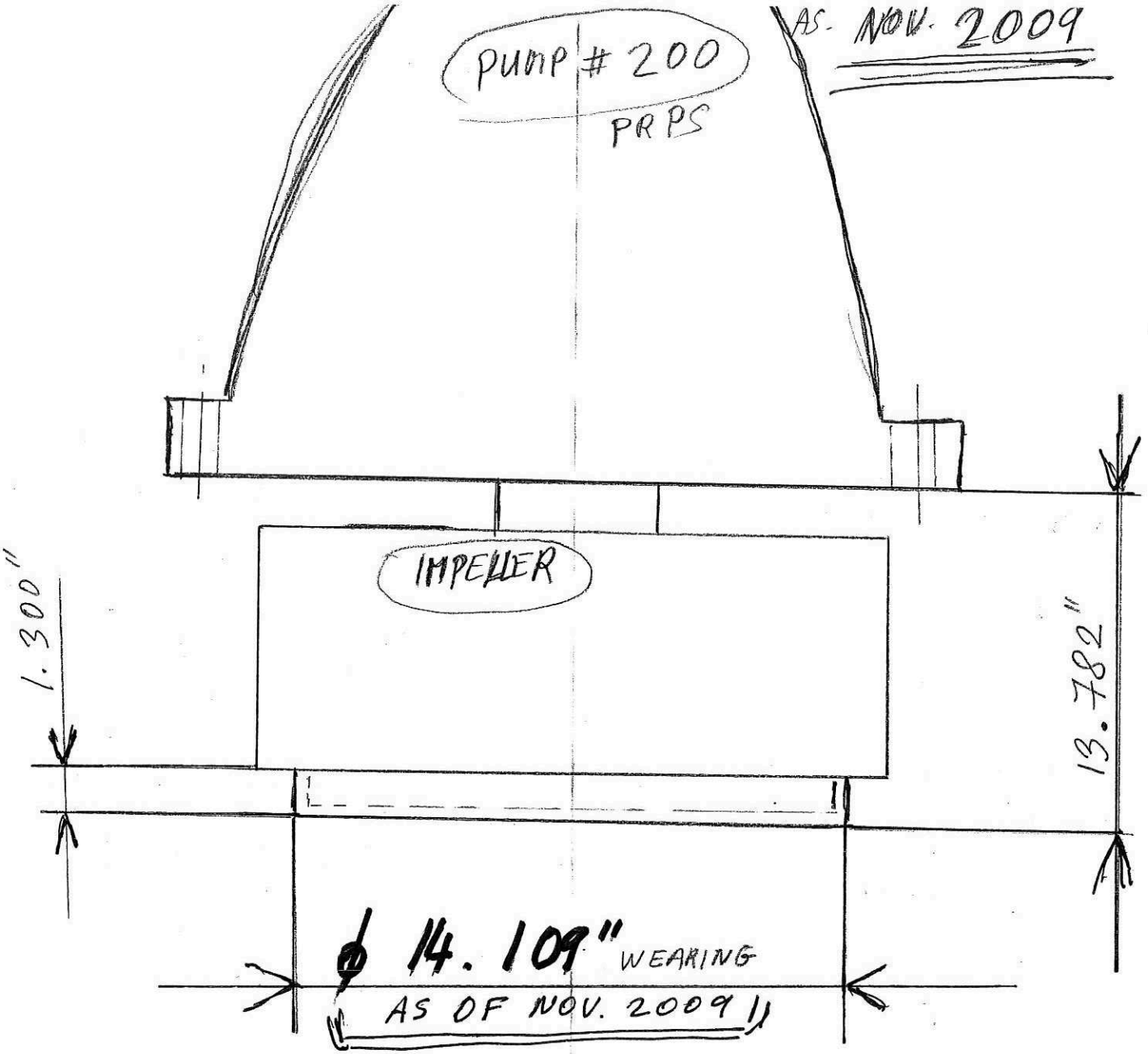
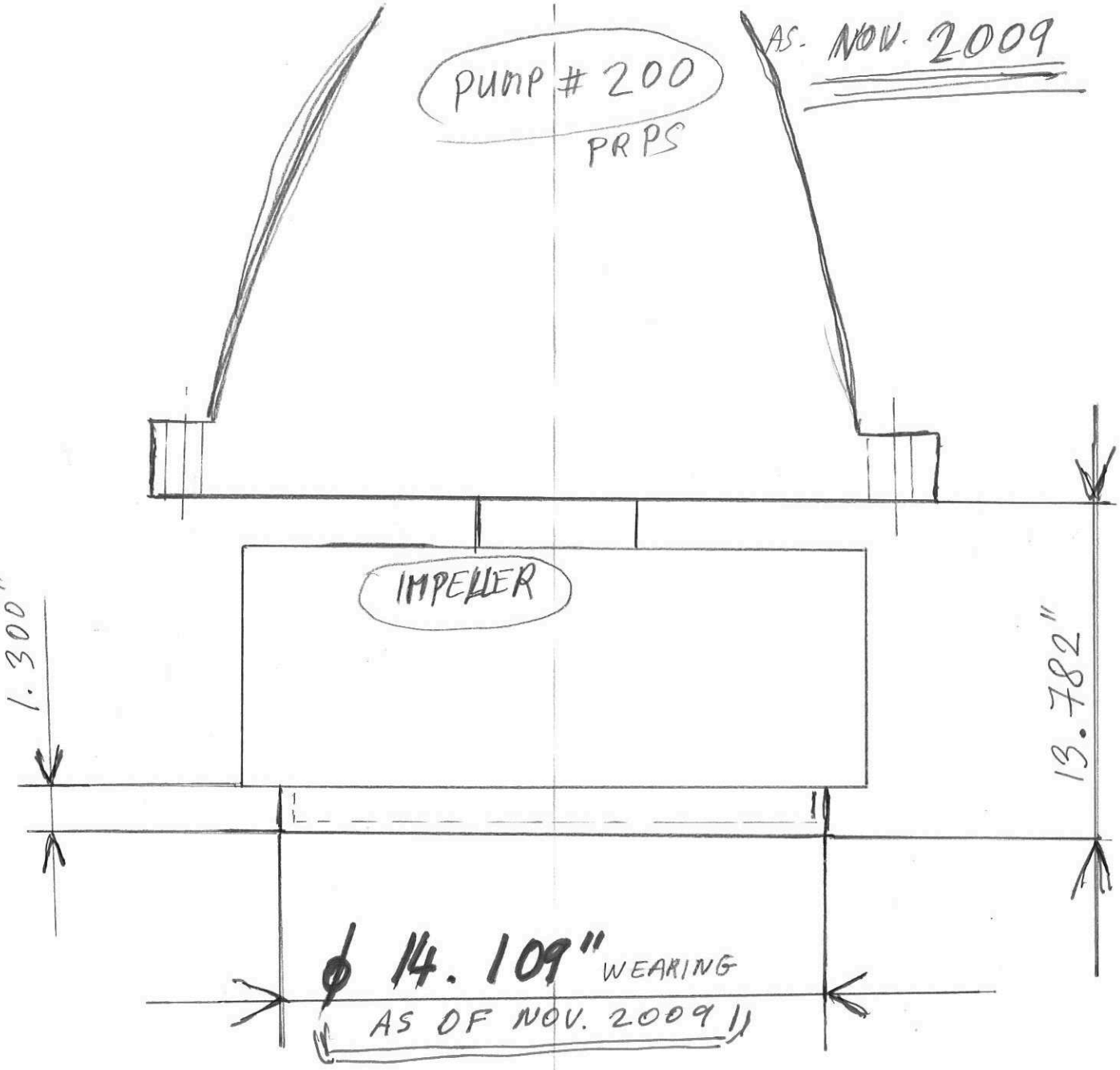
3 Easily accessible stuffing box.

4 Back rings may be furnished to minimize hydraulic thrust.

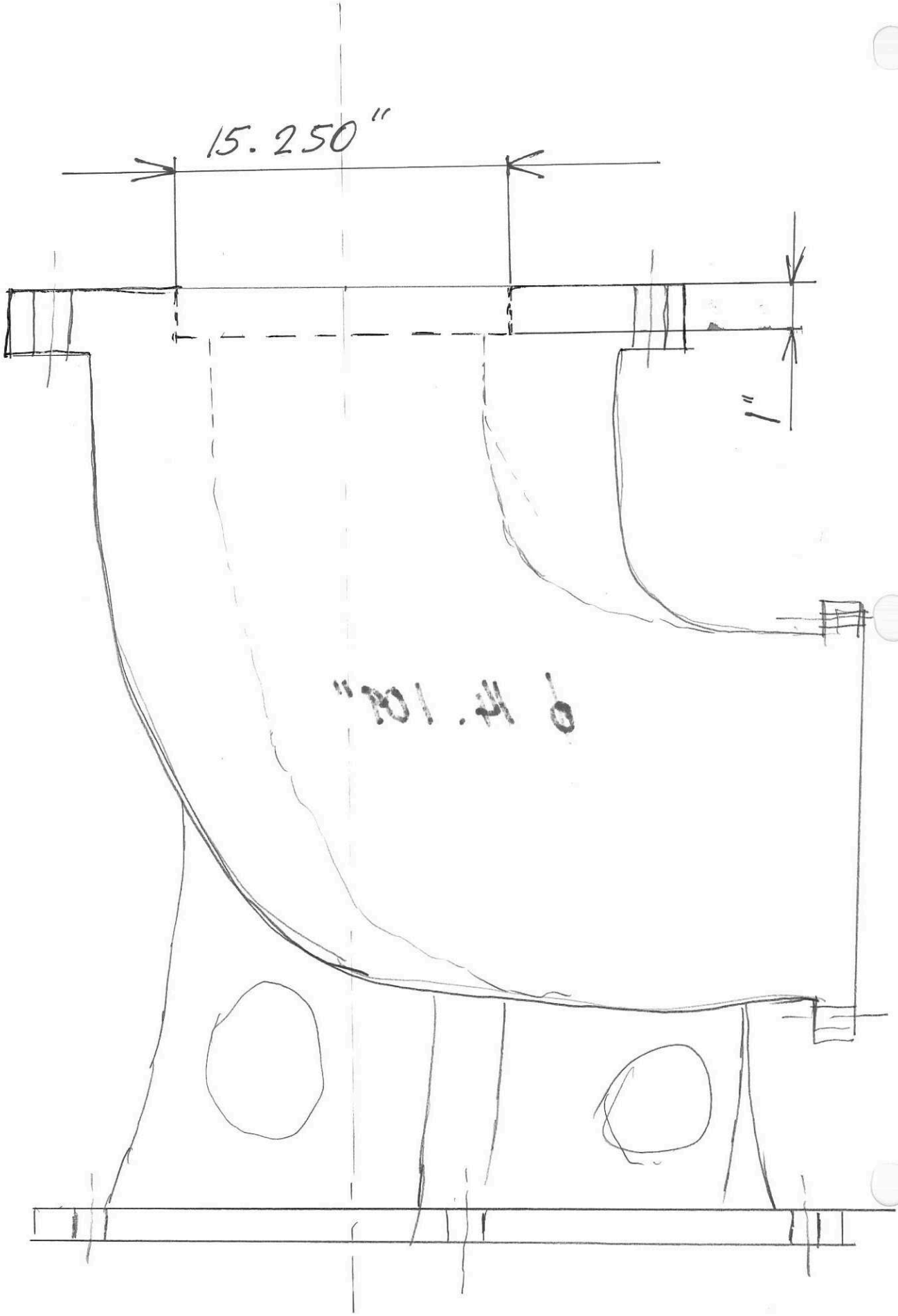
5 Generous renewable double wearing rings.

NEW PEDESTAL AND VOLUTE WEIGHT IS 2900 lb. (2009)


PUMP # 200
PRPS
AS. NOV. 2009
IMPELLER
1.300"
13.782"
ϕ 14.109" WEARING
AS OF NOV. 2009


PUMP # 200
PRPS
AS. NOV. 2009
IMPELLER
1.300"
13.782"
ϕ 14.109" WEARING
AS OF NOV. 2009

PUMP # 200 PRPS NOV. 2009



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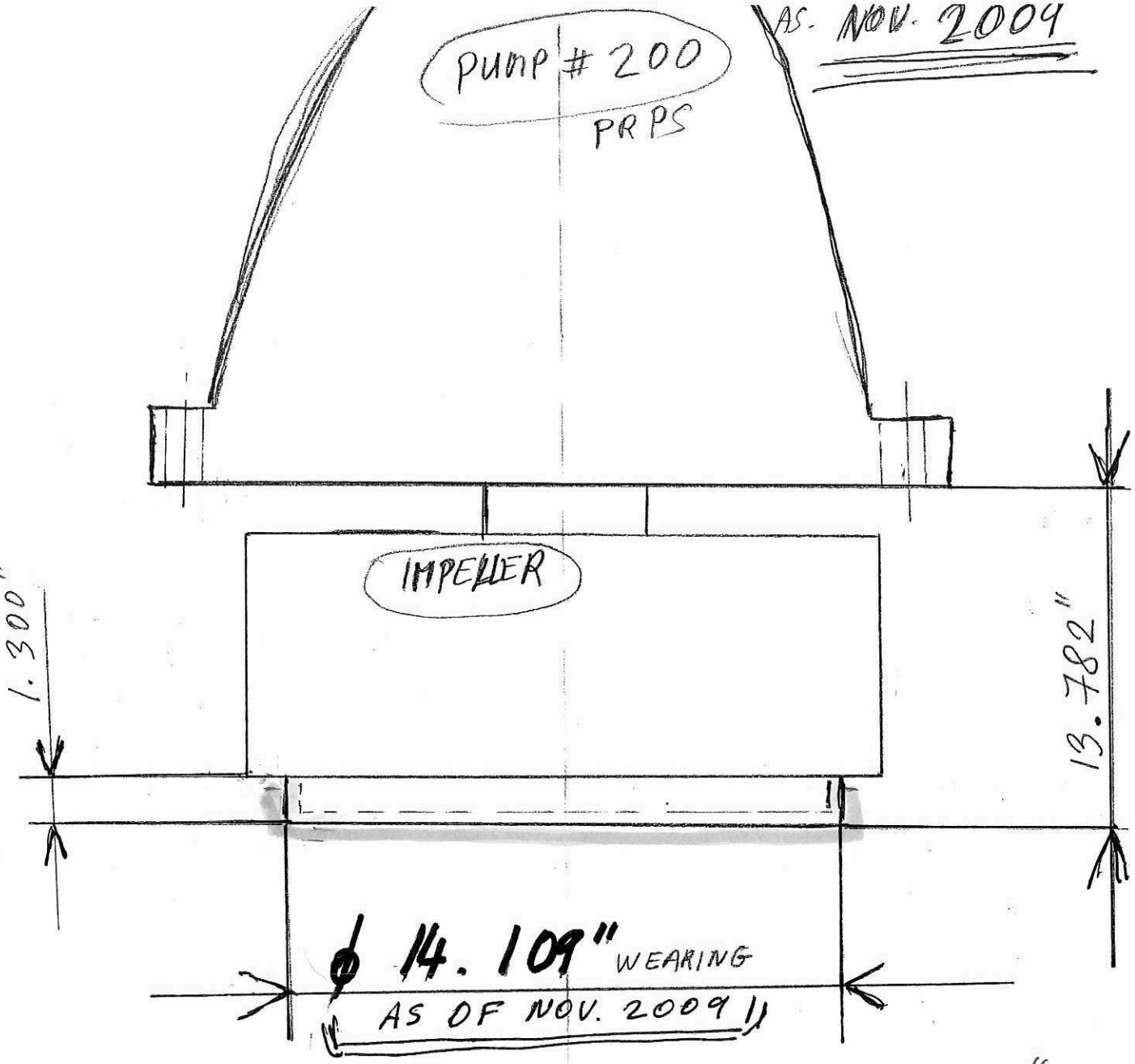
AS. NOV. 2009

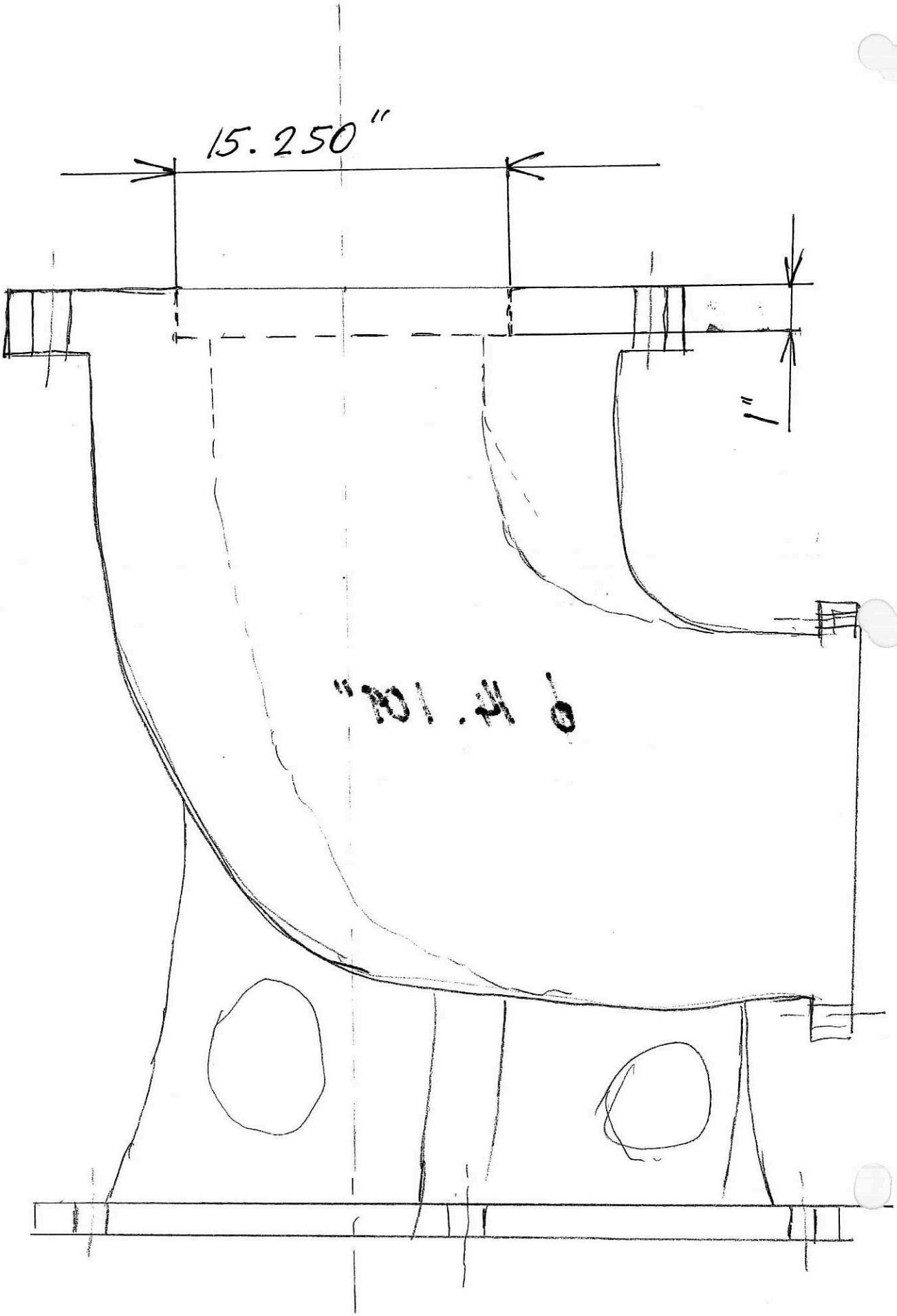


13.782"
− 1.300"
12.482"

14.000"
− 12.482
1.518"

14.00"
− 13.782"
0.218"
− 0.030"
0.188"

PUMP # 200 PRPS NOV. 2009



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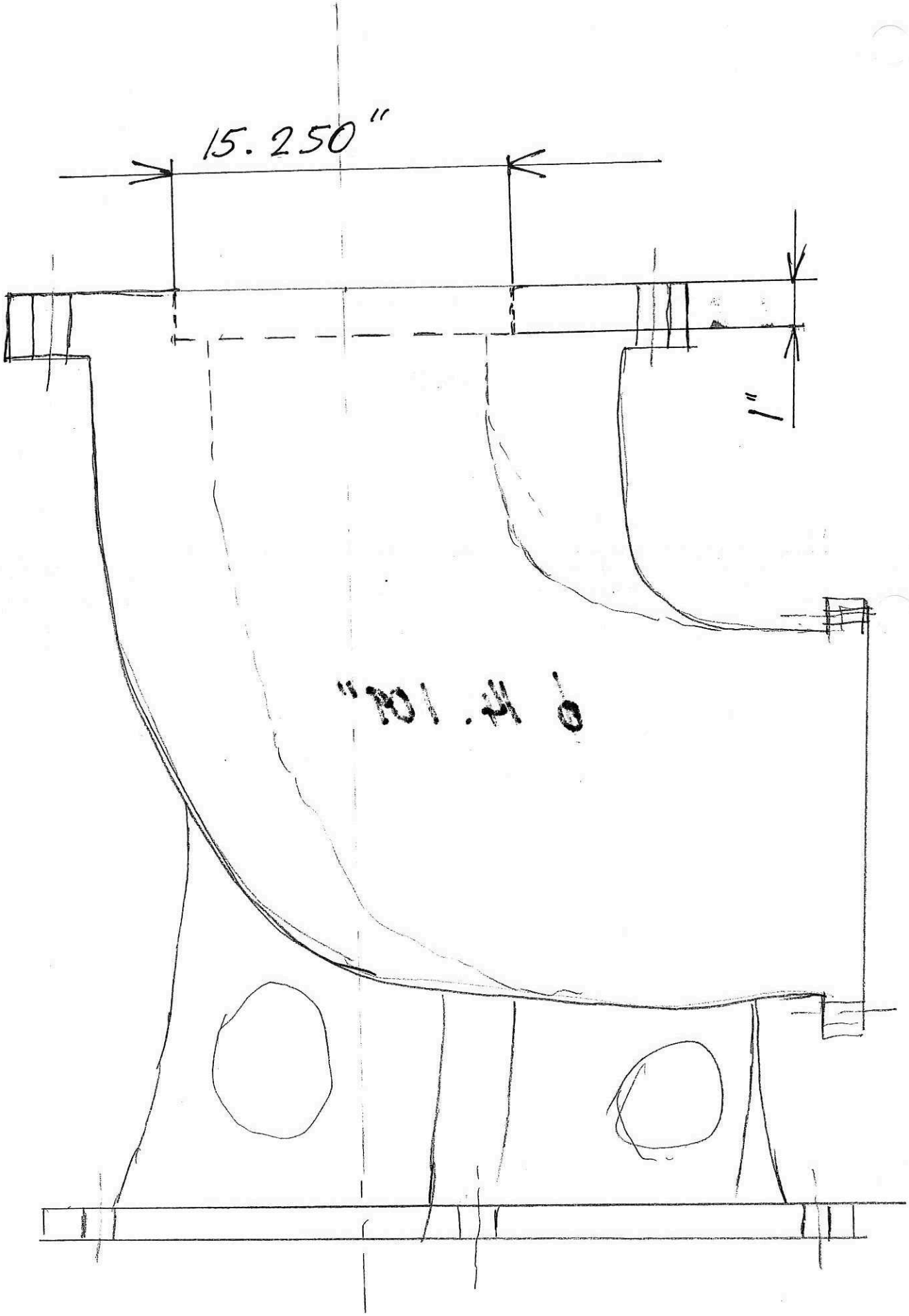
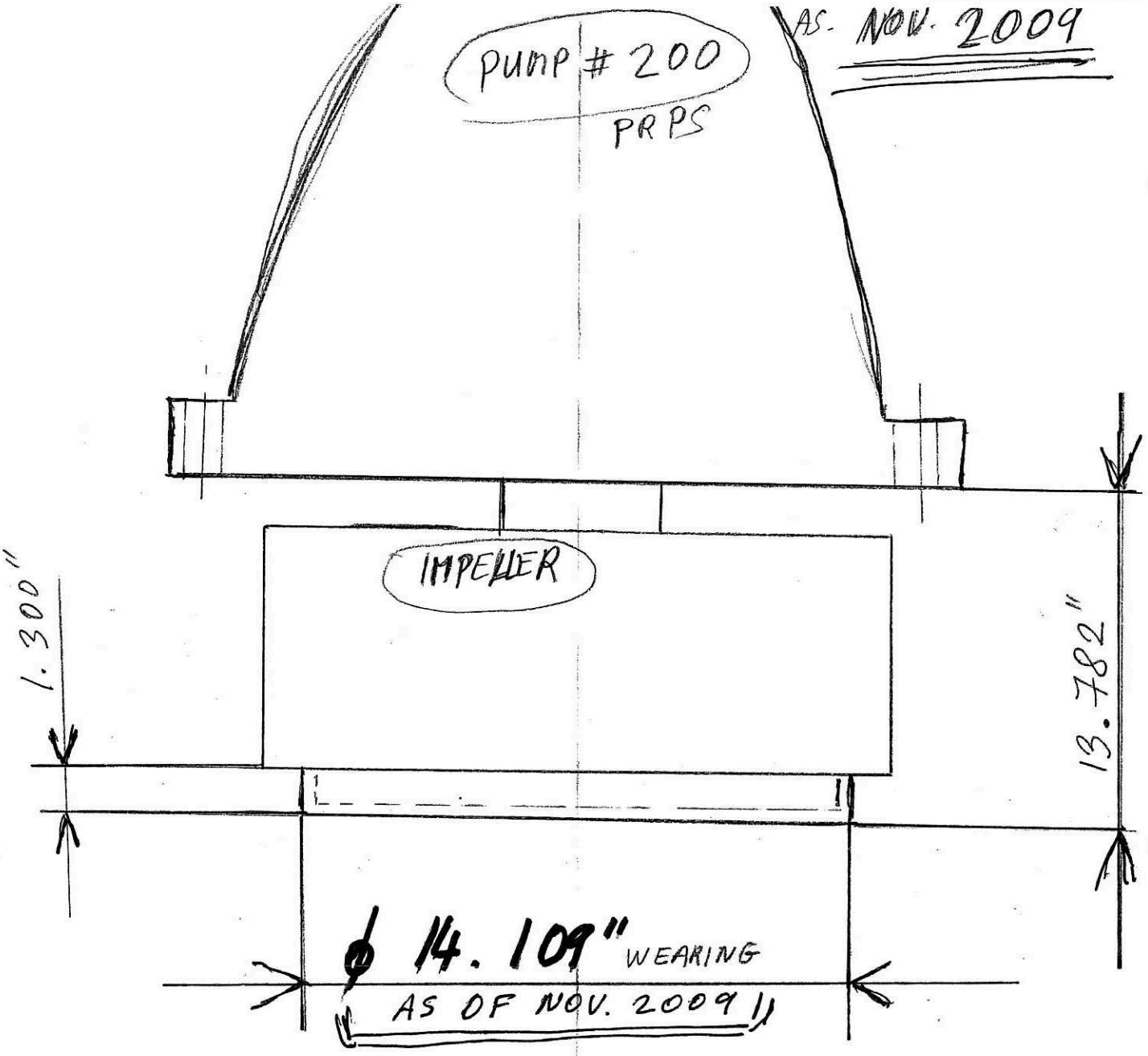
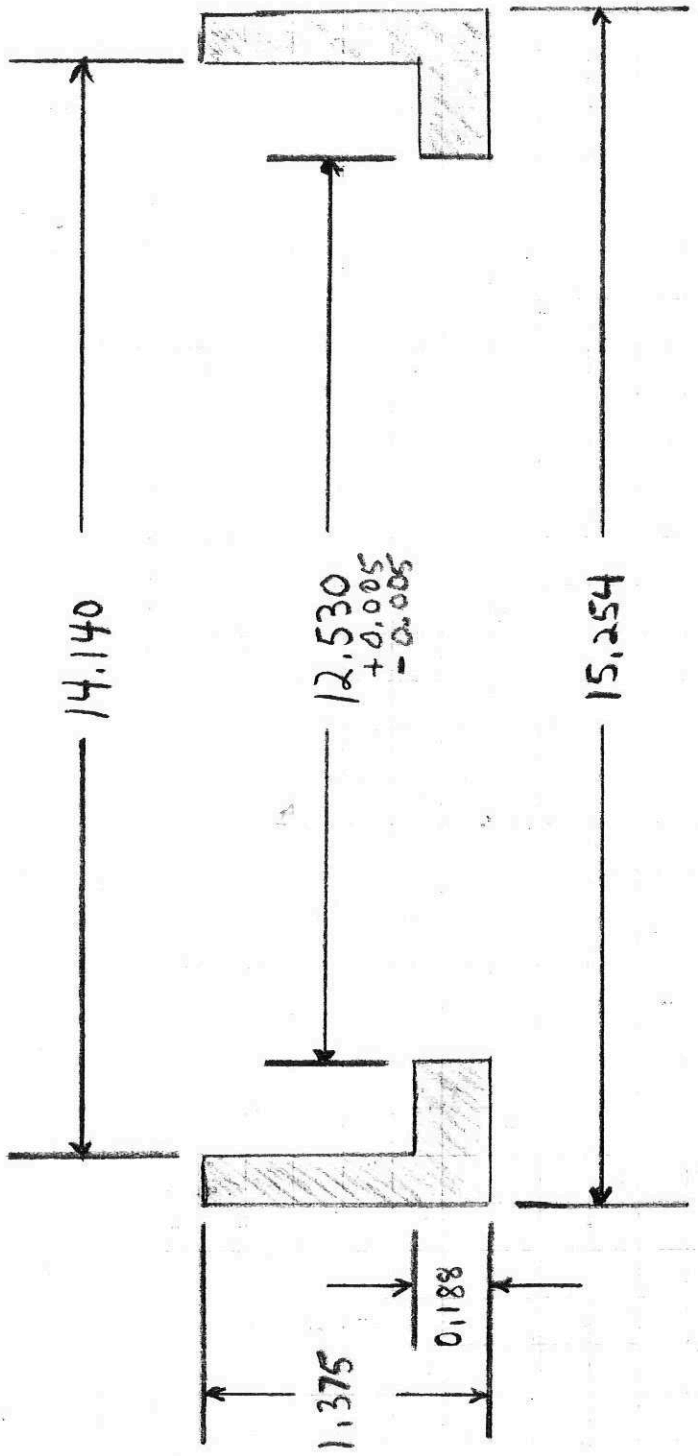


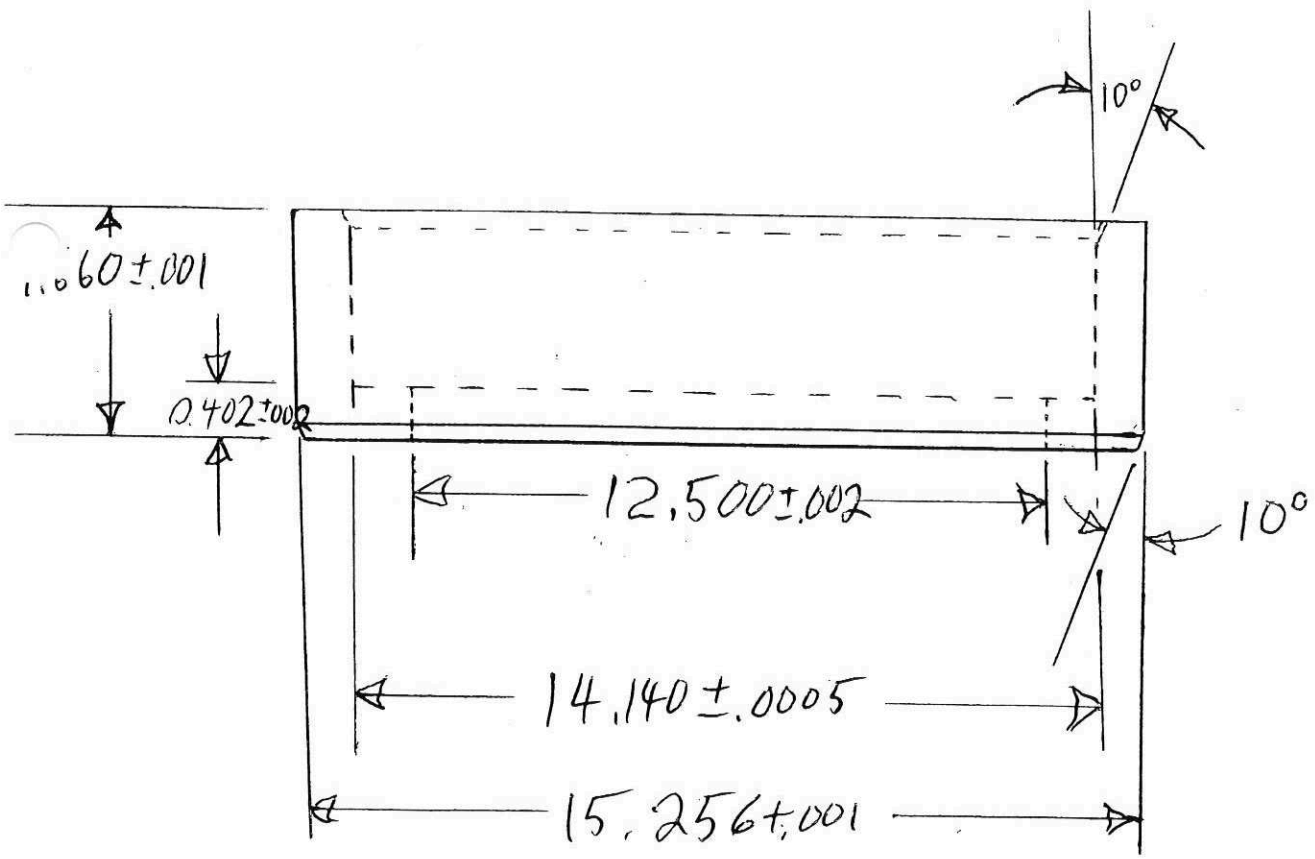

PUMP # 200
PRPS
AS. NOV. 2009
IMPELLER
1.300"
13.782"
ϕ 14.109" WEARING
AS OF NOV. 2009

West End Pump Wear Ring

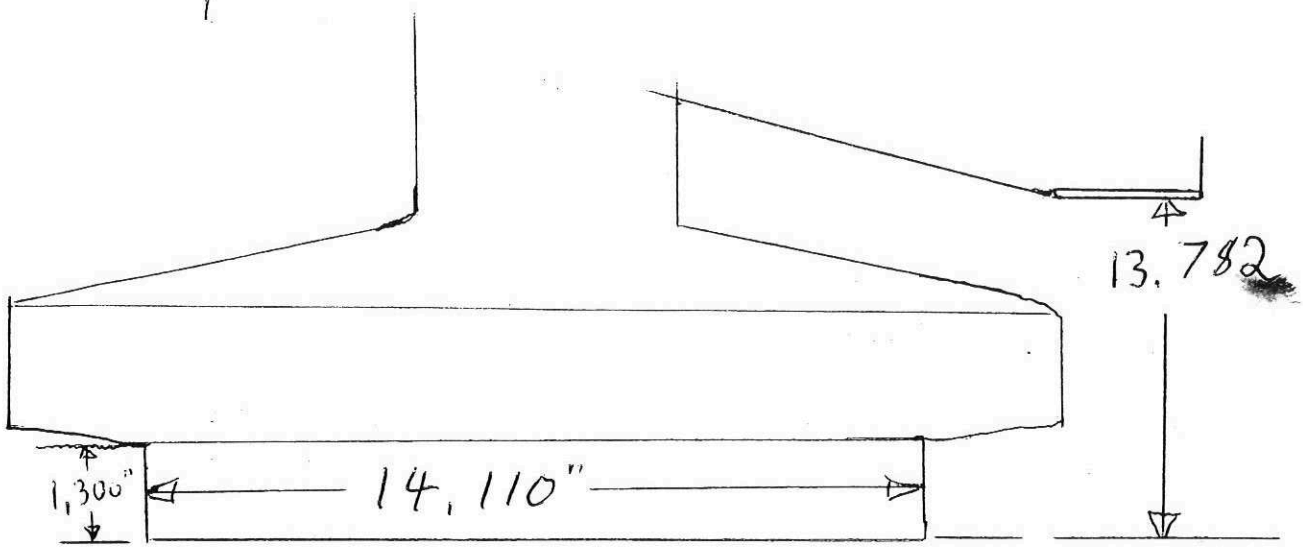
BOWL

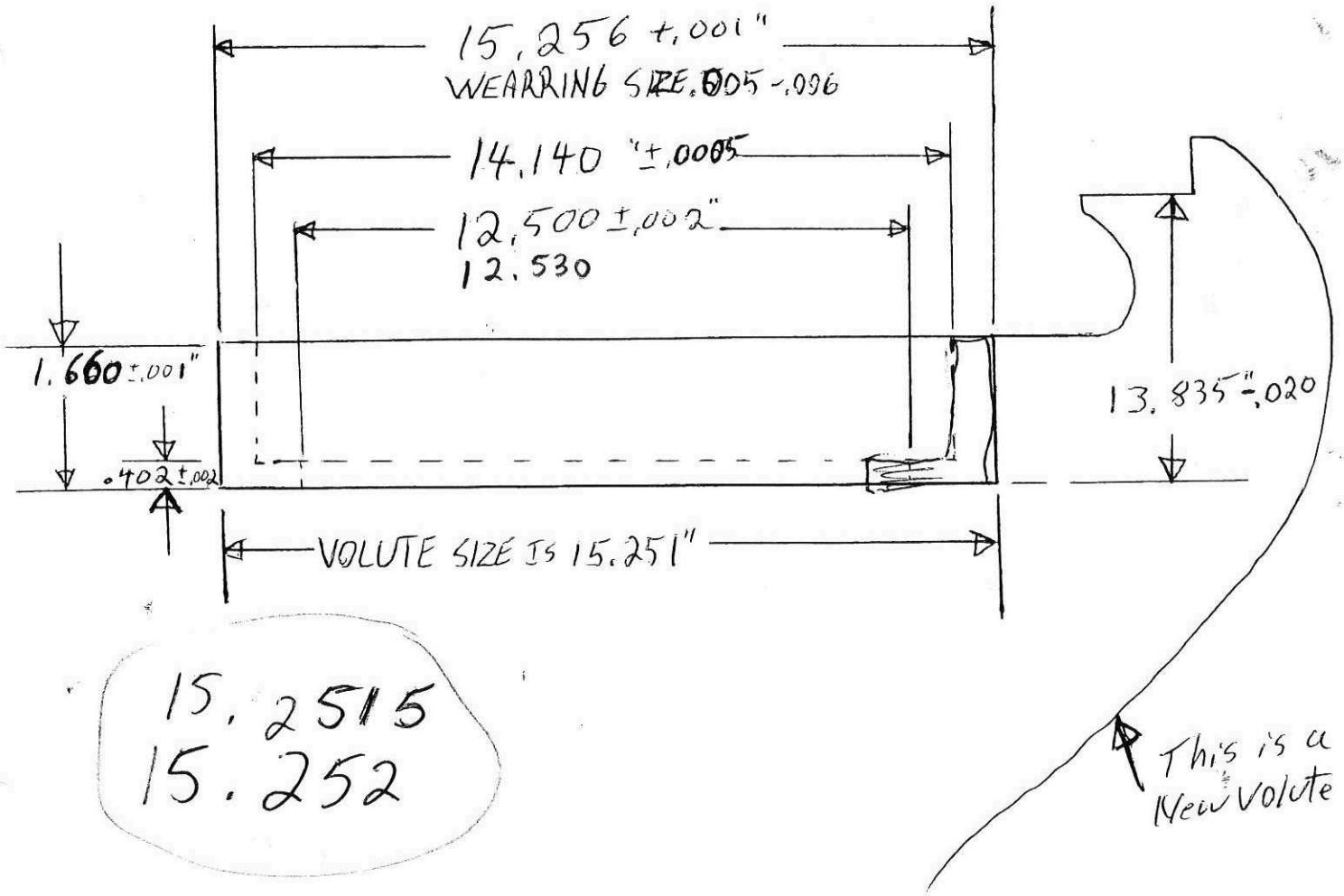


Wearing rings Dec 9/09



Nov 4/09
West END w/o 0907646/02
phone # 470 9694





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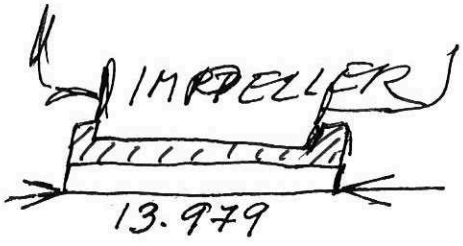
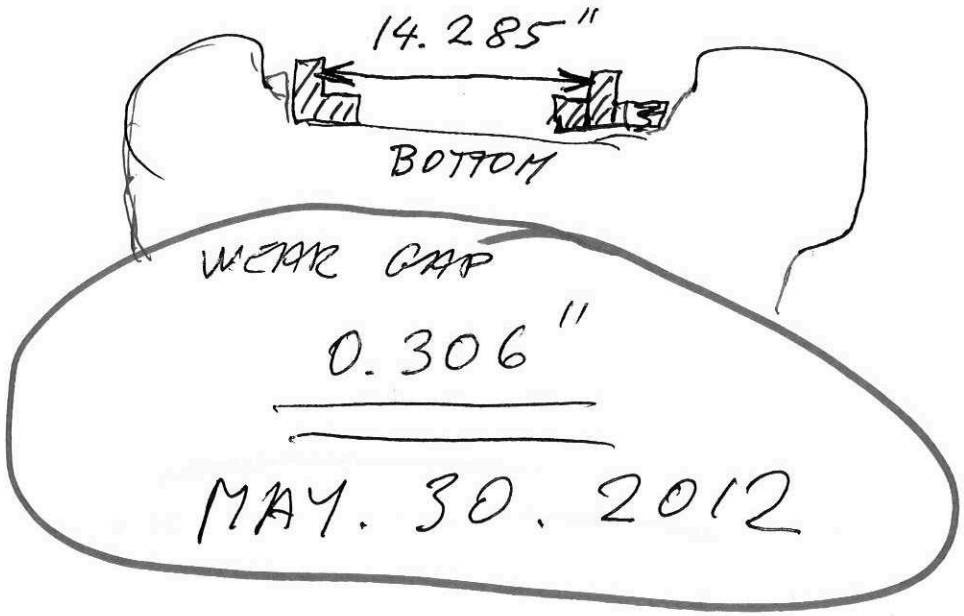
15.252

PRPS

MP 2





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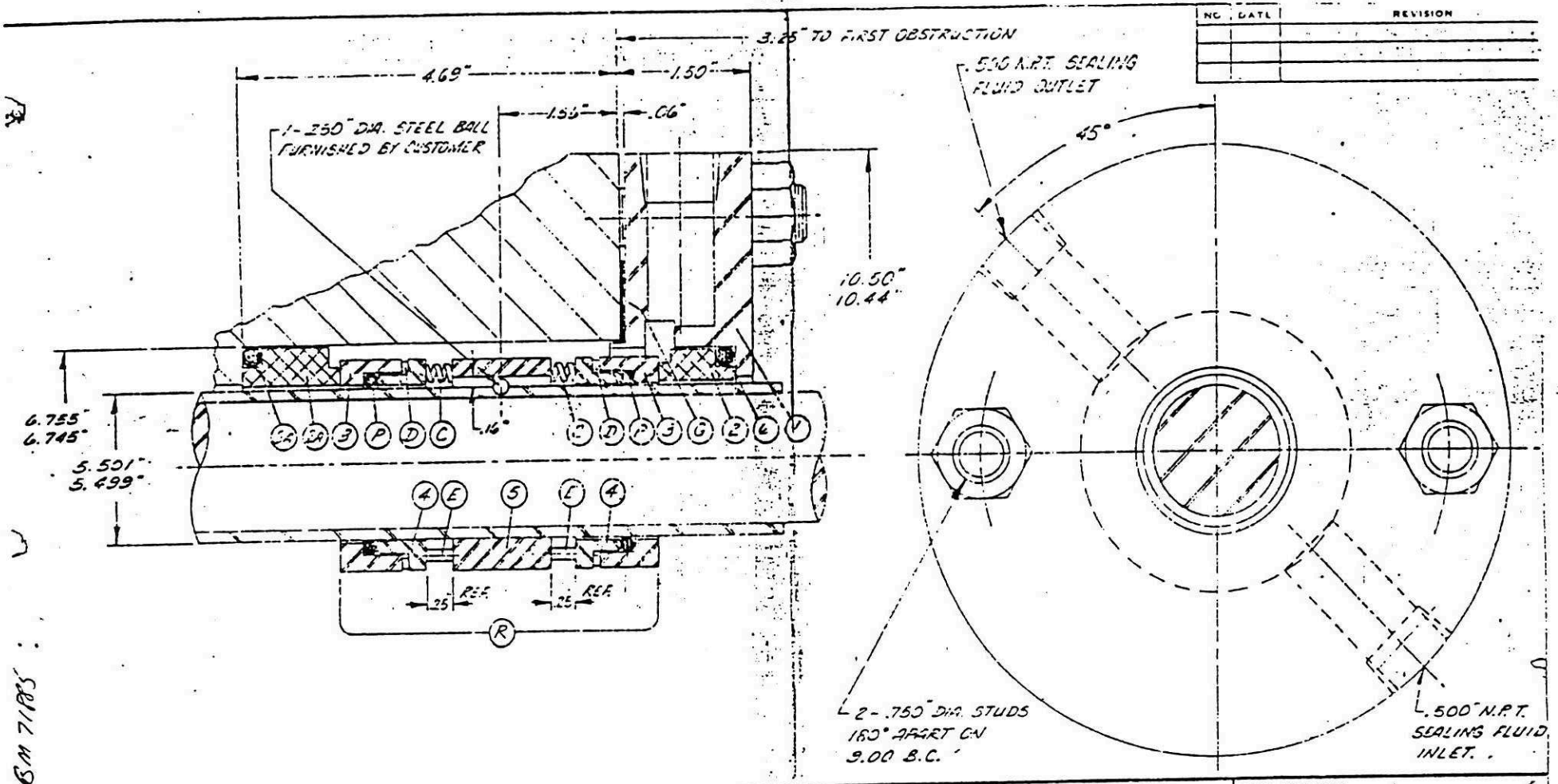
NEW TOD – 0.045

NEED TO BE 14.240

14.240"



NO.	DATE	REVISION

R	ROTARY UNIT CONSISTING OF:		1	GLAND RING	316 STAIN.
3	SEAL RING	DURAMATE	2	INSERT (OUTER)	#5 CARBON
4	COMP. RING	316 STAIN.	2A	INSERT (INNER)	#5 CARBON
5	COLLAR	316 STAIN.	6	"O" RING	BUNA "N"
C	SPRINGS	20 STAIN.	6A	"O" RING	BUNA "N"
D	DRIVE PINS	20 STAIN.	P	SHAFT PKG.	BUNA "N"
E	SPRING PINS	20 STAIN.	G	GASKET	DMC 340

RECOMMENDED SPARE PARTS. 1 2A 6 6A 3 P

BUYER – NORTHINGTON (CANADA) LTD., BRANTFORD, ONTARIO

ORDER NO – B-0754021-0000-105

USER:– CITY OF WINNIPEG, WINNIPEG, MANITOBA

PUMP TYPE & SIZE	PUMP ITEM NO.	PUMP SERIAL NO.	REFERENCE DRAWING NO.	FLUID	PRESSURE SUCT.	PRESSURE DISCH.	R.P.M.	TEMP. °F	SP. GR.
ADEPTUS-TDN 1½ CCEV-1		B07540-211 C		RAW SEWAGE	FLOOD-ED	75 FT	854	AMB.	1.0

DURA SEAL TYPE: DOUBLE INSIDE "RO"

MAT'L CODE: E D 5 E F 0

DURAMETALLIC CORPORATION
KALAMAZOO, MICH.

ORDER PARTS BY S/N NO. 71885

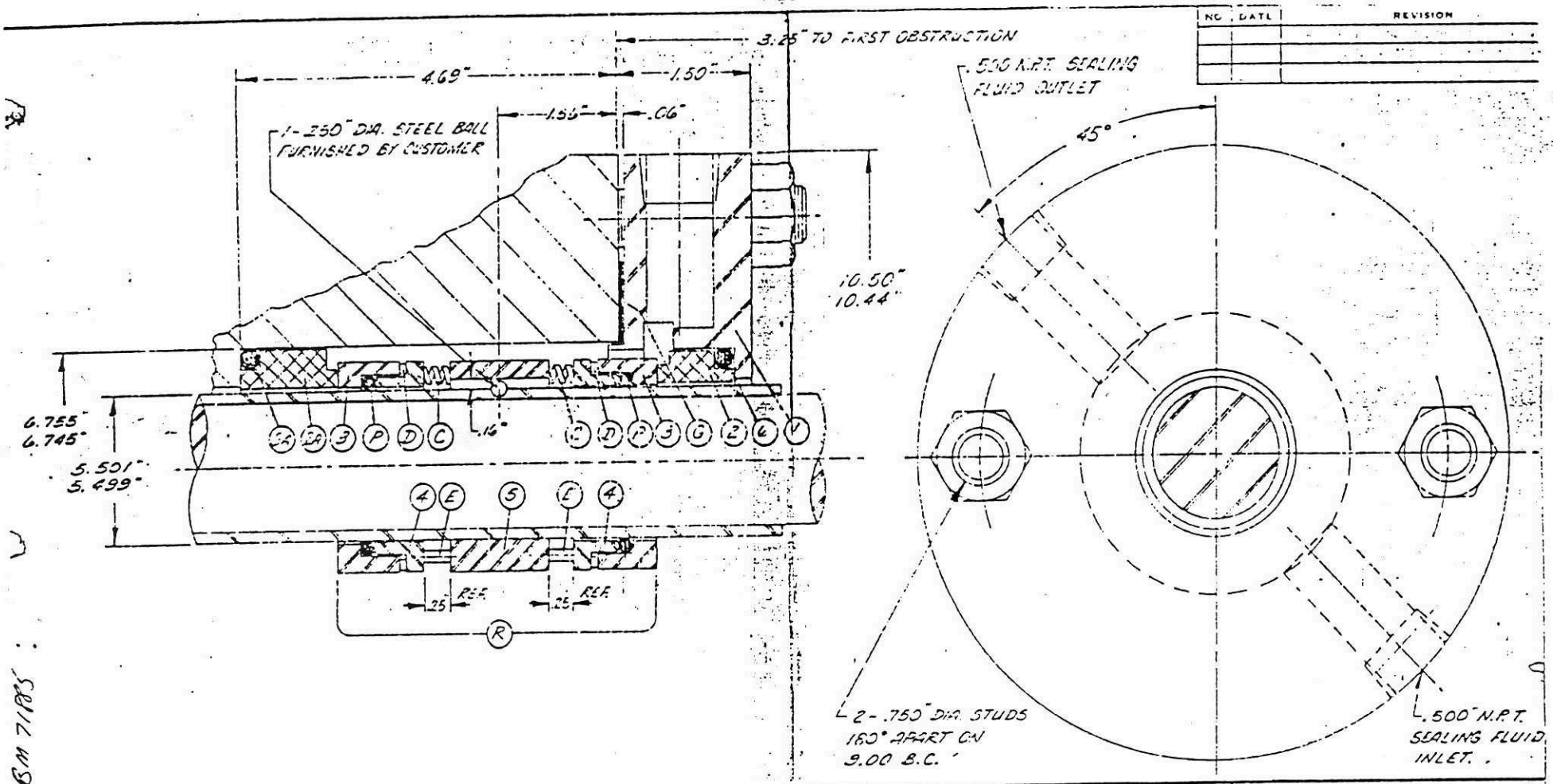
P.O. NO.: C1475-75 SCALE: N.T.S.

DATE: 9-3-75 DWG. NO. 2D-138810

DWN: WLN CHK'D: I.

FORM:

6M 7/85



NO.	DATE	REVISION

R	ROTARY UNIT CONSISTING OF:				
3	SEAL RING	DURAMATE	1	GLAND RING	316 STAIN.
4	COMP. RING	316 STAIN.	2	INSERT (OUTER)	#5 CARBON
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D	DRIVE PINS	20 STAIN	6A	"O" RING	BUNA "N"
E	SPRING PINS	20 STAIN	P	SHAFT PKG.	BUNA "N"
			G	GASKET	DMC 340

RECOMMENDED SPARE PARTS. 2 2A 6 6A 3 P

BUYER – NORTHINGTON (CANADA) LTD., BRANTFORD, ONTARIO

ORDER NO – B-0254021-0000-105

USER:– CITY OF WINNIPEG, WINNIPEG, MANITOBA

PUMP TYPE & SIZE	PUMP ITEM NO.	PUMP SERIAL NO.	REFERENCE DRAWING NO.	FLUID	PRESSURE SUCT.	PRESSURE DISCH.	R.P.M.	TEMP. °F	SP. GR.
NORTHINGTON 16 CFCV-1		B07540 -211 C		RAW SEWAGE	FLOOD -ED	75 FT	854	AMB.	1.0

DURA SEAL TYPE: DOUBLE INSIDE "RO"

MAT'L CODE: E D 5 E F 0

DURAMETALLIC CORPORATION
KALAMAZOO, MICH.

ORDER PARTS BY B/M NO. 71885

P.O. NO.: C1475-75

SCALE: N.T.S.

DATE: 9-3-75

DWN: HLN CHK'D: I.

FORM:

DWG. NO. 2D-138810

Perimeter

2 Pump Motor.

Mod. 5K6318XC295A
Ser # A.M.J. 128014 575 V.
H.P. 200 Full Load R.P.M. 880 Full Load Amps 190
Type K. Frame 6318 P24 Service Factor 1.15
Time Rating Continuous 60 Cycle 3 Phase
Insulation Class B Max Ambient Temp 40° C
Upper And Lower Bearings K5903498 P015

Adjustable Speed Magnetic Drive Ser 175210231
Input Speed 880 Full Load 225 H.P. At 97% Speed
Instrument Book 291 Frame MD520

Pump H.P. 181 T.D.H. -79 G.P.M. 7500
R.P.M. 854 S/N - B07540211 Pump - 16CFC

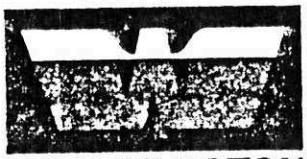
Diesel Motor Drive

Right Angle
Mod 20 H.P. 300 At 780 R.P.M.
Ratio 5-2 Fig. 2 R01
Ser # P100507 S-S

Pump Fairbanks Morse
Size 14 X 16 Inch Figure 5712 Stage 1
G.P.M. 10794 Total Ho. 88 Ft. R.P.M. 720
Frame _____ Mod _____ Imp Dia. 29.50
Ser. # K3E16034 18

INSTRUCTIONS FOR INSTALLATION, OPERATION AND MAINTENANCE

FC PUMPS



WORTHINGTON CORPORATION

TABLE OF CONTENTS

FC PUMP

TABLE OF CONTENTS (CONT'D.)

SECTION 1

INTRODUCTION AND GENERAL DESCRIPTION

The Worthington FC pump is a volute type centrifugal pump designed for dry pit operation. It is supplied with a bottom suction nozzle. The flow of liquid is both axial and radial.

The pump can be arranged for close-coupled mounting with an attached driver base or for long coupled mounting with an independent driver base and intermediate shafting.

CASING AND REMOVABLE HEADS

The pump casing with its integrally cast discharge nozzle is a volute type. It is machined to provide a rabbet fit for both the stuffing box head and the suction piece.

The removable head is bolted and centered in the casing. The suction piece is provided with a handhole for inspection and cleaning without dismantling the pump.

IMPELLER AND WEARING RINGS

The impeller is the enclosed type. It is capable of passing stringy material, trash and solids of limited size. The impeller hub is keyed to the shaft and held in position by an impeller nut. The nut is locked to the impeller with a set screw.

The pump is provided with renewable casing and impeller wearing rings which are locked in position by set screws.

SHAFT AND SHAFT SLEEVE

The pump shaft is carefully designed and machined to insure rigid support of the impeller. The shaft is protected at the stuffing box with a removable sleeve keyed to the shaft and held in axial position by the shaft shoulder or by a sleeve adjusting nut. The nut, in turn, butts against the shaft shoulder.

STUFFING BOX

The liquid sealed stuffing box seals the pump against leakage along the shaft sleeve at the point where it passes through the casing. It should be packed with rings of braided, graphited asbestos packing and a seal cage. The stuffing box is not packed when the pump is shipped. Independent sealing should be provided from a supply of clean water at a positive pressure slightly higher than the pump discharge pressure.

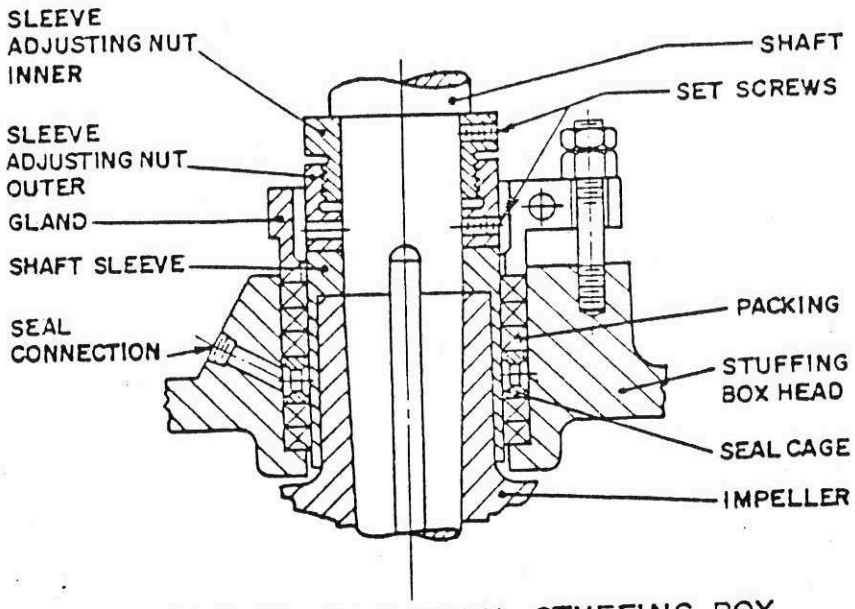


FIG. SECTION OF TYPICAL STUFFING BOX

BEARINGS

The pump is equipped with anti-friction bearings arranged for grease lubrication. The upper or thrust bearing is a double-row angular contact, combined thrust and line bearing mounted back-to-back. It is press fitted on the shaft and secured axially with a nut. The outer races are contained between a shoulder in the bearing housing and a protruding face on the thrust bearing cover to prevent end movement.

The lower or line bearing is a double row self aligning bearing. It is press fitted on the shaft. Clearance in the bearing housing bore allows the outer race to move axially to prevent shaft bending or binding of internal parts as a result of axial shaft expansion.

Both bearings are mounted in the bearing frame which is bolted to the stuffing box head.

For bearing lubrication refer to Section V.

COUPLINGS

Refer to coupling manufacturer's instructions. Where flexible shafting with universal joints is used, refer to "Service Instructions for Flexible Shafting".

SECTION II

PRE-INSTALLATION

INSPECTION OF EQUIPMENT

Immediately on receipt of the equipment, inspect and check it against the shipping manifest. Examine the crate and wrapping before discarding. Parts or accessories are sometimes wrapped individually or fastened to the crate. Report any damage or shortage to the transportation company's local agent.

STORAGE

When it is necessary to store a pump for a short time before it can be installed, place it in a dry location. Protect it thoroughly from moisture. When protecting flanges are bolted to the suction and discharge nozzles at the factory, they should not be removed.

Protect the bearings and the couplings against sand, grit or other foreign matter. To prevent rusting-in or seizing, lubricate the unit (refer to Lubrication, Section V). Turn the rotor over by hand at least once a week.

Check the stuffing box to insure that it contains no packing which could cause rusting of internal parts as a result of condensation.

CLEANING PRIOR TO INSTALLATION

If rust preventative has been used on stored parts they should be thoroughly cleaned. Re-lubricate the bearings. Extreme care must be taken to assure that all traces of the protective coating are removed.

SECTION III

INSTALLATION

LOCATION OF EQUIPMENT

The pump should be placed so that it is easily accessible for inspection during operation while giving due attention to the desirability of simplifying the discharge piping layout. The pump should always be located as near as possible to the suction well or supply to keep suction losses and lift at a minimum. There should be ample head room to allow the use of an overhead crane or lifting device with sufficient capacity to lift the heaviest part of the unit.

FOUNDATION

The foundation may consist of any material that will afford permanent, rigid support to the full area of the pump or driver supporting member and that will absorb expected strains and shocks that may be encountered in service.

Concrete foundations built on solid ground are desirable. Foundation bolts of the specified size should be located according to elevation drawings. Each bolt should be surrounded by a pipe sleeve 2 to 3 times the diameter of the bolt. The sleeves should be held rigidly yet allowing the bolts to be moved to conform with the holes in the bedplate. (Refer to Fig. below).

When the pump unit is mounted directly on structural steel framing, it should be located directly over or as near as possible to the main building members, beams or walls. The pump base should be bolted and doweled to the steel supports to avoid distortion, prevent vibration and retain proper alignment.

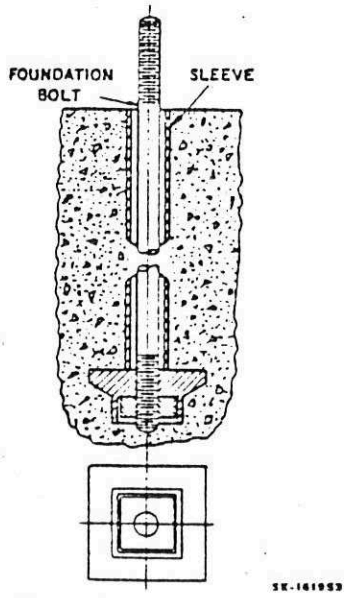


Fig. —Foundation Bolt

ALIGNMENT

Accurate alignment of pump and driver shafts is essential to successful operation regardless of the type of coupling used.

Important - Alignment must be checked after a pump has been completely piped-up. Serious pump misalignment can be caused by drawing up on flange piping bolts if the flange faces are not parallel. Particular care must be taken to properly support the suction and discharge piping so that they cannot exert a strain or pull on the pump. Pipe strains are a common cause of misalignment, hot bearings, worn couplings and vibration.

A flexible coupling is used to compensate for slight changes in alignment which occur during normal operation and is not used to correct for angularity.

Important Note: Couplings must be uncoupled until after a final alignment check has been made prior to starting the unit.

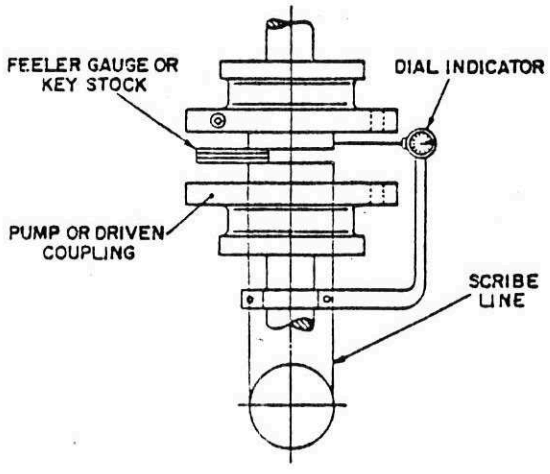
To align the pump and driver, proceed as follows:

CLOSE COUPLED UNITS

1. Disconnect the coupling halves by removing the coupling bolts.
2. Set pump on foundation and shim to correct elevation to insure that the suction and discharge flanges are level and plumb and at the proper elevation.
3. Grout pump base to foundation and tighten anchor bolts.
4. Check the gap between the coupling halves (or coupling hubs where appropriate) against the dimensions shown on the installation drawing.

NOTE: 1/16 in. variation is allowed.

5. Check angular and parallel alignment of coupling halves using a dial indicator and a feeler gauge. The dial indicator should be mounted on the pump-half-coupling with the probe resting on the outer diameter of the driver coupling. Rotate the pump shaft and take readings at every quarter turn to check parallel alignment. For angular alignment rotate both the pump and motor shafts together and take feeler gauge readings at 90 degree intervals around the coupling. Move and shim the driver until the coupling is accurately aligned.
6. Bolt driver to pump securely and recheck alignment as in previous step.
7. Drill, ream, and dowel driver to motor stand (minimum of two dowel pins).



METHOD FOR CHECKING ANGULAR AND PARALLEL ALIGNMENT

LONG COUPLED UNITS

A. INSTALLATION WITH FLEXIBLE SHAFTING (NO GUIDE BEARING) WITH MOTOR BASE RESTING IN PLACE.

1. Set pump on foundation and shim to correct elevation to insure that the discharge flanges are level and plumb and at the proper elevation. During this procedure, align the pump with a plumb bob so that the pump coupling is centered in relation to the motor mounting flange and check the face of the coupling with a precision machinist's level.

2. Place the motor on the motor base and check to determine if the distance between the pump and motor coupling faces agrees with the installation drawing and if the motor coupling face is level. If these conditions are not realized, shim motor base to suit.

3. Tighten motor base foundation bolts.

4. Center motor and pump couplings with a plumb bob by sliding motor on motor base. Scribe motor base for motor hold down bolts. Remove motor and drill and tap holes.

5. Remount and center motor with a plumb bob by sliding motor on motor base. Check coupling faces for parallelism. Adjustment can be made by shimming between motor and motor base.

6. Tighten motor hold-down bolts on motor base and recheck alignment.

7. Install intermediate shafting.

8. Grout pump and motor into place, and dowel motor to motor base.

B. INSTALLATION WITH FLEXIBLE SHAFTING AND ONE OR MORE GUIDE BEARINGS.

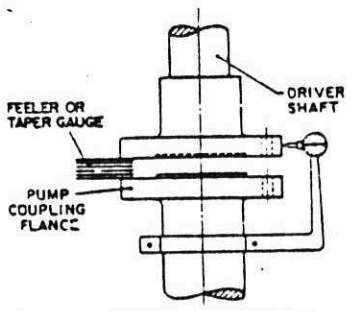
NOTE: Follow first 6 steps of procedure listed under A.

7. Install intermediate shafting with guide bearings in place. Note match marks (if any) on coupling flanges and match numbers at coupling holes and at coupling bolts.

8. Align guide bearing supports to shaft using a plumb line. Shim under guide bearing housing, if necessary, and tighten in place. Recheck guide bearing alignment.

9. Grout pump and motor base into place, and dowel motor to motor base.

NOTE: Due to the many variations and complexity of installations, it is recommended that a Worthington erector be obtained to assist in installation and alignment on long coupled vertical units.



METHOD OF CHECKING ALIGNMENT USING DIAL INDICATOR AND FEELER OR TAPER GAUGE

GROUTING

The purpose of grouting is to prevent lateral shifting of the sole plate, not to take up irregularities in the foundation. We recommend the following procedure:

The typical mixture for grouting-in is composed of one part pure portland cement and two parts building sand, with sufficient water to cause the mixture to flow freely.

The top of the rough concrete foundation should be well saturated with water before grouting. A wooden form should be built around the outside of the sole plate to contain the grout. In some cases this form is placed tightly against the lower edge of the base and in other cases, it is placed a slight distance from the edge of the supporting feet. Grout is added until the entire space under the sole plate is filled. A stiff wire should be used to work the grout and release any air pockets.

After the grout is poured, the exposed surfaces should be covered with wet burlap to effect slow drying in order to prevent cracking. When the grout is set (about 48 hours) remove the forms and smooth the exposed surfaces if desired. The grout should be hard in approximately 72 hours.

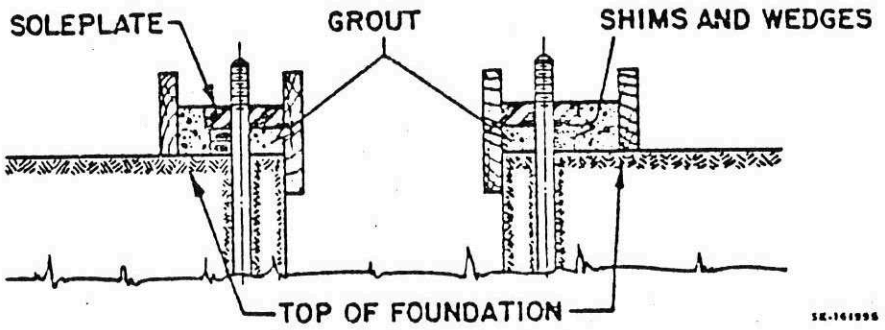


Fig. —Placing Form for Grouting

PIPING

Piping Strains - Satisfactory operation cannot be maintained when piping imposes a force on the pump. Pumps can be sprung and pulled out of position by drawing up on the bolts in the piping flanges. Flanges must be brought squarely together before the bolts are tightened.

Suction and discharge pipes and associated equipment should be supported and anchored near but independent of the pump so that no strain will be transmitted to the pump casing. Pipe strains are a common cause of misalignment, hot bearings, worn couplings and vibration.

Suction Piping - Experience has shown that the major source of trouble in centrifugal pump installations other than misalignment is traceable to a faulty suction line. The utmost attention must be given to this portion of the installation. The suction piping should be as direct as possible and its length held to a minimum. If a long suction line is required, increase the pipe size to

reduce friction losses. The piping should be run without high spots and have continual rise towards the pump. This prevents air pockets which inevitably cause trouble.

The suction piping should be checked before initial start-up to insure that there are no leaks.

A gate valve is required on the suction line if a positive head exists above the invert of the suction piping.

SECTION IV

OPERATION

The following procedures are presented to outline the most important steps involved in pump operation. Any modifications of these procedures due to particular installation peculiarities should conform to good engineering practices.

SUCTION LIFT

Sometimes the suction conditions imposed upon a centrifugal pump are extremely unfavorable and lead to a complete breakdown of the operation of the pump. The suction lift must be kept within the suction limitations for which the pump was sold. If the original operating conditions must be changed for any reason, consult your nearest Worthington District Office.

Care should also be exercised to keep the suction piping air tight and sealed against leakage.

PRIMING

CAUTION - PRIME YOUR PUMP BEFORE STARTING

Priming a centrifugal pump means removing the air, gas or vapor from the suction piping and pump casing. Internal pump parts depending on water for lubrication may seize if the casing is not completely filled with liquid prior to starting.

With a positive suction head on the pump, priming is accomplished in the following manner:

1. Open all suction valves to allow liquid to enter the suction piping and pump casing.

2. Open vent valve located on highest point on the pump casing in order to release all entrapped air.

3. When liquid appears as a steady stream (no air bubbles) the pump is primed and may be started.

STARTING AND OPERATING PUMPS

Preliminary Instructions - Test the driver for rotation with the coupling bolts removed. The arrow on the pump casing will show the correct rotation. Replace the coupling bolts.

Refer to the lubrication section, and be sure that the bearings have been properly lubricated.

The valves on the liquid supply line to the stuffing boxes should now be opened.

The pump should now be primed according to instructions given under "Priming". Do not operate the pump unless it is primed as there is danger of damaging

internal parts which depend on the pumped liquid for lubrication. Turn the rotor over by hand; if it is bound, do not operate the pump until the cause of the trouble is found.

Starting Pumps - Turn the rotor several times by hand to lubricate the bearings.

Start the driver according to the driver manufacturer's instructions.

Open the discharge valve slowly as soon as the pump attains full speed.

During the routine operation of the pump, the bearings should be occasionally checked for proper lubrication.

The amount of valve opening on the liquid seal supply lines to the stuffing boxes must be controlled. The stuffing box glands should be adjusted to permit a slight seepage of liquid out of the stuffing box at all times during operation to prevent excessive wear of the shaft sleeves due to lack of lubrication.

STOPPING PUMPS

Normally, there should be a check valve and a gate valve in the discharge line. The check valve should be located between the pump and the gate valve. In such cases the pump can be shut down by stopping the driver according to the driver manufacturer's instructions. The remaining valves should then be closed in the following order: discharge, suction, and sealing liquid supply.

SECTION V

LUBRICATION

GREASE LUBRICATED ANTI-FRICTION BEARINGS

Grease lubricated anti-friction bearings are packed with grease at the factory and ordinarily will require no attention before the pump is started providing the pump has been stored for only a short period in a clean dry location (refer to Pre-Installation Section II). The bearings should be checked for the first hour or so after the pump has been started to insure that they are functioning properly. Proper grease lubrication is very important. The characteristics of the installation and the severity of the service will determine the frequency of lubrication. Do not use graphite. A good No. 2 grease is satisfactory for operation at ordinary room temperatures, a lighter grease (No. 1) for operation at high speeds or low room temperatures. For specific recommendations consult a reputable grease manufacturer. An anti-friction bearing should never have its housing fully packed with grease. It is recommended that the void spaces in the bearings and the housings be 1/3 to 1/2 filled with grease. A fully packed housing will cause the bearing to overheat and will result in reduced bearing life.

The maximum desirable operating temperatures for anti-friction bearings varies from unit to unit. Rising temperatures or an abrupt temperature rise are indicative of trouble. These symptoms require immediate stopping of the pump. Before the unit is returned to service, the trouble must be located and correct

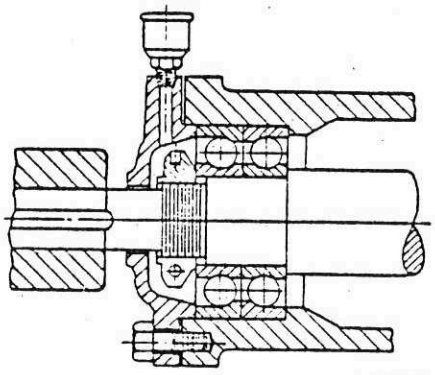


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Fig. —Typical Grease Lubricated Anti-Friction Bearing Arrangement

REGULAR GREASE CHANGE

It is recommended that the grease be changed completely every six months to one year depending on the total running hours of the pump. If the pump is a stand-by unit or if it is run only a few hours each month, the grease should be changed every six months. If the pump runs fifty per cent or more of the time, the grease need not be changed more than once a year.

REGULAR LUBRICATION

Normally, two or three turns of the grease cup caps should add sufficient grease to the bearings, when additional lubrication is required.

COMPLETE CLEANING DURING A MAJOR OVERHAUL

When an overhaul period offers the opportunity, the bearings and the housing should be completely cleaned out in the following manner:

Remove the rotor from the bearing housing. Use a brush and wash out the housing with hot kerosene (200F to 240F) or other nontoxic solvent. Flush out the housing with a light mineral oil to prevent rust and to remove all traces of solvent. Do not use waste to clean the housing.

To clean the bearings wipe off as much grease as possible with clean non-linting cloth. Using a brush dipped in hot kerosene at 180F to 200F, remove the remaining grease and solid particles, gently spinning the bearing. Spin each ball to insure that each one is clean.

If any badly oxidized grease is present and refuses to come off with the above procedure, the rotor should be supported so the bearing can be immersed in the hot kerosene and allowed to soak. Brush and spin the bearing until the oxidized grease is removed. Difficult spots can sometimes be removed with a mixture of alcohol and light mineral solvent.

Reflush the bearings with clean, light oil to remove any contaminated oil.

Fresh grease should now be forced through the bearing to purge any remaining contaminated grease or oil.

REPACKING BEARINGS AND HOUSINGS

Fill all the void spaces between the balls or rollers with clean grease. Fill the bearing housing cover cavities and the bearing housing cavities 1/3 to 1/2 full of grease and assemble the rotor in the bearing housing. Observe the bearing temperatures closely for the first few hours of operation.

SECTION VI

MAINTENANCE

INSPECTIONS

Daily observations should be made of pump operations to avert trouble. Whether or not you consider a log of these inspections necessary, the operator must be alert for irregularities in the operation of the pumps. He should immediately report any trouble symptoms which he detects. Stuffing box operation and bearing temperatures should be checked periodically. An abrupt change in bearing temperatures is much more indicative of trouble than a constant high temperature. A change in the sound of a running pump is also a warning of possible trouble (refer to Locating Troubles).

SEMI-ANNUAL AND ANNUAL INSPECTIONS

Check for free movement of the stuffing box gland, clean and oil the gland bolts and nuts. Closely observe the stuffing box for excessive leakage which cannot be reduced by gland adjustment and replace packing if necessary. Check the pump running records for hourly usage to determine if bearings should be cleaned and regreased. (See Lubrication, Section V).

Check the pump for capacity and discharge pressure to determine if new casing rings or impeller rings are required.

COMPLETE OVERHAULS

Frequency of a complete overhaul depends upon the hours of operation of the pump, the severity of the conditions of service, the materials used in the pump construction, and the care the pump receives in operation. Do not open your pump for inspection unless there is definite evidence that the capacity has fallen off excessively or unless there is indication of trouble inside the pump or in the bearings.

DISMANTLING PROCEDURE

Care must be exercised in the dismantling operation to prevent damage to internal parts of the pump. For convenience at reassembly, lay out all parts in the order in which they are removed. Protect all machined faces against metal-to-metal contact and corrosion. Do not remove bearings unless absolutely necessary.

Close the suction and discharge valves and shut off the sealing water. Drain all water from the casing.

Proceed as follows for complete dismantling: (Not always required)

1. Close Coupled Units. Disconnect coupling halves, unbolt the motor stand and remove the motor and stand from the pump casing.

1A. Long Coupled Units. Remove the intermediate shaft nearest the pump.

2. Unbolt the stuffing [illegible]

3. Draw out the rotor assembly complete with the stuffing box head, bearing housing, etc. Care must be exercised in slinging and handling the unit.

4. Remove the impeller nut, using the special wrench which is supplied with the pump.

5. Remove the impeller and impeller key.

6. Remove the gland, the packing, the seal cage and the stuffing box head.

7. Remove the shaft sleeve.

8. Remove the pump coupling half.

9. Unbolt and remove the bearing housing covers.

10. Withdraw the shaft and the bearings from the bearing frame toward the coupling end.

11. Remove the bearing locknut, bearings and retainers only if replacement is required.

As the pump and rotor is dismantled, all individual parts, all important joints and all wearing surfaces should be carefully examined.

As a general rule, regardless of the performance of the unit, parts appreciably worn should be renewed if it is not intended to examine the pump until the next overhaul period. It should be remembered that when parts (in new or good condition) with metal seats are assembled in contact with dirty or worn parts, the new parts are very likely to wear out rapidly.

ASSEMBLY PROCEDURE

To assemble the pump, reverse the dismantling procedure previously described except for the packing and seal cage instructions. Install the rotor in the casing and check to see that the rotor turns freely by hand. Wearing surfaces at the impeller must not touch. Align the pump carefully. Install packing and seal cage. (See "Packing".)

MAINTENANCE OF CASING

The casing waterways must be kept clean and clear of rust. Whenever a unit has been dismantled, clean and paint the waterways of the casing with a suitable paint which will adhere firmly to the metal. To give best results an enamel-like finish is desirable. Based on experience, a routine program of cleaning and re-painting the casing should be followed. In this manner,

the protective coat will never be fully eroded before replacement.

Two casing gaskets may be damaged when the pump is opened. One is the gasket between the stuffing box head and the casing, and the other is between the suction head and the casing. A new casing gasket must be of the same thickness and material as the original one so it will compress to the same extent. When installing a new gasket trim the edges squarely and neatly. Coat gasket with suitable agent when installing.

MAINTENANCE OF WEARING RINGS

Impeller and casing wearing rings are pressed into place and held by screws. To remove these rings for replacement it is necessary to remove the recessed screws and pry off the rings using wedges or some other suitable device. Care must be exercised to make sure the impeller or the casing is not damaged during this operation.

Due to the press fit of the impeller rings, there is always a danger that some runout may develop at assembly. It is advisable to check the shaft and impeller assembly after mounting the ring on the impeller to determine if the new ring surfaces are true.

NOTE: Generally, it is recommended that the rings should be renewed or overhauled when the original clearance has doubled. This will be dependent upon the required pump performance.

Excessive wear at the running joint can be remedied by reboring the stationary ring to a slightly larger diameter and replacing the impeller ring with an oversize ring. The next repair should be made by turning down the impeller ring and then boring an undersize stationary ring (spare) to suit. Clearance at the running joint should be the same as that provided on the original ring. By alternately renewing or remachining the two rings, each ring can be used two or more times. (Refer to Section VII Service Parts).

MAINTENANCE OF SHAFT AND SHAFT SLEEVE

When the pump is dismantled, examine the shaft carefully. Its condition should be checked at the impeller hub fit, under the shaft sleeves and at the bearings. The shaft may become damaged by rusting or pitting due to leakage along the shaft at the impeller or shaft sleeve. Anti-friction bearings improperly fitted to the pump shaft will result in the inner race rotating on the shaft thus causing undue damage. Check the shaft keyway for distortion. Excessive thermal stresses or corrosion may loosen the impeller on the shaft and subject the keyway to excessive shock. Replace a shaft that is bent or distorted. After a shaft has been repaired, check it for possible runout (maximum .002).

When the sleeve has become worn appreciably, it becomes impossible to adjust the packing to prevent leakage and it should be replaced. Excessively grooved and scored sleeves will tear and score new packing as soon as it is inserted into the stuffing box.

MAINTENANCE OF BEARINGS

Anti-friction bearings are usually pressed or shrunk on the shaft and a pulling device must be used to remove them. The pulling jaws or fingers must be located behind the shoulder of the inner race. When other parts on a shaft do not interfere, the bearing may be supported by a split ring and the shaft pressed out using an arbor press.

NOTE: Unless extreme care is used when removing an anti-friction bearing, the bearing may be damaged to the extent that it is no longer useable. Always check the bearing immediately after removal for any imperfections or any play between the races. It is recommended that new bearings be used for replacement of removed bearings since very often bearing damage due to removal cannot be detected until the pump is put into operation.

When mounting anti-friction bearings on the pump shaft, remember that the satisfactory operation of anti-friction bearings require that the inner race be firmly held on the shaft so that it cannot turn on the shaft. It is also important that the fit of the outer race prevent its free rotation in the housing.

There are two methods in general use for mounting a bearing on a pump shaft:

1. Heating the bearing to expand the inner race and shrinking it on the shaft.

2. Forcing the bearing onto the shaft.

The first method is preferred. Heat the bearing in an oil bath or electric oven to a uniform temperature of 200-250°F. When heated, quickly mount it on the shaft.

If the alternate method is used, apply the force by means of an arbor press or hammer blows (see Fig. below). If an arbor press is available, use a tubular sleeve, a ring, or small blocks of equal thickness to apply the force to the inner race. With proper care it is possible to drive a bearing onto a shaft by hammering alternately on opposite sides of a tubular sleeve held against the inner race.

In forcing a bearing onto a shaft care must be exercised to see that the race is never cocked at any time. Check the position of the bearing on the shaft with a feeler gage to make sure it is pressing firmly against the shaft shoulder.

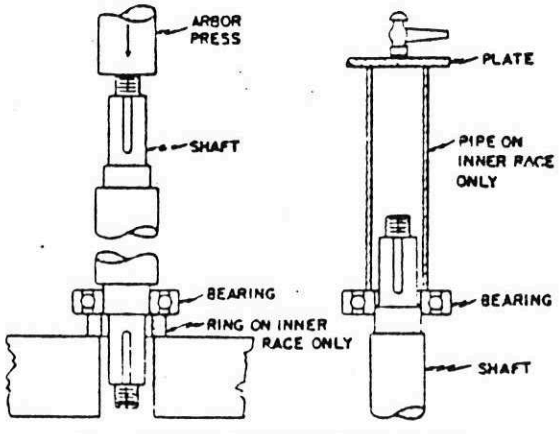

Fig. —Two Methods of Mounting a Ball Bearing on a Shaft

PACKING

For packing the stuffing box use a good grade of graphited braided asbestos packing. Do not under any circumstances use flax packing in the pump since it tends to swell and can cause the rotor to lock should the pump remain idle for short periods of time. Flax packing will also cause rapid wear of the sleeves.

The following procedure should be followed in repacking a stuffing box:

1. Loosen the stuffing box gland.

2. Remove the old packing with a packing puller and clean the stuffing box.

3. Make sure the packing to be used is of correct type and size. Measure the stuffing box to determine the proper length of the packing. Packing should be cut long enough (approximately 1/16" longer than measured) to insure that the O.D. of the packing ring hugs the stuffing box wall rather than the sleeve.

4. Insert each ring of packing separately, pushing it as far as possible into the stuffing box and seating it firmly. Stagger the rings so that the joints are 90 degrees or 180 degrees apart.

5. After inserting the required number of rings of packing, the seal cage can be inserted. Make sure the seal cage is located directly under the sealing connection and that the insertion of successive rings will not displace it.

6. Continue adding the required number of packing rings. Install the gland and tighten the gland nuts by hand; then back off the nuts until the gland is loose. In tightening the gland the nuts should be brought up uniformly so that the gland will not be cocked and so that the packing is subjected to uniform pressure.

7. New packing has to be run in. It is good practice to start the pump with the stuffing box gland quite loose. After the pump has been running for approximately 10 to 15 minutes, gradually tighten the stuffing box gland until leakage is reduced to a constant drip. Packing that is too tight in the box will cause undue friction, creating heat which will glaze the packing and possibly score the shaft sleeves. Packing must remain soft and pliable.

Precaution: It may be impossible to add the last ring of packing in the stuffing box and still insert the gland. When this occasion arises, omit the last ring of packing and tighten the gland. Continue to tighten the gland daily, allowing for proper leakage, until the packing has seated itself well enough to allow the final ring to be inserted.

LOCATING TROUBLES

The troubles which may occur with your pump and their causes are listed below. The operator can often avoid unnecessary expense by careful consideration of the points outlined.

Failure to Deliver Liquid
(a) Pump not primed.
(b) Insufficient speed.
(c) Discharge head too high (greater than that for which the pump is rated).
(d) Suction lift too high.
(e) Impeller passages partially clogged.
(f) Wrong direction of rotation.

Insufficient Capacity
(a) Air leaks in suction piping.
(b) Speed too low.
(c) Total head higher than that for which pump is rated.
(d) Suction lift too high.
(e) Impeller passages partially clogged.
(f) Mechanical defects:
Impeller damaged.
Wearing rings worn.

Insufficient Discharge Pressure
(a) Speed too low.
(b) Air in liquid.
(c) Mechanical defects:
Impeller damaged.
Wearing rings worn.

Pump Loses Prime After Starting
(a) Leaky suction line.
(b) Suction lift too high.
(c) Air or gases in the liquid.

Pump Overloads Driver
(a) Speed too high.
(b) Liquid pumped of different specific gravity and viscosity than that for which pump is rated.
(c) Mechanical defects.
(d) Packing gland too tight causing excessive friction loss in the stuffing box.

Pump Vibrates
(a) Misalignment.
(b) Foundation not rigid.
(c) Impeller partially clogged, causing unbalance.
(d) Mechanical defects:
Bent shaft.
Rotating element binds.
Worn bearings.

SECTION VII

SERVICE PARTS AND PARTS LIST

SERVICE PARTS

The severity of the conditions of service, the extent to which repairs can be carried out in the field and the number of units installed will determine to a great extent the minimum number of service parts which should be carried in stock at the site of the installation.

The minimum service parts for one pump should include the following:

1. A set of bearings.
2. A shaft sleeve.
3. *A set of wearing rings.
4. A set of grease seals.
5. Sufficient stock of spare stuffing box packing and material for the casing gaskets.

*NOTE: If rings are ordered as service parts after the pump has been put into service, undersized stationary rings or oversized impeller rings will not be furnished unless specifically requested by the customer. If undersize or oversize rings are desired, the amount of undersize or oversize of the rings will be 1/8" on the I.D. or the O.D.

It is recommended as insurance against delays that spare parts be purchased at the time the order for the complete unit is placed or as soon after receiving the pump as possible.

HOW TO ORDER SERVICE PARTS

When ordering service parts the pump serial number, size, and type of pump must be given.

Refer to the nameplate. This information is essential in order that Worthington may identify the pump and furnish the correct parts. Give the name and number of the part as listed in the parts list of the sectional elevation applicable to the pump, the quantity required and where possible the complete symbols stamped on the old part. Orders for service parts should be sent to the nearest Worthington Sales Office.

RETURNING PARTS

All materials returned to the factory must have a shipping label attached. Consult the nearest Sales Office or Worthington Service Corporation (W.S.C.) office for shipping instructions. Unnecessary delays are avoided when parts or equipment are returned to the proper factory using the correct procedure. Contact your nearest Sales Office or W.S.C. Office, listing the material to be returned and the reasons for returning it.

GEH-3296C

INSTRUCTIONS

TRI/CLAD® VERTICAL INDUCTION MOTORS

NORMAL THRUST, SOLID SHAFT, "P" BASE

FRAMES 213-445, B254-B445, 6284-6289, 6314-6339

OPEN ENCLOSURES

Lubrication Page 4

INTRODUCTION

General Electric vertical motors covered by these instructions are carefully constructed of high-quality materials and are designed to give long periods of trouble-free service when properly installed and maintained.

The ventilating openings and the bearing lubrication system have been arranged for the ultimate in vertical motor operation. Therefore, these normal-thrust motors (see Fig. 1) are suitable for operation in the shaft-down position only unless otherwise recommended by the General Electric Company.

General mechanical construction for wound-rotor motors is the same as for other types with the addition of rings, brushes, rotor windings, etc. (see Fig. 4).

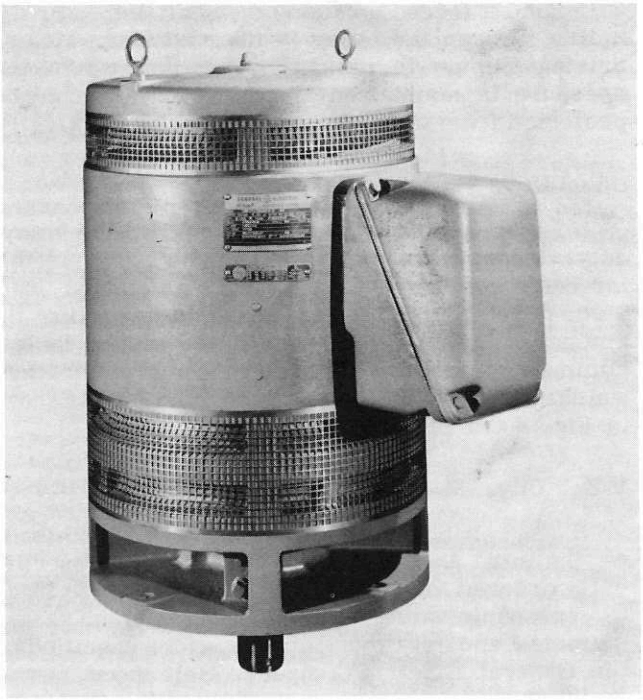

Fig. 1. Typical vertical motor

RECEIVING, HANDLING AND STORAGE

Each motor should be carefully examined upon arrival, and any damage reported promptly to the carrier and to the nearest office of the General Electric Company.

WARNING: *MOTORS SHOULD BE LIFTED BY THE EYEBOLTS OR LUGS PROVIDED. THESE LUGS OR EYEBOLTS ARE INTENDED FOR LIFTING THE MOTOR ONLY AND MUST NOT BE USED TO LIFT ANY ADDITIONAL WEIGHT. CHECK EYEBOLTS BEFORE LIFTING TO BE SURE THAT THEY ARE SCREWED IN ALL THE WAY. BE CAREFUL NOT TO TOUCH OVERHEAD POWER LINES WITH LIFTING EQUIPMENT. FAILURE TO OBSERVE THIS WARNING MAY RESULT IN PERSONAL INJURY OR DEATH.*

If the motor is not to be installed immediately, it should be stored in a clean, dry location. Precautions should be taken to prevent the entrance of moisture, dust, or dirt during storage and installation.

During storage, windings should be protected from excessive moisture absorption by some safe and reliable method of heating. Space heaters, if supplied, may be used for this purpose. The temperature of the windings should always be maintained a few degrees above the temperature of the surrounding air. It is recommended that motors in storage be inspected, the windings meggered, and a log of pertinent data kept. Any significant decrease in insulation resistance should be investigated.

See RELUBRICATION for details of lubrication of motors in storage.

If the motor is to be in storage for over one year, it is recommended that competent technical inspection service be contracted for, such as General Electric Installation and Service Engineering Department, to ensure that the storage has been adequate and that the motor is suitable for service.

GENERAL ELECTRIC INSTALLATION AND SERVICE ENGINEERING OFFICES

FIELD SERVICE OFFICE CODE KEY
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- † Electrical & Electronic Service
- ‡ Marine Service
- ✗ Transportation

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- † Jackson 49201 . . . . . 210 W. Franklin St.
- † Saginaw 48607
  . . . . . 1008 Second National Bank Bldg.

MINNESOTA
- † ‡ Duluth 55802 . . . . . 300 W. Superior St.
- * † ‡ Minneapolis 55416 . . . 1500 Lilac Drive So.

MISSOURI
- * † Kansas City 64199. . . . . 911 Main St.
- * † St. Louis 63101 . . . . . .1015 Locust St.

MONTANA
- † Butte 59701 . . . . . 103 N. Wyoming St.

NEBRASKA
- * † Omaha 68102 . . . . . 409 S. 17th St.

NEW JERSEY
- * † Millburn 07041. . . . . 25 E. Willow St.

NEW YORK
- † ‡ Albany 12205. . . . 15 Computer Drive, West
- * † ‡ Buffalo 14205 . . . . . 325 Delaware Ave.
- * † ‡ ✗ New York 10022 . . . . . 641 Lexington Ave.
- * Rochester 14604. . . . . 89 East Ave.
- * † ‡ Syracuse 13206 . . . . . 3532 James St.

NORTH CAROLINA
- * † ‡ Charlotte 28207 . . . . . 141 Providence Rd.
- * Wilmington
  Reigelwood 28456 . . . . . P. O. Box 186

OHIO
- * † Cincinnati 45206. . . . . 2621 Victory Pkwy.
- * † ‡ Cleveland 44104 . . . . . 1000 Lakeside Ave.
- † Columbus 43229 . . . . . 1110 Morse Rd.
- † ‡ Toledo 43606 . . . . . 3125 Douglas Rd.
- † Youngstown 44507. . . . . 272 Indianola Ave.

OKLAHOMA
- * † Oklahoma City 73106. . . 2000 Classen Blvd.
- † Tulsa 74105 . . P. O. Box 7646, Southside Sta.

OREGON
- † Eugene 97401. . . . . 1170 Pearl St.
- * † ‡ Portland 97210. . . . . 2929 NW 29th Ave.

PENNSYLVANIA
- * Allentown 18102 . . . . . 1444 Hamilton St.
- * † ‡ Philadelphia 19102 . . . 3 Penn Center Plaza
- * † Pittsburgh 15222 . . . . 300 6th Avenue Bldg.

SOUTH CAROLINA
- † ‡ Columbia 29204 . . . . . 2700 Middleburg Dr.
- † Greenville 29607. . 41 No. Pleasantburg Dr.

TENNESSEE
- * † Chattanooga 37411
  . . . . . 5800 Bldg, Eastgate Center
- † Memphis 38130. . . . . 3385 Airways Blvd.

TEXAS
- * † Amarillo 79101 . . . . . 303 Polk St.
- * † ‡ Beaumont 77704 . . . . . .1385 Calder Ave.
- * ‡ Corpus Christi 78401. . 205 N. Chaparral St.
- * † Dallas 75222 . . . . 8101 Stemmons Freeway
- * † El Paso 79945 . . . . . 215 N. Stanton
- † Fort Worth 76102 . . . . . 408 W. Seventh St.
- * † ‡ Houston 77027 . . . . . 4219 Richmond Ave.
- † San Antonio 78204. . . . . 434 S. Main St.

UTAH
- † Salt Lake City 84111 . . 431 S. Third East St.

VIRGINIA
- * ‡ Newport News 23601 . . . . . 311 Main St.
- † ‡ Richmond 23230. . . . 1508 Willow Lawn Dr.
- † Roanoke 24015. . . . . 2018 Colonial Ave.

WASHINGTON
- * † ‡ Seattle 98188
  . . . . . 112 Andover Park East, Tukwila
- † Spokane 99202 . . . . . E. 1805 Trent Ave.

WEST VIRGINIA
- * † Charleston 25328 . .306 MacCorkle Ave., SE

WISCONSIN
- * Appleton 54911. . . . 3003 West College Dr.
- † ‡ Milwaukee 53202 . . . . . 615 E. Michigan St.

GENERAL ELECTRIC SERVICE SHOPS

WHEN YOU NEED SERVICE . . . These GE Service Shops will repair, recondition, and rebuild your electric apparatus. The facilities are available day and night, seven days a week, for work in the shops or on your premises. Latest factory methods and genuine GE renewal parts are used to maintain performance of your equipment. For full information about these services, contact your nearest service shop or sales office.

ALABAMA
- • * Birmingham 35211 . . 1500 Mims Ave., S. W.
- • Mobile 36609 . . . . . 721 Lakeside Dr.

ARIZONA
- • (Phoenix) Glendale 85019 . 4911 W. Colter St.
- • Phoenix 85019 . . . . . 3840 W. Clarendon St.
- • Tucson 85713. . . . 2942 So. Palo Verde Ave.

CALIFORNIA
- • Los Angeles 90301 . . . . 6900 Stanford Ave.
- • (Los Angeles) Anaheim 92805
  . . . . . 3601 E. LaPalma Ave.
- * (Los Angeles) Inglewood 90301
  . . . . . 228 W. Florence Ave.
- • Sacramento 95814. . . . . 99 North 17th St.
- • * (San Francisco) Oakland 94608
  . . . . . 1650 34th St.

COLORADO
- • * Denver 80205. . . . . 3353 Larimer St.

CONNECTICUT
- • * (Southington) Plantsville 06479
  . . . . . .370 Atwater St.

FLORIDA
- • * Jacksonville 32203 . . . . 2020 W. Beaver St.
- • (Miami) Hialeah 33010. . . 1062 East 28th St.
- • * Tampa 33601 . . . . . 19th & Grant Sts.

GEORGIA
- • (Atlanta) Chamblee 30341
  . . . . . 5035 Peachtree Industrial-Blvd.
- * Atlanta . . . . . 2379 John Glenn Dr.

ILLINOIS
- • * Chicago 60638 . . . . 6045 S. Nottingham Ave.

INDIANA
- • Evansville 47711 . . . 401 N. Congress Ave.
- • Ft. Wayne 46803. . . . . 1731 Edsall Ave.
- • Hammond 46320 . . . . . 1138 164th Place
- • * Indianapolis 46222 . . . 1740 W. Vermont St.

IOWA
- • (Davenport) Bettendorf 52722 . 1025 State St.

KENTUCKY
- • Louisville 40209. . . . 3900 Crittenden Drive

LOUISIANA
- • Baton Rouge 70814 . . . 10955 North Dual St.
- • * New Orleans 70114 . . . . .1115 DeArmas St.

MARYLAND
- • * Baltimore 21230. . . . . 920 E. Fort Ave.

MASSACHUSETTS
- • * △ (Boston) Medford 02155
  . . . . . .3960 Mystic Valley Pkwy.

MICHIGAN
- • * △ (Detroit) Riverview . . . . 18075 Krause Ave.
- • Flint 48505 . . . . . 1506 E. Carpenter Rd.

MINNESOTA
- • Duluth 55807 . . . 50th Ave. W & St. Louis Bay
- • * Minneapolis 55430 . . . . 2025 49th Ave., N.

MISSOURI
- • * Kansas City 64120. . . . . 3525 Gardner Ave.
- • * St. Louis 63110 . . . . . 1115 East Rd.

NEW JERSEY
- • New Brunswick 08902 . . . . . 3 Lawrence St.

NEW MEXICO
- • Albuquerque 87109 . . . 4420 McLeod Rd. NE

NEW YORK
- • Albany 12205 . . . . . 1097 Central Ave.
- • * (Buffalo) Tonawanda 14150 . . 175 Milens Rd.
- • (Long Island) Old Bethpage 11804
  . . . . . 183 Bethpage-Sweet Hollow Rd.
- • (New York City) North Bergen, N. J. 07012
  . . . . . 6001 Tonnelle Ave.
- * (New York City) Clifton, N. J. 07012
  . . . . . 9 Brighton Rd.
- * △ Schenectady 12305 . . . . . 1 River Rd.
- • Syracuse 13208. . . . 1015 E. Hiawatha Blvd.

NORTH CAROLINA
- • * Charlotte 28208 . . . . . 2328 Thrift Rd.

OHIO
- • Akron (Canton) 44720
  . . . . . 7900 Whipple Ave. N. W.
- • * Cincinnati 45202. . . . . .444 West 3rd St.
- • * △ Cleveland 44125 . . . . . 4477 East 49th St.
- • Columbus 43229 . . . . . 6660 Huntley Rd.
- • * Toledo 43605 . . . . . 405 Dearborn Ave.
- • Youngstown 44507. . . . 272 E. Indianola Ave.

OKLAHOMA
- • Tulsa 74145. . . . . 5220 S. 100th East Ave.

OREGON
- • Eugene 97402 . . . . . 570 Wilson St.
- • * Portland 97210 . . . . . 2727 NW 29th Ave.

PENNSYLVANIA
- • Allentown 18103 . . . . . 668 E. Highland St.
- * (Delaware Valley) Cherry Hill, N. J., 08034
  . . . . . 1790 E. Marlton Pike
- • Johnstown 15802 . . . . . 841 Oak St.
- • Philadelphia 19124 . . . 1040 East Erie Ave.
- • * (Pittsburgh) West Mifflin 15122
  . . . . . 4930 Buttermilk Hollow Rd.
- • York 17403 . . . . . 54 N. Harrison St.

SOUTH CAROLINA
- • (Charleston) No. Charleston 29401
  . . . . . 2490 Debonair St.

TENNESSEE
- • Knoxville 37914
  . . . . . 2621 Governor John Sevier Hwy.
- • Memphis 38107. . . . . 708 North Main St.

TEXAS
- • Beaumont 77705 . . . . . 1490 W. Cardinal Dr.
- • Corpus Christi 78401 . . . . . 115 Waco St.
- • * Dallas 75235 . . . . . 3202 Manor Way
- • Houston 77036 . . . . 5534 Harvey Wilson Dr.
- * Houston 77036 . . . . . 6916 Harwin Dr.
- • Midland 79701 . . . . . 704 S. Johnston St.

UTAH
- • * Salt Lake City 84110 . . . 301 S. 7th West St.

VIRGINIA
- • * Richmond 23224 . . . . . 1403 Ingram Ave.
- • Roanoke 24013 . . . . . 1004 River Ave., SE

WASHINGTON
- • * Seattle 98134 . . . . . 3422 First Ave., South
- • Spokane 99211 . . . . . E. 4323 Mission St.

WEST VIRGINIA
- • * Charleston 25328 . .306 MacCorkle Ave., SE

WISCONSIN
- • (Appleton) Menasha 54910 . . 1725 Racine St.
- • Milwaukee 53207 . . . 235 W. Oklahoma Ave.

• Electrical/Mechanical Service Shop * Instrumentation Shop △ Special Manufacturing Shop

GENERAL ELECTRIC COMPANY • VERTICAL MOTOR PRODUCTS SECTION • SAN JOSE MOTOR PLANT
SAN JOSE, CALIFORNIA 95114

6–75 (5M)

PRINTED IN U.S.A.

INDUSTRIAL DRIVE SHAFTS

Lubrication Instructions

The Universal Joints should be lubricated through the centrally located lubrication fitting in the Journal Cross.

Use 140 S.A.E. Straight Mineral Oil or

Lithium Base Greases - such as -

Shell Alvania E.P. No. 2

Imperial Esso MP-EP

Gulf Crown E.P. No. 2

.....

The Sliding Splines should be lubricated through the Lubrication Fitting in the Sleeve Yoke.

Use a good grade of long fibre grease.

.....

Observe this lubrication cycle:

For Continuous Service - Every 200 hours.

For Intermittent Service - Every 500 hours.

.....

INDUSTRIAL DRIVE SHAFTS

Installation Instructions

It is of primary importance that these conditions are observed.

1 - That the Universal Joints are of sufficient capacity.

2 - That the lugs of the yokes are in Line.
Use a straight edge, to align the lugs of the sleeve Yoke with the lugs of the Stub Ball Yoke so that lugs of both Yokes are in line.

3 - For Two Joint Assemblies make sure that both driving and driven shafts are parallel.

Assemble the Companion Flanges to the Shafts and check the angles with a protractor.

The preferred offset between the parallel Shafts should be from 1/4" to 1/2" per foot.

The difference between the parallel faces of the Companion Flanges when measured first at the top and then at the bottom with a 24" straight edge should not exceed 1/8". Shim the space between the foundation and either the driving or driven unit to obtain this alignment within 1/8".

Normally, the Slip Joint is installed nearest the source of power to eliminate End Thrust.

4 - In vertical shaft installations, observe item 3, except install Slip Joint of the driven (lower) end of the Shaft to permit suspension from the top by the Motor Thrust Bearings. If the suspended weight exceeds 200 pounds, the Companion Flange at the Motor should be securely locked to the Motor Shaft by a Flange Nut or Cap Screw, Washer and Lock Washer or by drilling through the Flange and Motor Shaft and securing with a Pin or Bolt.

5 - In vertical shaft installations, install the Two Joint Assembly at the driven end (pump), use as many Joint and Shafts (Center Sections) with Center Bearings as are needed, arranging these alternately parallel to the driving and driven shafts so that the joint angles do not exceed 3°.

6 - If there is a difference between the speed of the driving unit and the speed of the driven unit, the Universal Joints should be used between the driving unit and the Shaft of the Speed Reducer, Chain or V-Belt.

CUSTOMER: CANADIAN GENERAL ELECTRIC CO.

DATE: AUGUST 27, 1975

REQN. 9203-9261-00-06324-000

C.O.# 80754021

MODEL 5K6318XC295A
ITEM 1

REED CRITICAL FREQUENCY DATA

TO AVOID EXCESSIVE VIBRATION IT IS NECESSARY THAT THE REED CRITICAL FREQUENCY (CPM) OF THE MOTOR-PUMP SYSTEM BE NUMERICALLY AT LEAST 25% ABOVE OR BELOW MOTOR OPERATING SPEED (RPM). DESIGN OF COMPLETE SYSTEM (MOTOR, PUMP, FOUNDATIONS AND PIPING) MUST PROVIDE FOR THIS.

MOTOR DATA FOR SYSTEM CRITICAL CALCULATION ARE BELOW. REED CRITICAL FREQUENCY AND DEFLECTION OF MOTOR AT CENTER OF GRAVITY (C.G.) ARE SHOWN FOR MOTOR BOLTED TO A RIGID MASS AND CONSIDERED AS A HORIZONTAL CANTILEVER BEAM. DEFLECTION OF MOTOR AT C.G. IS THAT CAUSED BY WEIGHT OF MOTOR ONLY, AT STANDSTILL.

MOTOR WEIGHT	2450 LBS.
DIST. FROM MOTOR BASE TO C.G.	25 INCHES
MOTOR REED CRITICAL FREQUENCY	2420 CPM
DEFLECTION ON MOTOR AT C.G.	.0060 INCHES

MINIMUM ALLOWABLE CONTINOUS DOWNTHRUST TO PREVENT DAMAGE TO GUIDE BEARING -0-.

MOMENTARY PERIODS OF UPTHRUST OR LIGHTER DOWNTHRUST ARE PERMISSIBLE.

GENERAL ELECTRIC COMPANY
SAN JOSE, CALIFORNIA

RCF-1

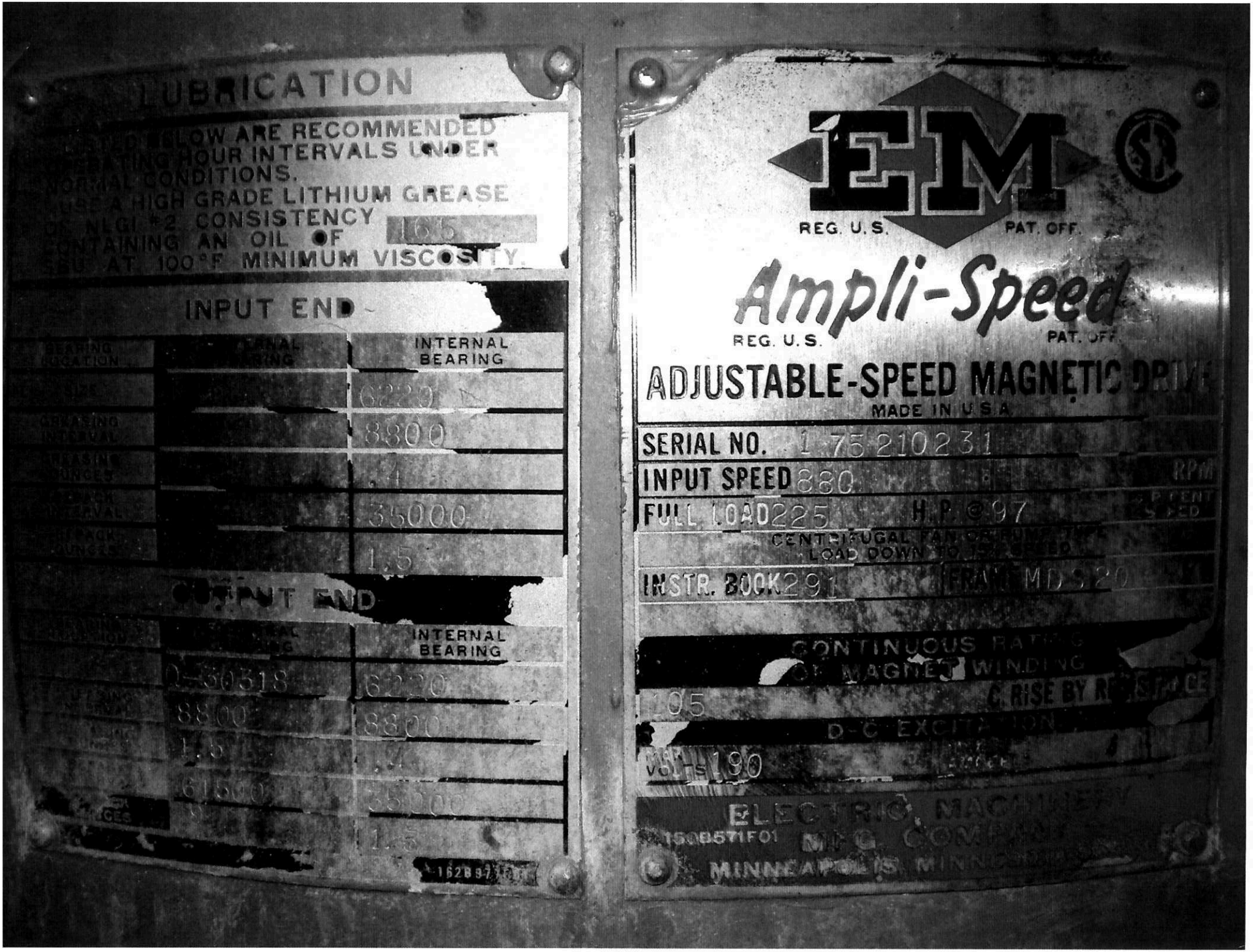
HOW TO ORDER SERVICE PARTS

When ordering service parts the pump serial number, size, and type of pump must be given.

Refer to the nameplate. This information is essential in order that Worthington may identify the pump and furnish the correct parts. Give the name and number of the part as listed in the parts list of the sectional elevation applicable to the pump, the quantity required and where possible the complete symbols stamped on the old part. Orders for service parts should be sent to the nearest Worthington Sales Office.

RETURNING PARTS

All materials returned to the factory must have a shipping label attached. Consult the nearest Sales Office or Worthington Service Corporation (W.S.C.) office for shipping instructions. Unnecessary delays are avoided when parts or equipment are returned to the proper factory using the correct procedure. Contact your nearest Sales Office or W.S.C. Office, listing the material to be returned and the reasons for returning it.


LUBRICATION
ARE RECOMMENDED
HOUR INTERVALS UNDER
NORMAL CONDITIONS.
A HIGH GRADE LITHIUM GREASE
CONSISTENCY
AN OIL OF
AT 100°F MINIMUM VISCOSITY.
INPUT END
INTERNAL BEARING
6220
8800
35000
1.5
OUTPUT END
INTERNAL BEARING
6220
8800
8800
35000
1.5
REG. U.S.
PAT. OFF.
Ampli-Speed
REG. U.S.
PAT. OFF.
ADJUSTABLE-SPEED MAGNETIC DRIVE
MADE IN U.S.A.
SERIAL NO. 1 75 210231
INPUT SPEED 880
RPM
FULL LOAD 225
H.P. @ 97
PERCENT SPEED
CENTRIFUGAL FAN OR PUMP TYPE
LOAD DOWN TO
INSTR. BOOK 291
FRAME MD 320
CONTINUOUS RATING
OF MAGNET WINDING
C. RISE BY RESISTANCE
105
D-C EXCITATION
VOLTS 190
ELECTRIC
MFG. CO.
MINNEAPOLIS, MINN.

9-1-612-378-8000

RSCHWINN@WEB.NET

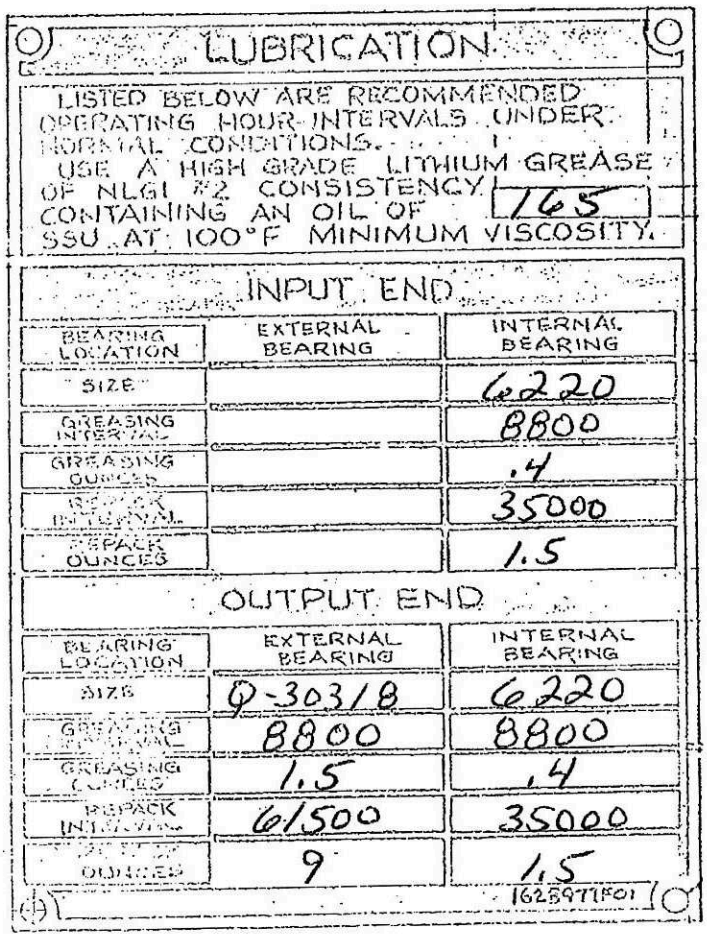
RONALD.SCHWINN@CONVERTEAM

PROD. NO. 75-2102-31

EM-13 PAGE 2

ITEM #40 CONTINUED

LUBRICATION PLATE STAMPING



LUBRICATION

LISTED BELOW ARE RECOMMENDED OPERATING HOUR INTERVALS UNDER NORMAL CONDITIONS.

USE A HIGH GRADE LITHIUM GREASE OF NLGI #2 CONSISTENCY CONTAINING AN OIL OF 165 SSU AT 100°F MINIMUM VISCOSITY.

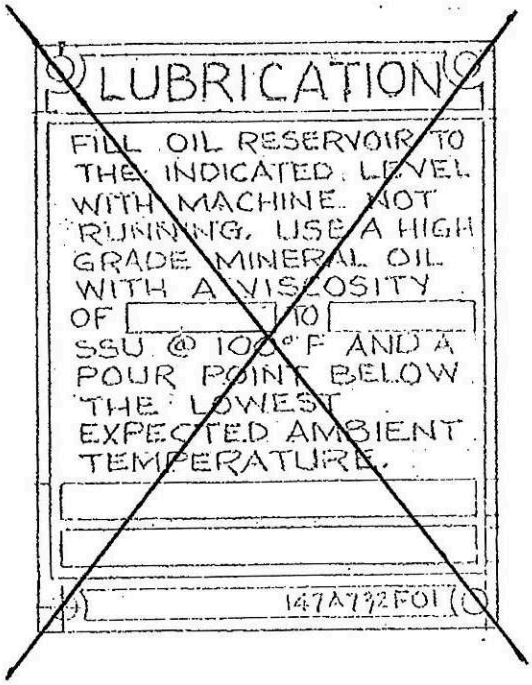
INPUT END

BEARING LOCATION	EXTERNAL BEARING	INTERNAL BEARING
SIZE		6220
GREASING INTERVAL		8800
GREASING OUNCES		.4
REPACK INTERVAL		35000
REPACK OUNCES		1.5

OUTPUT END

BEARING LOCATION	EXTERNAL BEARING	INTERNAL BEARING
SIZE	Q-30318	6220
GREASING INTERVAL	8800	8800
GREASING OUNCES	1.5	.4
REPACK INTERVAL	61500	35000
REPACK OUNCES	9	1.5

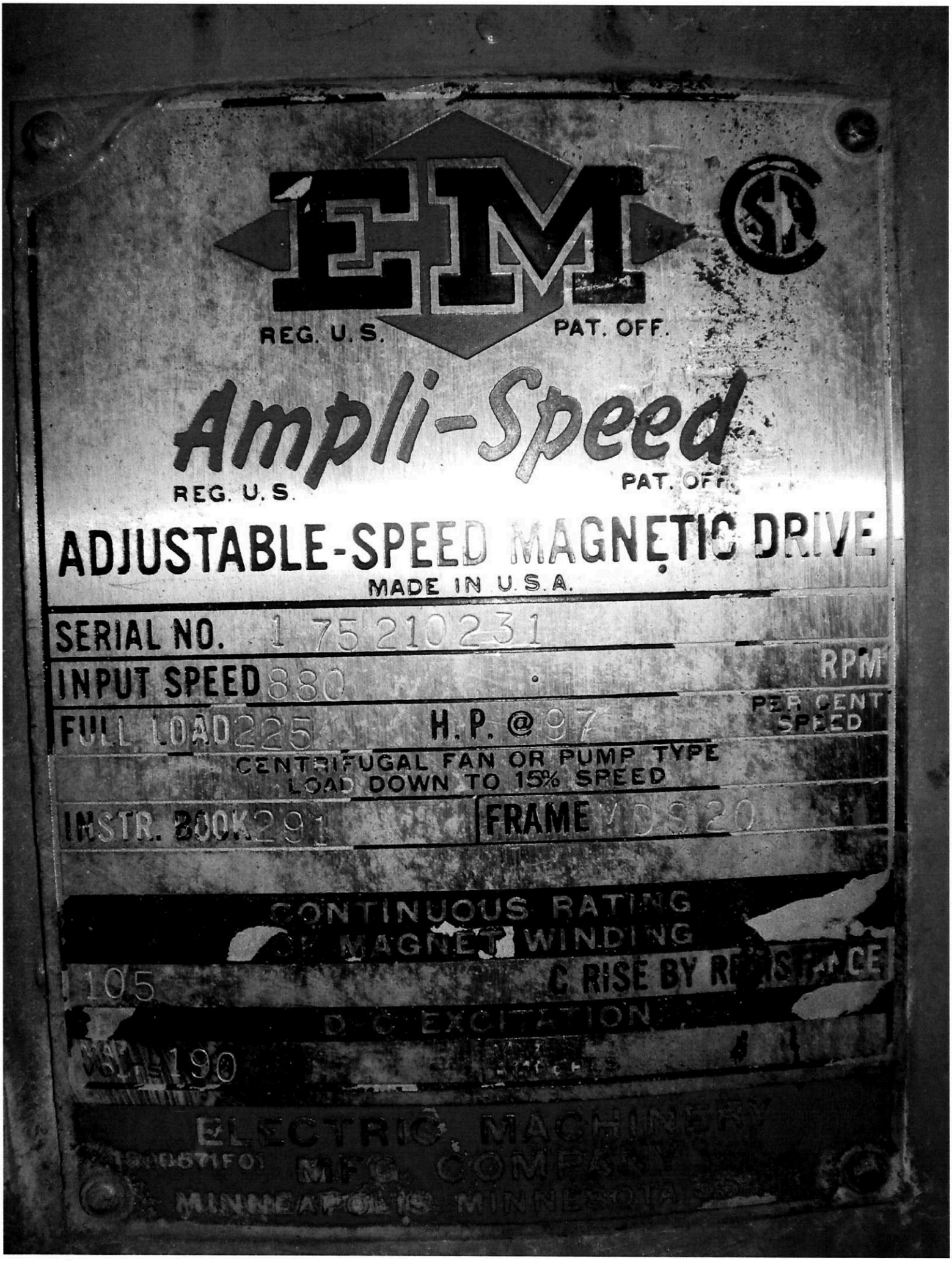
1625971F01

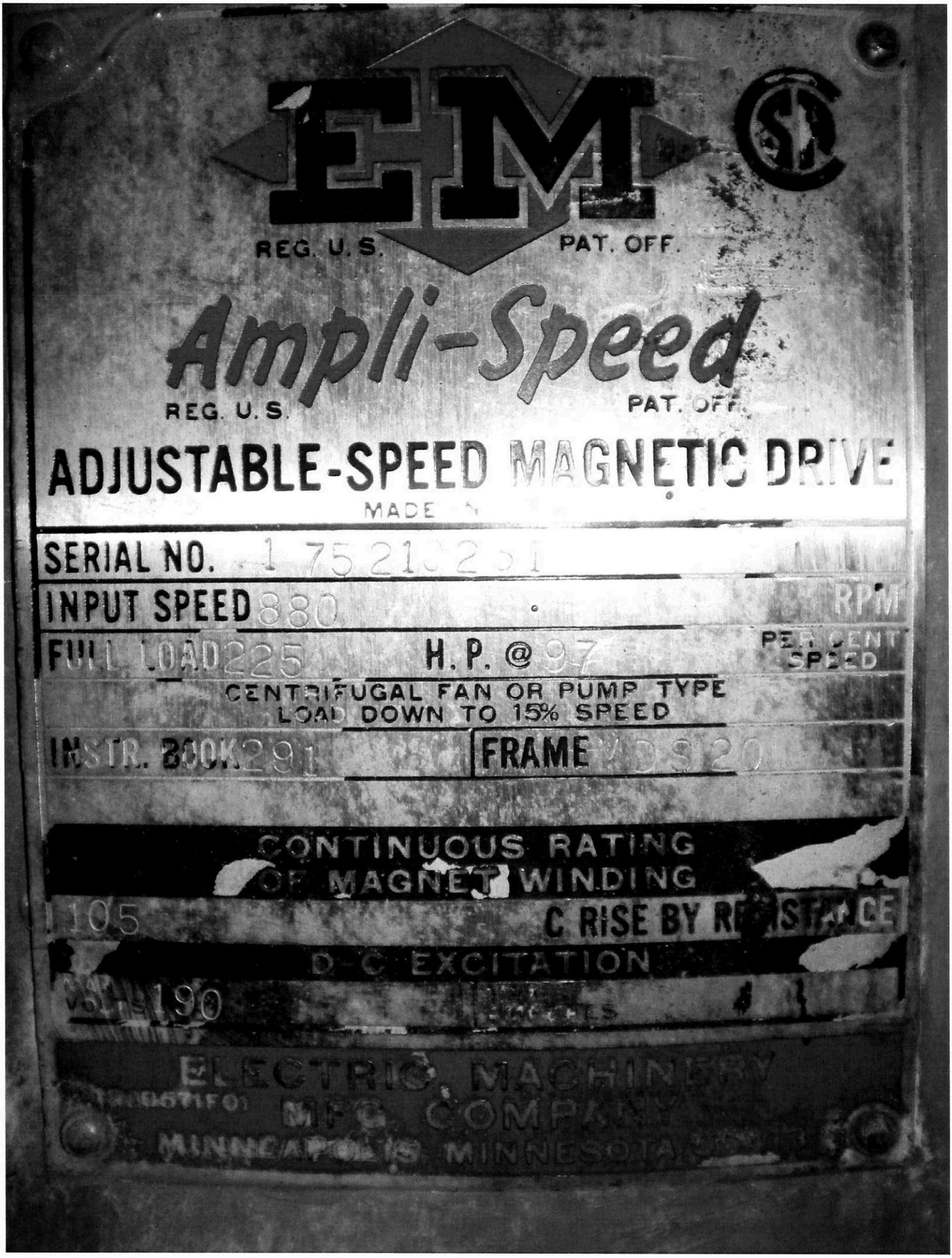


LUBRICATION

FILL OIL RESERVOIR TO THE INDICATED LEVEL WITH MACHINE NOT RUNNING. USE A HIGH GRADE MINERAL OIL WITH A VISCOSITY OF [ ] TO [ ] SSU @ 100°F AND A POUR POINT BELOW THE LOWEST EXPECTED AMBIENT TEMPERATURE.

147A732F01


EM
REG. U. S.
PAT. OFF.
Ampli-Speed
REG. U. S.
PAT. OFF.
ADJUSTABLE-SPEED MAGNETIC DRIVE
MADE IN U.S.A.
SERIAL NO. 1 75 210 231
INPUT SPEED 880
RPM
FULL LOAD 225
H.P. @ 97
PER CENT SPEED
CENTRIFUGAL FAN OR PUMP TYPE
LOAD DOWN TO 15% SPEED
INSTR. BOOK 291
FRAME VDS20
CONTINUOUS RATING
MAGNET WINDING
105
RISE BY RESISTANCE
D C EXCITATION
VOLTS 190
ELECTRIC MACHINERY
MFG. COMPANY
MINNEAPOLIS MINNESOTA


EM
REG. U. S. PAT. OFF.
Ampli-Speed
REG. U. S. PAT. OFF.
ADJUSTABLE-SPEED MAGNETIC DRIVE
MADE
SERIAL NO.
INPUT SPEED 880 RPM
FULL LOAD 225 H.P. @ 97 PER CENT SPEED
CENTRIFUGAL FAN OR PUMP TYPE
LOAD DOWN TO 15% SPEED
INSTR. BOOK 291
FRAME
CONTINUOUS RATING
OF MAGNET WINDING
105
C RISE BY RESISTANCE
D-C EXCITATION
VOLTS 190
ELECTRIC MACHINERY
MFG. COMPANY
MINNEAPOLIS MINNESOTA

ADJUSTABLE-SPEED MAGNETIC DRIVE

PUMP M 200

Krocil, Emil

From: Ronald Schwinn [RSchwinn@weg.net]
Sent: Friday, February 03, 2012 9:46 AM
To: Krocil, Emil
Subject: FW: S/N 75-2102-31 225 hp magnetic drive 880 rpm input

Mr Emil Krocil
City winnepeg, Manitoba Canada
Tele 204-986-5216
Cell 204-470-9694
Serial Number 1-75-2102-31
Email **ekrocil@winnipeg.ca**

Emil:

Below is the technical information you requested, will send attachments in following email
Hope this technical information is of some assistance.....Ron S EM

Clutch fld resistance between collector rings 14.5 ohms hot (operating temp)
, 12 ohms cold (25 C)

Full load current to clutch filed 12.1 amps dc

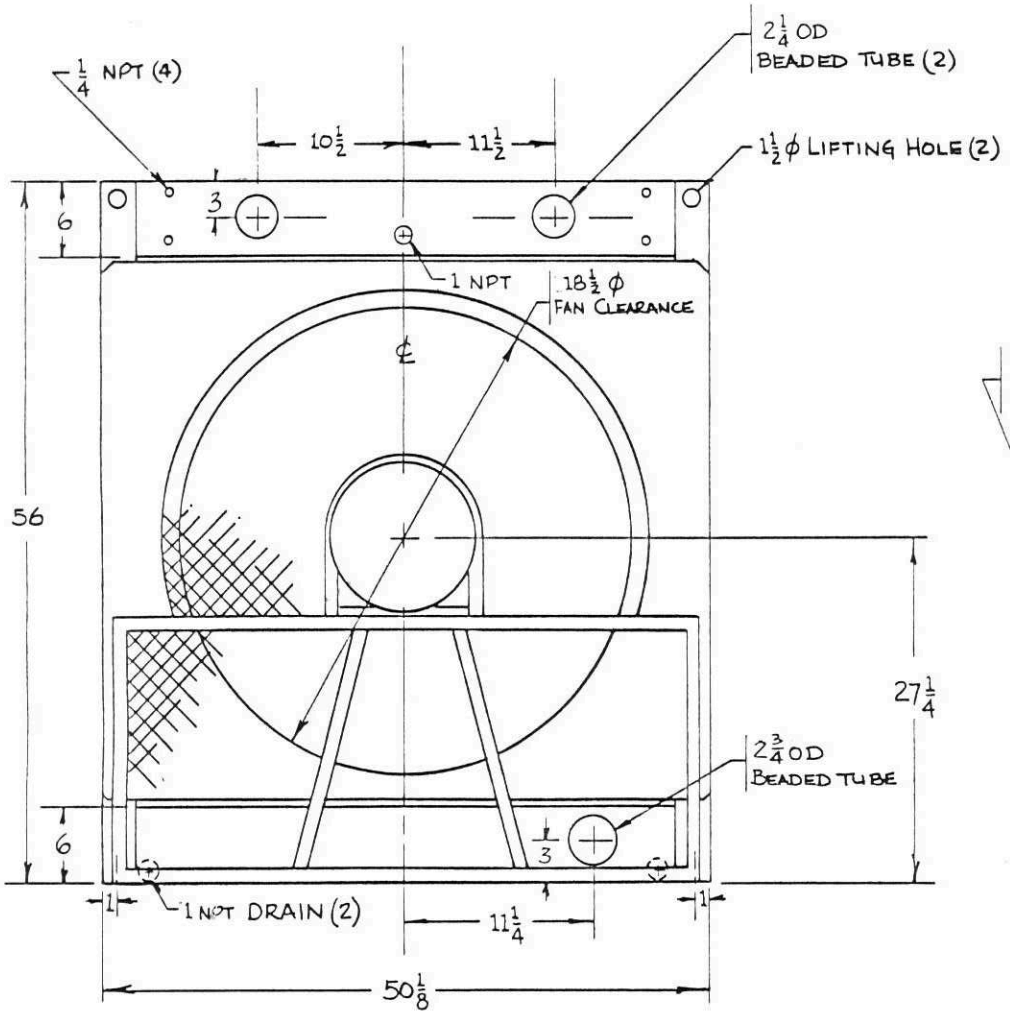
Control listed TCRS 16 , 190 VOLT DC (Capable of outputting to clutch 190 vdc and 16 amps dc)

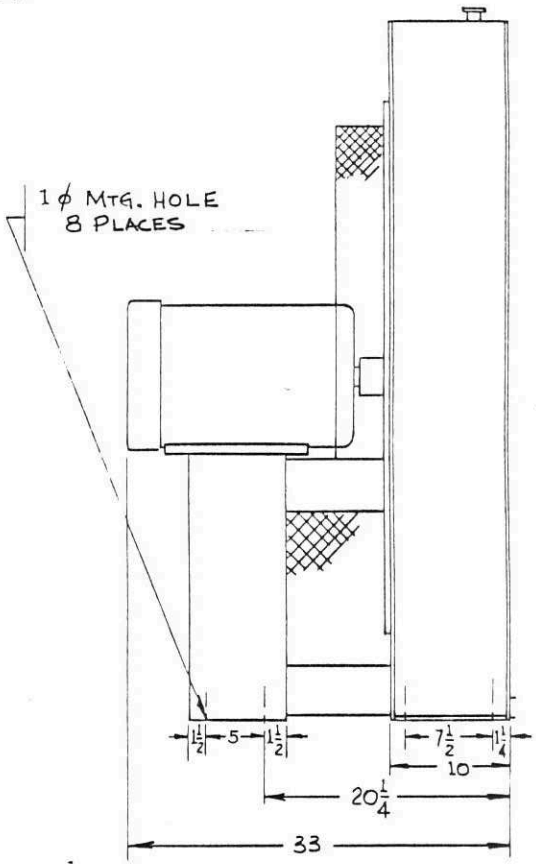
Lubrication: from nameplate drwg and file
Use a high grade lithium grease NLG#2
Containing an oil of 165 SSU @100F

BEARINGS SKF 6220
GREASING INTERVAL 8800 HRS
.4 OZS OF GREASE
REPACK INTERVAL 35,000 HRS
REPACK OZS 1.5

Perimeter

Diesel Pump.





NOTES:

1. ALL DIMENSIONS IN INCHES
2. MOTOR: 575/3/60, TEFC, 1200 RPM, 254-T, 7.5 HP.
3. FAN: 36ϕ, AXIAL, 8 BLADE.
4. COOLANT: 60/40 GLYCOL.
5. ENGINE POWER: 396 BHP @ 1800 RPM
6. ENGINE MODEL: 8V71-T

TOLERANCES	FANRAD CORP. MISSISSAUGA ONTARIO		
DECIMAL .	CLIENT HARPER DETROIT DIESEL	SCALE NTS	DRAWN BY JY
FRACTIONAL .	TITLE RADIATOR GENERAL ARRANGEMENT		
ANGULAR :	DATE 6 OCT. '80	DRAWING NUMBER MODEL FDR-3411	

INSTALLATION
AND
OPERATION
INSTRUCTIONS

FAIRBANKS MORSE
NO. 5700
HORIZONTAL, VERTICAL
VERTICAL BILTOGETHER
DRY PIT
ANGLEFLOW PUMPS

Colt Industries
Fairbanks Morse
Pump Division
KANSAS CITY, KANSAS 66110

STANDARD WARRANTY

Fairbanks Morse Inc Pump Division warrants products of its own manufacture against defects in materials and workmanship under normal use and service for the following periods:

Pumps One (1) year from date of installation or start-up, but not more than eighteen (18) months after date of shipment from the Fairbanks Morse Inc Pump Division factory.

This warranty is subject to the following terms and conditions:

Accessories and components not manufactured by Fairbanks Morse Inc Pump Division are warranted only to the extent of the original manufacturer's warranty.

THIS WARRANTY IS THE SOLE WARRANTY OF SELLER AND ANY OTHER WARRANTIES, EXPRESS, IMPLIED IN LAW OR IMPLIED IN FACT, INCLUDING ANY WARRANTIES OF MERCHANTABILITY AND FITNESS FOR USE ARE HEREBY SPECIFICALLY EXCLUDED.

The manufacturer's sole obligation under this warranty shall be, at its option, to repair or replace or refund the purchase price of, any product or part thereof which proves to be other than as warranted. Written permission must be obtained before returning any product or part(s) for replacement; no allowances will be made for repairs or alterations effected without written authorization from Fairbanks Morse Inc Pump Division.

Notice of the alleged defect must be given to the manufacturer within thirty days of the discovery of same during the warranty period and must state the serial number, type of equipment and date of purchase. If requested by the manufacturer, such product or part thereof must be promptly and prior to any attempted repair returned to the manufacturer or to an authorized service station designated by the manufacturer with shipping charges prepaid by customer. Manufacturer accepts no responsibility for loss or damage in transit of the goods nor will any claim be considered unless the returned goods are received intact and undamaged as the result of shipment. Replaced material returned to customer will be shipped F.O.B. the manufacturer's factory.

Under the terms of this warranty, the manufacturer shall not be responsible nor liable for:

a Consequential, collateral or special losses or damages;

b Defects caused by fair wear and tear, abnormal conditions of use, accident, neglect or misuse of equipment;

c Labor charges, loss or damage resulting from the supplying of defective part(s) or improper repairs by unauthorized persons;

d Damage caused by sand or abrasive materials, scale or chemical deposits, corrosion, lightning, improper voltage or mishandling.

If any servicing or repair is done by the manufacturer which is not covered by this warranty, a charge will be made in accordance with the manufacturer's current service contract prices.

The manufacturer reserves the right to substitute new and/or improved part(s) on any equipment adjudged defective and shall not be responsible for delays in shipment from the factory.

CREDIT WILL NOT BE ALLOWED ON ANY PART(S) OR EQUIPMENT RETURNED UNLESS PRIOR APPROVAL IN WRITING HAS BEEN OBTAINED.

This warranty is void unless the purchaser stores, installs and maintains the equipment in accordance with published instructions.

No employee of the manufacturer and no agent, dealer or distributor has any authority to change or enlarge the terms of this warranty or make any other or different warranty, and the manufacturer's obligation is limited strictly to the terms of this written warranty.

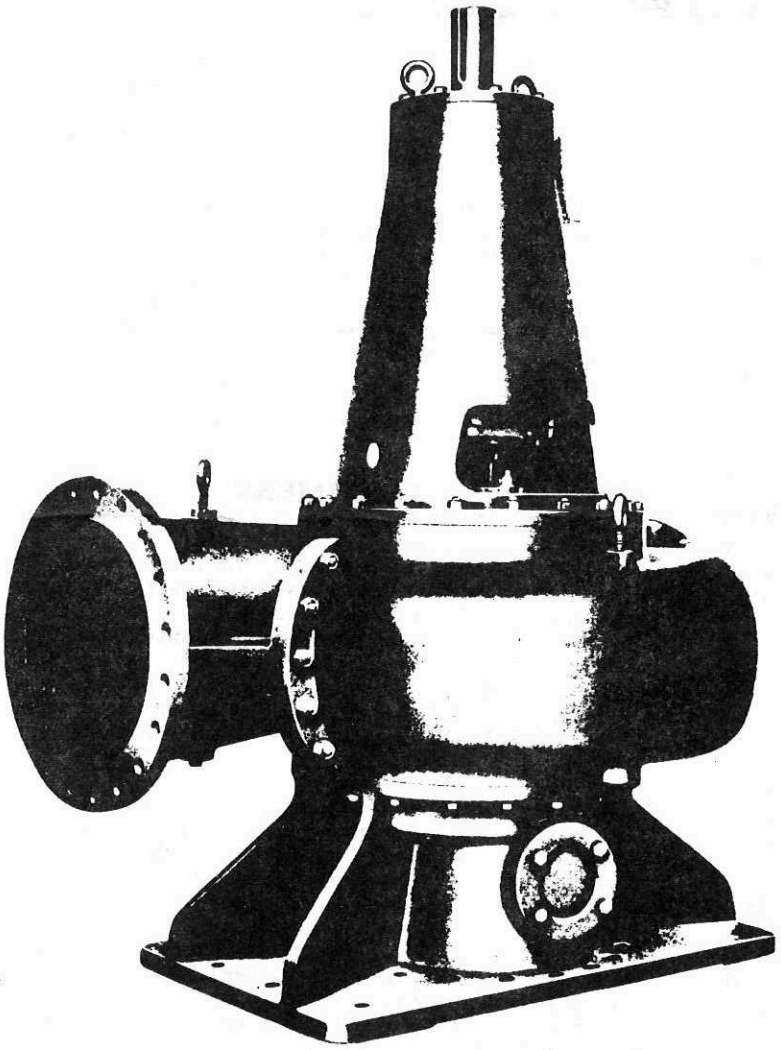
Claims under this warranty should be made to:

Colt Industries

Fairbanks Morse Pump Division
3601 Kansas Avenue
Kansas City, Kansas 66110

A division of the Colt Industries Operating Corp

INSTRUCTIONS NO. 5700



Horizontal
Vertical
Vertical Builtogethe
Dry Pit
Angleflow Pump

- **INSTALLATION**
- **OPERATION**
- **MAINTENANCE**
- **SERVICE & REPAIR**

FAIRBANKS MORSE
A MAJOR INDUSTRIAL COMPONENT OF
FAIRBANKS WHITNEY

PUMP AND HYDRAULIC DIVISION – KANSAS CITY, KANSAS

INSTRUCTIONS NO. 5700

for Installing and Operating

FAIRBANKS-MORSE

FIGURES 5710 5720 5730 & 5750

VERTICAL HORIZONTAL DRY PIT VERTICAL BUILTOGETHER CENTRIFUGAL

ANGLEFLOW PUMPS

Location -

The angle flow pumps should be located as close to the liquid supply as possible and preferably with a very low suction lift or a positive suction head. For the best operation it is advisable, whenever possible, to locate the pump so that the liquid flows to the suction opening by gravity. This is especially desirable where there is any possibility of the suction line becoming clogged by suspended solids. The total suction lift, including pipe friction, should not exceed 15 feet.

Foundations -

Massive foundations are unnecessary, but they should be constructed sufficiently heavy to support the pump so that it will be free from vibration. If the pump is to be belt driven, the foundation must be constructed to withstand the belt strain. It must be located so as to make the pump accessible at all times, and a suitable support for the piping must be provided. The top of the foundation should be finished off reasonably smooth and level; and the height be left a little less than desired. This allows for grouting after the pump has been set on the foundation.

ERECTING THE PUMP

Placing the Pump on the Foundation -

Place the pump on the foundation with foundation bolts in place, but not tightened. Support the base at several points, preferably near the foundation bolts, with steel wedges. These wedges should be of the proper thickness to bring the pump to the required level.

Single Base Mountings -

Upon installing a direct connected unit mounted on a single base, care should be taken to support the base at several points where the weight comes on the foundation, as it is liable to spring in handling and thus throw the shaft out of alignment. A good way to do this is to set the pump over the foundation bolts on as many steel or iron wedges as there are foundation bolts, placing the wedges as close to the foundation bolts as possible. These wedges should be of the proper thickness to bring the pump unit to its predetermined level. In case of larger sub-bases, other wedges may be placed at convenient points. After the unit has been leveled and the weight evenly distributed on all the wedges, attention should be given to the alignment of the coupling.

Support of Intermediate Shaft -

The installation of a vertical Angle Flow pump must be made in such a manner that the weight of the intermediate shaft (when required) is not borne by the pump bearings. For average installations, the weight of the shaft, including compression coupling, can be safety carried by the motor bearings. If the weight of the shaft cannot be borne by the motor bearings, a special thrust bearing must be installed immediately below the motor for the purpose of carrying the weight in which case a flexible coupling must be introduced between the motor shaft and the intermediate shaft so that the entire load will be carried by the special thrust bearing.

Connection of Pump and Intermediate Shaft -

A flexible coupling is introduced between the pump and the intermediate shaft and either a rigid or compression type coupling between the intermediate and motor shafts. It is good practice to install a piece of shafting immediately above the pump, that will permit removing the pump rotor without disturbing the intermediate shaft bearings or dismantling pipe connections; this should be connected by a compression coupling to the adjacent piece of intermediate shafting.

ALIGNMENT

Check Pump and Driving Machine Alignment -

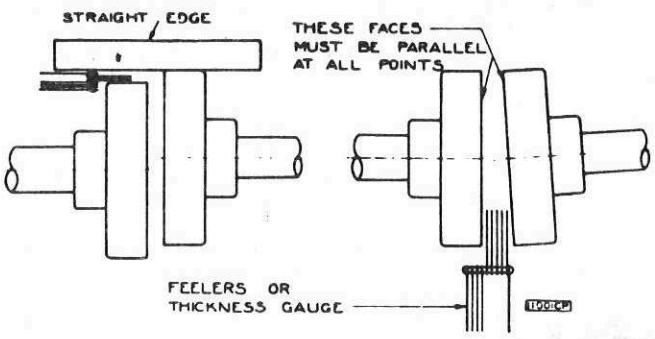
The following instructions cover foreign makes of couplings as well as Fairbanks-Morse. With couplings that are properly machined, accurate alignment is secured when the coupling faces are absolutely parallel as measured by feelers, and a straight edge placed squarely across the rings of the coupling halves. See Illustration. This alignment adjustment is accomplished by the use of wedges and shims under the pump feet.

When installing a coupling, it is well to check it carefully. Should there be any indication of misalignment, the adjustment is made by driving the wedges in or out until no variation is registered by the feelers or the straight edge.

Should the outside diameter of the coupling flanges vary slightly, this must be allowed for in checking the alignment. Any difference in height of one flange over the other should be checked with a straight edge and feelers at all points.

Chalk four marks 90° apart on the circumference of both coupling halves. Hold the pump half coupling stationary and rotate the driver half coupling 90° at a time and check the alignment each time. Particular care must be taken to keep all end play on the revolving coupling in one direction. The driver half coupling should now be held stationary, the pump half coupling revolved and the four points on the pump coupling checked with one point on the driver coupling. If any variation appears, it is advisable to check the coupling by placing it on an arbor.

The clearance between the faces of the coupling halves should be set so that they cannot strike, rub, or exert a pull on either machine. After the pump has been aligned and leveled, the foundation bolts can be tightened.



Suggested method of aligning couplings

Do not put the coupling bolts in until the engine has been tried out for proper rotation. After the unit has been leveled and connected, the alignment should be tested again, and if necessary, realigned by use of shims; when rechecking the alignment, make sure that the coupling bolts have been removed.

PIPING

Support Piping System Independently -

Always support all suction and discharge piping independently from the pump, otherwise the combined weight of the piping and the contained water would tend to spring the base and draw the pump out of alignment. It is a good plan when installing the piping to leave the suction and discharge connections to the pump until the last, being sure at the time these joints are made up that all flanges match without undue forcing. This eliminates the possibility of the pump being drawn out of alignment by the piping.

Remove Burrs and Sharp Edges -

When making up joints in the piping system, always remove the burrs and sharp edges from the pipe ends, and when flanged joints are used, be careful to have the inner diameters match. Burrs, sharp edges, unmatched joints, etc., all cause extra pipe friction and will reduce the capacity of the pump.

Install Make-Up Pieces -

In installations where the piping is cemented firmly, into the walls or foundation, it is a good plan to install short liners or "make-up" pieces next to the pump which can be removed easily and altered at any time to suit new fittings or additions to the pumping equipment.

Installations of Suction Pipe -

In making up the suction piping, too much care cannot be taken to have all joints absolutely air tight. If air is admitted, the capacity of the pump will be reduced. All horizontal sections of the suction pipe should be inclined gradually upward toward the pump in order to avoid all danger of air pockets.

Where possible, avoid connecting a pump to a series of wells, if this is necessary however, make sure that all piping and connections are air tight.

When necessary to connect two or more angle flow pumps to the same suction line, gate valves should be provided so that any pump may be taken out of operation and isolated from the line. Installations of this character require great care at all times to keep all gate valve stems and pump stuffing boxes well packed and air tight. If possible, install gate valves with the stems in a horizontal position, to avoid possible air pockets.

Suction Pipe Size

If the suction pipe is short, it may be of the same size as the suction opening in the pump. If, however, the pump is placed at a considerable distance from the water supply, the size should be increased one or two sizes depending on the distance.

Discharge Pipe Size -

If the discharge pipe is short, it may be of the same size as the discharge opening in the pump, but where it is of considerable length, it should be one or two sizes larger. If the pump is to discharge into a closed system or an elevated tank, it is always good practice to place a gate valve or a check valve in the discharge line close to the pump, so that the pump may be opened for inspection without flooding the immediate vicinity.

Avoid Elbows -

Make the suction and discharge piping as straight as possible, avoiding unnecessary elbows. Where elbows are required, it is preferable to use 45 degree fittings or long sweep 90 degree fittings instead of the regular 90 degree type.

Check Valves -

For pumps operating against high discharge heads, an effective check valve as well as a gate valve should be placed in the discharge line. The check valve should be installed between the gate valve and the pump. When shutting down the pump in installations where a foot valve is provided or there are other possibilities of water hammer, it is advisable that the discharge valve be closed before shutting off the power. A check valve is not furnished as regular equipment with the pump.

Foot Valve -

Where the pump operates against a low head or is installed for automatic operation, a foot valve should be provided to avoid the necessity of priming each time it is started. The valve should be of the flap type rather than the multiple spring type and should be of ample size to introduce no undue friction in the suction line. A foot valve is not furnished as regular equipment with the pump.

Expansion Allowance -

When pumps are driven by steam turbines, an allowance must be made for the fact that the turbine will expand as it is heated and the distance between the feet and the shaft center will increase. To allow for this expansion when lining up cold, the turbine should be set approximately .0005" low for every inch of height from the bottom of the feet to the centerline of the shaft. In any event when the turbine is lined up cold, the alignment should be checked when hot. Further checking should be made after the unit has been in service several hours. No heat allowance is made for electric motors. If possible, the motor should be operated alone before aligning up the pump so as to determine the magnetic center of the rotor. If this is not possible the rotor of the motor should be pulled over and pushed back to determine the collar clearance and then the rotor placed in mid-position for aligning.

LUBRICATION

Lubrication

Fairbanks-Morse recommends that all ball and roller bearings be lubricated with FMC05 "Oil Film Grease", unless otherwise specified by the Engineering Department. A definite procedure must be followed to insure proper and adequate lubrication. It is very important that the correct amount and the proper grade of grease be used in each bearing assembly. FMCO "Oil Film" grease prevents overheating even in cases where bearings are over greased. It is recommended that the

bearing housings be filled not more than 3/4 full.

When it is impossible to obtain FMCO "Oil Film Grease"; pure high grade vasoline can be used as a substitute.

Inspect the bearings at regular intervals to insure proper and adequate lubrication.

Packing -

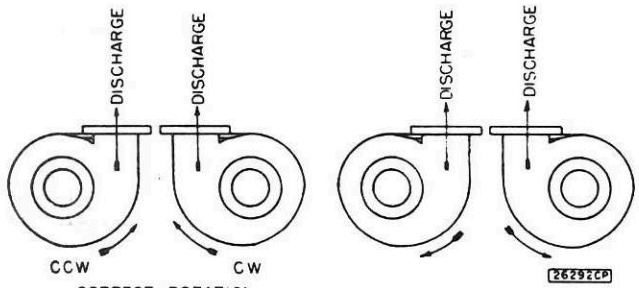
Before starting the pump, make sure that the packing gland nuts are drawn up evenly and the glands fit squarely in the stuffing boxes. Do not draw up the gland too tightly, as this will cause heating and in high speed pumps especially, the packing will be burned and glazed where it bears on the shaft thus rendering it useless and causing undue wear and grooving of the shaft sleeves. It is best to draw up the glands with a wrench sufficiently to set the packing and then release the nuts until they can be turned with the fingers. Always use a good grade of soft packing for renewal, as hard, inferior grades allow excessive water leakage and quickly wear grooves in the shaft sleeves.

Water Seal -

The stuffing boxes are fitted with water seal rings. This sealing chamber should be connected to a source of clear fresh water whenever possible. A grease seal may be used if clear fresh water is not available. This water seal insures cool running and at the same time prevents any air from being drawn through the stuffing box into the suction chamber of the pump. To insure that the water seal space is always supplied, be sure that the proper number of rings of packing are first placed in the stuffing box to bring the water seal ring directly in line with the supply pipe. When the pump is in operation, a small amount of water should be allowed to drip from the glands at all times, both to insure cool running and as an indication that the packing is not drawn up excessively tight.

Rotation -

If for any reason the pump is dismantled or a new impeller installed, make sure that the proper relations exist upon reassembly. The impeller must always rotate towards the discharge flange.



CORRECT ROTATION
ALWAYS VIEWED FROM THE DRIVEN END OF THE PUMP, PUMPS ROTATING TOWARD THE DISCHARGE OUTLET

WRONG ROTATION
PUMPS ROTATING AWAY FROM THE DISCHARGE OUTLET

BEFORE STARTING THE PUMP

Before starting the pump for the first time, attention to the following points should be given:

Water Seal -

Be sure that the water seal piping is connected properly.

Lubrication -

Make sure that the bearings are properly lubricated and that no dirt or grit has entered the bearing housings.

Packing -

It will be necessary to install the packing before starting the pump. Examine the packing glands and see that they fit in the stuffing boxes squarely and evenly. Also make sure that the gland nuts are not drawn up too tightly.

Rotation -

Be sure that the driving machine rotates the pump in the proper direction after it is started.

Rotate the pump a few revolutions by hand to be sure there is no binding due to mis-alignment, tight packing, etc.

Foreign Matter -

Take an inventory of tools used during installation. The suction and discharge nozzles of the pump make excellent places to lay tools which are apt to be forgotten and may be drawn into the pump when first started, causing damage to the impeller and casing. If any doubt exists as to the freedom of the suction line and casing from tools, bolts, nuts, etc., much time and expense may be saved by checking over this point before starting.

STARTING THE PUMP

Priming -

All centrifugal pumps, unless the water supply flows to them with sufficient head to fill the pump casing, must be primed before they will deliver water. This may be done by any one of the following methods, as best suit the local conditions.

Priming by Ejector -

Where steam or compressed air is available, this is a very convenient method of priming. Attach an ejector at the pipe tap on the top of the pump casing and make the necessary air or steam connections. A valve should be provided between the ejector and the pump which may be closed after the pump is primed and started. The discharge line from the pump must also be provided with a tight fitting gate valve, located so as to allow all the air to be exhausted from the pump casing and suction line. The length of time required for priming will be shortened and operation of the pump facilitated if this valve is placed as close to the pump as possible.

Priming by Vacuum Pump -

When steam or compressed air is not available, a hand or power operated air pump may be substituted for the ejector, the same statements applying as in the preceding paragraph on priming by ejector. If the pumping installation contains a power or steam driven pump of the reciprocating type, priming may be readily accomplished by connecting the top of the pump casing to the suction line of the reciprocating pump through suitable valves and piping. If the reciprocating pump is small, it may be necessary to provide a valve in the suction line of the reciprocating pump, so that the full suction force may be available at the centrifugal pump priming connection.

Priming by Water Supply -

When it is feasible to place a foot valve at the end of the suction pipe and a supply of water is available, this is a very convenient method of priming. A valve should be provided near the pump in the discharge line which should be closed during the priming operation. The water supply may be piped to the pump casing at any convenient point, and priming is accomplished by allowing the suction pipe and casing to fill. An air vent at the top of the pump casing must be provided, either by removing the pipe plug or by substituting an air cock for the plug.

Close Discharge Valve -

When starting the pump, close the gate valve in the discharge line.

Start at Reduced Speed -

After the pump is primed, start the driving machine, at reduced speed if possible, until satisfied that everything is operating satisfactorily. After this, bring up to full speed.

Do Not Run Empty -

If the pump fails to prime, do not run empty, as the wearing rings, which have very small clearances, are apt to heat, bind and cut. Locate and correct the condition preventing the proper priming of the unit before attempting to start again. It will do no good to run it empty and may cause damage.

Open Discharge Valve -

After the pump is properly primed and running at full speed, open the discharge line gate valve. This should be done slowly in order to bring the load on the driver gradually, and prevent water hammer in the distribution system. This is especially important on the larger units.

Air in Water Supply -

In some localities, the water supply contains an excessive amount of air or gas which tends to separate from the water and remain in the passages of the pump, thus causing the pump to become "Air Bound" and reducing the capacity. To prevent this condition, the pipe plug at the top of the casing should be loosened occasionally, enough to allow any entrapped air or gas to escape.

Drain Pump Casing -

Whenever there is a possibility of freezing, the pump should be drained during the shut down periods, to prevent breakage of the pump casing. Also drain all piping which may freeze during cold weather when the pump is not in operation.

Balance -

The unbalanced hydraulic end thrust due to the suction opening in one side of the impeller, is taken by a generously proportioned thrust bearing. This bearing is so designed that it carries radial load as well as axial load. The other bearing is mounted so that it carries radial load only. In addition, all impellers, pulleys, and couplings are given a careful static balance before leaving the factory, thus insuring freedom from vibration while in operation.

Guarantee -

All guarantees of performance of pumps made by Fairbanks, Morse & Co. are based on the understanding that the pump is to handle clear, fresh water, having a temperature not to exceed 85 degrees F., unless otherwise expressly stated.

Inspect Frequently -

If after the pump is installed, there is reason to suspect that the water has a deteriorating effect on the metals of which the pump is constructed, it is advisable to inspect them frequently so that any renewals can be made in sufficient time. Particular attention should be given to pumps handling sea water or acidulous water.

Special Metals -

Fairbanks, Morse & Co. does not guarantee the metals to withstand any corrosive action of the liquid; it does, however, advise the use of special metals, where such corrosive action is anticipated. When specially ordered, acid resisting metals are furnished as experience has proved to be best adapted for the service.

TROUBLE CHART

No Water Delivered -

1. Pump not primed.
2. Speed too low.
3. Discharge head too high.
4. Suction lift too high, check with gauges.
5. Impeller completely plugged.
6. Wrong direction of rotation.

Not Enough Water Delivered -

1. Air leaks in suction or stuffing boxes.
2. Speed too low.
3. Discharge head higher than anticipated.
4. Suction lift too high, check with gauges.
5. Impeller partially plugged.
6. Not enough suction head for hot water.
7. Mechanical defects:
   - Wearing rings worn.
   - Impeller damaged.
   - Casing packing defective.
8. Foot Valve too small.
9. Foot Valve not submerged to proper depth.

Not Enough Pressure -

1. Speed too low.
2. Air in water.
3. Mechanical defects.
   - Wearing rings worn.
   - Impeller damaged.
   - Casing packing defective.
4. Impeller too small in diameter.

Water Delivery Irregular -

1. Leaky suction line.
2. Water seal plugged.
3. Suction lift too high.
4. Air or gases in liquid.

Pump Takes Too Much Power -

1. Speed too high.
2. Head lower than calculated, pump too much water.
3. Liquid heavier than water.
   - Viscosity greater than water.
4. Mechanical defects:
   - Misalignment.
   - Shaft bent.
   - Rotating element binds.
   - Stuffing boxes too tight.
   - Wearing rings worn.
   - Casing packing defective.

Low Speed -

When pumps are direct connected to electric motors, check whether motor is across the line and receives full voltage. If the voltage of the supply circuit falls, motors will lose speed and power in most cases depending on the type. If the voltage fails completely, the motors will stop.

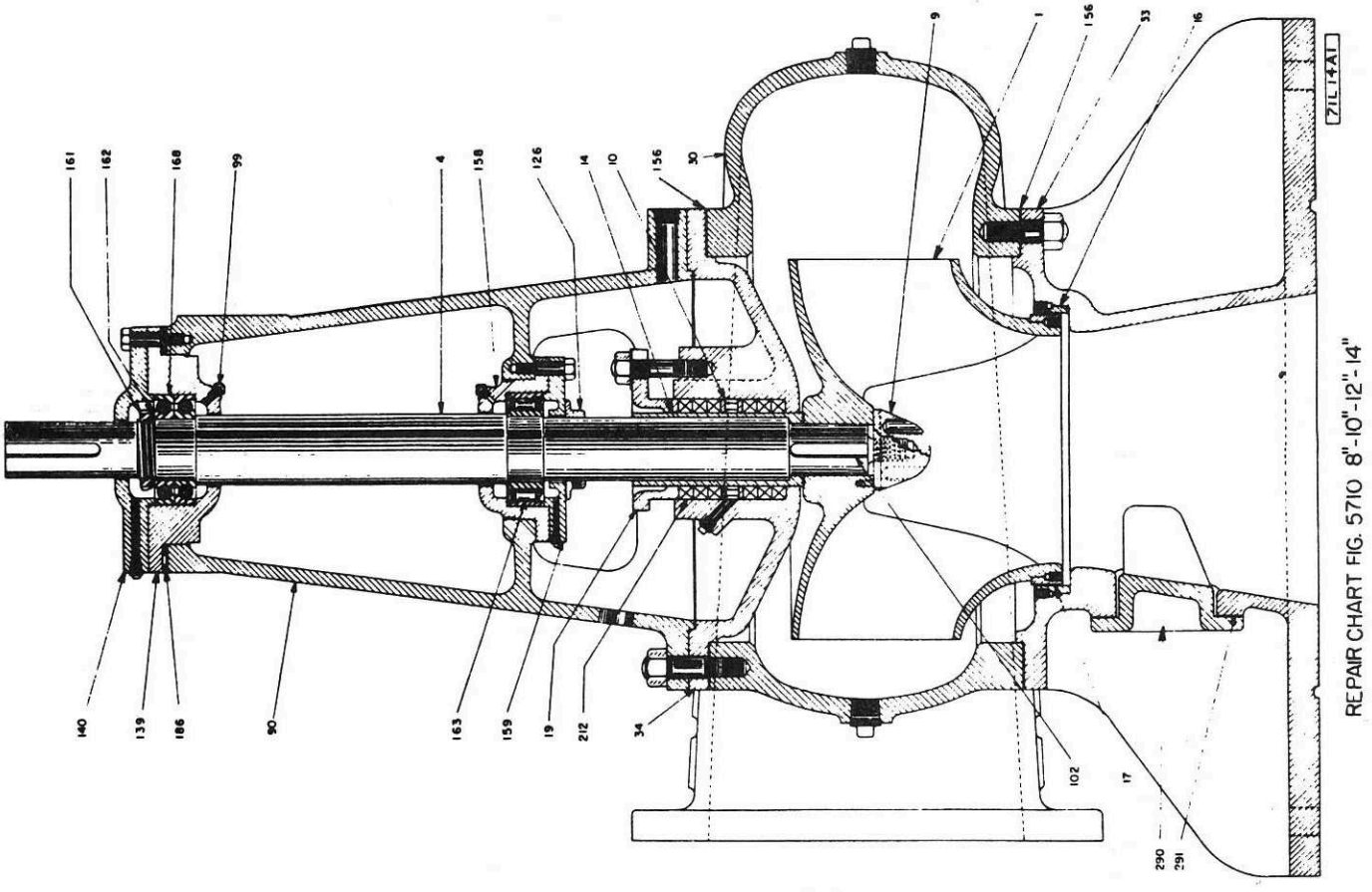
When pumps are direct connected to steam turbines, make sure that the turbine receives the full steam pressure.

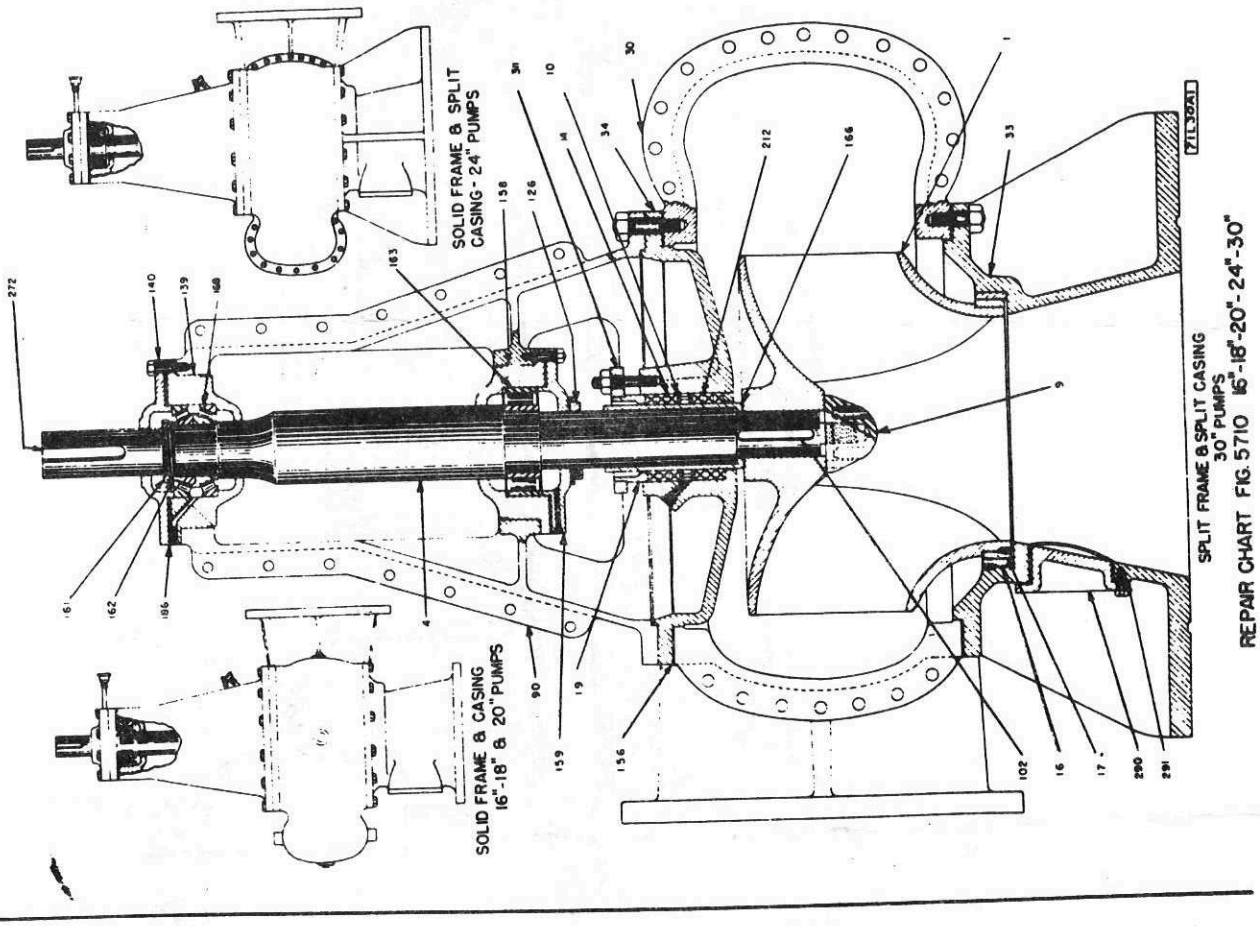
ORDERING REPAIR PARTS

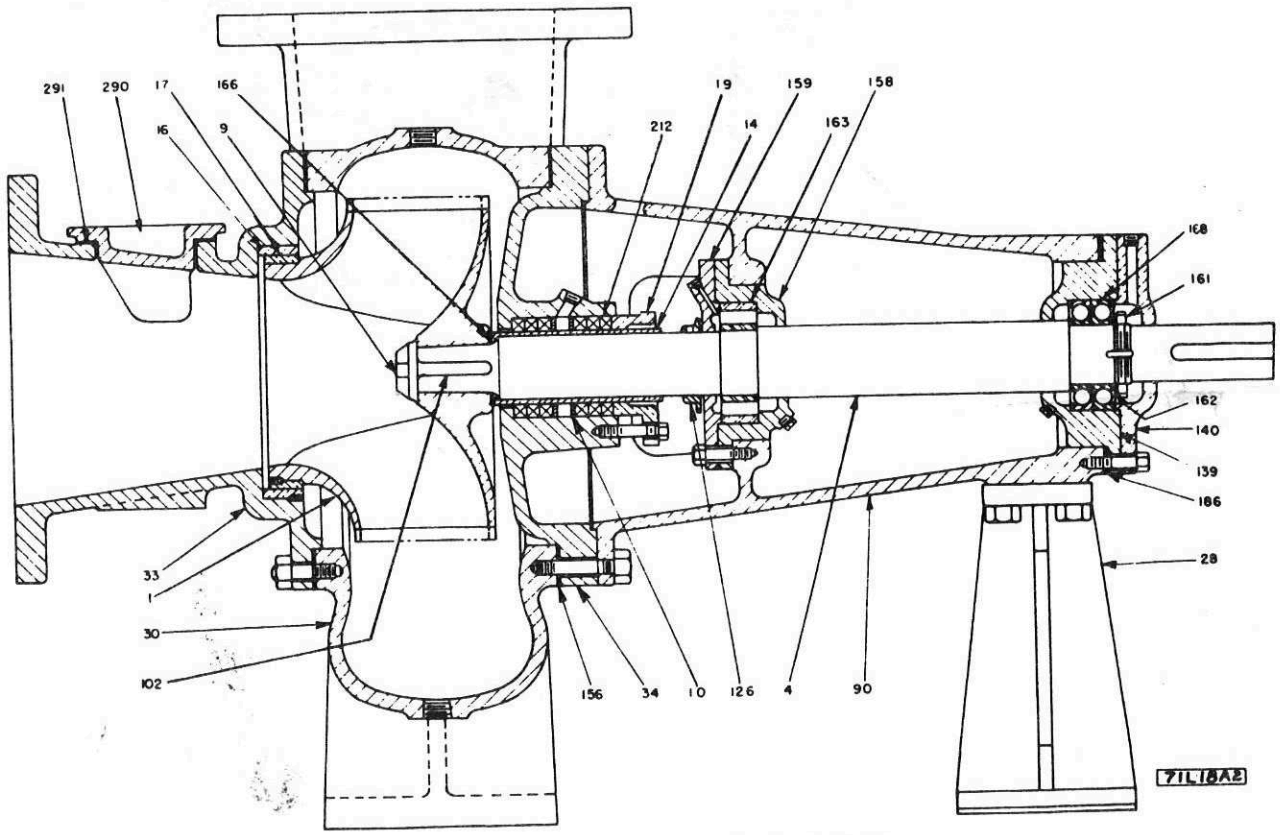
When ordering repairs, always give the size, type, and shop number of the pump (Serial Number). The number is very important. It is stamped on the name plate and the discharge nozzle of the volute. Also, give the description as given in the list by the repair number and name of part wanted. In ordering an impeller, give the diameter across the blade tips and also the symbol that is stamped on the flange where the water enters. With a coupling, state the number of pins or bushings it contains. Too much care cannot be taken in giving these particulars.

REPAIR PARTS LIST

1 - Impeller
4 - Impeller Shaft
9 - Impeller Nut
10 - Water Seal Ring
14 - Shaft Sleeve
16 - Front Head Wearing Ring
17 - Impeller Wearing Ring
19 - Gland Half
28 - Pedestal
30 - Casing
33 - Front Head
34 - Back Head
90 - Frame
95 - Stuffing Box Bushing
99 - Grease Relief Fitting
102 - Impeller Key
126 - Liquid Deflector
136 - Nameplate
139 - Thrust Bearing Housing
140 - Thrust Bearing Housing Cover
156 - Casing Gasket
158 - Inner Bearing Housing
159 - Inner Bearing Housing Cover
161 - Bearing Locknut
162 - Bearing Lockwasher
163 - Guide Bearing
166 - Shaft Sleeve Gasket
168 - Thrust Bearing
186 - Shims
198 - Impeller Screw Key
202 - Casing Handhole Cover
203 - Casing Handhole Cover Gasket
212 - Packing
219 - Gland Clip
272 - Coupling Key
290 - Front Head Hand Hole Cover
291 - Front Head Hand Hole Cover Gasket







REPAIR CHART FIG. 5720 8"-10"-12"-14"-16"-18"

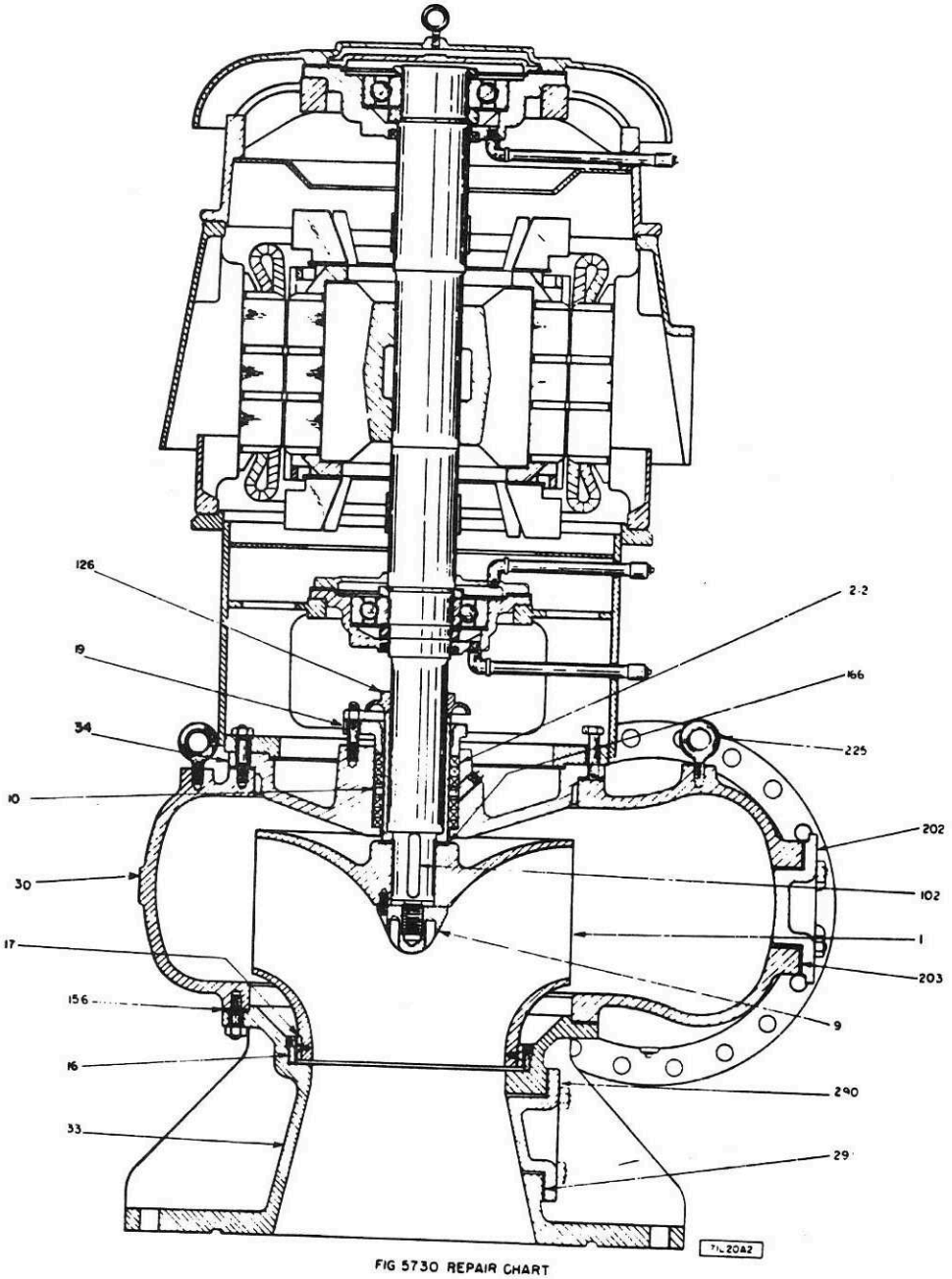


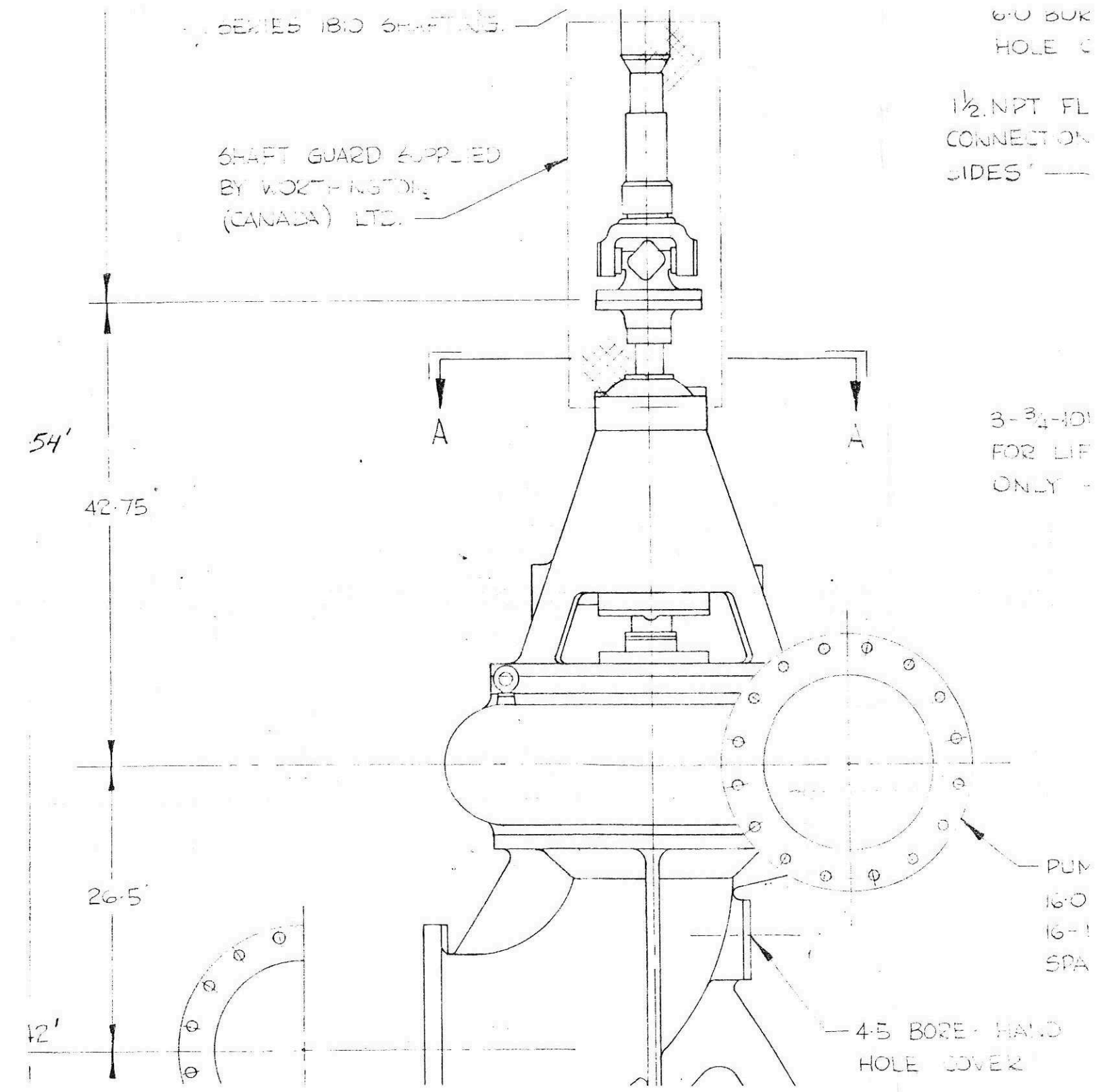
FIG 5730 REPAIR CHART

Colt Industries

Fairbanks Morse
Pump Division

KANSAS CITY, KANSAS 66110

40038355
JK3M1166


SERIES 1810 SHAFTING.
SHAFT GUARD SUPPLIED BY WORTHINGTON (CANADA) LTD.
A
A
54'
42·75'
26·5'
12'
4·5 BORE · HAND HOLE COVER

DRAWING NOTES

02" X 45° MAX
URRS
IOJECTION UNLESS STATED

RE INDICATED BY / UNLESS
ERWISE
CES FOR FINISHED SURFACES
TED OTHERWISE.

3 PLACE DECIMAL | 2 PLACE DECIMAL

SHAFT GUARD SUPPLIED
BY WORTHINGTON
(CANADA) LTD.

17·54'

42·75

26·5'

ELEV. 44·42'

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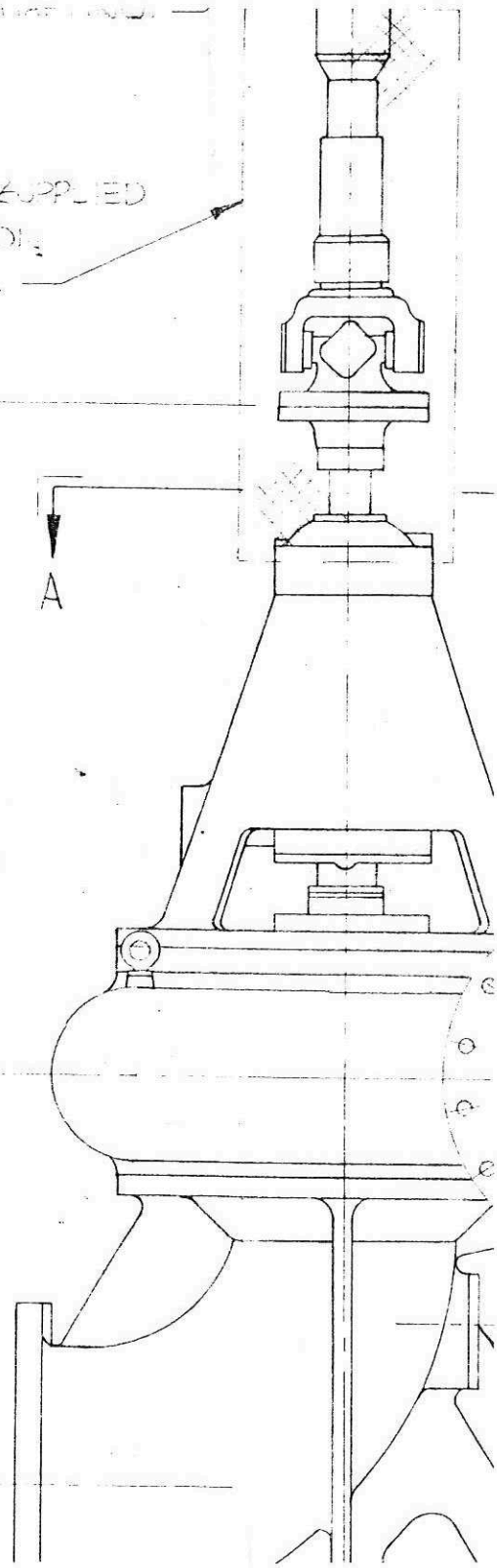

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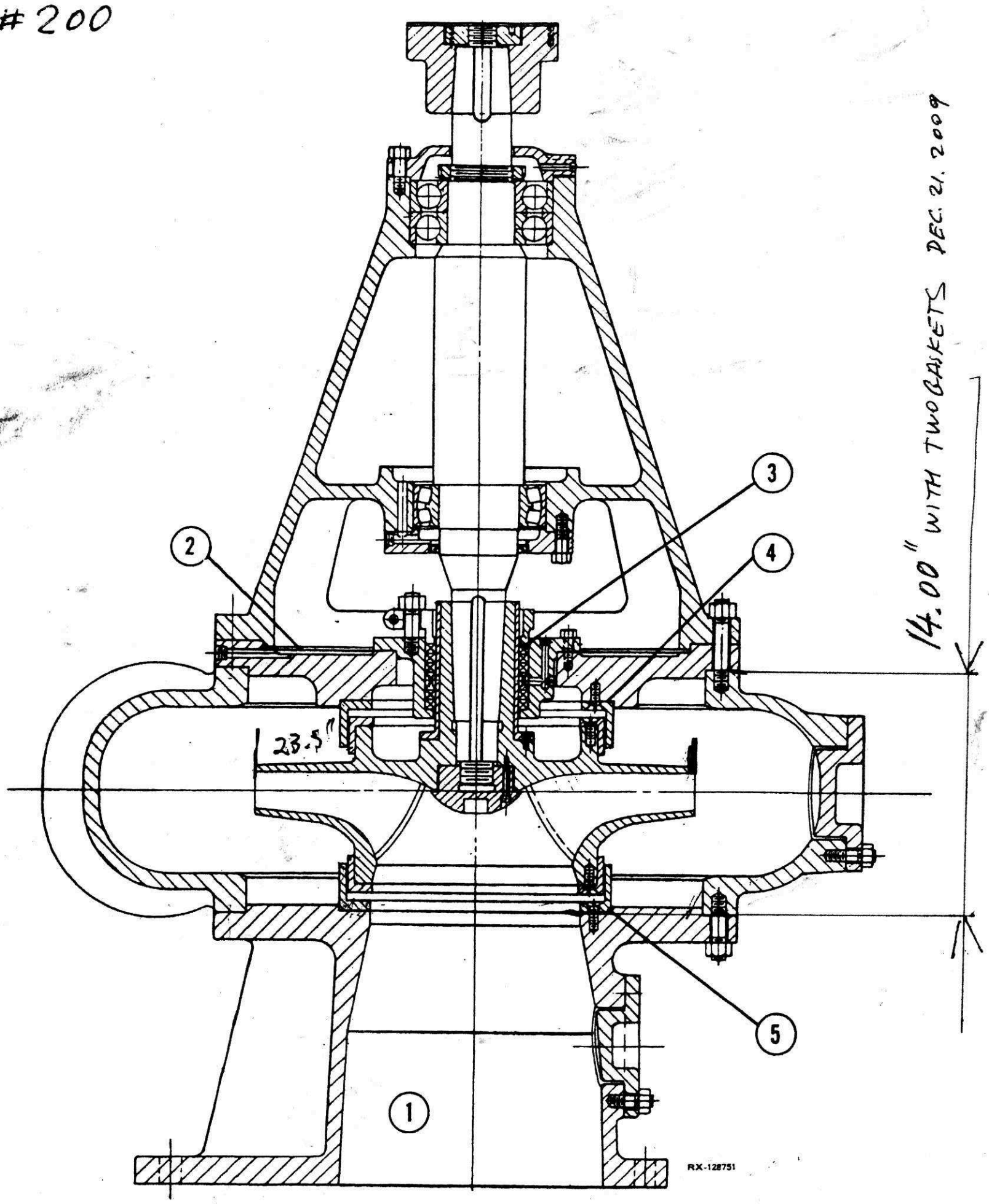


TYPES FA-FC Typical Section

Section Elevation showing typical construction of the type FA and FC pump. Refer to Harrison for specific construction of any given pump.

1 Bottom suction with two winged feet rigidly supporting the pump.

2 Stuffing box head permits easy drainage.

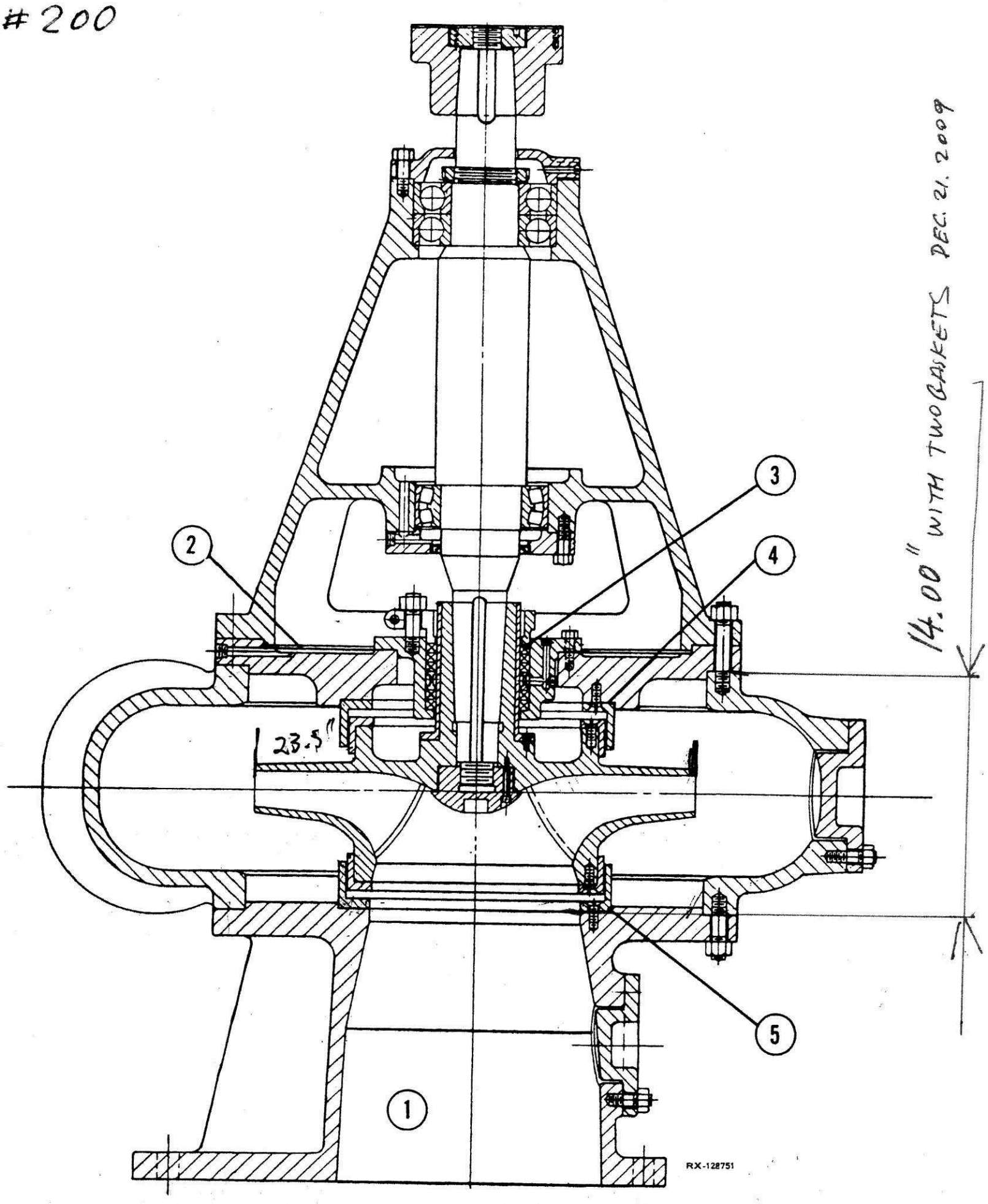
3 Easily accessible stuffing box.

4 Back rings may be furnished to minimize hydraulic thrust.

5 Generous renewable double wearing rings.

14.00" WITH TWO GASKETS DEC. 21, 2009

PUMP # 200
PRPS



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2013 NEW SEAL
PUMP 17200 PMPS

POWERPUMPER
DOUBLE/TANDEM CARTRIDGE SEAL
INSTALLATION INSTRUCTIONS

PREPARE PUMP

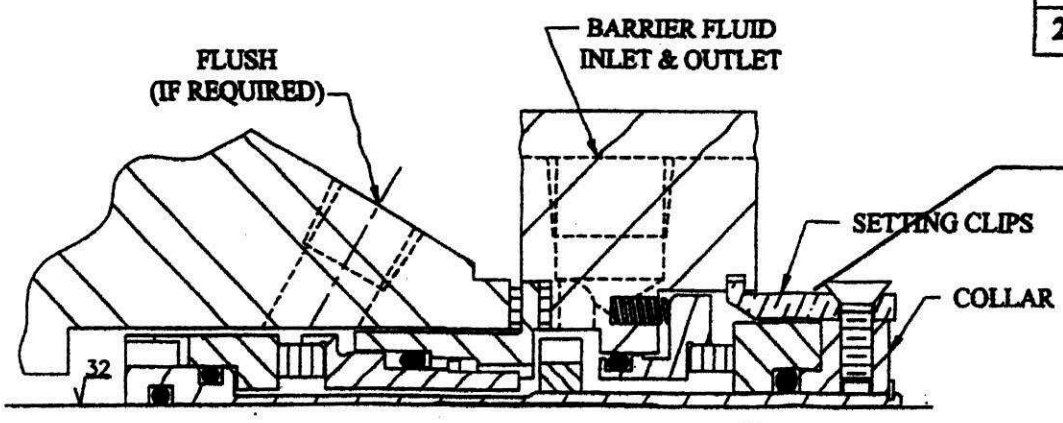
1. Clean and inspect pump parts.
2. Replace shaft or shaft sleeve if worn in secondary sealing areas under o-rings.
3. Check for good starting bevel and remove all burrs that would cut secondary seal o-rings or cause misalignment.
4. Check shaft run out (to be within .001" TIR per inch of shaft dia.), shaft end play (not to exceed .005"), stuffing box face alignment (must be square to shaft within .003" TIR and have good sealing surface, 125 RMS min.), and condition of the pump bearings: Replace if necessary.

INSTALLING SEAL

1. Lubricate shaft or sleeve.
2. Insert seal into stuffing box with barrier fluid ports facing desired location.
3. Loosely thread gland bolts into back plate. **IMPORTANT:** Do not tighten gland bolts at this time. Also, do not remove any setting clips at this time. **NOTE:** For larger pumps with heavy back plates, install the seal on the shaft or sleeve, then slip on the back plate and loosely thread the gland bolts.
4. Install and bolt back plate to pump frame.
5. Install and tighten impeller.
6. Make all necessary impeller adjustments as required. The impeller can be reset at any time, as long as the setting clips are in place and the seal set screws are loosened while the shaft is being moved.
7. Tighten gland bolts evenly.
8. Tighten set screws in collar.
9. Remove setting clips and flat head screws. **NOTE:** Apply pressure to clip at the gland face, as shown, with a screwdriver or flat edge then lift rear of clip to remove. (The setting clips must be removed entirely)
10. Turn shaft by hand to make sure there is no rubbing between rotating and stationary parts.
11. Make all necessary pump connections and alignments.
12. Clean out barrier fluid lines and seal pot.
13. Connect and open barrier fluid lines to seal.
14. If a seal pot is used, fill seal pot with barrier fluid and bleed out air in lines. For API Plan 53 pressurize to 20-30 PSI above stuffing box pressure.
15. Run pump according to normal start up and operating procedures.

GLAND BOLT TORQUE

Seal Size	Torque Value
1 to 1-3/8"	15 – 20 ft-lbs.
1-1/2 to 2"	25 – 30 ft-lbs.
2-1/8 to 3-1/4"	30 – 35 ft-lbs.



SLEEVE HAS TO BE LONGER