UOP RUSSELL LLC
Tulsa, Oklahoma

JOB NO: J-447 DATE: 7/14/2011
CLIENT: UOP Russell BY: JRG
SUBJECT: 60 MM Cryo

POSITIVE DISPLACEMENT PUMP

Tag No.	P-654			
Service	Expander Lube Oil Make-up Pump			
Quantity	One (1)			
Fluid Properties at Operating Temp.	SAE 10 Oil			
Flow Norm / Design GPM	3	3.1		
Operating Temperature °F	Ambient			
Specific Gravity	0.87 - 0.89			
Suction Pressure PSIG	0			
Discharge Pressure PSIG	350			
Viscosity cP	175 SSU @ 100F			
Vapor Pressure PSIA	Nil			
Corrosion / Erosion Due To	None			
Pump Mechanical Data				
Mat'l Case / Plung. or Rot.	CI	CI		
Fluid End MWP @ °F	500 @ 100			
Inlet Connection	1/2" NPTF			
Outlet Connection	1/2" NPTF			
Plunger Size Des/Max/No	Gear			
Stroke x RPM		1200		
Hydraulic HP / Design Efficiency	0.67			
BHP Design				
NPSH Req'd / Available	4.0'	Flooded		
Rod / Shaft Seal Type	Single mechanical			
Drive (Coupling / Belt)	Close Coupled			
Pulsation Dampeners	No			
Fluid End Lube	No			
PSV Supplied	By Pump Vendor			
PSV Location / Set Pressure	Internal / 450 psig			
Driver Data				
Driver Type	Induction Motor			
Driver HP @ RPM	1 @ 1200			
Electric Power V / Ph / Hz	460 / 3 / 60			
Motor Enclosure / Service Factor	Ex. Pr. / 1.15		Class 1 Div. 2	
Ambient Temp. Min / Max (°F)	-20 / 100°F			
Site Elevation Ft	3000 ft. MSL			
Space Heater	No			
Manufacturer	Tuthilll (Best Equipment)			
Model No.	2LEVH-C-7			
Min. Continuous Flow GPM				

NOTES:

REVISION	0			
ENGINEER/DATE	JRG	07/14/11		
ISSUED FOR	Purchase			

UOP Russell LLC
7050 S. Yale, Ste. 210
Tulsa, OK 74136
Tag #: P-654
PO No. : 4500755127

Final Data Package
Rev 0

DXP Job No.: 8608733
Proposal No.:
Date Prepared: 11/10/2017
Office No.: (918) 446-5515
Direct Line: (713) 396-8104
Fax No.: (918) 446-0338

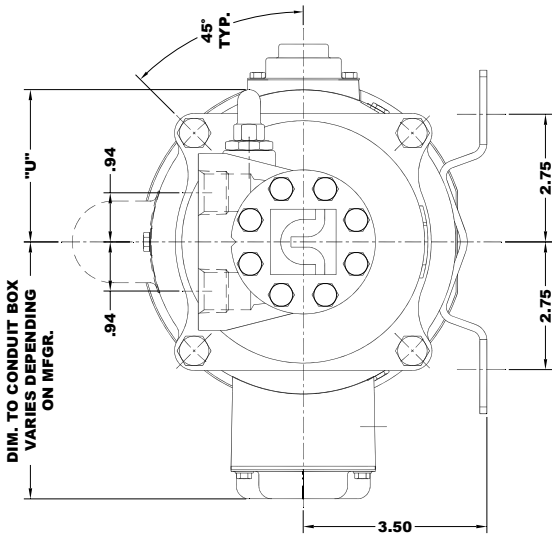
TABLE OF CONTENTS

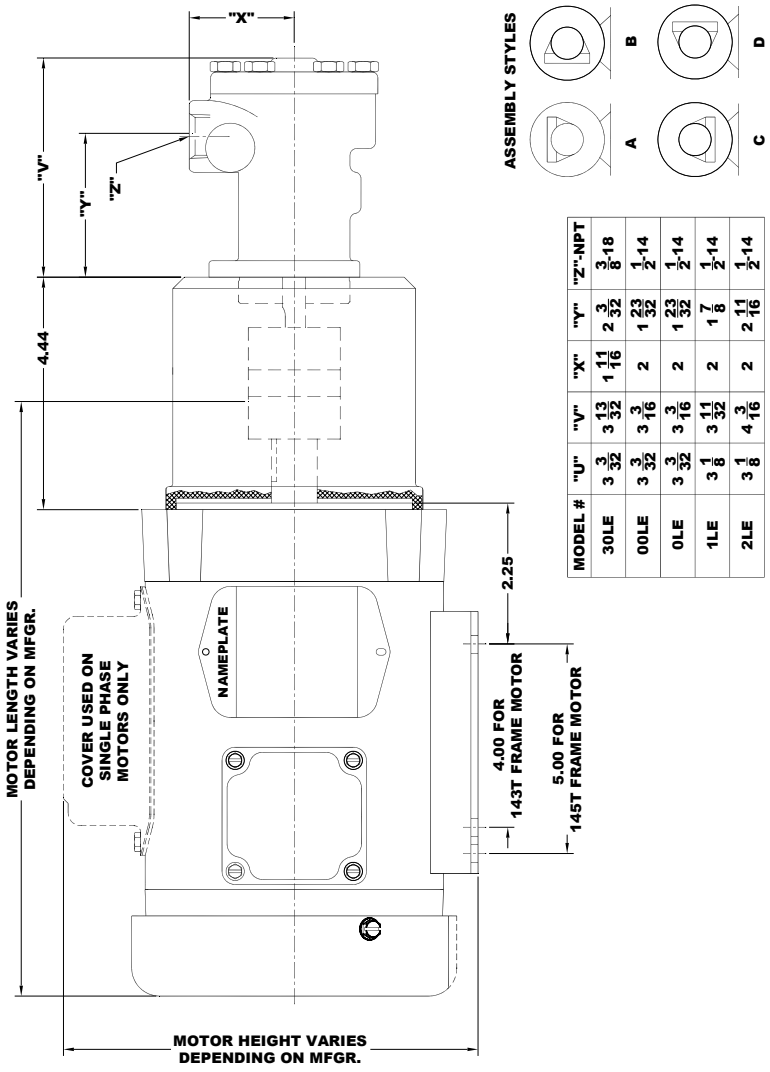
Section 1

TUTHILL Pump Group
12500 South Pulaski Road
Alsip, Illinois USA 60803
Tel 708 389-2500 Fax 708 388-0869
email: tuthillpump@tuthill.com
www.tuthill.com

PO#4500755127
Item: P-654
Proj: J-447XX
Order: 8608733
Rev. 0

Dimensions for 30LE-2LE, 4101-4105 & 4121-4125
Adapter Mounted to a 143/145TC Frame Single & Three Phase Motor





MODEL #	"U"	"V"	"X"	"Y"	"Z"-NPT
30LE	3 3/32	3 13/32	1 11/16	2 3/32	3/8-18
00LE	3 3/32	3 3/16	2	1 23/32	1/2-14
0LE	3 3/32	3 3/16	2	1 23/32	1/2-14
1LE	3 1/8	3 11/32	2	1 7/8	1/2-14
2LE	3 1/8	4 3/16	2	2 11/16	1/2-14

Section 2

Scope of Supply	
Item-	P-654 Expander Lube Oil Make-up
Liquid-	SAE 10 Oil @ 0.87-0.89 S.G. Ambient Temp. 175 SSU @ 100 F
Flow-Discharge	3 - 3.1 GPM / 350 PSIG

- **Pump -** Tuthill, Series L, Size 2LEVH450-C-RH-7, Cast Iron, Brz. housing & Idler Bushings, Hardened Gears, 1/2" NPTF Inlet & Outlet Ports, Single Mechanical Seal with Viton elastomers, Adapter Mounted With Footed C-Face Motor / Close Coupled Pump, 500 PSI MAWP At 100 F, Internal PSV 450 PSIG Set Pressure
- **Adapter -** Adapter For C-Face Footed Motor, 145TC Frame
- **Motor -**Teco Type AEHHXU Catalog XP0016C NEMA Prem. Eff. Explosion Proof, Footed C-Face, Frame 145TC, 1.0 HP 1200RPM, 1.15 S.F. 230-460v/3/60 Supply

Price Each:	$ 2,995.00 net each, plus freight
Delivery:	8 Weeks After Receipt of Order

Section 3

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Alsip, Illinois USA 60803
Tel 708 389-2500 Fax 708 388-0869
email: tuthillpump@tuthill.com
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12500 South Pulaski Road
Alsip, Illinois 60803
USA
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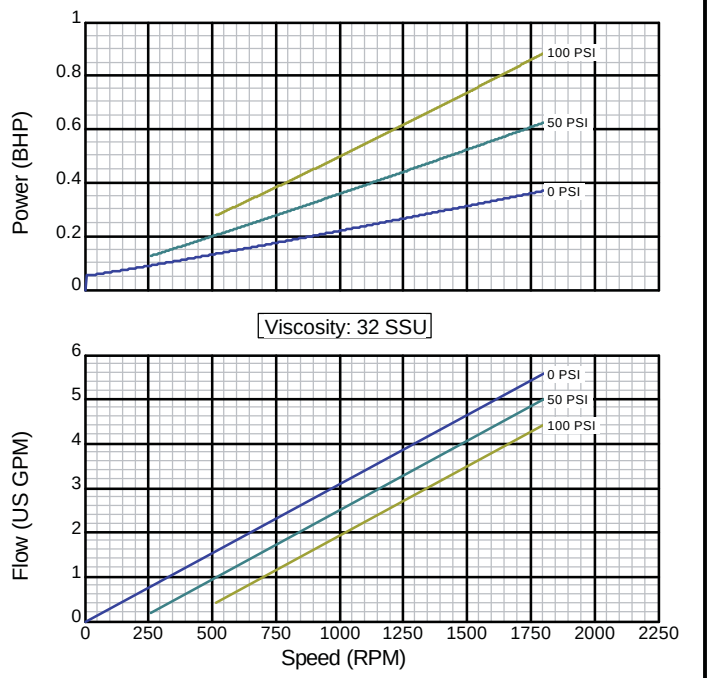
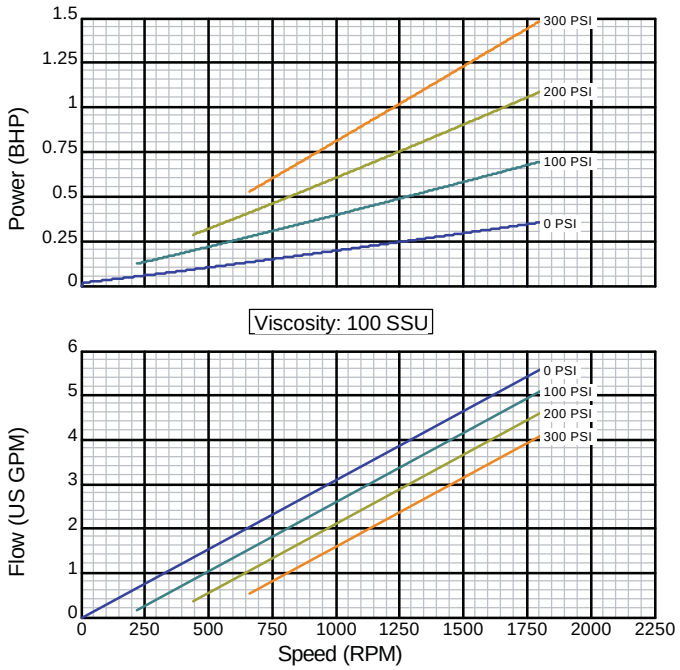
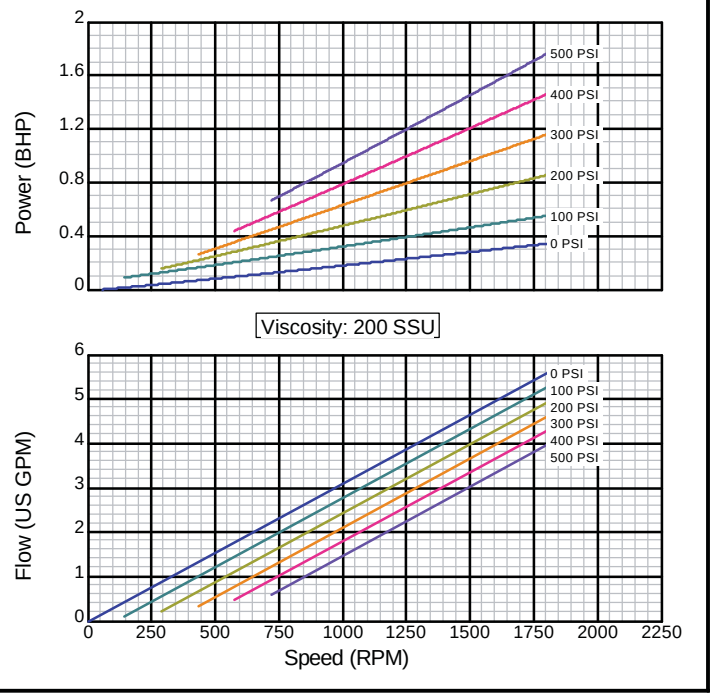
Performance Data For L/C Series Pump

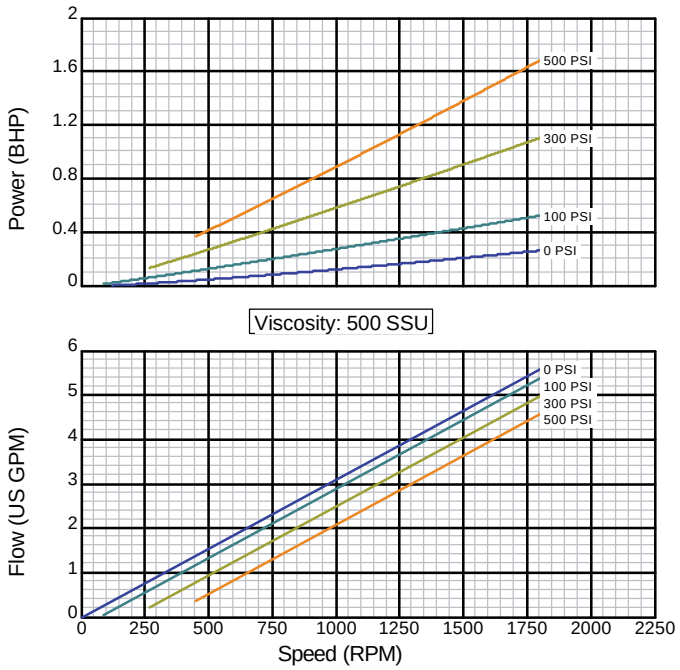
Model 2L

Iron Construction	Standard Clearance	1/2" Std. Port Size









There are many additional factors to consider when selecting a pump,
including (but not limited to) suction conditions, temperature limitations and material compatabilities.
Curve data is typical only, actual performance may vary.
Consult the factory or an authorized Tuthill Pump Group representative for assistance.

Version 2.0.beta.0

Created on
November 30, 2000

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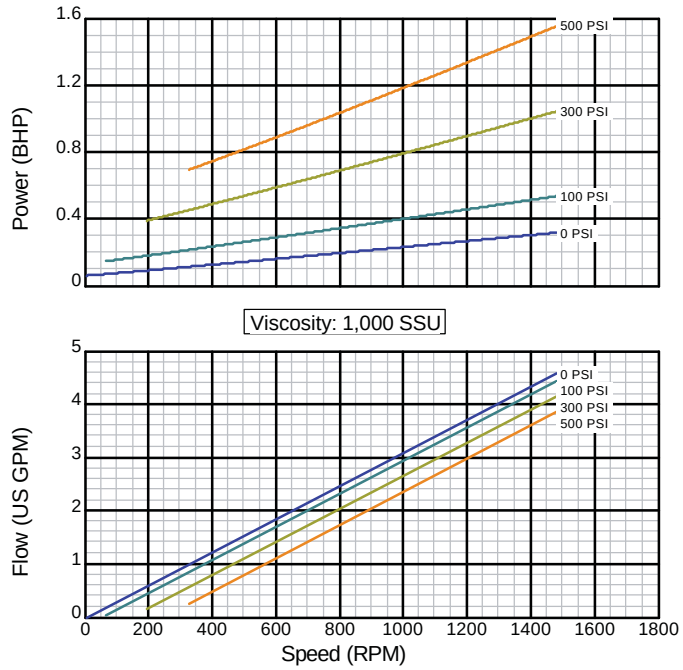

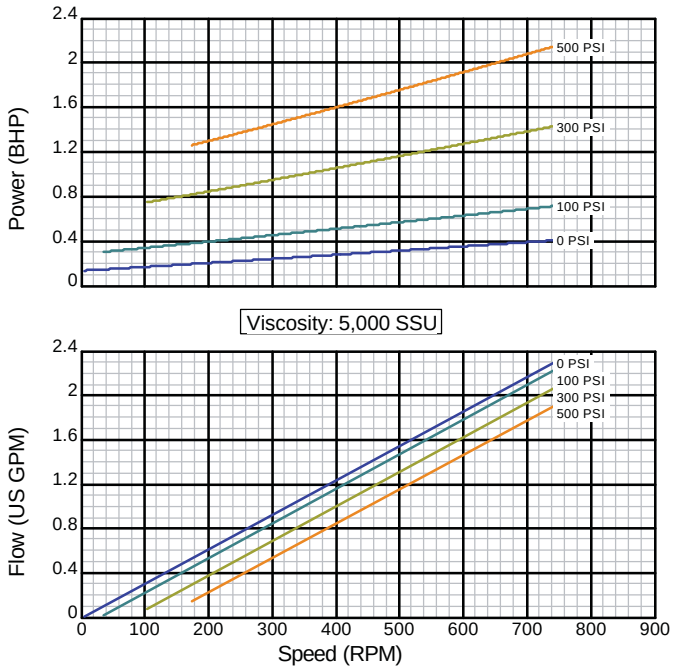

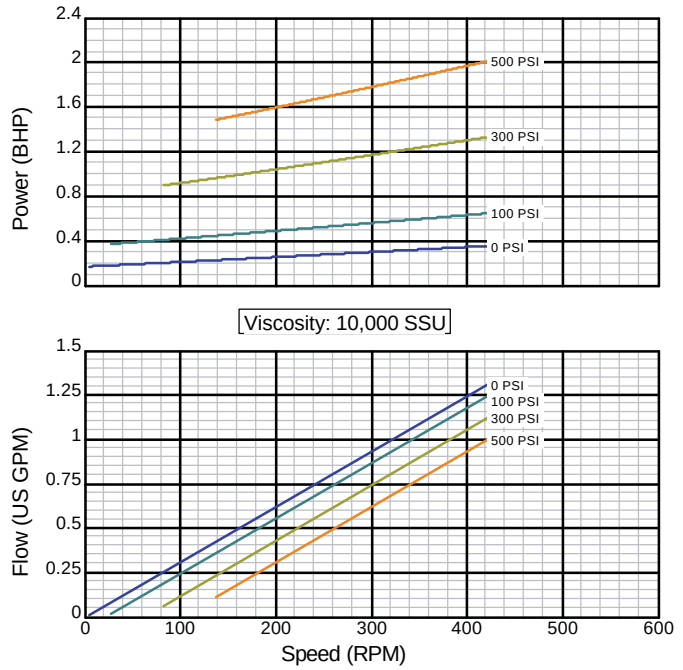

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Version 2.0.beta.0

Created on
November 30, 2000

L/4100 Pump Performance Data

		40 SSU					
		0 PSI		50 PSI		100 PSI	
SIZE	RPM	GPM	HP	GPM	HP	GPM	HP
	300	-	-	-	-	-	-
	900	0.2	1/8	0.1	1/8	0.1	1/8
30	1200	0.3	1/8	0.2	1/8	0.2	1/8
	1800	0.4	1/8	0.4	1/8	0.3	1/8
	3600	-	-	-	-	-	-
	300	.15	1/8	.10	1/8	-	-
	900	.45	1/8	.40	1/8	.35	1/8
00	1200	.65	1/8	.55	1/8	.50	1/8
	1800	.95	1/8	.90	1/8	.85	1/4
	3600	-	-	-	-	-	-
	300	-	-	-	-	-	-
	900	0.8	1/8	0.7	1/8	0.6	1/8
0	1200	1.0	1/8	0.9	1/8	0.8	1/4
	1800	1.6	1/4	1.4	1/4	1.3	1/4
	3600	-	-	-	-	-	-
	300	0.4	1/8	0.3	1/8	-	-
	900	1.4	1/4	1.1	1/4	1.1	1/3
1	1200	1.9	1/4	1.7	1/4	1.5	1/3
	1800	2.9	1/4	2.7	1/2	2.5	1/2
	3600	-	-	-	-	-	-
	300	0.9	1/8	0.7	1/4	0.5	1/3
	900	2.8	1/4	2.5	1/2	2.2	3/4
2	1200	3.7	1/3	3.4	1/2	3.1	3/4
	1800	5.4	1/2	4.9	3/4	4.8	1
	3600	-	-	-	-	-	-
	300	2.0	1/8	1.4	1/8	0.8	1/4
	900	6.3	1/8	5.0	1/2	3.6	1
5	1200	9.0	1/4	7.6	3/4	6.0	1
	1800	11.5	1/3	11.1	1	10.7	1 1/2
	3600	-	-	-	-	-	-

		200 SSU											
		0 PSI		50 PSI		100 PSI		200 PSI		300 PSI		500 PSI	
SIZE	RPM	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP
	300	-	-	-	-	-	-	-	-	-	-	-	-
	900	0.1	1/8	0.1	1/8	0.1	1/8	0.1	1/8	0.1	1/8	0.1	1/8
30	1200	0.3	1/8	0.2	1/8	0.2	1/8	0.2	1/8	0.2	1/8	0.2	1/4
	1800	0.4	1/8	0.4	1/8	0.3	1/8	0.3	1/4	0.3	1/4	0.3	1/3
	3600	0.8	1/4	0.8	1/4	0.8	1/4	0.8	1/3	0.7	1/2	-	-
	300	-	-	-	-	-	-	-	-	-	-	-	-
	900	0.4	1/8	0.4	1/8	0.4	1/8	0.3	1/8	0.2	1/4	0.1	1/4
00	1200	0.5	1/8	0.5	1/8	0.5	1/8	0.4	1/4	0.4	1/4	0.3	1/3
	1800	0.9	1/8	0.9	1/8	0.8	1/8	0.7	1/4	0.7	1/3	0.5	1/2
	3600	1.8	1/4	1.7	1/4	1.7	1/3	1.6	1/2	1.5	3/4	-	-
	300	-	-	-	-	-	-	-	-	-	-	-	-
	900	0.8	1/8	0.8	1/8	0.8	1/8	0.7	1/4	0.5	1/3	0.3	1/2
0	1200	1.0	1/8	1.0	1/8	1.0	1/8	0.9	1/4	0.8	1/2	0.6	3/4
	1800	1.6	1/8	1.6	1/4	1.6	1/4	1.5	1/4	1.4	3/4	1.2	1
	3600	3.2	1/4	3.1	1/3	3.1	1/2	3.1	1/2	2.9	1	-	-
	300	0.4	1/8	0.4	1/8	0.2	1/8	0.1	1/8	-	-	-	-
	900	1.4	1/8	1.4	1/8	1.2	1/4	1.0	1/3	0.8	1/2	0.4	3/4
1	1200	1.9	1/8	1.9	1/8	1.7	1/4	1.5	1/3	1.4	1/2	1.2	3/4
	1800	2.9	1/8	2.8	1/4	2.7	1/3	2.5	1/2	2.3	3/4	2.1	1 1/2
	3600	5.6	1/3	5.6	1/2	5.5	3/4	5.2	1	5.1	1 1/2	-	-
	300	0.9	1/8	0.8	1/8	0.8	1/8	0.7	1/4	0.6	1/4	-	-
	900	2.8	1/8	2.7	1/4	2.7	1/4	2.6	1/2	2.4	3/4	2.2	1 1/2
2	1200	3.7	1/8	3.4	1/4	3.1	1/4	2.8	1/2	3.0	1	2.8	1 1/2
	1800	5.5	1/4	4.9	1/3	4.9	1/2	4.6	3/4	4.3	1 1/2	3.8	2
	3600	-	-	-	-	-	-	-	-	-	-	-	-
	300	2.2	1/8	1.7	1/8	1.4	1/4	-	-	-	-	-	-
	900	6.8	1/4	6.4	1/2	6.0	3/4	5.6	1 1/2	4.9	2	-	-
5	1200	9.0	1/3	8.6	1/2	8.2	1	7.7	2	7.1	3	-	-
	1800	13.7	1/2	13.3	1	12.9	1 1/2	10.9	3	10.2	5	-	-
	3600	-	-	-	-	-	-	-	-	-	-	-	-

		500 SSU											
		0 PSI		50 PSI		100 PSI		200 PSI		300 PSI		500 PSI	
SIZE	RPM	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP
	300	-	-	-	-	-	-	-	-	-	-	-	-
	900	0.2	1/8	0.2	1/8	0.1	1/8	0.1	1/8	0.1	1/8	0.1	1/8
30	1200	0.2	1/8	0.2	1/8	0.2	1/8	0.2	1/8	0.2	1/8	0.2	1/4
	1800	0.4	1/8	0.3	1/8	0.3	1/4	0.3	1/4	0.3	1/4	0.3	1/4
	3600	0.8	1/4	0.7	1/4	0.7	1/4	0.6	1/4	0.6	1/3	-	-
	300	-	-	-	-	-	-	-	-	-	-	-	-
	900	0.4	1/8	0.4	1/8	0.4	1/8	0.4	1/8	0.4	1/8	0.3	1/4
00	1200	0.6	1/8	0.6	1/8	0.6	1/8	0.5	1/8	0.5	1/4	0.4	1/4
	1800	0.9	1/8	0.9	1/8	0.8	1/8	0.8	1/4	0.8	1/4	0.7	1/2
	3600	1.7	1/4	1.7	1/4	1.6	1/3	1.5	1/2	1.5	3/4	-	-
	300	-	-	-	-	-	-	-	-	-	-	-	-
	900	0.7	1/8	0.7	1/8	0.7	1/8	0.6	1/4	0.6	1/4	0.5	1/2
0	1200	1.0	1/8	1.0	1/8	1.0	1/4	0.9	1/4	0.9	1/3	0.7	1/2
	1800	1.6	1/8	1.5	1/4	1.5	1/4	1.4	1/2	1.4	1/2	1.3	3/4
	3600	2.9	1/3	2.8	1/2	2.8	1/2	2.8	3/4	2.8	1 1/2	-	-
	300	0.4	1/8	0.4	1/8	0.4	1/8	0.3	1/8	0.3	1/4	0.3	1/4
	900	1.3	1/8	1.3	1/8	1.3	1/4	1.1	1/3	1.1	1/2	0.9	3/4
1	1200	1.8	1/8	1.8	1/8	1.7	1/4	1.6	1/3	1.4	1/2	1.1	1
	1800	2.7	1/4	2.7	1/4	2.6	1/3	2.5	1/2	2.4	1	2.2	1 1/2
	3600	5.3	1/2	5.2	1/2	5.2	3/4	5.0	1 1/2	4.9	2	-	-
	300	0.9	1/8	0.9	1/8	0.8	1/8	0.7	1/4	0.7	1/4	0.5	1/2
	900	2.7	1/8	2.6	1/8	2.3	1/4	2.1	1/2	2.1	1/2	1.8	1
2	1200	3.6	1/8	3.5	1/4	3.3	1/3	2.8	1/2	2.7	3/4	2.0	1 1/2
	1800	5.3	1/4	5.2	1/3	4.9	1/2	4.4	1	4.0	1 1/2	3.0	2
	3600	-	-	-	-	-	-	-	-	-	-	-	-
	300	2.2	1/8	2.0	1/8	1.8	1/4	-	-	-	-	-	-
	900	6.8	1/4	6.6	1/2	6.3	3/4	6.1	1 1/2	5.5	2	-	-
5	1200	8.7	1/2	8.6	3/4	8.5	1 1/2	8.2	2	7.8	3	-	-
	1800	12.9	1	12.8	1 1/2	12.7	2	12.5	3	12.0	5	-	-
	3600	-	-	-	-	-	-	-	-	-	-	-	-

L/4100 Pump Performance Data

		1000 SSU												5000 SSU											
		0 PSI		50 PSI		100 PSI		200 PSI		300 PSI		500 PSI		0 PSI		50 PSI		100 PSI		200 PSI		300 PSI		500 PSI	
SIZE	RPM	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP	GPM	HP
30	300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	900	0.2	1/8	0.2	1/8	0.1	1/8	0.1	1/8	0.1	1/8	0.1	1/8	-	-	-	-	-	-	-	-	-	-	-	-
	1200	0.2	1/8	0.2	1/8	0.2	1/8	0.2	1/8	0.2	1/8	0.2	1/4	-	-	-	-	-	-	-	-	-	-	-	-
	1800	0.4	1/8	0.4	1/8	0.4	1/8	0.3	1/4	0.3	1/4	0.3	1/3	-	-	-	-	-	-	-	-	-	-	-	-
	3600	0.8	1/4	0.7	1/4	0.7	1/4	0.7	1/3	0.7	1/3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
00	300	-	-	-	-	-	-	-	-	-	-	-	-	0.1	1/8	0.1	1/8	0.1	1/8	0.1	1/8	-	-	-	-
	900	0.4	1/8	0.4	1/8	0.4	1/8	0.4	1/8	0.3	1/4	0.3	1/4	0.2	1/8	0.2	1/8	0.2	1/8	0.2	1/4	-	-	-	-
	1200	0.6	1/8	0.6	1/8	0.6	1/8	0.5	1/4	0.5	1/4	0.4	1/3	-	-	-	-	-	-	-	-	-	-	-	-
	1800	0.8	1/8	0.8	1/8	0.8	1/4	0.8	1/4	0.8	1/3	0.8	1/2	-	-	-	-	-	-	-	-	-	-	-	-
	3600	1.7	1/3	1.7	1/3	1.7	1/2	1.7	1/2	1.6	3/4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0	300	-	-	-	-	-	-	-	-	-	-	-	-	0.2	1/8	0.2	1/8	0.2	1/8	0.2	1/8	-	-	-	-
	900	0.8	1/8	0.7	1/8	0.7	1/8	0.7	1/4	0.7	1/4	0.6	1/2	0.7	1/8	0.7	1/8	0.7	1/4	0.7	1/4	-	-	-	-
	1200	1.0	1/8	1.0	1/8	1.0	1/4	1.0	1/4	0.9	1/3	0.8	1/2	-	-	-	-	-	-	-	-	-	-	-	-
	1800	1.5	1/4	1.5	1/4	1.5	1/4	1.4	1/2	1.4	1/2	1.3	3/4	-	-	-	-	-	-	-	-	-	-	-	-
	3600	2.5	1/2	2.5	1/2	2.5	3/4	2.3	1	2.3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1	300	0.4	1/8	0.4	1/8	0.4	1/8	0.3	1/8	-	-	-	-	0.3	1/8	0.3	1/8	0.3	1/8	0.2	1/8	0.2	1/4	-	-
	900	1.4	1/8	1.4	1/8	1.3	1/8	1.2	1/4	1.1	1/3	0.9	3/4	1.1	1/4	1.1	1/4	1.1	1/4	0.9	1/3	0.7	1/2	-	-
	1200	1.9	1/8	1.9	1/8	1.8	1/4	1.7	1/3	1.6	1/2	1.4	3/4	-	-	-	-	-	-	-	-	-	-	-	-
	1800	2.8	1/4	2.7	1/4	2.7	1/4	2.6	1/2	2.5	3/4	2.2	1 1/2	-	-	-	-	-	-	-	-	-	-	-	-
	3600	4.5	1/2	4.4	1/2	4.4	3/4	4.4	1 1/2	4.4	1 1/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	300	0.9	1/8	0.9	1/8	0.6	1/8	0.6	1/8	0.5	1/4	0.3	1/3	0.7	1/8	0.7	1/8	0.7	1/3	-	-	-	-	-	-
	900	2.7	1/8	2.6	1/4	2.5	1/4	2.2	1/2	1.6	3/4	0.7	1	1.9	1/4	1.8	1/3	0.7	1/2	-	-	-	-	-	-
	1200	3.5	1/4	3.4	1/4	3.3	1/3	3.0	3/4	2.6	3/4	1.8	1 1/2	-	-	-	-	-	-	-	-	-	-	-	-
	1800	5.0	1/3	4.9	1/2	4.9	3/4	4.7	1	4.2	1 1/2	3.4	2	-	-	-	-	-	-	-	-	-	-	-	-
	3600	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	300	2.2	1/8	2.1	1/4	2.0	1/3	1.8	1/2	1.5	3/4	-	-	2.2	1/3	2.2	1/2	2.1	1/2	2.0	3/4	1.9	3/4	-	-
	900	6.7	1/2	6.5	3/4	6.5	1	6.1	1 1/2	5.5	2	-	-	6.0	1	5.8	1	5.8	1 1/2	5.5	2	5.3	2	-	-
	1200	8.8	3/4	8.7	1	8.5	1 1/2	8.2	2	7.8	3	-	-	8.2	1	8.0	1 1/2	7.8	2	7.6	3	7.4	3	-	-
	1800	13.0	1 1/2	12.7	2	12.5	2	10.2	3	9.9	5	-	-	11.2	2	11.0	3	10.7	3	10.2	5	9.9	5	-	-
	3600	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

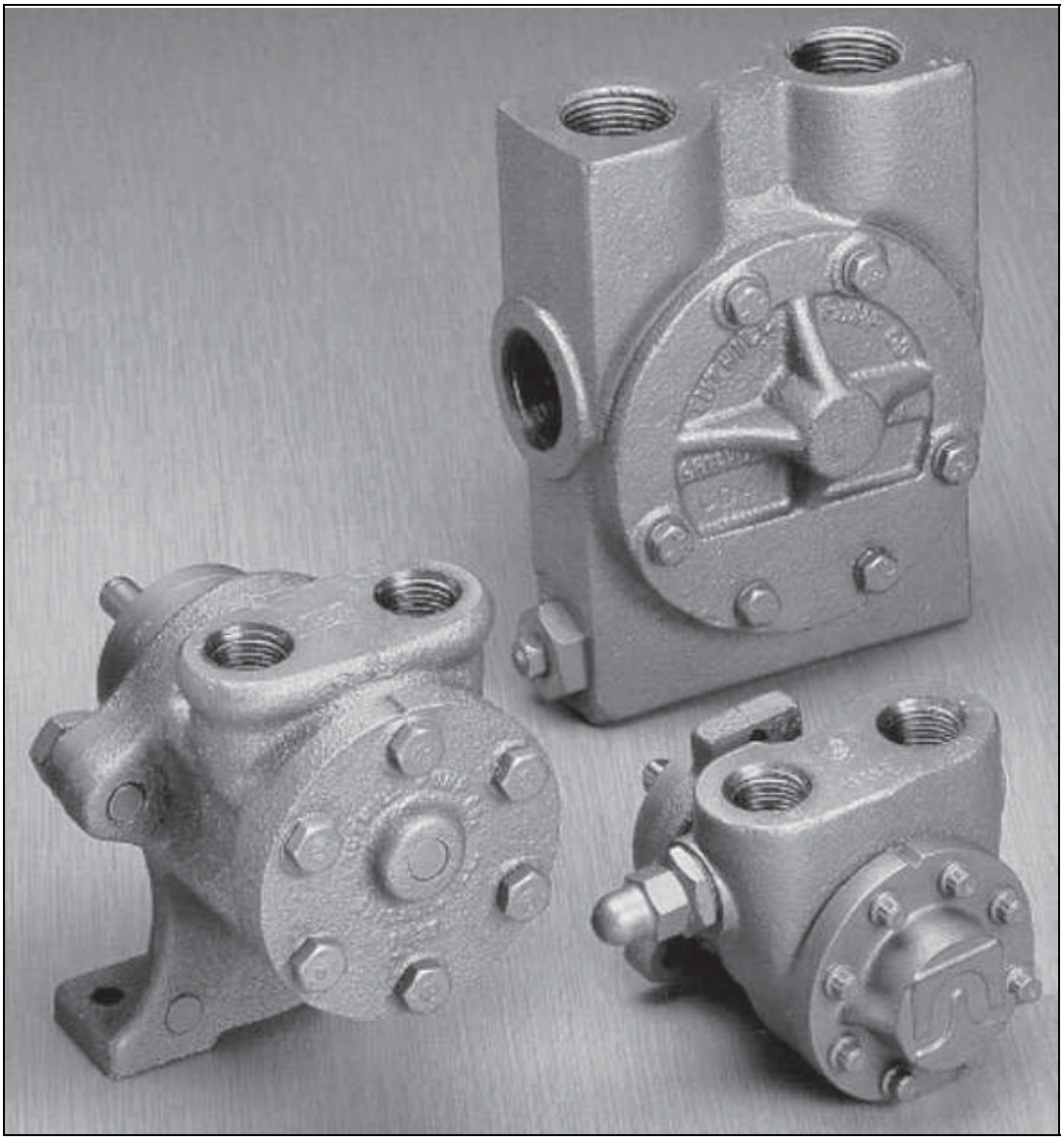
Section 4

TUTHILL
Pump Group

12500 South Pulaski Road
Alsip, Illinois USA 60803
Tel 708 389-2500 Fax 708 388-0869
email: tuthillpump@tuthill.com
www.tuthill.com

Installation and Service Instructions

L Series Pumps



General Description

Tuthill's LA and LE Series are compact, highly efficient, cast iron positive displacement rotary gear pumps with a mechanical seal. Built in six sizes, they provide nominal capacities from .5 to 14 gallons per minute and pressures up to 500 psi (300 psi in the 5LE). They are self priming and particularly suited to handle liquids of 35 to 1000 SSU viscosity. Higher viscosities can be handled at reduced speeds.

The LA Series is supplied with a two bolt flange, the LE Series with a three bolt flange. Optional mounting feet are available for both Series. An internal relief valve is an option with the LE Series. Both Series are bi-rotational (unless outfitted with a relief valve) and designed for direct drive at standard motor speeds, with modifications available for indirect drive.

The Pumping Principle

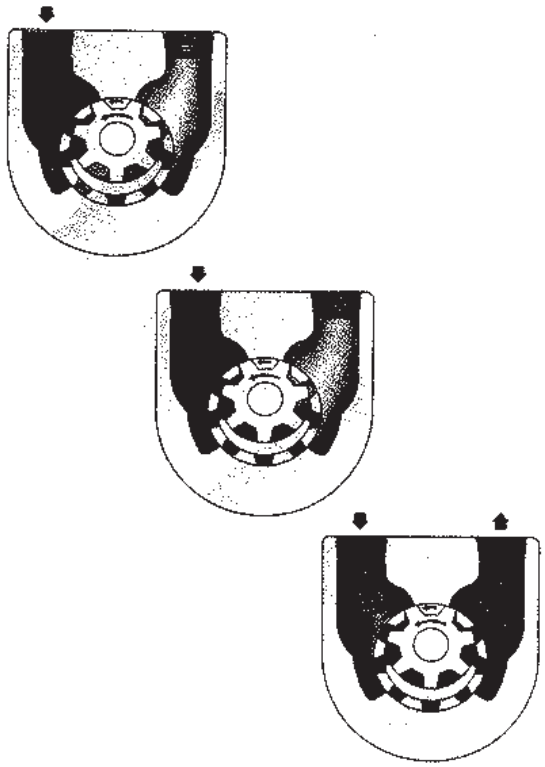
Tuthill's LA and LE Series employ the internal gear pumping principle. There are only two moving parts. Pumping action is based on a rotor, idler gear and crescent-shaped partition cast integral with the cover.

Power applied to the rotor is transmitted to the idler gear with which it meshes. The space between the outside diameter of the idler and the inside diameter of the rotor is sealed by the crescent.

As the pump starts, the teeth come out of mesh, increasing the volume. This creates a partial vacuum, drawing the liquid into the pump through the suction port.

The liquid fills the spaces between the teeth of the idler and the rotor and is carried past the crescent partition through the pressure side of the pump.

When the teeth mesh on the pressure side, the liquid is forced from the spaces and out through the discharge port.



⚠ WARNING

Failure to follow these instructions could result in serious bodily injury or death.

These pumps should **not** be used for handling plain water, corrosive or abrasive liquids or liquids not possessing adequate lubricity.

Do not attempt to work on any Tuthill pump installation before completing the steps below.

Disconnect the drive so that it cannot be started while work is being performed.

Review the Material Safety Data Sheet (MSDS) applicable to the liquid being pumped to determine its characteristics and the precautions necessary to ensure safe handling.

Vent all pressure within the pump through the suction or discharge lines.

All Tuthill pumps contain residual 200 SSU lube oil from the factory production test. Determine if this is compatible with the fluid you are pumping. If the fluid is incompatible, consult the factory.

Location

LA and LE Series pumps are designed for working pressures up to 500 psi (300 psi in the 5LE) and are required to develop 25" mercury vacuum at 0 psi on factory test. While these pumps will develop as high as 27" of vacuum, it is a sound engineering practice to avoid extreme vacuum whenever possible. Select a pipe size to reduce line friction loss to a minimum.

The pump should be located as close to the source of supply as conditions permit and if possible, below the level of the liquid in the reservoir. When necessary to locate the pump in a pit, provisions should be made to safeguard against flooding. Care must be taken to properly support the suction and discharge piping so that no strain is put on the pump due to either weight or expansion. Piping strain can result in misalignment, hot bearings, worn couplings, and vibration. It is important that the piping used be clean and free of chips or scales.

Proper Installation

Unsatisfactory pump installations are usually characterized by poor suction conditions for the specific liquid being handled. Suction conditions should be minimized to prevent vaporization of the liquid. If vacuum conditions force the liquid to vaporize, cavitation will occur, resulting in loss of capacity, premature wear and noisy operation.

When handling high viscosity liquids, the speed of the pump must be reduced and the size of the lines increased to prevent cavitation.

Note: Pipe line friction increases at a rapid rate with an increase in viscosity. For a given pump and motor, larger pipe lines are necessary to maintain the same pump pressure when changing from a thin fluid to a thick one.

Most Tuthill LA and LE Series pumps are supplied with both ports on the same plane. Pumps with this type of porting arrangement should always be installed with both ports pointing upward to

insure proper priming. If it is necessary to install the pump with the ports pointing to either side, it is recommended that the top port be the suction port. This will prevent gravity induced drainage of fluid through the suction port. When pipe lines are installed, an inverted "U" bend should be incorporated into the suction line close to the pump for priming purposes.

The multiple port arrangement in the 5LE offers flexibility but is limited to some common sense restrictions. There is an inlet and an outlet side to the pump. There must always be at least one pipe on each side. Units ordered with the side port option (modification S) are shipped with port plugs in the top ports. To adapt to a 90° porting arrangement, the plugs must be relocated.

Because of its size, the 5LE will not mount onto a NEMA 48 frame motor unless the motor is shimmed approximately ¼".

With the ports facing up, and viewing the pump from the shaft end, the inlet port is on the right for clockwise rotation and on the left for counter-clockwise rotation. Pumps with built in relief valves are directional. Therefore rotation must be specified at time of order. The adjusting screw of the internal relief valve must always be located on the suction side of the pump.

Pumps should be filled with oil at installation and should never be allowed to run dry.

Every pump installation should have a good foundation. Its structure should be sufficiently strong to hold the pump rigid and to absorb any strain or shock that may be encountered. The installation should be leveled, checked for proper piping alignment, and then fastened securely.

Method of Drive

Direct drive through a traditional flexible coupling is recommended. However, do not expect the flexible coupling to compensate for misalignment. Contact the coupling manufacturer to determine the maximum amount of misalignment to which the coupling can be subjected.

LA and LE Series pumps can be driven in either direction of rotation, unless outfitted with an internal relief valve. The seal chamber communicates with the neutral zone and therefore the seal is subjected to approximately one half of the discharge pressure.

All pump and motor units must be properly aligned during assembly and periodically checked since misalignment may occur later due to abuse or other conditions. Pipe strain can force the pump and motor shafts out of alignment. Therefore, all piping to the pump must be properly supported. Do not allow the pump to act as a pipe support.

Provide for proper expansion of pipes when handling hot liquids. Allow pump to reach operating temperature slowly. Rapid temperature change can result in damage to the cast iron components. Recheck the alignment.

Never align a pump and motor supplied with a pin type coupling without first removing the pins.

Never depend upon sight or feel. Use proper gauges when aligning the pump.

Never operate the pump without all guards in place.

Relief Valve Protection

The LA and LE Series are positive displacement pumps. As the pump rotates, liquid is positively delivered to the discharge side of the pump. If the discharge line is closed off, pressure will increase until the drive stalls and/or fails, the pump breaks or ruptures, or the piping bursts. To prevent this from happening, the use of a pressure relief valve is required. A relief valve that directs the flow back to the supply tank is recommended.

The internal relief valve available on LE Series pumps is designed for overpressure protection only. It is not intended as a flow control device or for any similar use. Continuous operation of the relief valve will result in excessive heat buildup within the pump cavity which could cause serious internal damage. Make certain the adjusting screw of the relief valve is located on the suction side of the pump.

Unless otherwise specified at the time of order, all LEV pumps are supplied with the standard spring, with a range of 55-120 psi (40-70 in the 5LE), set to provide full bypass relief at 55 psi.

To adjust the relief setting within the range of a given spring's capability:

- Remove the acorn nut. (Not supplied with model 5LEV).
- Insert a screwdriver into the slot of the adjusting screw and hold it steady.
- Loosen the locking nut with a wrench by turning counterclockwise.
- Throttle the outlet line until the differential pressure at the pump port is at the desired level:
    - If the pressure fails to reach this level with the throttling valve closed, turn the adjusting screw inward (clockwise) until the desired pressure is reached. (Adjusting clockwise raises the pressure setting).
    - If the pressure reaches the desired level before the throttling valve is completely closed, turn the adjusting screw outward (counterclockwise) until the desired pressure is reached. (Adjusting counterclockwise lowers the pressure setting).
- Retighten the nut to lock the setting in place and replace the acorn nut.
- Recheck the pressure gauge reading.

If an internal relief valve has not been supplied with the pump some other means of protection must be utilized. These include in-line safety relief valves, pressure shutdown switches or other similar devices.

Strainer Protection

Strainers are used to remove contaminated particles from the fluid system and extend pump life. Every pump should be protected from these particles by a strainer in the suction line.

Strainer size and mesh of screen are determined by the rate of flow and viscosity of the fluid. Consult the strainer manufacturer for recommendations.

Never use a strainer with a built-in automatic by-pass on the suction line set to open under 30" Hg. vacuum.

Install the strainer according to the designated direction of flow, locating it so that it is accessible for servicing. Use a duplex type strainer when shutdown during service is not possible.

Provide a vacuum gauge in the suction line for determining when the strainer requires cleaning.

Make certain strainer baskets are properly reinforced so as not to collapse under 30" Hg. vacuum.

⚠ WARNING

All Tuthill pumps contain residual 200 SSU lube oil from the factory production test. Determine if this is compatible with the fluid you are pumping. If the fluid is incompatible, consult the factory.

If the pump is to operate at elevated temperatures, it should be brought up to operating temperature gradually. Rapid or sudden introduction of liquid at an elevated temperature into the cold liquid chamber of the pump could cause damage to the seal or other internal parts.

Do not run the pump dry. This could cause severe damage to the seal, bushings and/or metal parts.

Startup

Prior to starting the pump double check the following:

- Pressure and vacuum gauges should be installed as close as possible to the pump.
- Rotate pump shaft to ensure it turns freely without binding.
- Recheck alignment and ensure all guards are in place.
- Make sure piping is independently supported and no strain is being transmitted to the pump.
- Make sure the safety relief valve is installed correctly.
- Check pump rotation.
- Open suction and discharge gate valves.
- Check for any leaks once gate valves are open.

After completing these checks the pump can be started.

⚠ CAUTION

The pump should not be run dry. If after approximately 60 seconds there is no discharge of liquid, stop the pump and investigate the possible cause. Failure to comply with this could cause severe damage to internal seals, bushings and/or metal parts.

Pump Performance Data

size	capacity (gpm)
30L	.3
00L	.8
0L	1.6
1L	2.7
2L	4.9
5L	12.9

Based on pumping a fluid of 200 SSU viscosity at 100 psi and 1750 rpm.

⚠ WARNING

Failure to follow these instructions could result in serious bodily injury or death.

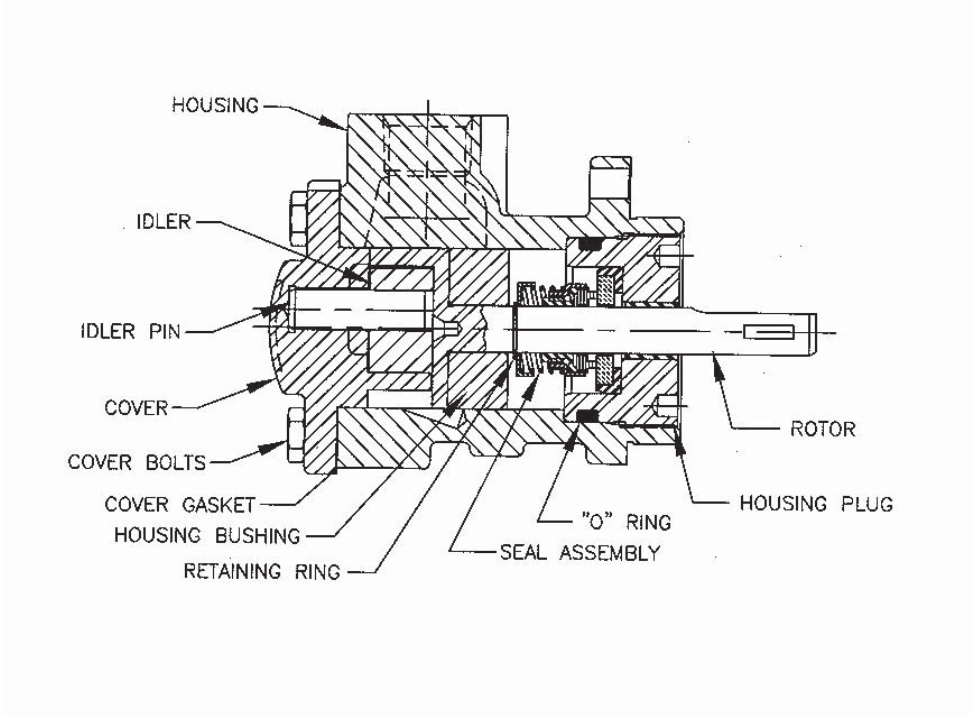
Do not attempt to work on any Tuthill pump installation before completing the steps below.

Disconnect the drive so that it cannot be started while work is being performed.

Review the Material Safety Data Sheet (MSDS) applicable to the liquid being pumped to determine its characteristics and the precautions necessary to ensure safe handling.

Vent all pressure within the pump through the suction or discharge lines.

All Tuthill pumps contain residual 200 SSU lube oil from the factory production test. Determine if this is compatible with the fluid you are pumping. If the fluid is incompatible, consult the factory.



Disassembly of Seal

The seal assembly in LA and LE Series pumps can be changed without disassembly of the rest of the pump.

- Place the pump in a vise with the shaft facing up so that one jaw grips across the two ports. Do not tighten excessively as the pump housing may be distorted.
- Inspect the shaft at the keyway, flat or tang. Any burrs will interfere with removal of the housing plug and bearing assembly.
- Remove the housing plug with a face-type spanner wrench, available from Tuthill as part number 0L 506.
- Remove the seal from the shaft. The rubber boot will be bonded to the shaft, so it is necessary to push down on the seal to break this bond. Grasp the metal outer shell with any suitable device and pull the seal assembly upward. Remove the spring and washer.

- Models 30LA through 1LA and models 30LE through 1LE have a snap ring on the shaft to back up the seal assembly. Do not remove this snap ring unless you are completely disassembling the pump. Models 2LA, 2LE and 5LE do not have a snap ring. A step on the shaft is used as the seal backup.
- Remove the stationary seal face from the housing plug by pressing out from the opposite side.
- If damaged, remove the O ring from the OD of the housing plug.

Disassembly of Pump

The seal assembly must be removed before the pump can be disassembled.

- Remove the snap ring from the shaft on all models except 2LA, 2LE and 5LE.
- Mark the cover and housing of the pump for proper re-assembly.
- Remove cover screws, cover, idler and rotor from the housing.

Inspection

Check the pump housing, rotor, idler gear. idler pin and cover for wear and chipped or broken teeth.

The housing bore and rotor OD may be checked for wear by positioning the rotor in the housing and checking for clearance in the bearing. The shaft must turn freely without any detectable side play. Any side play will require replacement of the housing and/or rotor. If either of these two parts must be replaced, it is economically advisable to replace the entire pump.

Assembly of Pump

The following must be carefully followed when the pump is re-assembled:

- Clean all parts thoroughly using great care to eliminate all dirt.
- Install the rotor in the pump housing.
- Apply the gasket to the cover. Use a new gasket if the old one is damaged. (Models 30LA, 30LE and 5LE are also supplied with an O ring in the cover. Replace if damaged.)
- Place the idler gear on the pin in the cover assembly.
- Place the cover assembly with gear on the pump, aligning the matching marks for proper location.
- Install the cover screws. Tighten gradually, alternating from a screw on one side to a screw on the opposite side.
- Install the snap ring on the shaft (except models 2LA, 2LE and 5LE).

Assembly of Seal

- Clean all parts thoroughly using great care to eliminate all dirt.
- Oil the shaft with a suitable lubricating oil. (If the pump has an EPR seal, apply a silicon based lubricant instead.)
- Apply the appropriate lubricant to the inside of the new seal assembly.

For standard full length shafts with flat and/or keyway:

- Place seal assembly on the pump shaft.
- Push seal down with your fingers to a position approximately half way down the shaft.

For modification "A" tang shafts:

- Use tapered plastic sleeve, available from Tuthill as part number 1LPF 531 7010.
- Lubricate the sleeve.
- Place seal assembly on the sleeve. The tapered end of the sleeve fits into the spring end of the seal assembly.
- Place the slotted end of the sleeve on a bench. Press down on the carbon face of the seal with your fingers and slide the seal to about the midpoint on the sleeve.
- Place the slotted end of the sleeve over the tang on the pump shaft. Line up the outside diameters of the sleeve and shaft by eye.
- Push seal down with your fingers so that it passes from the sleeve to a position approximately halfway down the shaft.

- Press the stationary face into the housing plug. The lapped surface must be up. Protect this lapped surface by covering it with a piece of paper when pressing down on the face. Use your fingers for this operation.
- Place a new O ring on the OD of the housing plug, if required, and lubricate.
- Lubricate the carbon face liberally.
- Re-assemble the housing plug into position over the pump shaft. Do not nick the seal face by hitting the pump shaft. Tighten the housing plug with the spanner wrench. The seal will automatically be positioned by this operation.
- If the pump is equipped with a ball bearing (modification K), press the bearing onto the shaft. Press on the bearing inner race with a suitable sleeve. Do not hammer into position or press on the bearing outer race.
- Check pump for free rotation by turning the shaft with a suitable wench. There will be a definite resistance to turning because of the seal load. The pump must turn freely without binding.

Changing Rotation

LA and LE Series pumps are bi-directional and will work equally well in either direction with no modification. However, if outfitted with an internal relief valve (model LEV), these pumps become rotational. Rotation cannot be changed in the field unless the housing is replaced.

To change the location of the suction port on a pump outfitted with Tuthill's unique automatic reversing feature (models RLA and RLE):

- Remove the cover screws.
- Rotate the cover 180° so that the boss on the cover points to the new suction (inlet) port.
- Align the mounting holes and reinstall the cover screws.

Note: Location of the suction port cannot be changed in the field on RLEV pumps unless the housing is replaced.

Troubleshooting

No fluid is delivered.

- Power is not on.
- Net positive suction head available (NPSHA) is lower than required for the inlet conditions and the vapor pressure of the liquid pumped. Calculate NPSHA and redesign piping if necessary.
- Leaks in suction line or port passages. These can be detected by submerging the pressure line from the discharge side of the pump into a pail of liquid where the air will be seen in the form of bubbles.
- Direction of shaft rotation is incorrect.
- Pump shaft is not rotating. The coupling is defective or the tongue and groove are not engaged.
- The relief valve setting is too low. Liquid is discharging through the by-pass port.

Capacity is too low.

- There are air leaks in the suction line.
- Suction losses are too high. The suction lift is too great or the suction line too small or too long. This can be detected by installing a vacuum gauge directly at the pump suction. The maximum vacuum at the pump suction should never exceed 15" of mercury. Vaporization caused by higher vacuums will generally result in capacity drop off. Suction conditions must be redesigned.
- Pump speed is too slow.
- The strainer is too small or obstructed.
- The suction port or pipe is not immersed deeply enough in the liquid.
- Piping is improperly installed, permitting an air pocket to form in the pump.
- Increased clearances or wear in the pump will sometimes cause the pump to deliver an insufficient supply of fluid. This can generally be corrected by reducing the thickness of the cover gaskets. A folded gasket or a slight amount of dirt can exaggerate the problem and cause leakage.

Pump works spasmodically.

- Leaky suction line.
- Varying suction conditions.
- Air or vapor in the fluid.

Excessive power draw.

- Pressure too high.
- Liquid is more viscous than originally expected.
- Suction or discharge lines obstructed.
- Insufficient horsepower.
- Drive shaft and pump misaligned.
- Pump binding due to insufficient end clearance.
- Pump shaft is bent.
- Misalignment within the pump due to bad piping or poor installation, causing strain or distortion.

Pump is noisy.

- Pump is cavitating due to inadequate suction conditions.
- Misalignment of coupling.
- Coupling is set too close to pump.
- Vibration of pump due to worn or bent shaft.
- Air leaks on suction side of pump or air entrainment in the fluid.

Pump leaks.

- Cover bolts need tightening or cover gasket is defective.
- Worn or defective seal.

Material Returns

If it becomes necessary to return a pump to the factory, a Return Goods Authorization (RGA) must be obtained from either your local Authorized Distributor or our Chicago plant. No RGA can be issued until a completed Material Safety Data Sheet (MSDS) has been forwarded to our Chicago plant and return of the pump approved.

- Tuthill pumps are precision built and must be handled with care.
- Pumps must be drained of all fluid and the ports plugged to prevent foreign material from getting into the pump.
- Pumps must be packaged securely to prevent damage while in transit.

Notes:

TUTHILL
Pump Group

12500 South Pulaski Road
Alsip, Illinois USA 60803
Tel 708 389-2500 Fax 708 388-0869
email: tuthillpump@tuthill.com
www.tuthill.com

Section 5

TECO Westinghouse

ISSUED		ENCLOSURE
October 28, 2013	**PERFORMANCE DATA**	EXPLOSION PROOF
TYPE	**3-PHASE INDUCTION MOTOR**	CATALOG#
AEHHXF		XP0016C

NAMEPLATE INFORMATION

OUTPUT HP	OUTPUT KW	POLE	FRAME SIZE	VOLTAGE	HZ	RATED AMBIENT	INS. CLASS	NEMA DESIGN	TIME RATING	SERVICE FACTOR
1	0.7	6	145TC	230/460	60	40°C	F	B	CONT.	1.15

TYPICAL PERFORMANCE

FULL LOAD RPM	EFFICIENCY				POWER FACTOR			MAXIMUM POWER FACTOR CORRECTION
	FULL LOAD MIN. %	FULL LOAD NOM. %	3/4 LOAD %	1/2 LOAD %	F. L. %	3/4 LOAD %	1/2 LOAD %	
1150	80	82.5	82	79.5	66	57	45	0.9 KVAR

CURRENTS									NEMA KVA CODE LETTER
NO LOAD			FULL LOAD			LOCKED ROTOR			
AT 208 VOLT	AT 230 VOLT	AT 460 VOLT	AT 208 VOLT	AT 230 VOLT	AT 460 VOLT	AT 208 VOLT	AT 230 VOLT	AT 460 VOLT	
1.85	2.26	1.13	3.80	3.44	1.72	27.13	30.00	15.00	N

TORQUE				INERTIA			ACCEL TIME	
FULL LOAD lb-ft	LOCKED ROTOR %FLT	PULL UP %FLT	BREAK DOWN %FLT	ROTOR WR^2 $lb\text{-}ft^2$	NEMA LOAD WK^2 $lb\text{-}ft^2$	MAX ALLOWABLE WK^2 $lb\text{-}ft^2$	NEMA LOAD WK^2 Sec	MAX ALLOWABLE WK^2 Sec
4.566	250	235	305	0.122	15	79.00	4.90	25.62

SAFE STALL TIME IN SECONDS		ALLOWABLE STARTS PER HOUR		SOUND PRESSURE LEVEL @ 3 FT dB(A)
COLD	HOT	COLD	HOT	
60	42	2	1	50

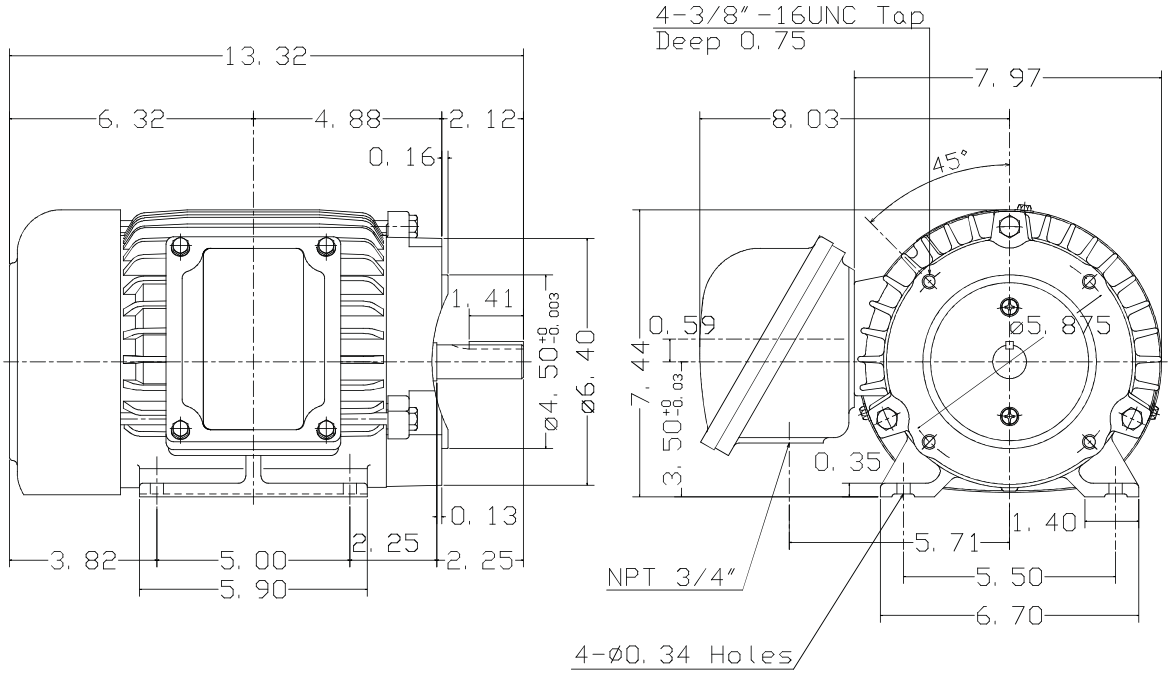
APPROVED:	M. PRATER	DRAWING NO.	31057XP0016C	REVISION 0

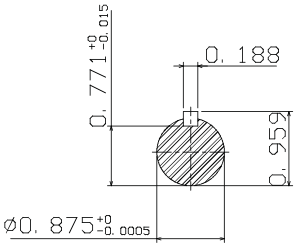
DATE	OUTLINE DIMENSIONS	MOTOR TYPE:
JAN 4, 2012		AEHHXF
CATALOG NO. XP0016C	3-PHASE INDUCTION MOTOR	FRAME NO. 145TC

Pole	HP	KW	Hz	VOLT	Syn. Speed RPM
6	1	.75	60	230/460	1200

Ins	Rating	Dimension in	Approx Weight	Bearings	
F	CONT.	inches	102 lbs.	DE: 6205ZZ	NDE: 6205ZZ

Totally Enclosed Fan-Cooled Type, Squirrel-Cage Rotor.

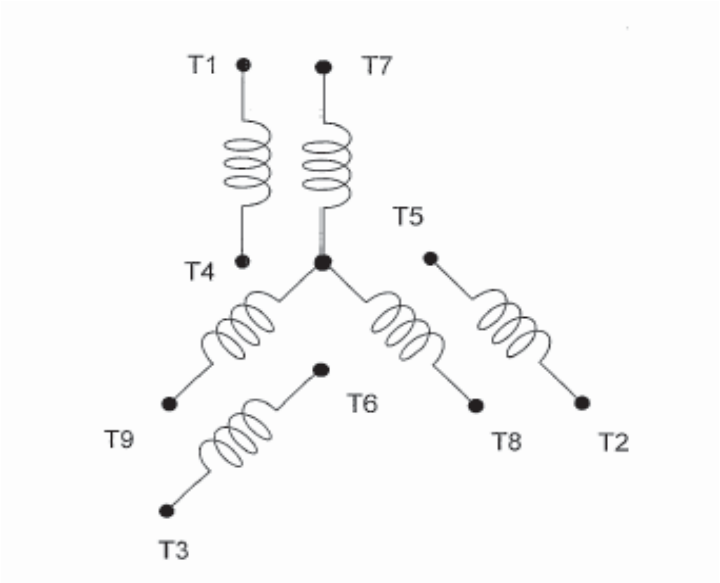




NOTE:
1. EXPLOSION PROOF:
CLASS I GROUP C, D AND
CLASS II GROUP E,F,G.

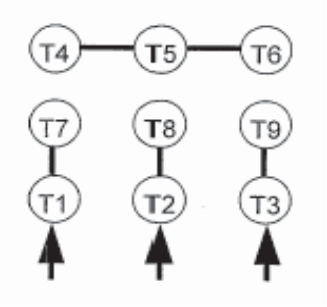
DWN.	J. H. LIANG	11-12-98	TECO Westinghouse	DWG NO.	31049M620020
CHKD.	C. S. LO	11-23-98			
APPD.	Y. B. HUANG	11-23-98			

DATE: May 14, 2011	CONNECTION DIAGRAM	CATALOG NO.: XP0016

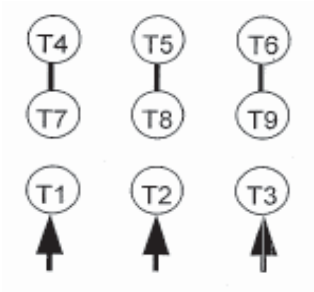


SCHEMATIC - 2Y/Y CONNECTION

ACROSS THE LINE CONNECTION



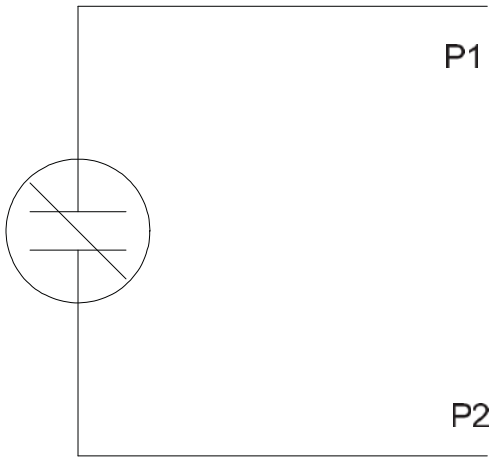
LINE
230 VOLT CONNECTION



LINE
460 VOLT CONNECTION

TECO Westinghouse

DWG NO.
DAC-1566-2



NORMALLY CLOSED
OPENS ON RISING TEMP

STATOR WINDING THERMOSTATS SCHEMATIC DIAGRAM

REV DATA							
				DFTM D. BRYAN	061581	S.O. 1625AA	REV
				APPD G. GODWIN	070881	D SPEC 110A75	02
		APPD J. BROWN	071481	APPD CULBERTSON	070881	DIMENSIONS IN INCHES - NTS	
	AMT; DEM; 04/30/99	APPD	_____	APPD D.F. KOSAR	071381	8629A28	

TECO-WESTINGHOUSE MOTOR COMPANY ROUND ROCK, TX USA

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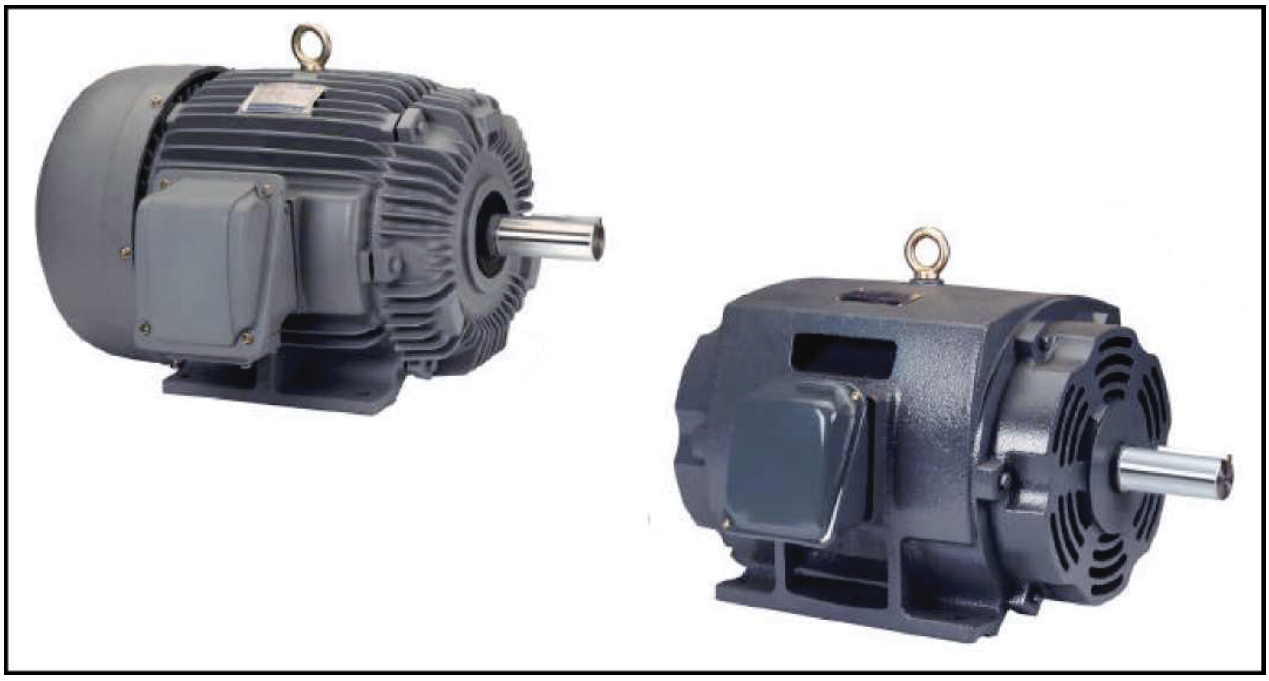
TECO Westinghouse

INSTALLATION AND MAINTENANCE INSTRUCTIONS FOR THREE PHASE INDUCTION MOTORS

Frames 56 and 143T - 449TZ



5100 North IH 35 Round Rock, Texas 78681

RECEIVING

1. Check nameplate data.
2. Check whether any damage has occurred during transportation.
3. After removal of shaft clamp, turn shaft by hand to check that it turns freely.
4. If motor is to be reshipped (alone or installed to another piece of equipment) the shaft must again be clamped to prevent axial movement.
   Note: Remove the bearing clamp before turning the shaft on 284T-449TZ frame motors.

WARNING
THE FOLLOWING SAFETY PRECAUTIONS MUST BE OBSERVED:

1. Electric rotating machinery and high voltage can cause serious or fatal injury if improperly installed, operated or maintained. Responsible personnel should be familiarized with NEMA MG-1; Safety Standards for Construction and Guide Selection. Installation and Use of Electric Motors and Generators; National Electric Code and all local safety requirements.
2. When servicing, all power sources to the motor and to the accessory devices should be de-energized and disconnected and all rotating parts should be at standstill.
3. Lifting means, when supplied, are intended for lifting the motor only. When two lifting devices are supplied with the motor a dual chain must be used.
4. Suitable protection must be used when working near machinery with high noise levels.
5. Safeguard or protective devices must not be by-passed or rendered inoperative.
6. The frame of this machine must be grounded in accordance with the National Electric Code and applicable local codes.
7. A suitable enclosure should be provided to prevent access to the motor by other than authorized personnel. Extra caution should be observed around motors that are automatically or have automatic re-setting relays as they may restart unexpectedly.
8. Shaft key must be fully captive or removed before motor is started.
9. Provide proper safeguards for personnel against possible failure of motor-mounted brake, particularly on applications involving overhauling loads.
10. Explosion proof motors are constructed to comply with the label service procedure manual, repair of these motors must be made by TECO-Westinghouse Motor Company or U/L listed service center in order to maintain U/L listing.

LOCATION

1. Drip-proof motors are intended for use where atmosphere is relatively clean, dry, well ventilated and non-corrosive.
2. Totally enclosed motors may be installed where dirt, moisture, or dust are present and in outdoor locations.
3. Explosion-proof motors are built for use in hazardous locations as indicated by Underwriters' label on the motor.
4. Chemical duty enclosed motors are designed for installation in high corrosion or excessive moisture locations.

   Note: in all cases, no surrounding structure should obstruct normal flow or ventilating air through or over the motor.

MOUNTING

1. Mount motor securely on a firm, flat base. All ball bearing normal thrust motors up to and including 256T frame size may be side-wall or ceiling mounted; all others check nearest TECO-Westinghouse office for mounting recommendations.
2. Align motor accurately, using a flexible coupling if possible. For drive recommendations, consult with drive or equipment manufacturer, or TECO-Westinghouse.
3. Mounting bolts must be carefully tightened to prevent changes in alignment and possible damage to the equipment. The recommended tightening torque's for medium carbon steel bolts, identified by three radial lines at 120 degrees on the head, are:

Bolt Size	Recommended Torque (Ft-lb.)	
	Minimum	Maximum
2/8	25	37
1/2	60	90
5/8	120	180
3/4	210	320

4. V-belts Sheave Pitch Diameters should not be less than those shown in Table 1 (NEMA recommended values)
5. Tighten belts only enough to prevent slippage. Belt speed should not exceed 5000 ft. per min.

TABLE 1. V-Belt Sheave Pitch Diameters (MG1-14.42)

Frame Number	Horsepower at Synchronous Speed, RPM				V-Belt Sheave			
					Conventional A, B, C, D AND E		Narrow 3V, 5V, AND 8V	
	3600	1800	1200	900	Minimum Pitch Diameter Inches	*Maximum Width Inches	Minimum Outside Diameter Inches	**Maximum Width Inches
143T	1.5	1	.75	.5	2.2	4.25	2.2	2.25
145T	2-3	1.5-2	1	.75	2.4	4.25	2.4	2.25
182T	3	3	1.5	1	2.4	5.25	2.4	2.75
182T	5	...	...	...	2.6	5.25	2.4	2.75
184T	...	...	2	1.5	2.4	5.25	2.4	2.75
184T	5	...	...	...	2.6	5.25	2.4	2.75
184T	7.5	5	...	...	3.0	5.25	3.0	2.75
213T	7.5-10	7.5	3	2	3.0	6.5	3.0	3.375
215T	10	...	5	3	3.0	6.5	3.0	3.375
215T	15	10	...	...	3.8	6.5	3.8	3.375
254T	15	...	7.5	5	3.8	7.75	3.8	4
254T	20	15	...	...	4.4	7.75	4.4	4
256T	20-25	...	10	7.5	4.4	7.75	4.4	4
256T	...	20	...	...	4.6	7.75	4.4	4
284T	...	...	15	10	4.6	9	4.4	4.625
284T	...	25	...	...	5.0	9	4.4	4.625
286T	...	30	20	15	5.4	9	5.2	4.625

TABLE 1. V-Belt Sheave Pitch Diameters (MG1-14.42)

Frame Number	Horsepower at Synchronous Speed, RPM				V-Belt Sheave			
					Conventional A, B, C, D AND E		Narrow 3V, 5V, AND 8V	
	3600	1800	1200	900	Minimum Pitch Diameter Inches	*Maximum Width Inches	Minimum Outside Diameter Inches	**Maximum Width Inches
324T	...	40	25	20	6.0	10.25	6.0	5.25
326T	...	50	30	25	6.8	10.25	6.8	5.25
364T	...	...	40	30	6.8	11.5	6.8	5
364T	...	60	...	...	7.4	11.5	7.4	5.785
365T	...	...	50	40	8.2	11.5	8.2	5.785
365T	...	75	...	...	9.0	11.5	8.6	5.785
404T	...	...	60	...	9.0	14.25	8.0	7.25
404T	...	...	...	50	9.0	14.25	8.4	7.25
404T	...	100	...	...	10.0	14.25	8.6	7.25
405T	...	...	75	60	10.0	14.25	10.0	7.25
405T	...	100	...	...	10.0	14.25	8.6	7.25
405T	...	125	...	...	11.5	14.25	10.5	7.25
444T	...	...	100	...	11.0	16.75	10.0	8.5
444T	...	...	...	75	10.5	16.75	9.5	8.5
444T	...	125	...	...	11.0	16.75	9.5	8.5
444T	...	150	...	...	...	16.75	10.5	8.5
445T	...	...	125	...	12.5	16.75	12.0	8.5
445T	...	...	...	100	12.5	16.75	12.0	8.5
445T	...	150	...	...	...	16.75	10.5	8.5

*****Max. Sheave width = 2(N-W) - .25

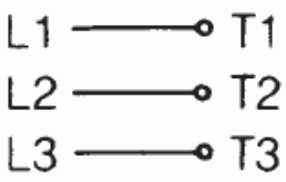
**Max Sheave width = N-W

***Sheave ratios grater than 5:1 and center-to-center distance less than the diameter of the large sheave should be referred to TECO-Westinghouse.

POWER SUPPLY & CONNECTIONS

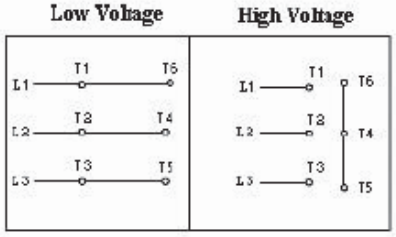
1. Wiring of motor and control, overload protection and grounding should be in accordance with National Electrical Code and all local safety requirements.
2. Nameplate voltage and frequency should agree with power supply. Motor will operate satisfactorily on line voltage within ±10% of nameplate voltage; or frequency with ±5% and with a combined variation not to exceed ±10%. 230-volt motors can be used on 208-volt network systems, but with slightly modified performance characteristics as shown on the nameplate.
3. Dual voltage and single voltage motors can be connected for the desired voltage by following connection diagram shown on the nameplate or inside of the conduit box.
4. All Explosion Proof motors have Temperature Limiting Devices in the motor enclosure to prevent excessive external surface temperature of the motor in accordance with U/L standards. Terminals of thermal protectors (P1 & P2) should be connected to the motor control equipment, according to the connection diagram inside of the conduit box.
5. Standard connection diagram for three phase, not thermally protected, dual rotation motors are shown in diagrams A through E. **(Note: To change rotation, Interchange any two line leads)**

A. 3 Lead, Single Voltage

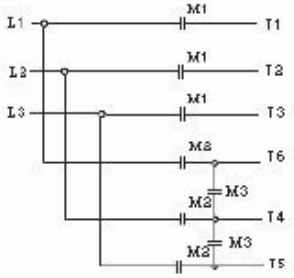


B. 6 Lead, Dual Voltage & Voltage Ration 1 to 3

B-1 Across the Line Start & Run



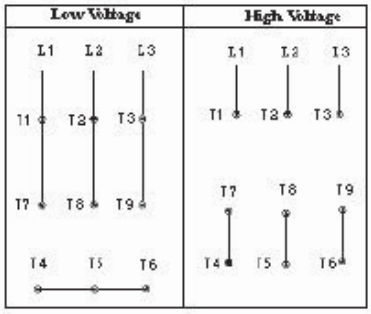
B-2 Wye Start & Delta Run
(Low Voltage only)



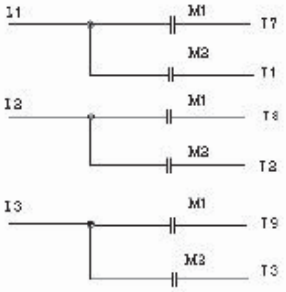
	START	RUN
M1	CLOSE	CLOSE
M2	OPEN	CLOSE
M3	CLOSE	OPEN

C. 9 Leads; Dual Voltage & Voltage Ratio 1 to 2, Wye Connected

C-1 Across the Line Start & Run



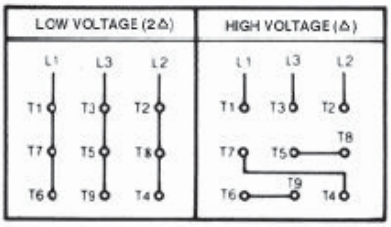
C-2 Part Winding Start
(Low Voltage only)



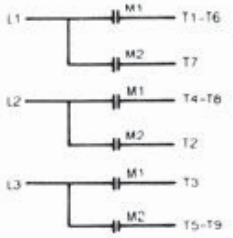
	START	RUN
M1	CLOSE	CLOSE
M2	OPEN	CLOSE
Tie Together	(T4-T5-T6)	

D. 9 Leads; Dual Voltage & Voltage Ration 1 to 2, Delta Connected

D-1 Across the Line Start & Run



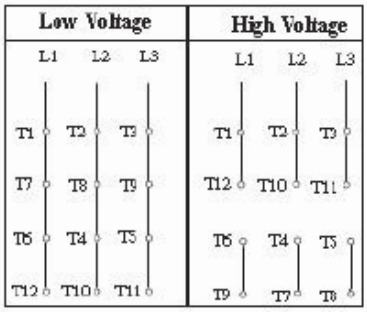
D-2 Part Winding Start (Low Voltage only)



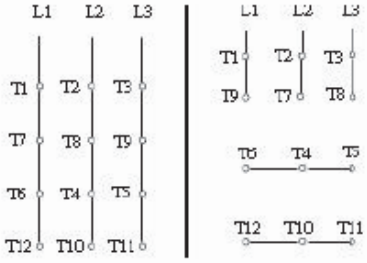
	START	RUN
M1	CLOSE	CLOSE
M2	OPEN	CLOSE

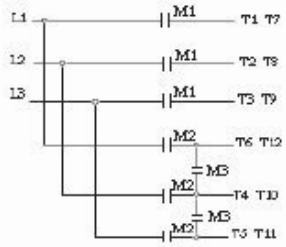
E. 12 Leads, Dual Voltage

E-1 Across the Line Start & Run



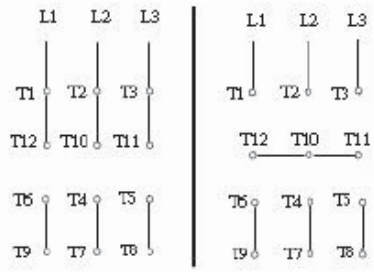
E-2-1 Wye Start & Delta Run (Low Voltage only)

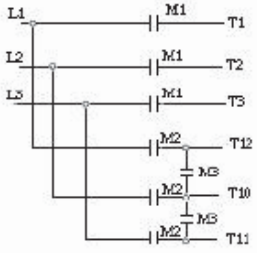




	START	RUN
M1	CLOSE	CLOSE
M2	OPEN	CLOSE
M3	CLOSE	OPEN

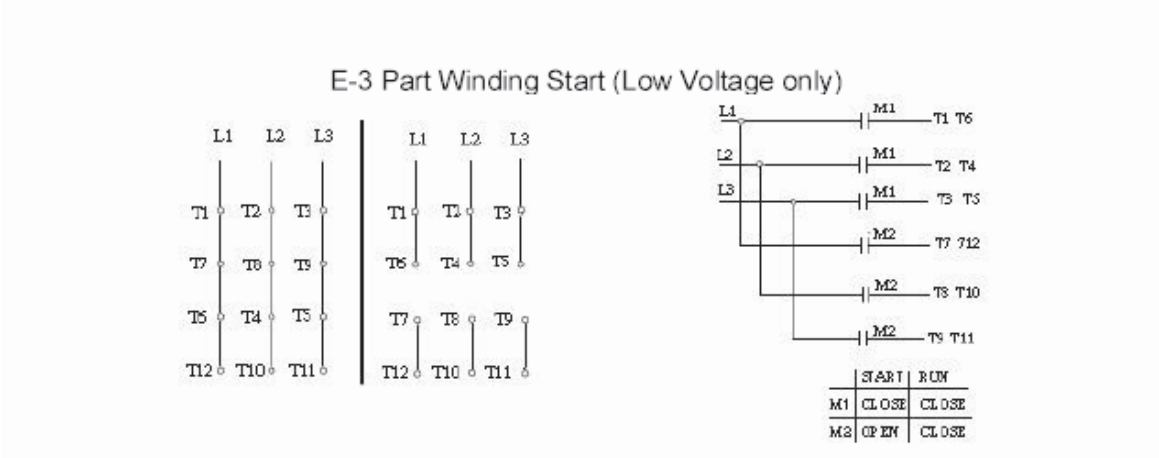
E-2-2 Wye Start & Delta Run (High Voltage only)





	START	RUN
M1	CLOSE	CLOSE
M2	OPEN	CLOSE
M3	CLOSE	OPEN

T4 Together (T4-T7); (T5-T8); (T6-T9)



*Important: For Part Winding Start, M2 contactor should be closed within two (2) seconds after M1 contactor is closed.
Only 4 pole and above (e.g., 6P, 8P...) motors are satisfactory for Part Winding Start at low voltage.

START UP

1. Disconnect load and start motor. Check direction of rotation. If rotation must be changed, ALLOW THE MOTOR TO STOP COMPLETLEY. Interchange any two leads of a three-phase motor.
2. Connect load. The motor should start quickly and run smoothly. If no, shut power off at once. Recheck the assembly including all connections before restarting.
3. If excessive vibration is noted, check for loose mounting bolts too flexible motor support structure or transmitted vibration from adjacent machinery. Periodic vibration checks should be made; foundations often settle.
4. Operate under load for short period of time and check operating current against nameplate.

TESTING

If the motor has been in storage for an extensive period or has been subjected to adverse moisture conditions, it is best to check the insulation resistance of the stator winding with a megometer. Depending on the length and conditions of storage it may be necessary to regrease or change rusted bearings.
If the resistance is lower than one megohm the windings should be dried in one of the following two ways:

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

MAINTENANCE

INSPECTION

Inspect motor at regular intervals. Keep motor clean and ventilation openings clear.

LUBRICATION

1. Frame 143T-256T: Double shielded and pre-lubricated ball-bearing motors without grease fittings and don't need re-lubrication, except on MAX-E1® and MAX-E2® products which have re-greasable features.
2. Frames 280TS, 320-449TZ(TS): Motors having grease fittings and grease discharge devices at brackets. Motors are shipped with grease for initial running. It is necessary to re-lubricate anti-friction bearing motors periodically, depending on size and type of service. See Table 2 to provide maximum bearing life. Excessive or too frequent lubrication may damage the motor.

TABLE 2

Horsepower	Standard Conditions	Severe Conditions	Extreme Conditions
1 Thru 30 Hp, 1800 rpm and below	7 years	3 years	180 days
40 Thru 75 Hp, 1800 rpm and below	210 days	70 days	30 days
100 Thru 150 Hp, 1800 rpm and below	90 days	30 days	15 days
1 Thru 20 Hp, 3600 rpm	5 years	2 years	90 days
25 Thru 75 Hp, 3600 rpm	180 days	60 days	30 days
100 Thru 150 Hp, 3600 rpm	90 days	30 days	15 days

Note:

A. Standard conditions: 8 hours operation per day, normal or light loading, clear and 40°C ambient conditions.
B. Severe conditions: 24-hour operation per day or light shock loading, vibration or in dirty or dusty conditions.
C. Extreme conditions: With heavy shock loading or vibration or dusty conditions.
D. For double shielded bearings, above data (lubrication frequency) means that the bearing must be replaced.

3. Be sure fittings are clean and free from dirt. Using a low-pressure grease gun, pump in the recommended grease until new grease appears at grease discharge hole.
4. Use the POLYUREA grease unless special grease is specified on the nameplate.
5. If re-lubrication is to be performed with the motor running, stay clear of rotating parts. After re-greasing, allow the motor to run for ten to thirty minutes.

RENEWAL PARTS

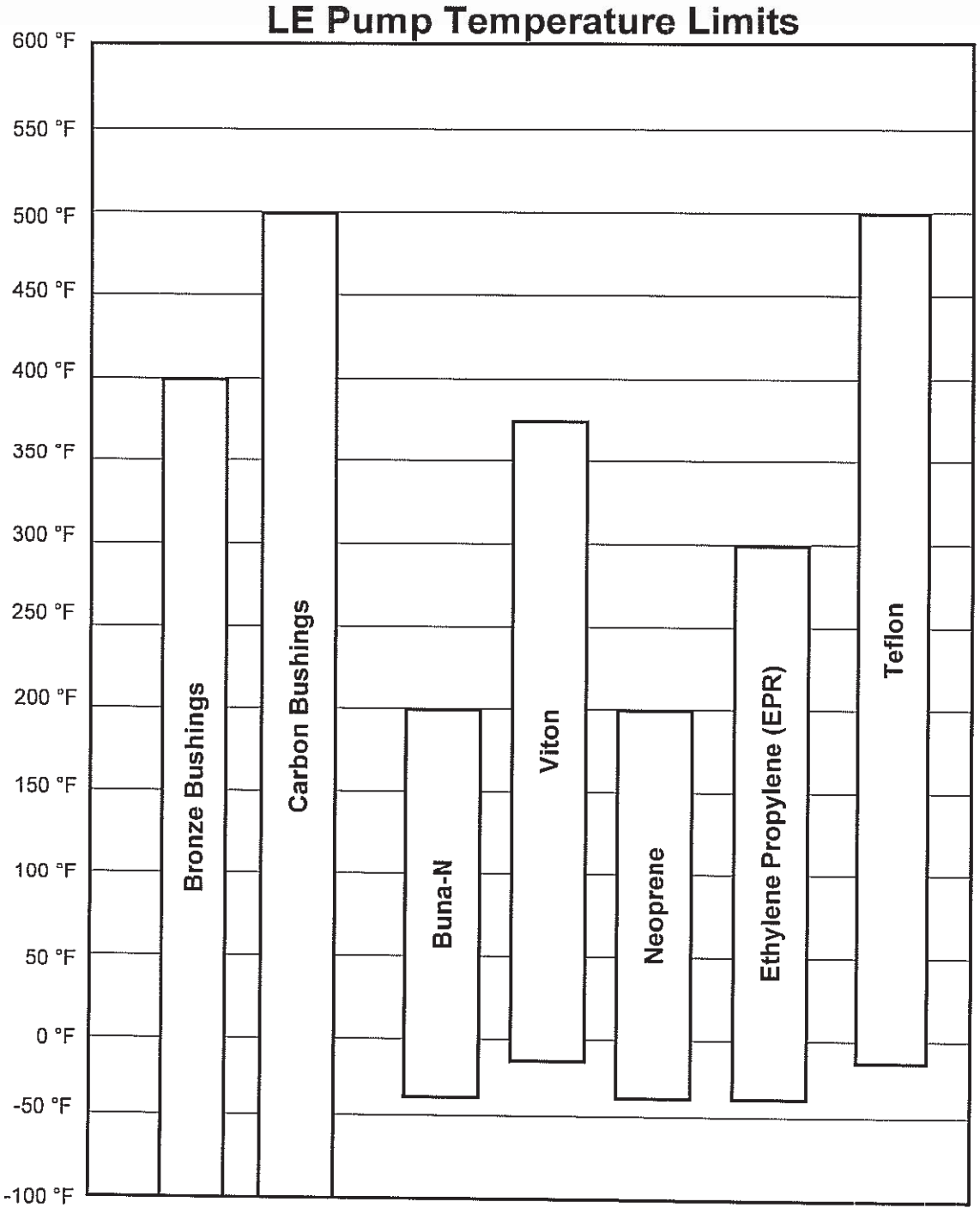
1. Use only genuine TECO-Westinghouse renewal parts or as recommended by TECO-Westinghouse Motor Company.
2. When you order renewal parts please specify complete information to TECO-Westinghouse office/agent such as type, frame no., poles, horsepower, voltage, series no., quantity, etc.

FOR FURTHER INFORMATION PLEASE CONTACT

TECO-WESTINGHOUSE MOTOR COMPANY

Round Rock, TX **800-873-8326**

Section 6



Notes:

1. A pump's performance is dependent on more than just the temperature ranges of the component materials.

LE Pump Materials of Construction

Part Name	*Material*	*Standard*	*Comments*	*Availability*
Housing	Cast Iron	ASTM A48 – 96a	Classes 25, 30, 35, or 40	Std.
Housing Bushing	Steel	AISI 12L14		Std.
	Carbon	Carbon Graphite Resin		Opt.
	Bronze	SAE 660	Available on 2L size only	Std.
Cover	Cast Iron	ASTM A48 – 96a	Classes 25, 30, 35, or 40	Std.
Rotor	Steel	ASTM A311	Stressproof	Std.
Idler	P/M Steel	MPIF-0508-P		Std.
	Steel	C1118 or C1117		Opt.
	Plastic	PPS	Available on 30L size only	Std.
Idler Pin	Steel	C1117	Heat Treated	Std.
Idler Bushing	Bronze	SAE 660		Std.*
	Carbon	Carbon Graphite Resin		Opt.
Housing Plug	Steel	AISI 12L14	DU Bushing is assembled in housing plug	Std.
Gaskets	Standard	Oriented Polyester		Std.
	Standard	Buna Coated Aluminum	Available on 2L size only	Std.
O-Rings	Buna			Std.
	Viton			Opt.
	Neoprene			Opt.
	EPR			Opt.
	Teflon			Opt.

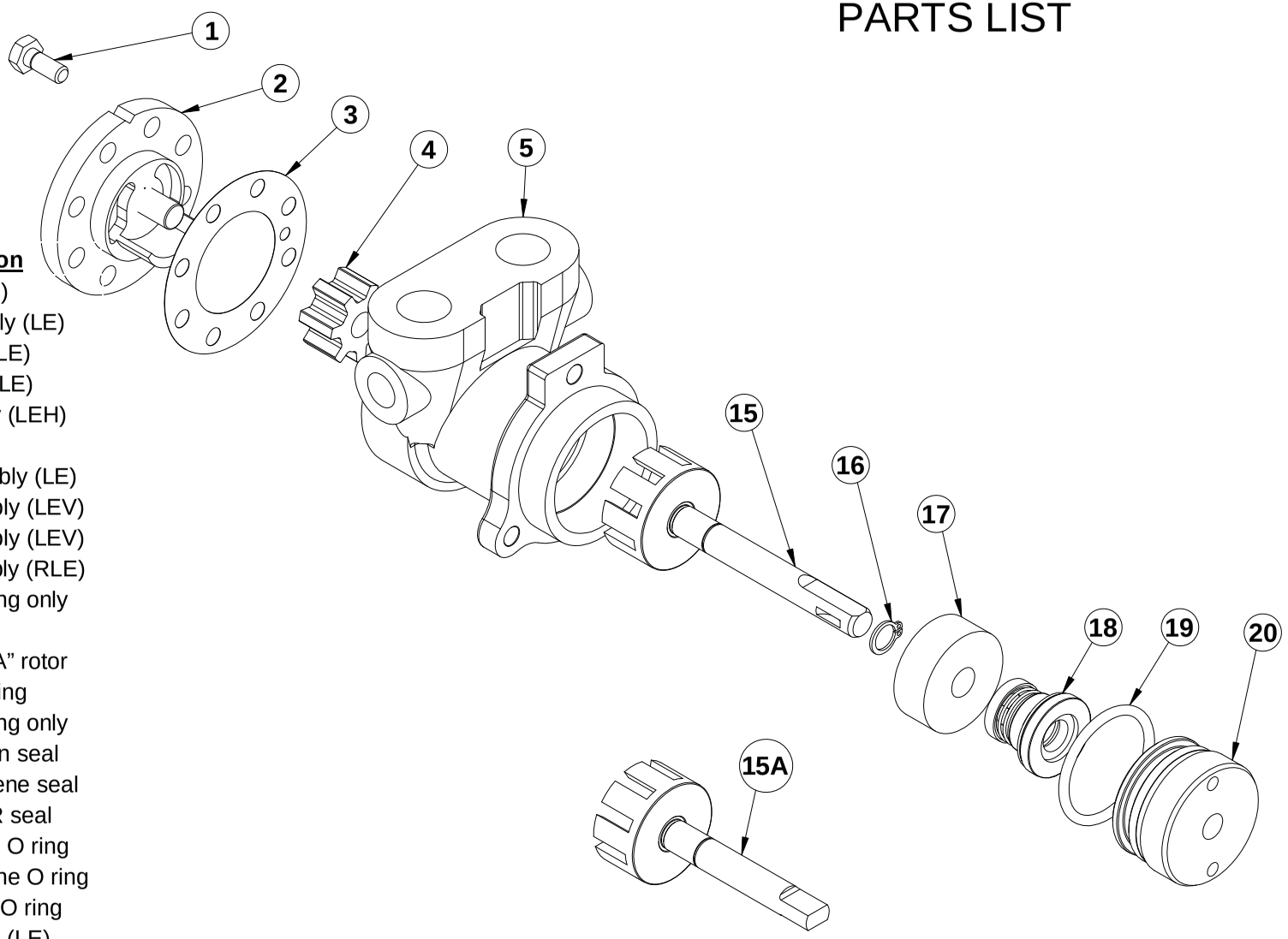
* Bronze idler bushing standard on 5LE pumps only.

Section 7

TUTHILL
Pump Group
12500 South Pulaski Road
Alsip, Illinois USA 60803
Tel 708 389-2500 Fax 708 388-0869
email: tuthillpump@tuthill.com
www.tuthill.com

2LE

PARTS LIST



Item	Part Number	Description
1	P101-3-H	screw (6)
2	2L6	cover assembly (LE)
3	2RFD34-.013	gasket (RLE)
4	2L32-1	idler gear (LE)
	2L5	idler assembly (LEH)
	2L33	bushing
5	2LE2	housing assembly (LE)
	2LEV2-C	housing assembly (LEV)
	2LEV2-CC	housing assembly (LEV)
	2RLE2	housing assembly (RLE)
	1MR71	housing bushing only
15	2LE24	rotor
15a	2LE24-A	modification "A" rotor
		retaining ring
17	1MR71	housing bushing only
18	1LA9-7	standard Viton seal
	1LA9-5	optional Neoprene seal
	1LA9-8	optional EPR seal
19	P701-34-77	standard Viton O ring
	P701-34-57	optional Neoprene O ring
	P701-34-87	optional EPR O ring
20	1LA11	housing plug (LE)

3/26/2009

TUTHILL
Pump Group
12500 South Pulaski Road
Alsip, Illinois USA 60803
Tel 708 389-2500 Fax 708 388-0869
email: tuthillpump@tuthill.com
www.tuthill.com

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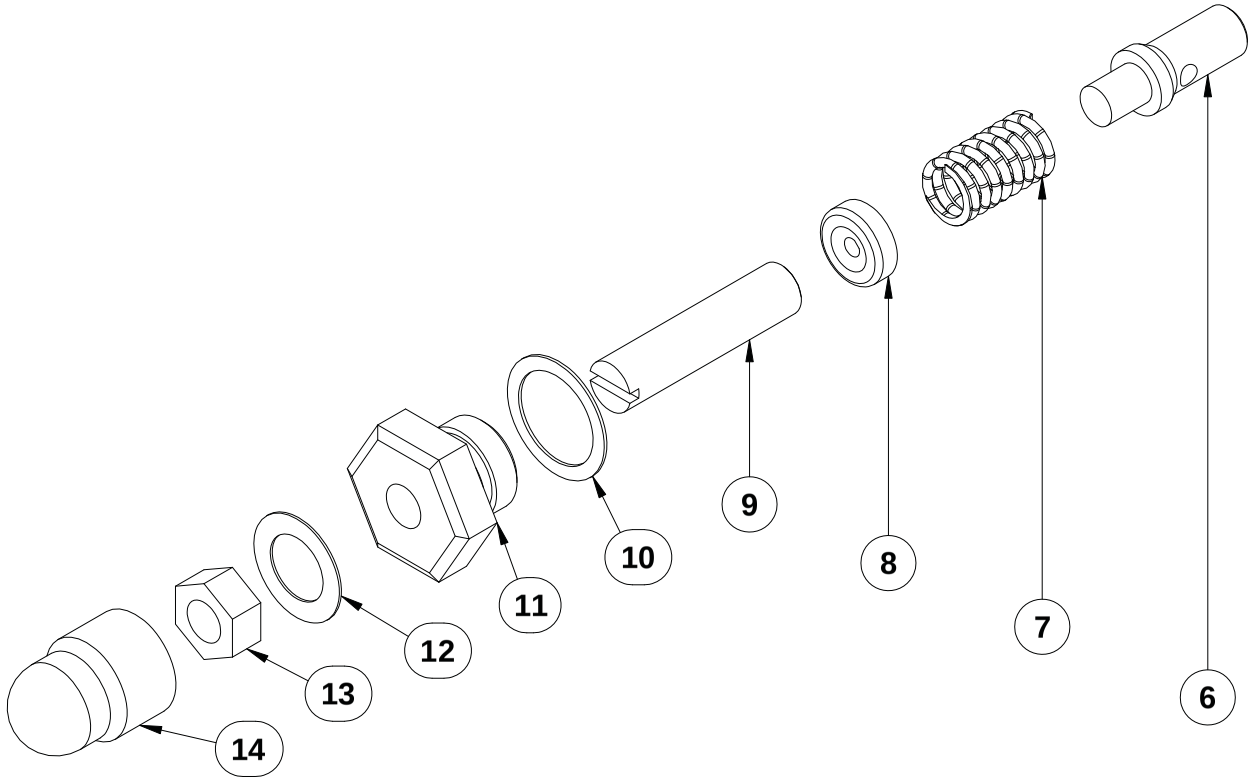
RELIEF VALVE OPTION

Item	Part Number	Description
6	0LV58-X201	plunger
7	0LWV63	standard spring (55-120)
	30F80-X	optional spring (15-30)
	0C62-X201	optional spring (30-34)
	0C62-X299	optional spring (35-54)
	0LWVH63	optional spring (121-169)
	0LPV63	optional spring (170-374)
	0LV63X	optional spring (375-500)
8	30EN92	retainer
9	P103-11	adjusting screw
10	30F64-X201	valve cap gasket
11	0LWV56	valve cap gasket
12	30LE64-A	cap cover gasket
13	30LE528	nut
14	30LE56	acorn nut



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Alsip, Illinois USA 60803
Tel 708 389-2500 Fax 708 388-0869
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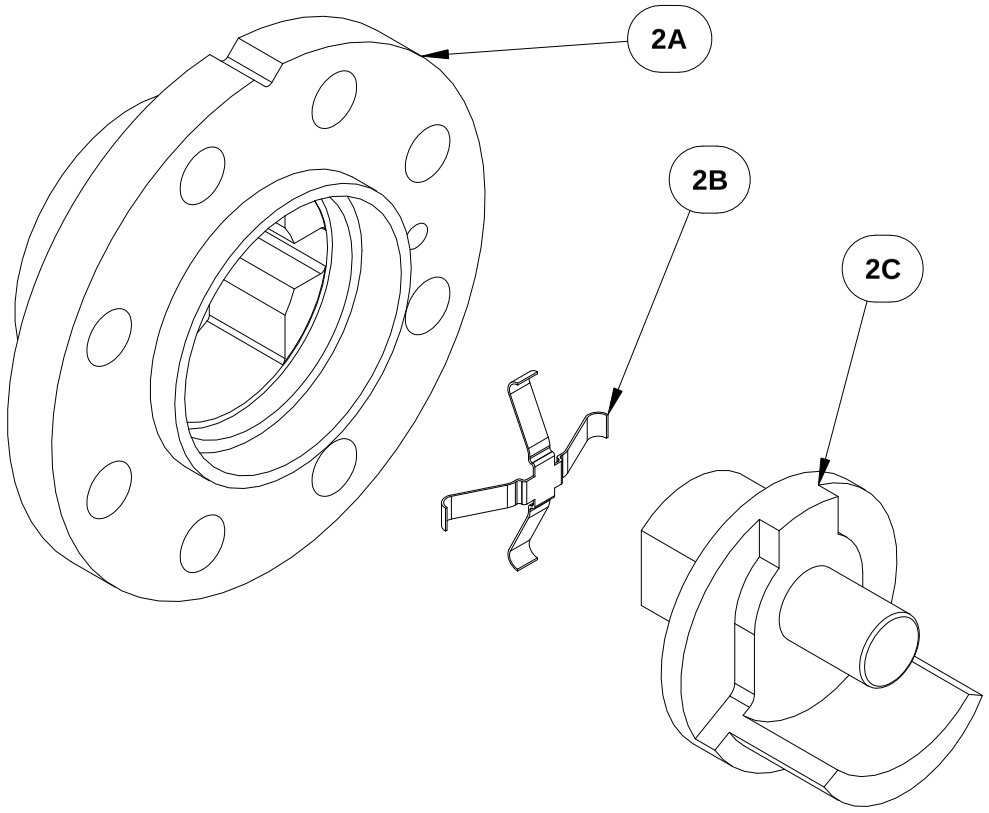
REVERSING OPTION

Item	Part Number	Description
2a	2RL35	cover (RLE)
2b	1R80-A	spring (RLE)
2c	2RL6	carrier assembly (RLE)
	2L31	pin



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Pump Group
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BALL BEARING OPTION

Item	Part Number	Description
20a	1LAK37	housing plug (LEK)
20b	0LK511-E	ball bearing (LEK)