Smith &
Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

VACUUM PRIMED NON-CLOG PUMPS
SECTION INDEX

4" – PUMPS

Pump Assembly Drawings & Curves (Continued)

6" – PUMPS

Pump Assembly Drawings & Curves

NOTES ON DESIGN FOR X-PELLER® PUMP

Smith & Loveless has raised non-clog pumping to a new level with the Smith & Loveless **X-PELLER®** pump design. In addition to all of the features and associated benefits incorporated in the traditional Smith & Loveless pump design (such as solid stainless steel shaft, oversized bearings, full diameter impeller shrouds, tapered shaft, long life seal, etc.), Smith & Loveless **X-PELLER®** pumps with the patented mono-port hydraulic design give a new meaning to the term "non-clog".

The unique mono-port, single passageway, "V" vane design virtually eliminates the opportunity for pump solids to hang up in the impeller. Stringy material, which used to hang up on the leading edges of the vanes of two-port impellers, now has no place to lodge, and passes freely through the pump. Passageway openings through the impeller have a cross-section of at least 10.6 square inches, and clearance to pass a three-inch (3") sphere, so large solids are not a problem either.

A typical two-port pump impeller includes a single suction eye having two ports opening into opposing expanding chambers. The ports have smaller openings than the single, axial opening of the suction eye, due to the fact that each port handles one-half of the total flow. Solids, which are small enough to enter the suction eye axial opening, may be too large to pass through either port, eventually significantly plugging the impeller. Stringy material may have one end drawn into one port and the other end drawn into the other port. Thus, the material may be draped around the base edge of an impeller vane. More stringy materials can build up this way, and the ports can become substantially clogged. Furthermore, even if the materials impeding flow through the ports do not completely clog the impeller, the buildup of these materials may cause the pump impeller to be out of balance, resulting in pump vibration.

To alleviate these problems, a mono-port centrifugal pump impeller is used in the **X-PELLER®** pump, making it ideal for solids handling, i.e., handling liquids with entrained solid matter. The mono-port impeller design eliminates clogging in solids-handling applications, particularly when handling stringy materials.

The single radial passage through the impeller is essentially the same size as the opening of the suction eye of the impeller, so that any object entering the pump will pass completely through the impeller without clogging. There are no impeller parts for stringy material to hang on, which would restrict flow through the impeller.

The **X-PELLER®** is ideally suited for pumping applications for prisons, hospitals, mental institutions, and other type applications where high concentrations of large or stringy solids might be expected. The **X-PELLER®** is also ideally suited for sludge pumping applications, such as RAS or WAS flows in a treatment plant. As with all Smith & Loveless pumps, a fresh water seal system is recommended when pumping sludge.

Field experience has shown that plugging is not often a problem with six-inch (6") pumps, and virtually unheard of in pumps eight inches (8") and larger, when handling raw sewage. It is mostly in the four-inch (4") size pumps that plugging has been traditionally a problem. This is due in part to the lower flows involved, as well as the smaller geometry. The **X-PELLER®** pump eliminates the catch points for stringy materials and passes the entire flow through a single port opening, with a cross-sectional area of up to fifty percent (50%) greater than that of the passageway of a two-port impeller. These features greatly improve its clogging resistance.

Another feature of the **X-PELLER®** design is it may be trimmed to a different diameter without having to rebalance the impeller assembly. This is unique to Smith & Loveless, as our competitors' single port design must be balanced after trimming, and re-balanced after re-trimming. In addition, the balance of the **X-PELLER®** is not only static and mechanically dynamic, but also hydraulic. This is important. It is one thing to have an impeller, which will spin without vibration on a dry test stand, but quite another thing to operate without vibration when subjected to the hydraulic forces of a centrifugal pump. The **X-PELLER®** is balanced to take all of these dynamic forces into consideration. Because of its unique vane shape and hydraulics, the **X-PELLER®** has a somewhat different vibration signature than the standard two-port design. This is entirely normal, and should not be cause for alarm. Vibration with the **X-PELLER®** design is within generally accepted industry standards for non-clog pumps.

There is another advantage to the **X-PELLER®** pump, inherent in the mono-port hydraulic design. The pump performance curve, or impeller line, has a rather steep downward slope. This is important in low flow pumping applications (which usually account for most clog-prone situations). By having a steep pump curve, variations in head on the pump do not have as significant an effect on the flow rate of the pump as they do on a pump with a flatter performance curve. Changes in wet well level, or force main conditions, will not be as apt to cause the pump to back up to Shut-Off or Run-Out and Over-Pump or overload the pump motor. This is a good feature to have in low flow pumping applications.

The **X-PELLER®** design offers good insurance against possible clogging problems when selecting pumps for new installations, especially those with large solids to handle. For existing problem applications where two-port impellers have proven inadequate, the **X-PELLER®** makes an excellent retrofit solution. Replacement **X-PELLERs®** can be retrofitted to most Smith & Loveless four-inch (4”) 2-frame pumps and some six-inch (6”) 3-frame pumps – both flooded suction and vacuum primed. In addition, the **X-PELLER®** is available for retrofitting into several of our competitors’ four-inch (4”) and six-inch (6”) pump models. Consult the Retrofit Department for specific applications.

Where plugging has been a problem or may be expected to be a problem, and for all large solids handling operations, the **X-PELLER®** is the solution.

DESIGN FACTORS – NOTES ON FORCE MAIN DESIGN

Under certain unusual conditions, the wet well mounted pump station force main requires special provisions to prevent loss of prime of the station.

Force mains for wastewater discharged from a wet well mounted pump station may be of iron, PVC or other material generally used in the area. Conventional design criteria for force main layout, anchoring, etc., should be followed. It is especially important to provide air release or air/vacuum valves at all high points in the force main.

The station has two rubber-seated check valves in the discharge piping. These valves must be seated airtight when the vacuum pump comes on or else the vacuum pump will suck air through the check valves and the station will not prime. For most installations this is not a problem; if we have a force main, such as shown in Figure 1, where the force main is of considerable length, (at least 150 feet), there is a static head on the check valves, and a large volume of sewage in the force main. Since the force main runs uphill, the sewage cannot flow out of the force main, and there is a static head on the check valves to keep them seated. If there is some sewage leaking back through the check valve, the length of the force main creates enough capacity that it takes a considerable length of time for the sewage to drain back through the check valve and create a loss of prime condition. Since the force main is long, we also have the advantage that the sewage flowing back through the check valve into the wet well will refill the wet well and bring the pump on before the force main is empty. Therefore, when we have a long force main running uphill as shown in Figure 1, we do not have a priming problem because of air being sucked through the check valves.

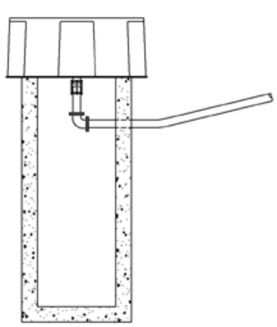


Figure 1

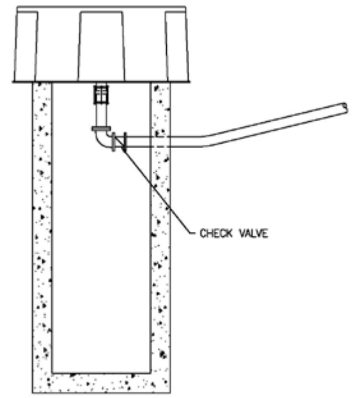


Figure 2

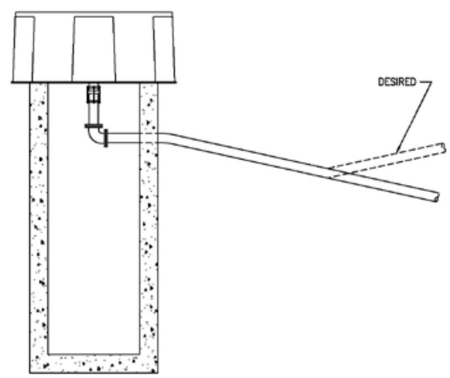


Figure 3

When we have a short force main running uphill from the station, as shown in Figure 2, we can have a priming problem.

If the force main is less than approximately 150 feet long, there is not much reserve capacity in the force main. If one of the discharge check valves is allowing the sewage in the force main to seep back into the wet well, it is possible that the force main will empty back into the wet well before the level in the wet well rises to bring a pump on. Since the check valves do not seal against air, the pump loses its prime, and when the vacuum pump comes on to prime either pump, it sucks air through the force main and leaking check valve and cannot prime the pump.

To prevent this problem, we recommend installing a third check valve in the common discharge from the station. This check valve should be installed in the horizontal run of pipe inside the wet well. The check valve is shipped loose, and is installed in the force main by the installing contractor. The reason for the third check valve is that this gives a double checking action on both pumps. It is very unlikely that both check valves will be hung up on a mop string or piece of paper at the same time, thus creating a loss of prime.

We can also have a priming problem if we have a long force main running downhill from the station as shown in Figure 3. In this type of installation, after the pump shuts off, the force main empties out by gravity, allowing air to get on the force main side of the check valve. Here again, the pump loses prime, and when the vacuum pump comes on and tries to prime the pump, it sucks air through the empty force main and leaking check valve. To prevent this from happening, we recommend that the force main be installed with the last 50 feet of pipe running uphill, as shown in Figure 3. The invert of the outfall should be at least two pipe diameters above the low point in the force main. This creates a water trap, and when the pump shuts off, air cannot get into the force main, allowing the contents to empty out by gravity. If it is not possible to run the last 50 feet of force main uphill, as shown in Figure 3, then an elbow can be installed on the end of the force main to create the same water trap effect.

The installation shown in Figure 4, a short force main (less than 150 feet) running downhill from the station also creates a possible priming problem. Here we have the possibility of both the force main emptying out by gravity, and the check valve allowing sewage to seep back through the pump. If at all possible, the force main should be extended down into the wet well, and exit at an elevation so that the force main can run uphill from the station. Refer to the dotted line of Figure 4 which shows the recommended force main installation. Here again, if it is not possible to run the force main uphill from the station, an elbow can be installed at the end of the force main. This creates a water trap effect, and does not allow air to enter the force main. If air cannot enter the force main, the sewage cannot flow out by gravity. Once this has been done, we have the same condition that we have in Figure 2. A third check valve must now be installed in the horizontal run of force main in the wet well. This check valve gives a double checking action and prevents the contents of the force main from seeping back through the pump, causing a loss of prime.

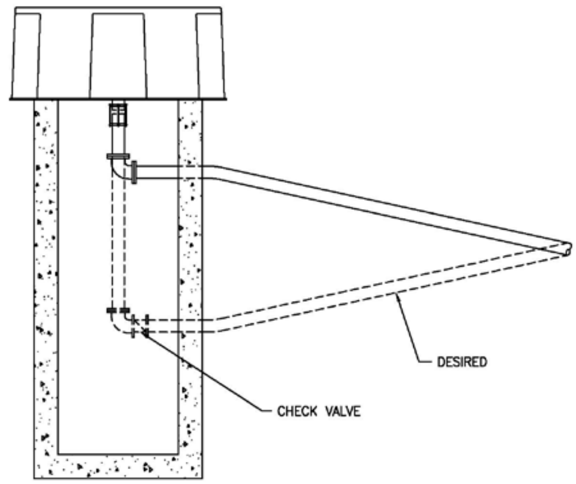


Figure 4

THE FOLLOWING INFORMATION IS GIVEN FOR GENERAL GUIDELINES

The force main is considered to run uphill from the station if the invert of the outfall is at least two pipe diameters above the low point of the force main. This creates the air-trap effect, so that the sewage will not flow out of the force main by gravity.

The force main is considered to be a short force main, and requires a third check valve, if the volume of the force main is less than the volume of the wet well between the “On” and “Off” levels. Assuming a wet well “On” “Off” capacity of 100 gallons and the force main is four-inch with a capacity of approximately seven-tenths gallon per foot, the force main would have to be approximately 150 feet long to have a capacity of 100 gallons. The reasoning behind this particular design requirements is that if the check valve should seep and allow the sewage to run back through the pump and into the wet well, there will be enough contents in the force main to bring the wet well back up to the “On” position, and the pump will start before the force main empties. As a minimum, the elevation between the “Low-Level Off” float switch and the “Low-Level On” float switch is such that the volume between switches is equal to the pump capacity. If the switches are set farther apart, more capacity is required in the force main.

Of course, in all cases, the outfall must be at a higher elevation than the lowest water level in the wet well. Otherwise, siphoning the wet well dry will cause loss of prime through the suction lines.

The above examples should cover every installation for a wet well mounted pump station. If you have an unusual condition that is not covered by the examples given above, consult the factory, and we will give you a special recommendation for your application.

PRIMING LOCK LOOP

Another solution that is suitable for any of the problem force mains described previously is a priming lock loop. The purpose here is to form a return loop in the force main, either inside or just outside the wet well. The bottom of the loop must be below the low level "Off" elevation (see Figure 5). This prevents the entire contents of the force main from returning by gravity to the wet well if the check valve does not seat. There will still be enough liquid in the pipe to prime the pump. On force mains that run horizontal or downhill from the station, the last few feet of the force main should run uphill to create a water trap effect in the force main.

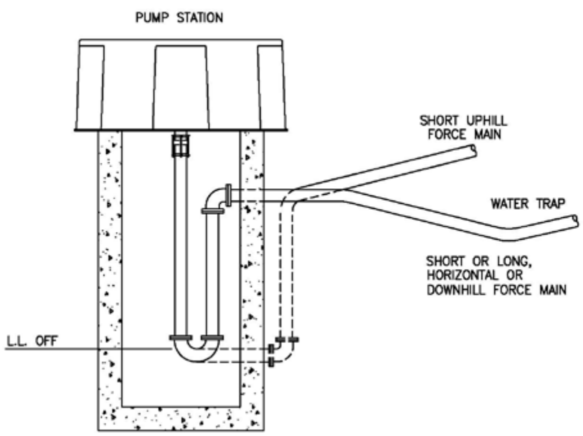
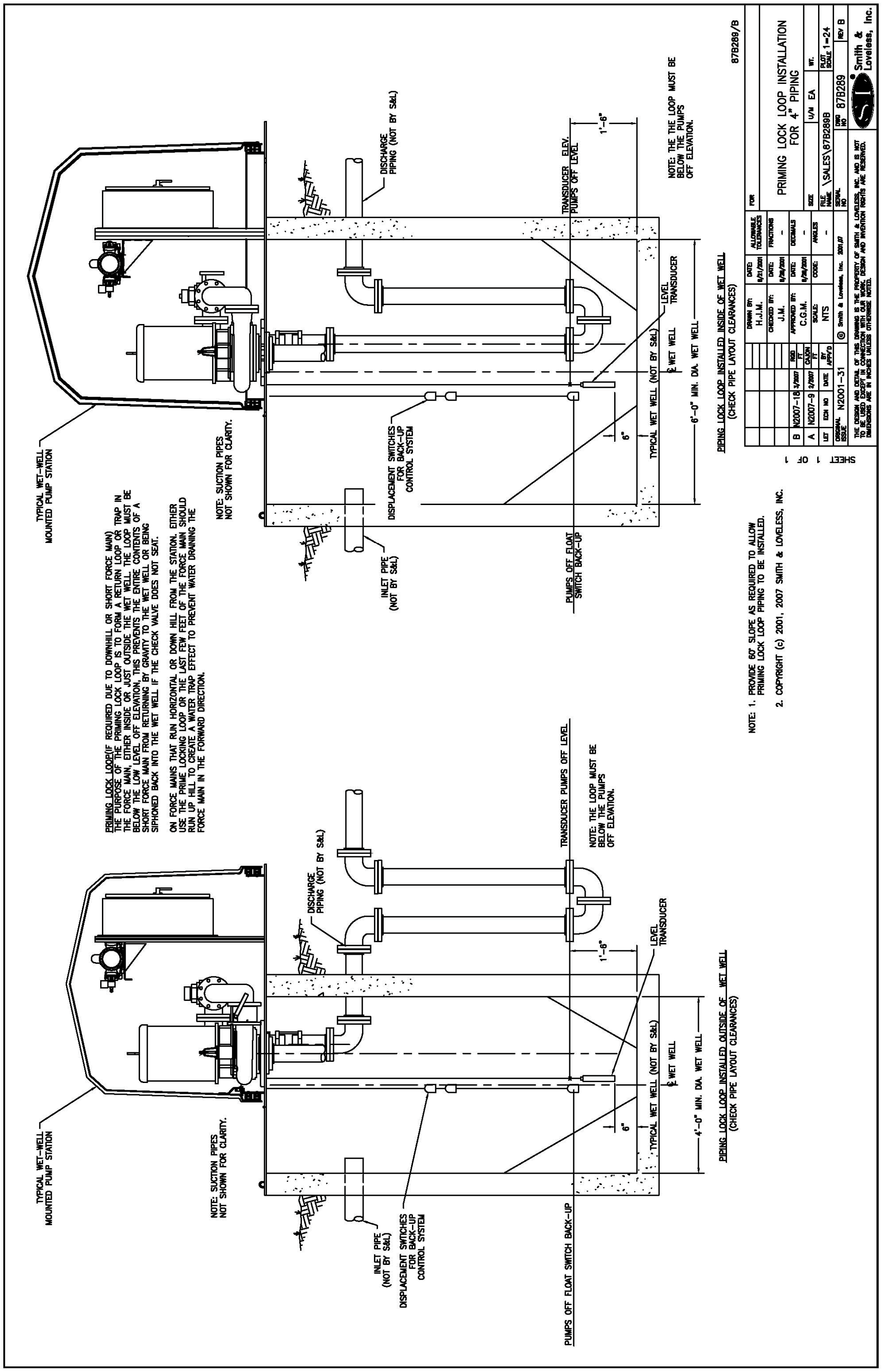


Figure 5



TYPICAL WET-WELL MOUNTED PUMP STATION
NOTE: SUCTION PIPES NOT SHOWN FOR CLARITY.
DISCHARGE PIPING (NOT BY S&L)
INLET PIPE (NOT BY S&L)
DISPLACEMENT SWITCHES FOR BACK-UP CONTROL SYSTEM
PUMPS OFF FLOAT SWITCH BACK-UP
TRANSDUCER ELEV. PUMPS OFF LEVEL
TRANSDUCER PUMPS OFF LEVEL
NOTE: THE THE LOOP MUST BE BELOW THE PUMPS OFF ELEVATION.
NOTE: THE LOOP MUST BE BELOW THE PUMPS OFF ELEVATION.
LEVEL TRANSDUCER
TYPICAL WET WELL (NOT BY S&L)
℄ WET WELL
6'-0" MIN. DIA. WET WELL
4'-0" MIN. DIA. WET WELL
1'-6"
6"
PIPING LOCK LOOP INSTALLED INSIDE OF WET WELL (CHECK PIPE LAYOUT CLEARANCES)
PIPING LOCK LOOP INSTALLED OUTSIDE OF WET WELL (CHECK PIPE LAYOUT CLEARANCES)
PRIMING LOCK LOOP(IF REQUIRED DUE TO DOWNHILL OR SHORT FORCE MAIN) THE PURPOSE OF THE PRIMING LOCK LOOP IS TO FORM A RETURN LOOP OR TRAP IN THE FORCE MAIN, EITHER INSIDE OR JUST OUTSIDE THE WET WELL. THE LOOP MUST BE BELOW THE LOW LEVEL OFF ELEVATION, THIS PREVENTS THE ENTIRE CONTENTS OF A SHORT FORCE MAIN FROM RETURNING BY GRAVITY TO THE WET WELL OR BEING SIPHONED BACK INTO THE WET WELL IF THE CHECK VALVE DOES NOT SEAT.
ON FORCE MAINS THAT RUN HORIZONTAL OR DOWN HILL FROM THE STATION, EITHER USE THE PRIME LOCKING LOOP OR THE LAST FEW FEET OF THE FORCE MAIN SHOULD RUN UP HILL TO CREATE A WATER TRAP EFFECT TO PREVENT WATER DRAINING THE FORCE MAIN IN THE FORWARD DIRECTION.
NOTE: 1. PROVIDE 60' SLOPE AS REQUIRED TO ALLOW PRIMING LOCK LOOP PIPING TO BE INSTALLED.
2. COPYRIGHT (c) 2001, 2007 SMITH & LOVELESS, INC.
PRIMING LOCK LOOP INSTALLATION FOR 4" PIPING
87B289/B
SHEET 1 OF 1

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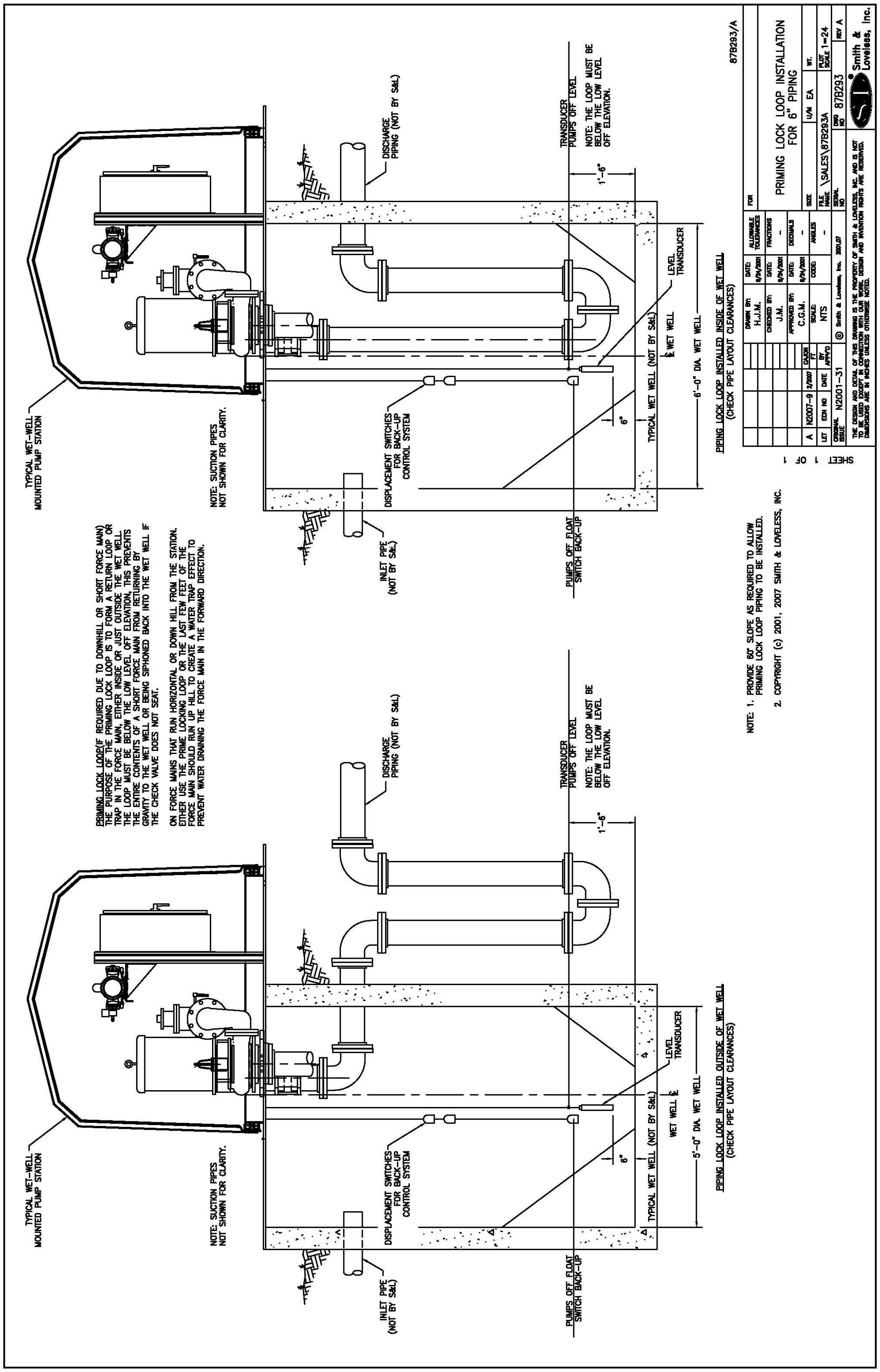

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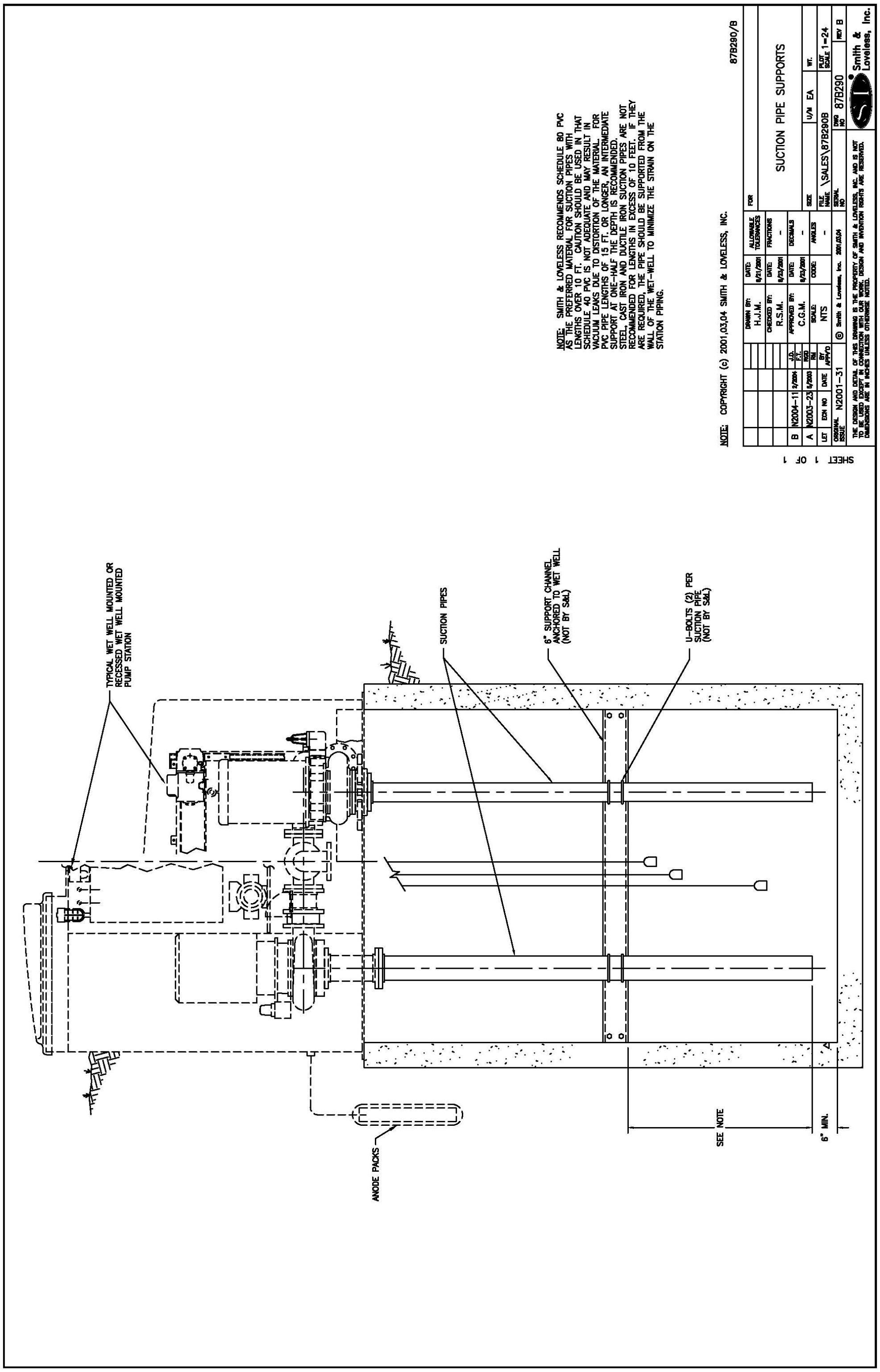
Vacuum Primed Pump Stations
Suction Pipe Supports
Drawing 87B290
July, 2012
Page 1



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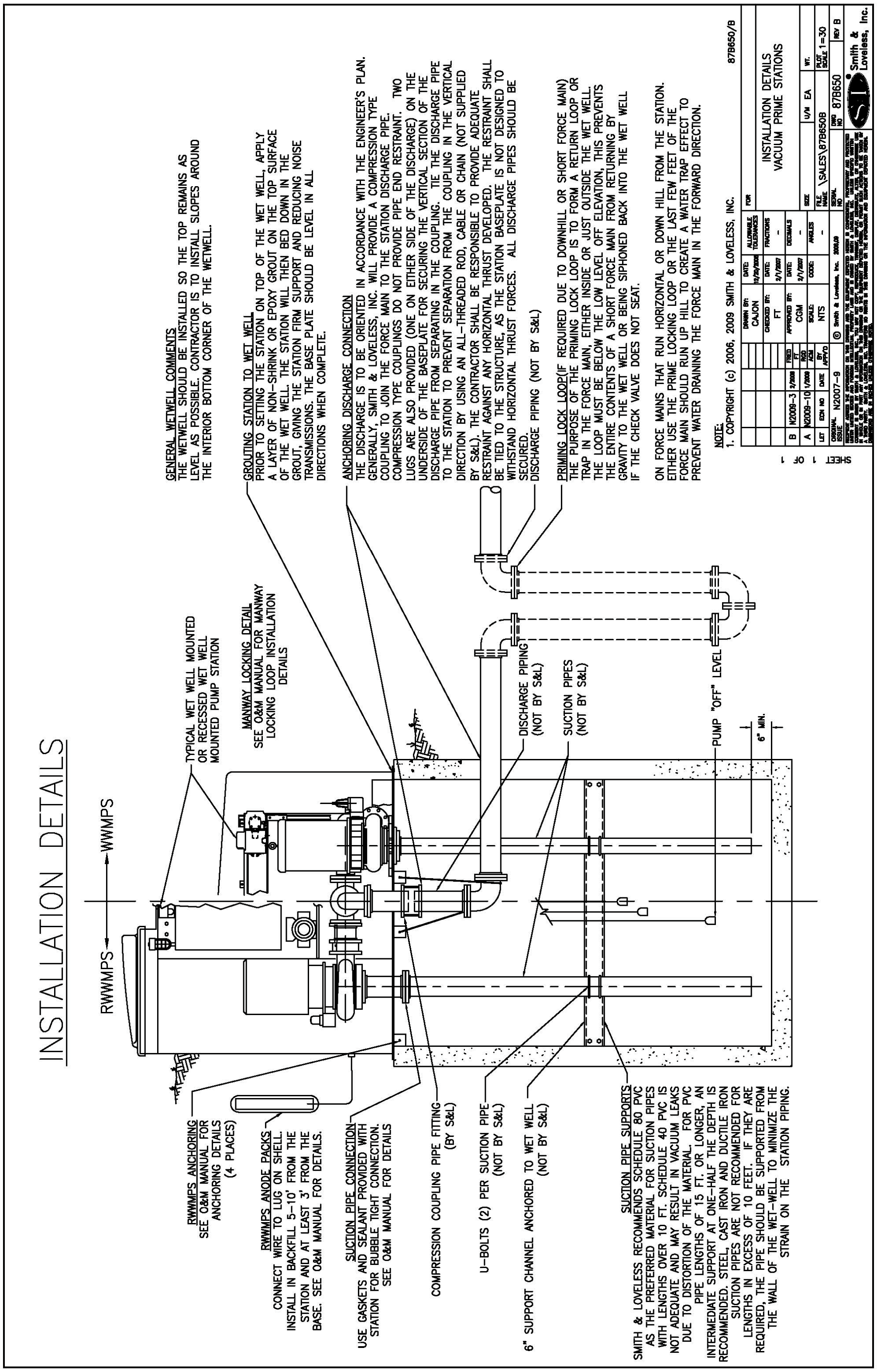

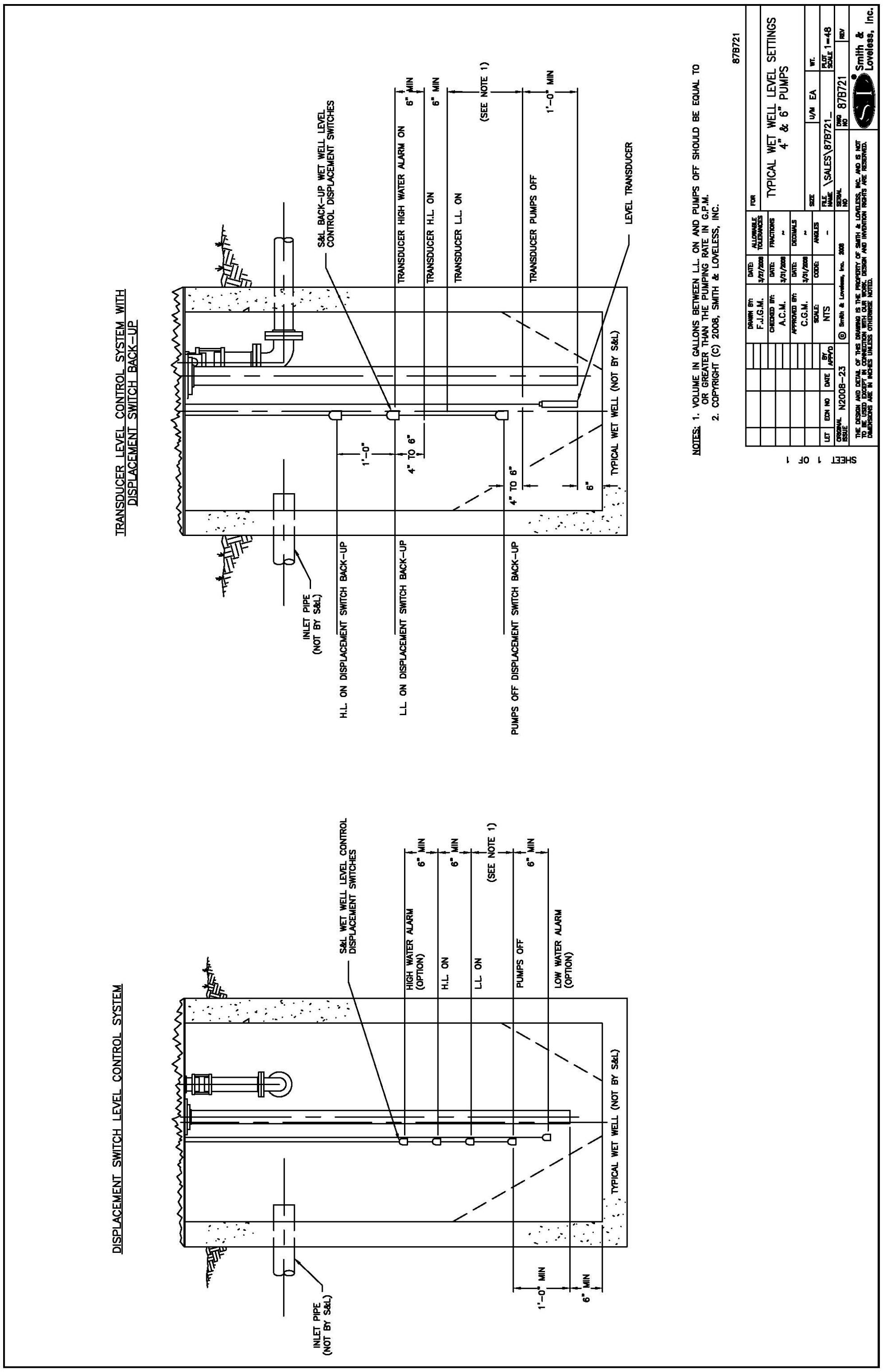

TRANSDUCER LEVEL CONTROL SYSTEM WITH DISPLACEMENT SWITCH BACK-UP
S&L BACK-UP WET WELL LEVEL CONTROL DISPLACEMENT SWITCHES
TRANSDUCER HIGH WATER ALARM ON
TRANSDUCER H.L. ON
TRANSDUCER L.L. ON
TRANSDUCER PUMPS OFF
LEVEL TRANSDUCER
6" MIN
(SEE NOTE 1)
1'-0" MIN
4" TO 6"
TYPICAL WET WELL (NOT BY S&L)
INLET PIPE (NOT BY S&L)
H.L. ON DISPLACEMENT SWITCH BACK-UP
L.L. ON DISPLACEMENT SWITCH BACK-UP
PUMPS OFF DISPLACEMENT SWITCH BACK-UP
DISPLACEMENT SWITCH LEVEL CONTROL SYSTEM
S&L WET WELL LEVEL CONTROL DISPLACEMENT SWITCHES
HIGH WATER ALARM (OPTION)
H.L. ON
L.L. ON
PUMPS OFF
LOW WATER ALARM (OPTION)
NOTES: 1. VOLUME IN GALLONS BETWEEN L.L. ON AND PUMPS OFF SHOULD BE EQUAL TO OR GREATER THAN THE PUMPING RATE IN G.P.M.
2. COPYRIGHT (C) 2008, SMITH & LOVELESS, INC.
TYPICAL WET WELL LEVEL SETTINGS 4" & 6" PUMPS
87B721
SHEET 1 OF 1

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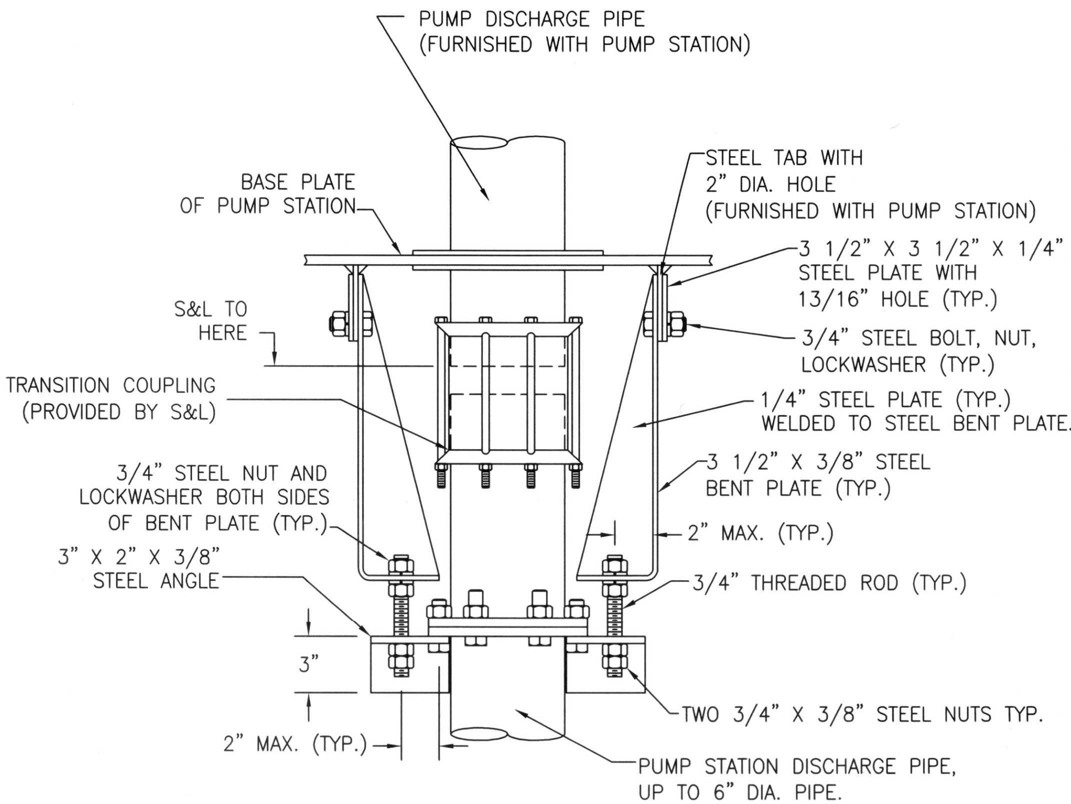

NOTES:
1. ALL COMPONENTS ARE PROVIDED BY OTHERS UNLESS NOTED ON DRAWING.
2. RESTRAINT IS INTENDED FOR USE WITH DISCHARGE PRESSURES LESS THAN 500 FT. (216.5 PSI) WITH MAXIMUM 6" DIAMETER VERTICAL DISCHARGE PIPE.
3. THIS DETAIL IS INTENDED FOR USE ONLY ON SMITH AND LOVELESS INC. WET WELL MOUNTED PUMP STATIONS.

SHEET 1 OF 1 87A622

LET	ECN NO	DATE	BY APPV'D				
				DRAWN BY: CAJON	DATE: 3/23/2006	ALLOWABLE TOLERANCES	RECOMMENDED PIPE RESTRAINT DETAIL (FOR VERTICAL DISCHARGE PIPE)
				CHECKED BY: ACM	DATE: 3/23/2006	FRACTIONS –	SIZE; U/M EA; WT.
				APPROVED BY: FT	DATE: 3/24/2006	DECIMALS –	FILE NAME \FIELD\87A622_; PLOT SCALE 1=8
				SCALE: NTS	CODE:	ANGLES –	SERIAL NO; DWG NO 87A622; REV
							ORIGINAL ISSUE N2006–29; © Smith & Loveless, Inc. 2006

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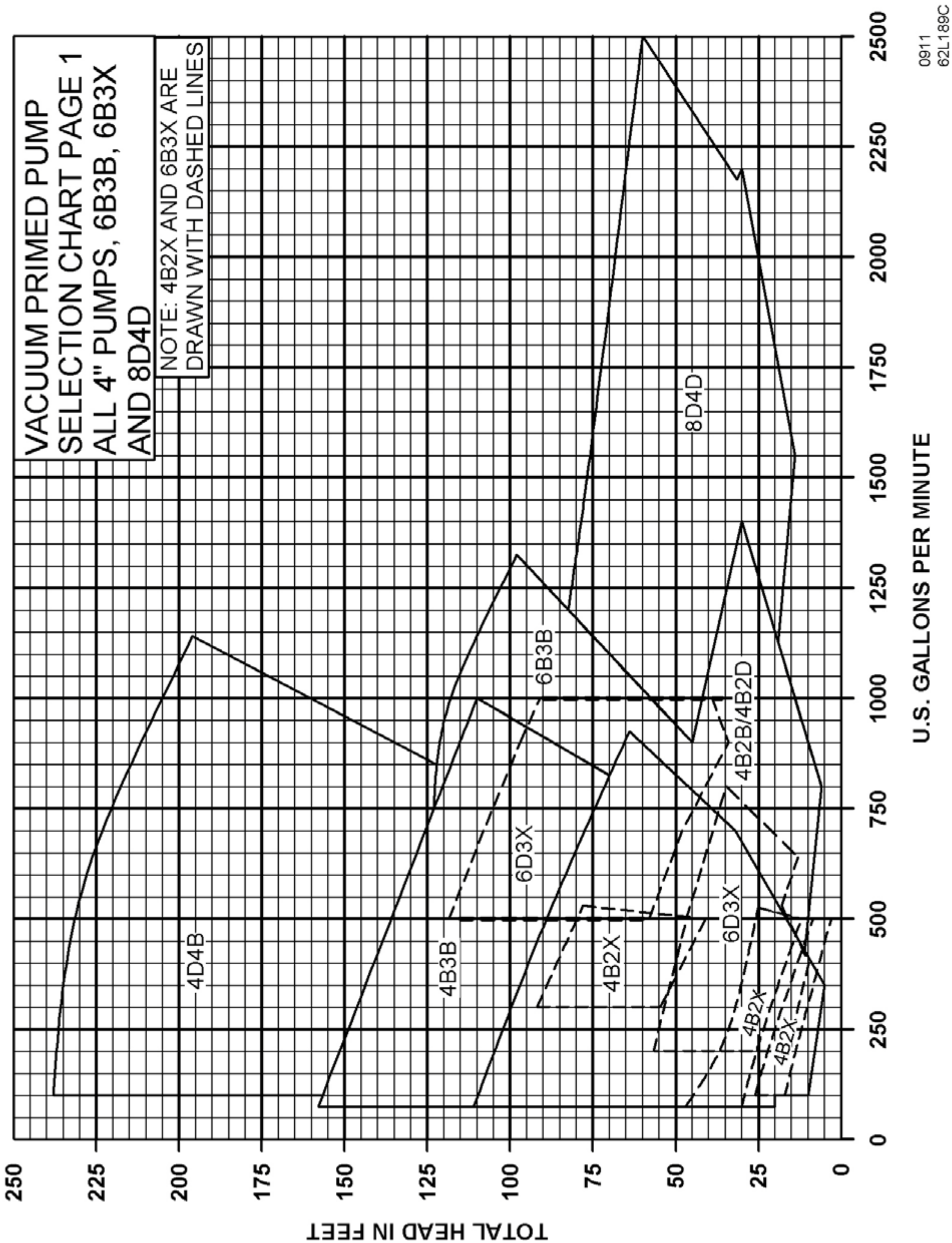
Vacuum Primed Pump Selection Chart
Drawing 62L189 – 4” Pumps
6B3B / 6B3X / 8D4D
July, 2012



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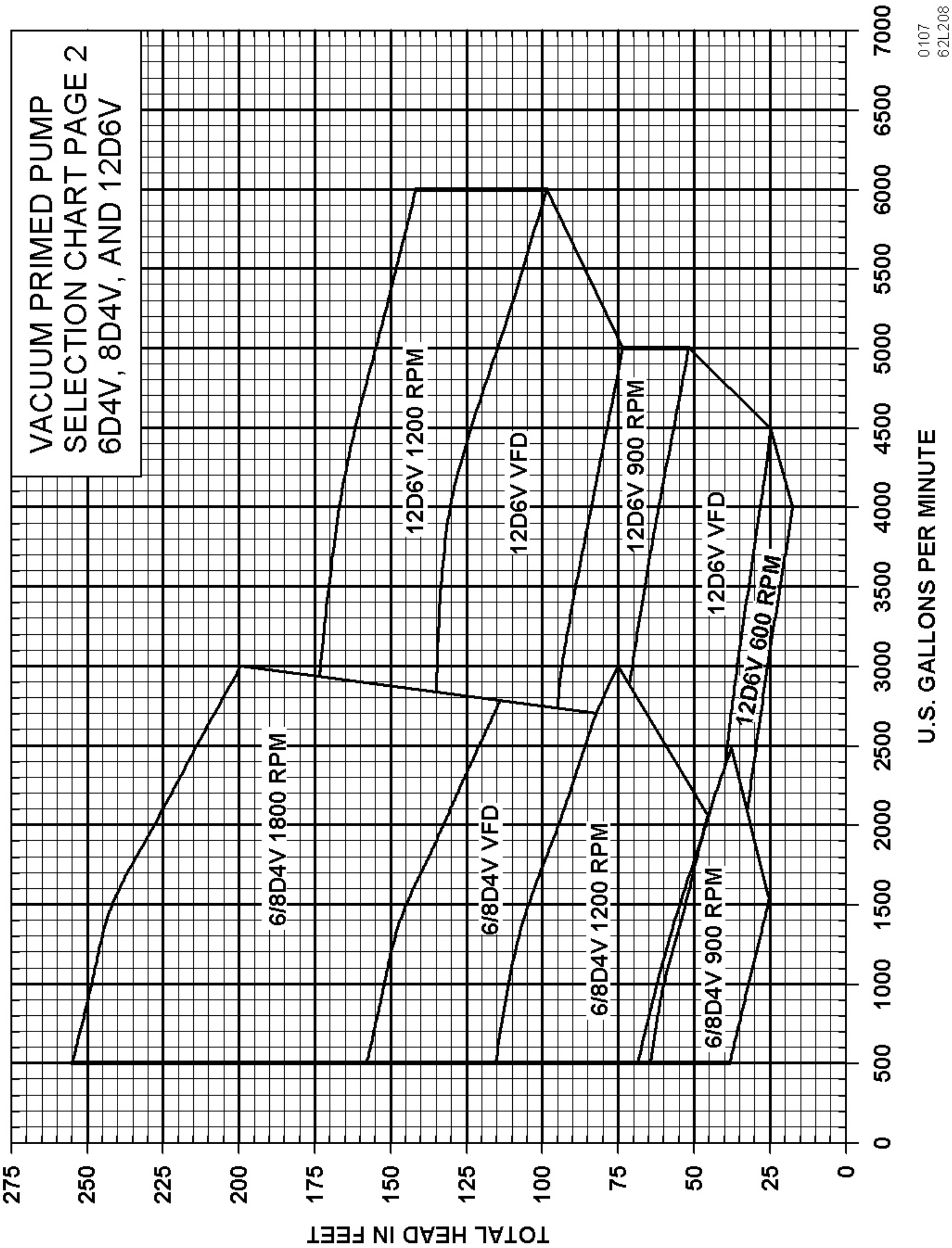


SUCTION LINE CONSIDERATIONS
8D4V & 12D6V PUMPS

MAXIMIZING SUCTION LIFT CAPABILITY

In addition to providing well supported and braced, leak-tight suction lines for vacuum primed pumps (reference Drawing 87B290 or 87B650), it is equally important to provide good hydraulic conditions to insure the optimum suction lift performance.

Suction lines should be as large in diameter as practical without reducing the velocity below the minimum for carrying solids, usually 2.0 fps. Refer to the recommended ranges on the Smith & Loveless pump curves as a guideline. Avoid unnecessary bends or ells, and horizontal runs of pipe, to minimize friction losses. Friction from any piping other than the straight downward run shown in the catalog drawings must be deducted from the allowable suction lift.

For 4” and 6” pumps, the bottom of the suction pipe should be approximately 6” above the floor of the wet well and a minimum of 12” below the “Off” level setting of the controls. For 8” and 12” pumps, refer to the following section, addressing them specifically. When using these distances, a bell or flare inlet is not necessary. A foot valve is not recommended for normal applications of vacuum primed pumps.

Liquid temperatures above about 85 degrees F. will cause a reduction in allowable suction lift due to the increase in vapor pressure. Consult the Factory in these cases.

DERATING FOR ALTITUDE

Most Smith & Loveless vacuum primed pump curves show the maximum allowable static suction lift, either as a note (Maximum Suction Lift at M.S.L. – 20’) or as a family of curves delineating the maximum, if below 20’. These values are based atmospheric pressure at Mean Sea Level and on the vertical distance measured from the “Off” control level setting in the wet well up to the station baseplate or top of the wet well where the station sits.

The maximum allowable static suction lift must be derated for altitude at higher elevations. For every 1000’ of altitude, it is necessary to derate the allowable static suction lift by 1.0’, to account for the decrease in atmospheric pressure. Therefore, a pump that is capable of 20’ of static suction lift at sea level is only good for 15’ at 5000’ elevation.

8D4V / 12D6V PUMPS

The suction pipe sizing and suction lift ratings of the 8D4V and 12D6V pumps are determined differently than for other Smith & Loveless vacuum primed pumps. In addition, some of the suction piping dimensions are different, all due to the high flows involved with these bigger pumps.

The chart with Max and Min flows on Page 3 will assist in selection of possible suction pipe sizes, based on the design flow rate of the pump (or the single pump run-out flow rate for multiple pump installations). It would be good to consider something larger than the absolute minimum allowable size, to keep losses down and suction lift up. This chart also will give the proper clearance distance from the bottom of the suction pipe to the bottom of the wet well (“C”) to provide good solids collection, and the minimum submergence of the suction inlet (“S”) to avoid vortexing and drawing in air. These numbers are based on Hydraulic Institute recommendations.

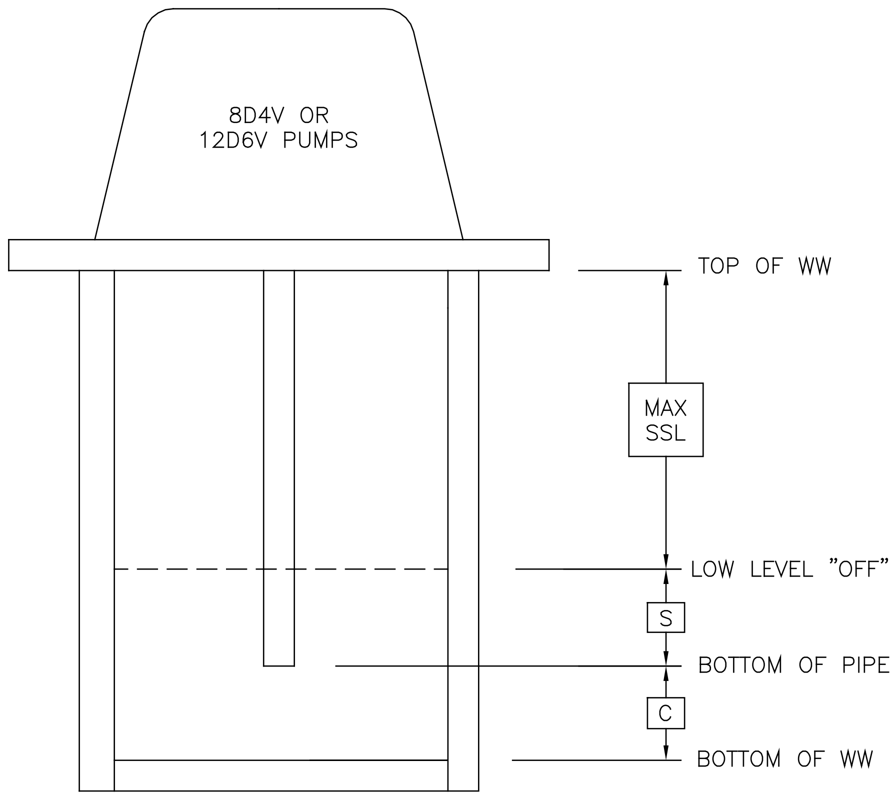
To determine the maximum static suction lift (the distance from the top of the wet well or baseplate of the station down to the “Low Level Off” elevation), use the appropriate chart on Page 4. The bottom chart is only for the 1760 RPM 8D4V pump, which has a flow conditioner. The top chart is for the other 8D4V pump speeds and all of the 12D6V pumps. These charges take into account the suction line friction, velocity and entry losses.

Find the intersection between the plotted line for the suction size selected and the vertical line for the maximum flow rate expected through the pump. From this intersection, read the maximum static suction lift horizontally from the scale on the left. Note that large suction lines allow more suction lift. Adjust your suction pipe selection if necessary.

The maximum static suction lift is based on using Schedule 80 PVC suction lines and atmospheric pressure at sea level. For higher altitudes, derate the maximum static suction lift by 1.0’ per 1000 feet above sea level.

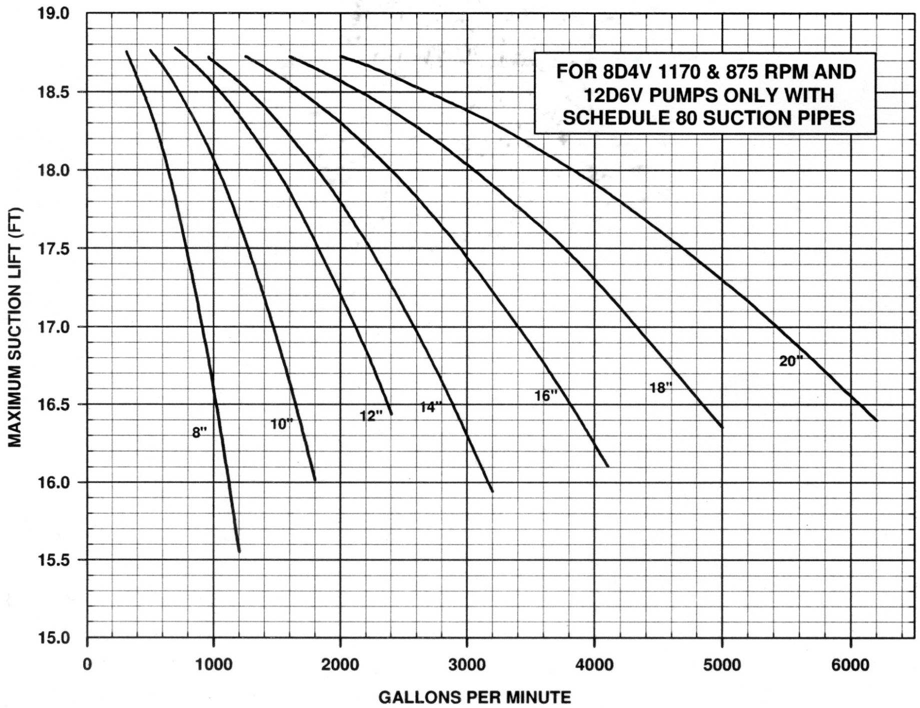
EXAMPLE: *For 3000 GPM, using the 8D4V pump at 1170 RPM, at 2050' elevation, the chart on Page 2 allows 14" and larger suction lines. Try the 14" first. From the top chart on Page 3, a 14" suction at 3000 GPM is good for 16.3' SSL. Derating that by 1'/1000 ft. altitude, we get 14.3' Max. If we go to 16", the chart allows 17.4', which, after derating, leaves 15.4'. Doing the same with 18" pipe results in 18.0' - 2' = 16.0' Max. and 20" gives us 18.4' - 2' = 16.4'. We see that larger suctions allow more suction lift, but at a diminishing rate. Do not skimp on suction size. Select a suction pipe size that gives more than the required SSL, but is still economical.*

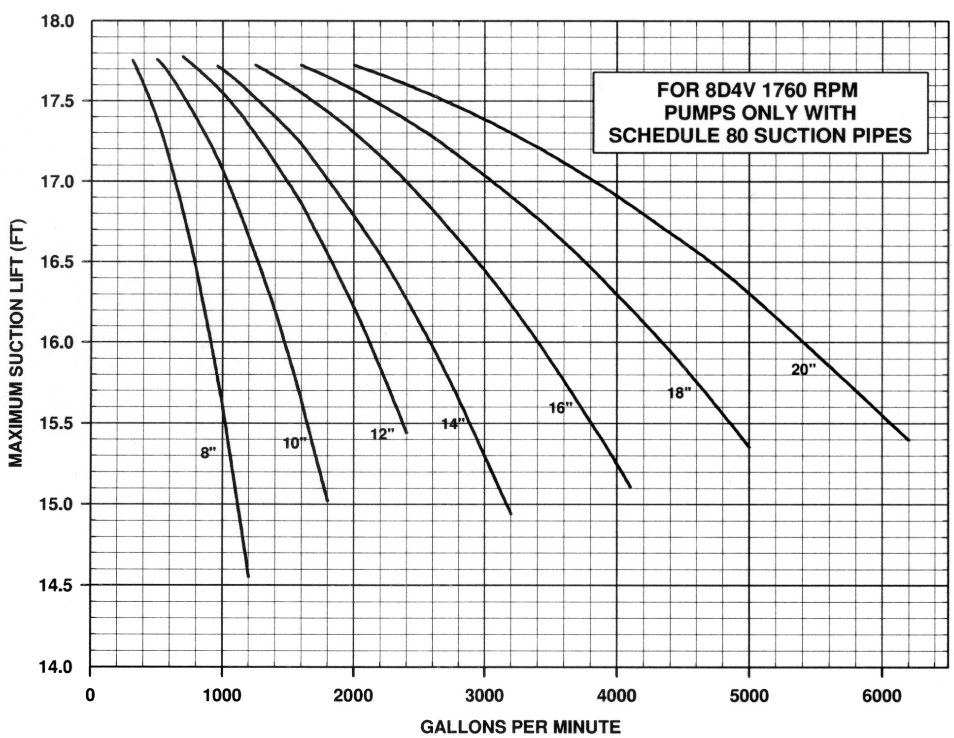
SUCTION LINE CONSIDERATIONS – 8D4V & 12D6V PUMPS



SUCTION PIPE DIA (in)	MAX FLOW (gpm)	MIN FLOW (gpm)	CLEARANCE "C" (in)	SUBMERGENCE "S" (in)
8	1200	315	6	16
10	1800	500	7	19
12	2400	700	8	22
14	3200	960	8	25
16	4100	1250	9	29
18	5000	1600	10	32
20	6200	2000	11	36

SUCTION LIFT LIMITS - 8D4V & 12D6V PUMPS





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Pump Assembly Drawing
4B2C Turbo Pump
Drawing 87B455
July, 2012

BILL OF MATERIAL

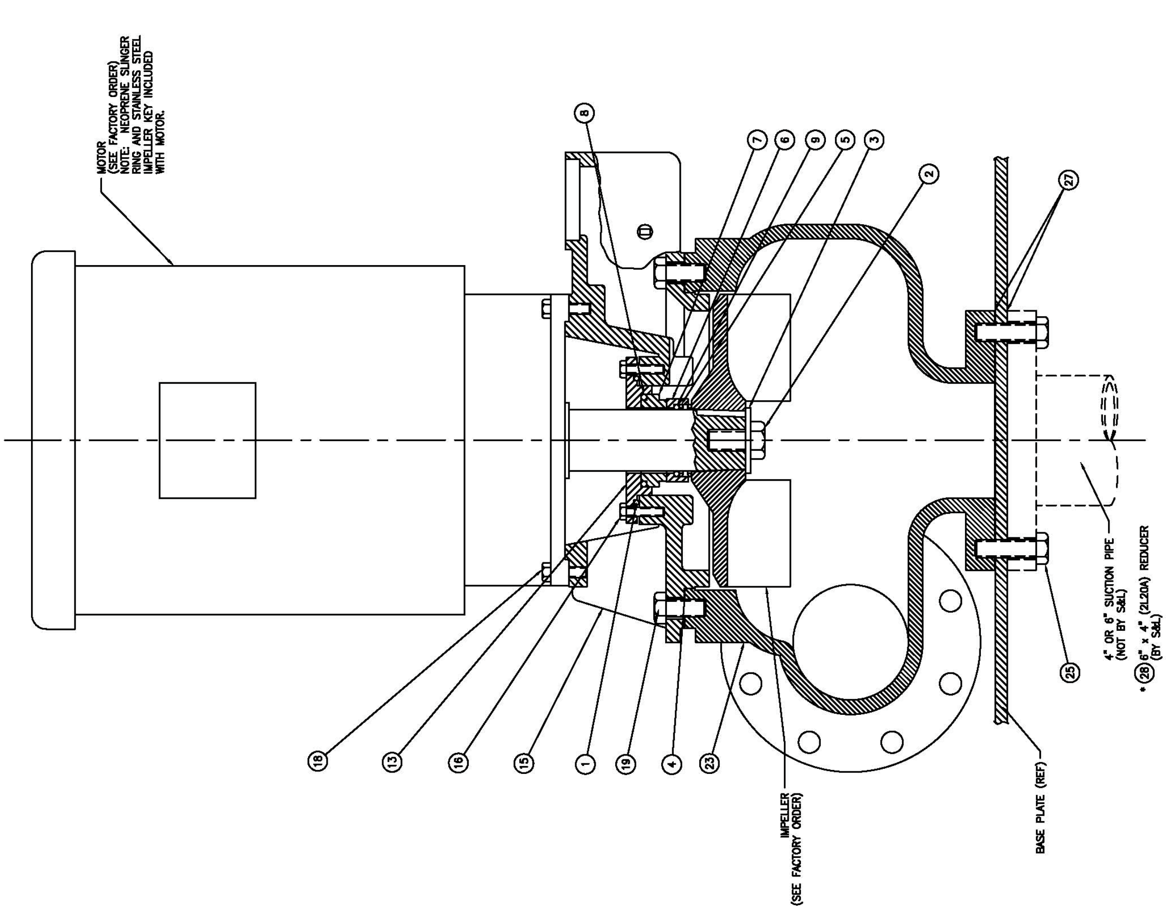
Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
1	1	EA	60A110		SEAL HOLDER GASKET QUAD RING		
2	1	EA	60A12		IMPELLER BOLT		
3	1	EA	60A20		IMPELLER WASHER		
4	2	EA	60A26		VOLUTE GASKET		
5	1	EA	60A30		SPRING		
6	1	EA	60A32		ROTATING CERAMIC SEAL		
7	1	EA	60A36		STATIONARY CARBON SEAL		
8	1	EA	60A38		QUAD RING		
9	1	EA	60A39		"O" RING		
13	1	EA	87B2		SEAL HOLDER		
15	1	EA	60B165A		MOTOR ADAPTER MODIFICATION	4B2C	
16	6	EA	6L59BC		CAPSCREW, SS	5/16"-18 X 1"	
18	4	EA	6L20DE		CAPSCREW	3/8"-16 X 1 1/2"	
19	8	EA	6L20HD		CAPSCREW	5/8"-11 X 1 1/4"	
25	8	EA	6L20HJ		CAPSCREW	5/8"-11 X 2 1/2"	
27	2	EA	11L1A		FLANGE GASKET	4"	
• 28	1	EA	2L20A		REDUCER	6" X 4"	

CW ASSY

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
23	1	EA	60D230		VOLUTE – STANDARD		

CCW ASSY

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
23	1	EA	60D231		VOLUTE – STANDARD		



NOTE:

1. NEOPRENE SLINGER RING AND STAINLESS STEEL IMPELLER KEY INCLUDED WITH MOTOR.
•2. FURNISHED ON 6" SUCTIONS ONLY.
3. COPYRIGHT (C) 2004, 2006, 2007 SMITH & LOVELESS, INC.

87B455/C

LET	ECN NO	DATE	BY APP'D
C	N2007-71	12/2007	RGD JK
B	N2007-67	12/2007	RGD RSM
A	N2006-60	1/2006	RGD FT
ORIGINAL ISSUE	N2004-29		

DRAWN BY: JRB — DATE: 5/2004
CHECKED BY: RGD — DATE: 6/2004
APPROVED BY: FT — DATE: 6/2004
SCALE: NTS — CODE:
ALLOWABLE TOLERANCES: FRACTIONS – ; DECIMALS – ; ANGLES –

FOR: PUMP ASSEMBLY 4B2C TURBO

SIZE: — U/M: EA — WT.:
FILE NAME: \SUB\87B455C — PLOT SCALE 1=2.667
SERIAL NO — DWG NO 87B455 — REV C

SHEET 1 OF 1

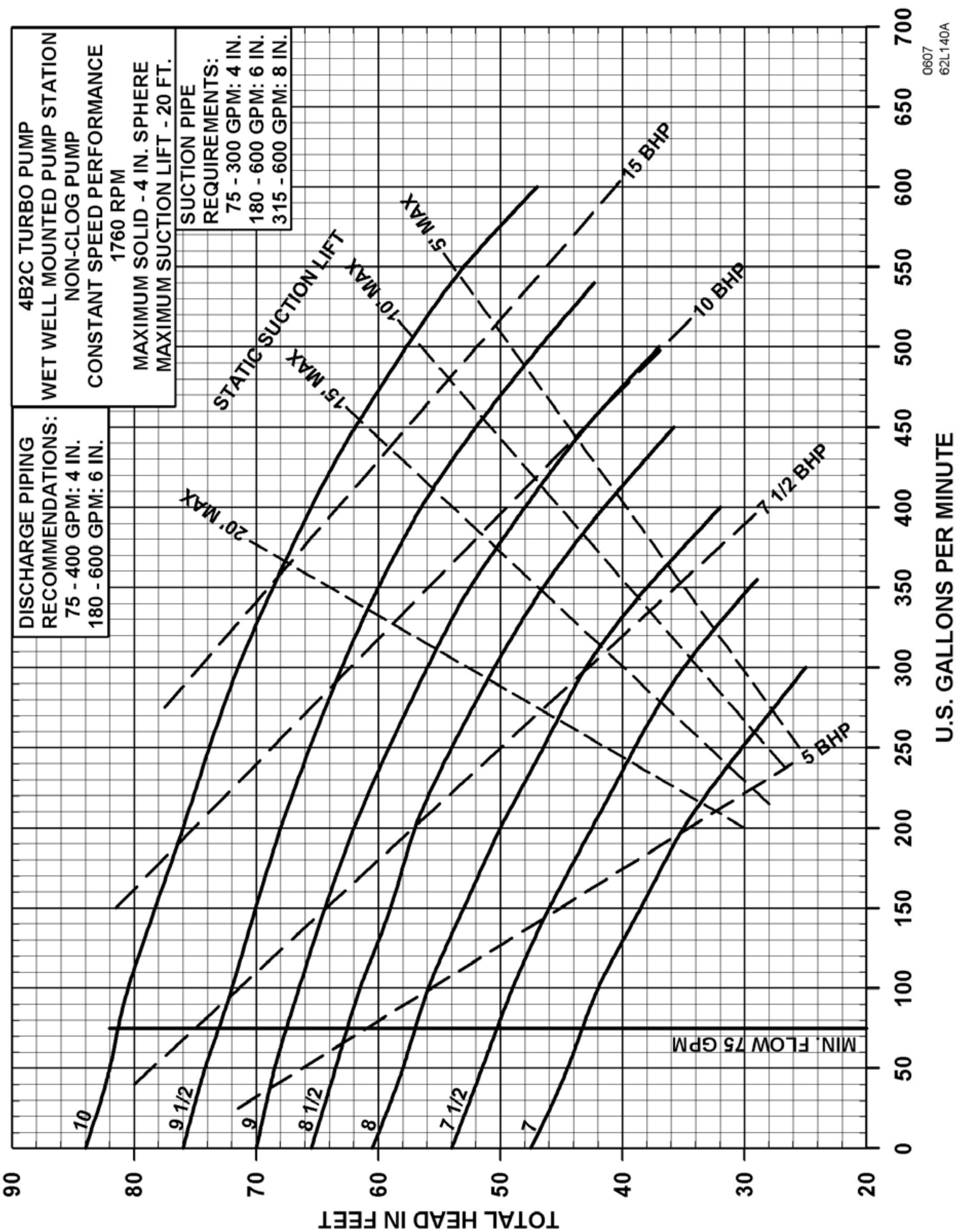
Smith & Loveless, Inc.

ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L140
Constant Speed
Non-Clog Pump
4B2C Turbo Pump
1760 RPM
July, 2012

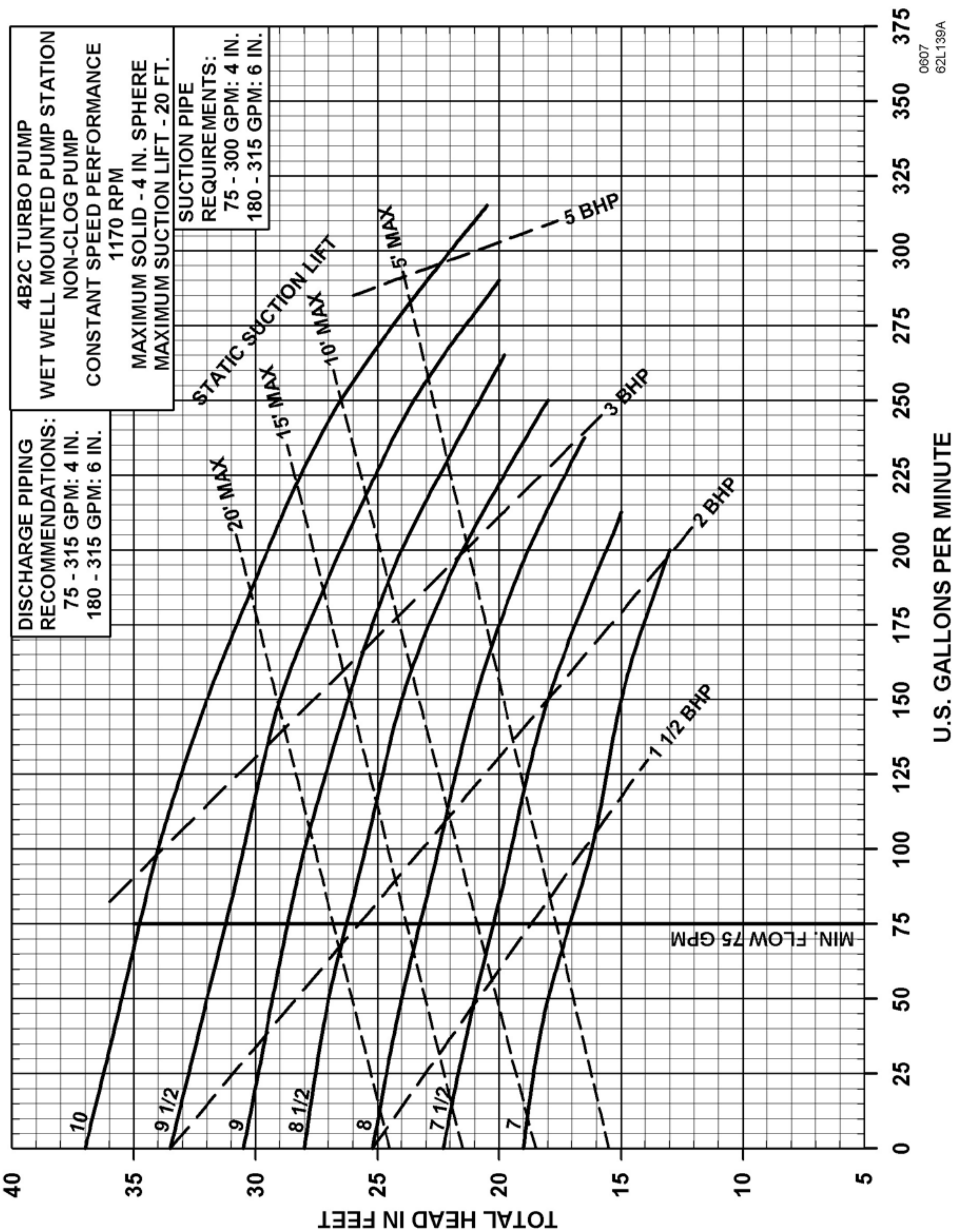


ENGINEERING DATA

Smith &
Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L139
Constant Speed
4B2C Turbo Pump
1170 RPM
July, 2012



ENGINEERING DATA

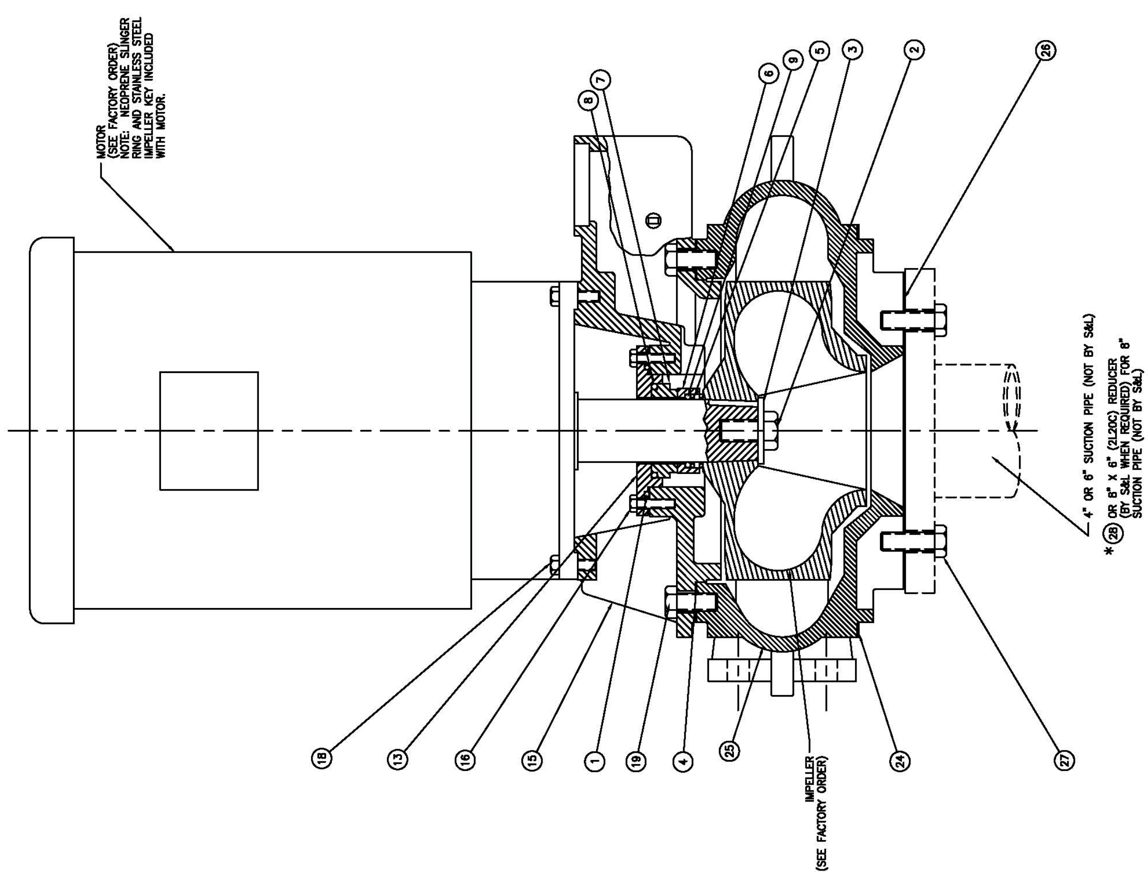
Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Pump Assembly Drawing
4B2B / 4B2D / 4B2X
Drawing 87B453
July, 2012

BILL OF MATERIAL

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
1	1	EA	60A110		SEAL HOLDER GASKET QUAD RING		
2	1	EA	60A12		IMPELLER BOLT		
3	1	EA	60A20		IMPELLER WASHER		
4	1	EA	60A26		VOLUTE GASKET		
5	1	EA	60A30		SPRING		
6	1	EA	60A32		ROTATING CERAMIC SEAL		
7	1	EA	60A36		STATIONARY CARBON SEAL		
8	1	EA	60A38		QUAD RING		
9	1	EA	60A39		"O" RING		
13	1	EA	87B2		SEAL HOLDER		
15	1	EA	60B165A		MOTOR ADAPTER MODIFICATION		
16	6	EA	6L59BC		CAPSCREW, SS	5/16"-18 X 1"	
18	4	EA	6L20OC		CAPSCREW	3/8"-16 X 1"	
19	4	EA	6L20HD		CAPSCREW	5/8"-11 X 1 1/4"	
24	1	EA	60A108		BASE SEAL GASKET		
					4" SUCTION PUMP		
25A	1	EA	87D308A		INTEGRAL VOLUTE--CCW	4"	
25B	1	EA	87D308B		INTEGRAL VOLUTE--CW	4"	
26	1	EA	11L1A		GASKET	4"	
27	8	EA	6L20HF		CAPSCREW	5/8-11 X 1 3/4"	
					6" SUCTION PUMP		
25A	1	EA	87D309A		INTEGRAL VOLUTE--CCW	6"	
25B	1	EA	87D309B		INTEGRAL VOLUTE--CW	6"	
26	1	EA	11L1C		GASKET	6"	
27	8	EA	6L20JG		CAPSCREW	3/4"-10 X 2"	
					8" SUCTION PUMP		
25A	1	EA	87D309A		INTEGRAL VOLUTE--CCW	6"	
25B	1	EA	87D309B		INTEGRAL VOLUTE--CW	6"	
26	1	EA	11L1C		GASKET	6"	
27	8	EA	6L20JF		CAPSCREW	3/4"-10 X 1 3/4"	
* 28	1	EA	2L20C		REDUCER	8" X 6"	



NOTES:
1. COPYRIGHT (C) 2004, 2006, 2007 SMITH & LOVELESS, INC.
2. SPECIFY CW OR CCW ON INTEGRAL VOLUTE.

87B453/C

PUMP ASSEMBLY 4B2B/4B2D/4B2X

DRAWN BY: JRB; DATE: 8/27/2004; CHECKED BY: RGD; DATE: 9/2004; APPROVED BY: FT; DATE: 9/2004; SCALE: NTS

REV C N2007-71 12/2007 RGD JK; B N2007-67 12/2007 RGD RGD; A N2006-60 6/2006 RGD FT; ORIGINAL ISSUE N2004-29

FILE NAME \SUB\87B453C; DWG NO 87B453; REV C; PLOT SCALE 1=2.667

SHEET 1 OF 1

ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Pump Assembly Drawing
4C2B / 4C2D / 4C2X
Drawing 87B454
July, 2012

BILL OF MATERIAL

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
1	1	EA	60A111		SEAL HOLDER GASKET QUAD RING		
2	1	EA	60A12		IMPELLER BOLT		
3	1	EA	60A20		IMPELLER WASHER		
4	1	EA	60A26		VOLUTE GASKET		
5	1	EA	60A31		SPRING		
6	1	EA	60A33		ROTATING CERAMIC SEAL		
7	1	EA	60A37		STATIONARY CARBON SEAL		
8	1	EA	60A40		QUAD RING		
9	1	EA	60A41		"O" RING		
13	1	EA	87B19		SEAL HOLDER		
15	1	EA	60B165B		MOTOR ADAPTER MODIFICATION		
16	6	EA	6L59BC		CAPSCREW, SS	5/16"-18 X 1"	
18	4	EA	6L20DC		CAPSCREW	3/8"-16 X 1"	
19	4	EA	6L20HD		CAPSCREW	5/8"-11" X 1 1/4"	
23	1	EA	60A108		BASE SEAL GASKET		

4" SUCTION PUMP

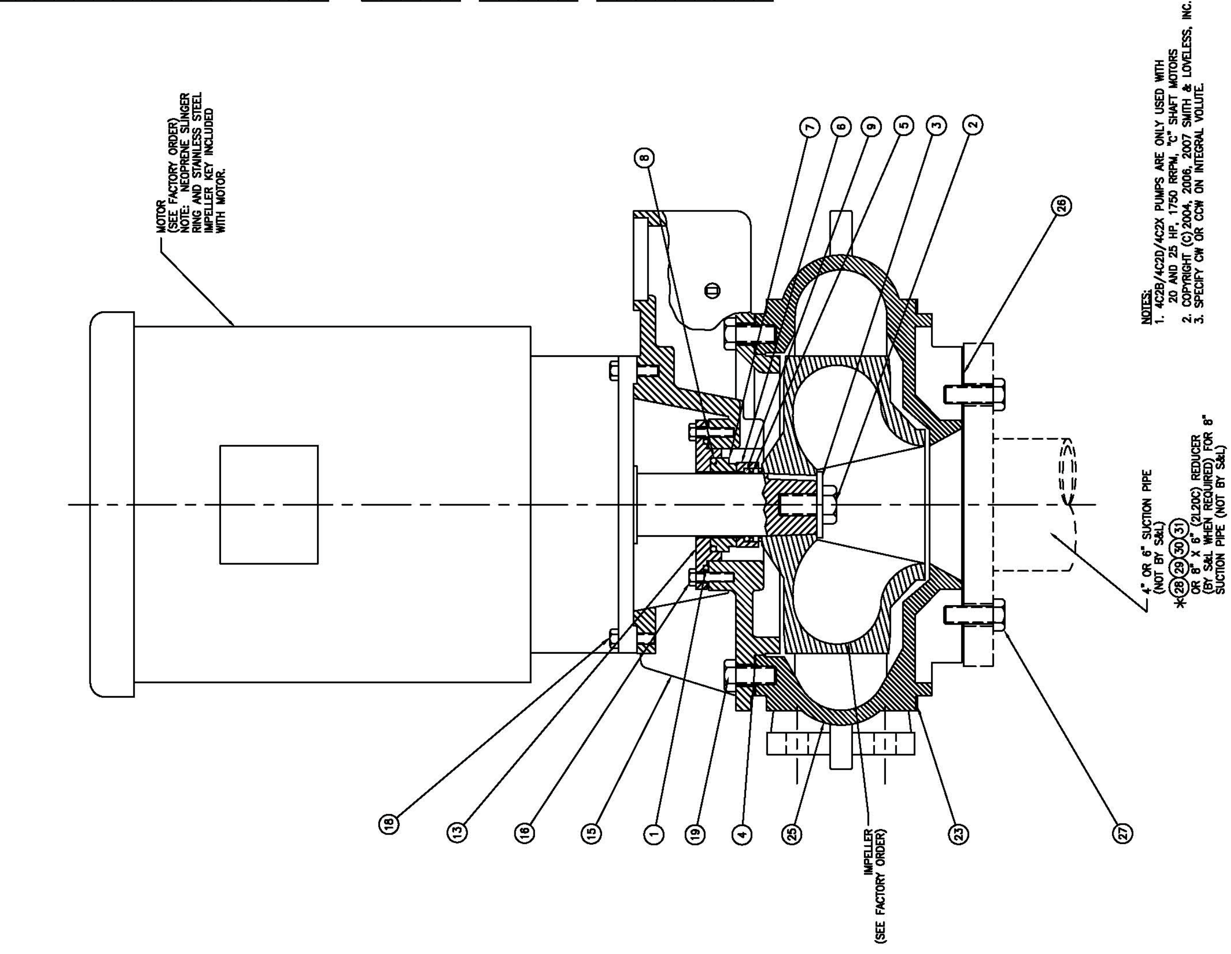
Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
25A	1	EA	87D308A		INTEGRAL VOLUTE--CCW	4"	
25B	1	EA	87D308B		INTEGRAL VOLUTE--CW	4"	
26	1	EA	11L1A		GASKET	4"	
27	8	EA	6L20HF		CAPSCREW	5/8"-11 X 1 3/4"	

6" SUCTION PUMP

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
25A	1	EA	87D309A		INTEGRAL VOLUTE--CCW	6"	
25B	1	EA	87D309B		INTEGRAL VOLUTE--CW	6"	
26	1	EA	11L1C		GASKET	6"	
27	8	EA	6L20JG		CAPSCREW	3/4"-10 X 2"	

* 8" SUCTION PUMP

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
25A	1	EA	87D309A		INTEGRAL VOLUTE--CCW	6"	
25B	1	EA	87D309B		INTEGRAL VOLUTE--CW	6"	
26	1	EA	11L1C		GASKET	6"	
27	8	EA	6L20JF		CAPSCREW	3/4"-10 X 1 3/4"	
28	1	EA	2L20C		REDUCER	8" X 6"	
29	1	EA	11L1D		GASKET	8"	
30	8	EA	6L20JN		CAPSCREW	3/4"-10 X 3 1/2"	
31	8	EA	6L60M		NUT	3/4"-10	



NOTES:
1. 4C2B/4C2D/4C2X PUMPS ARE ONLY USED WITH 20 AND 25 HP, 1750 RRPM, "C" SHAFT MOTORS
2. COPYRIGHT (C) 2004, 2006, 2007 SMITH & LOVELESS, INC.
3. SPECIFY CW OR CCW ON INTEGRAL VOLUTE.

87B454/C

LET	ECN NO	DATE	BY	APP'V'D
C	N2007-71	12/2007	RGD	JK
B	N2007-67	12/2007	RGD	RSM
A	N2006-60	6/2006	RGD	FT

ORIGINAL ISSUE N2004-29

DRAWN BY: JRB DATE: 5/27/2004
CHECKED BY: RGD DATE: 6/2004
APPROVED BY: FT DATE: 6/2004
SCALE: NTS CODE: -
ALLOWABLE TOLERANCES: FRACTIONS - DECIMALS - ANGLES -

FOR: PUMP ASSEMBLY 4C2B/4C2D/4C2X

SIZE | U/M EA | WT.
FILE NAME \SUB\87B454C | PLOT SCALE 1=2.667
SERIAL NO | DWG NO 87B454 | REV C

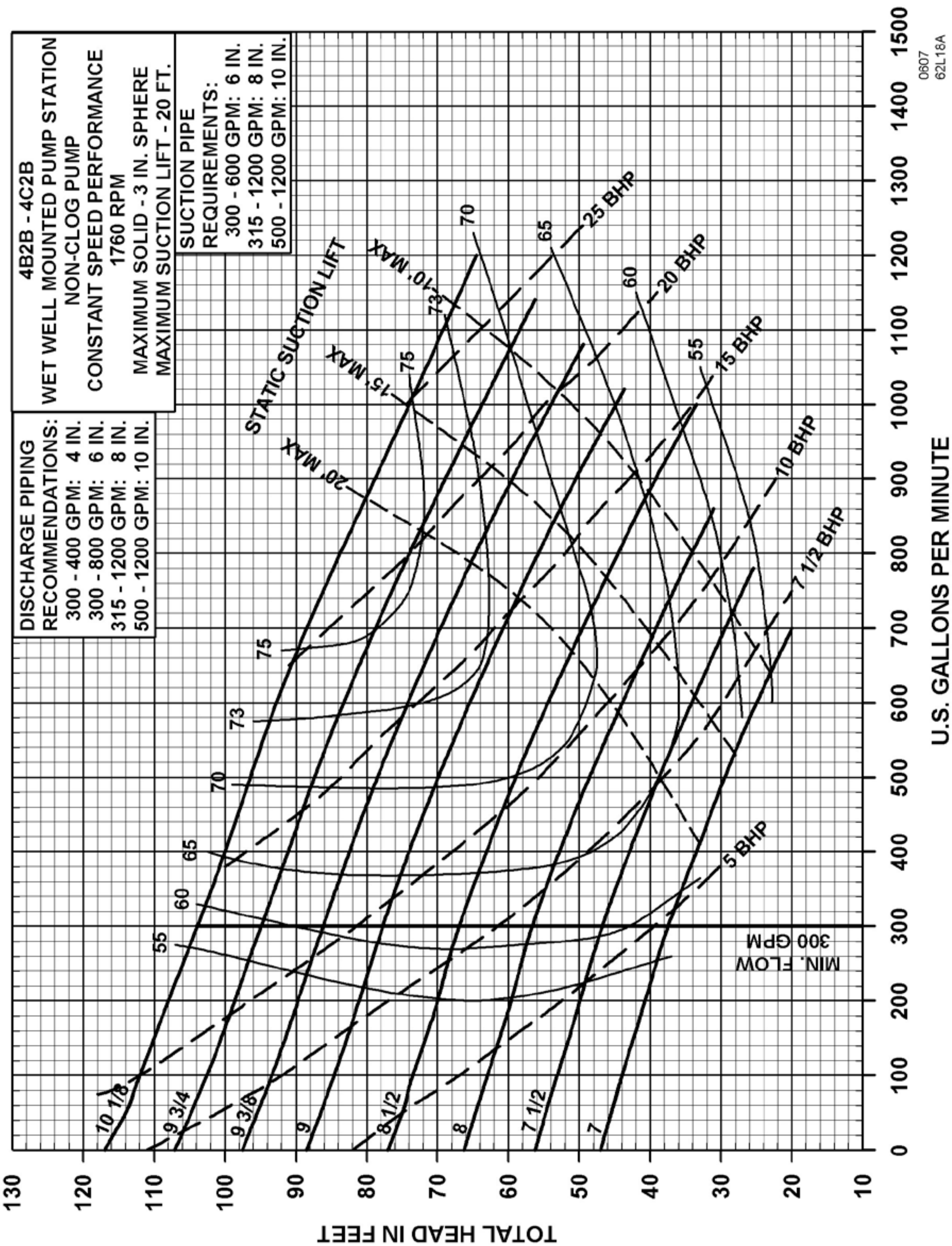
SHEET 1 OF 1

ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L18
Constant Speed
Non-Clog Pump
4B2B / 4C2B – 1760 RPM
July, 2012

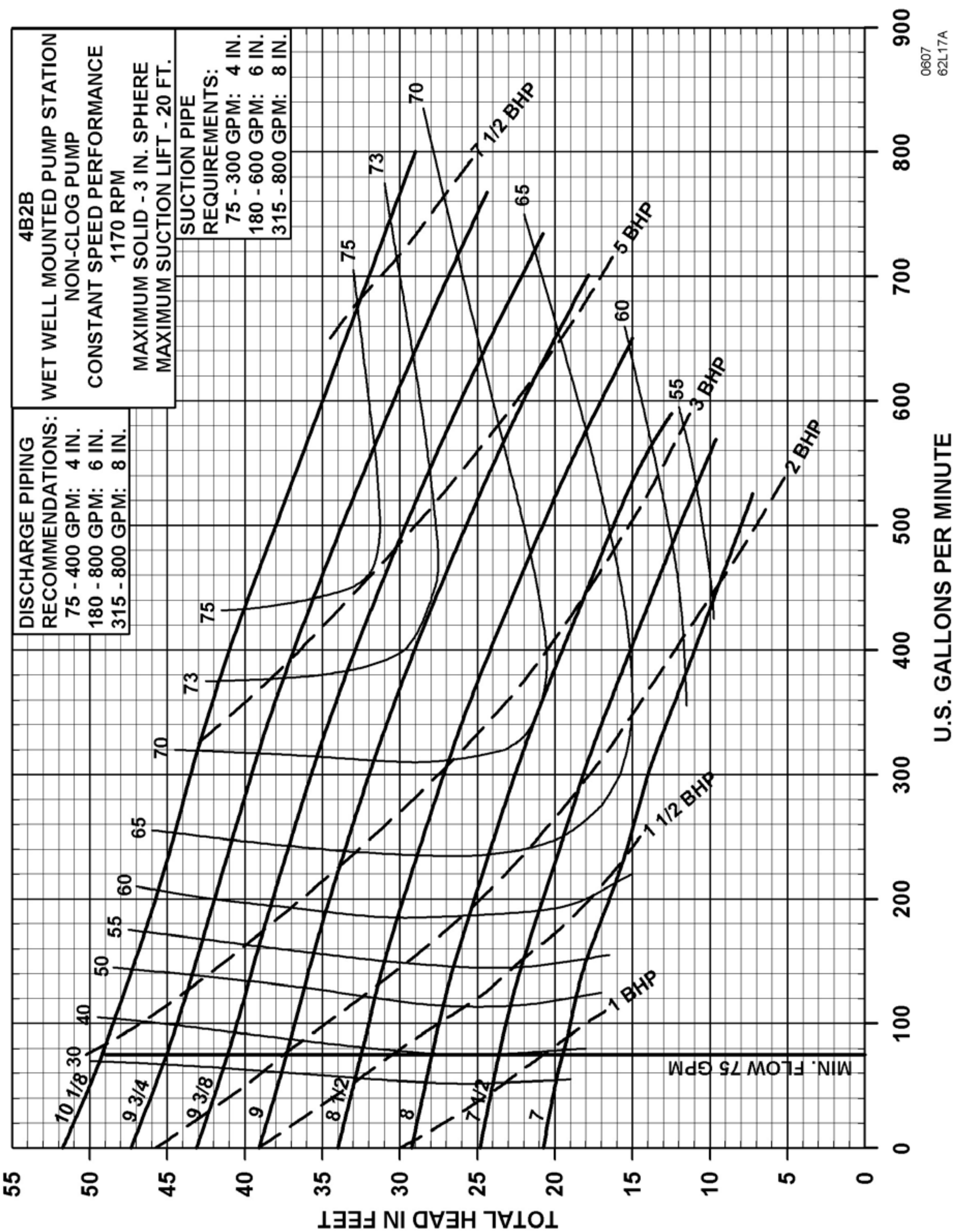


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L17
Constant Speed
Non-Clog Pump
4B2B – 1170 RPM
July, 2012

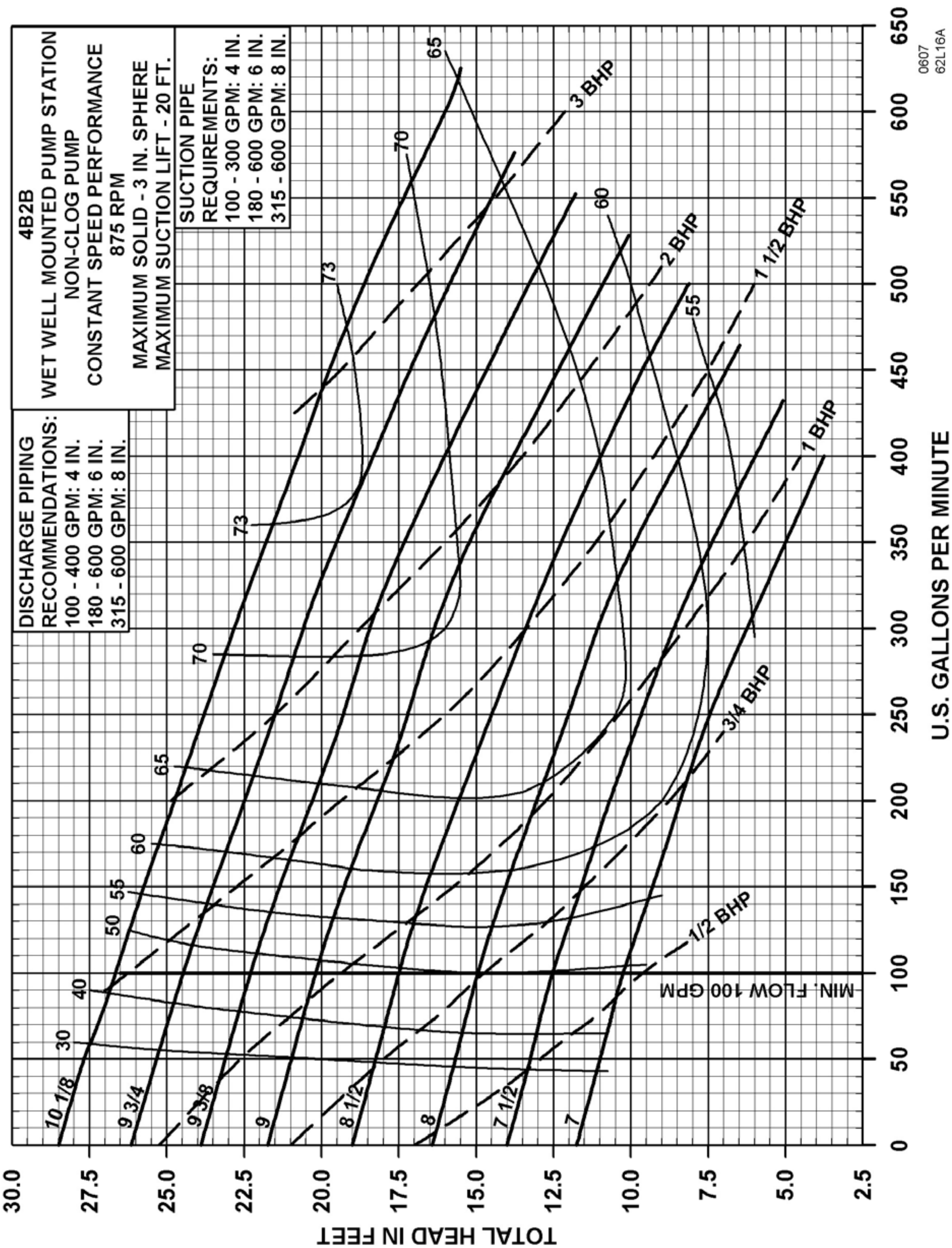


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L16
Constant Speed
Non-Clog Pump
4B2B – 875 RPM
July, 2012

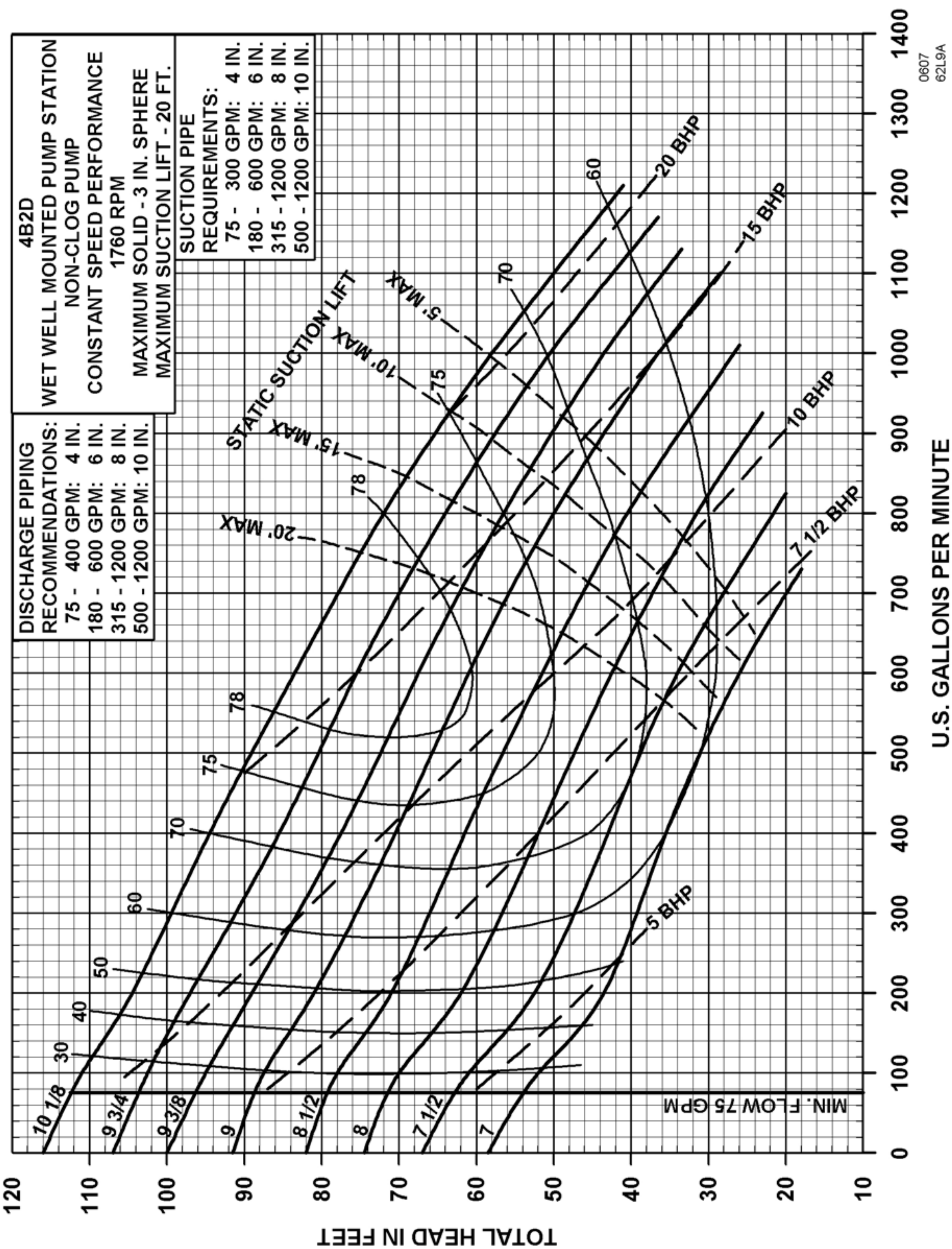


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

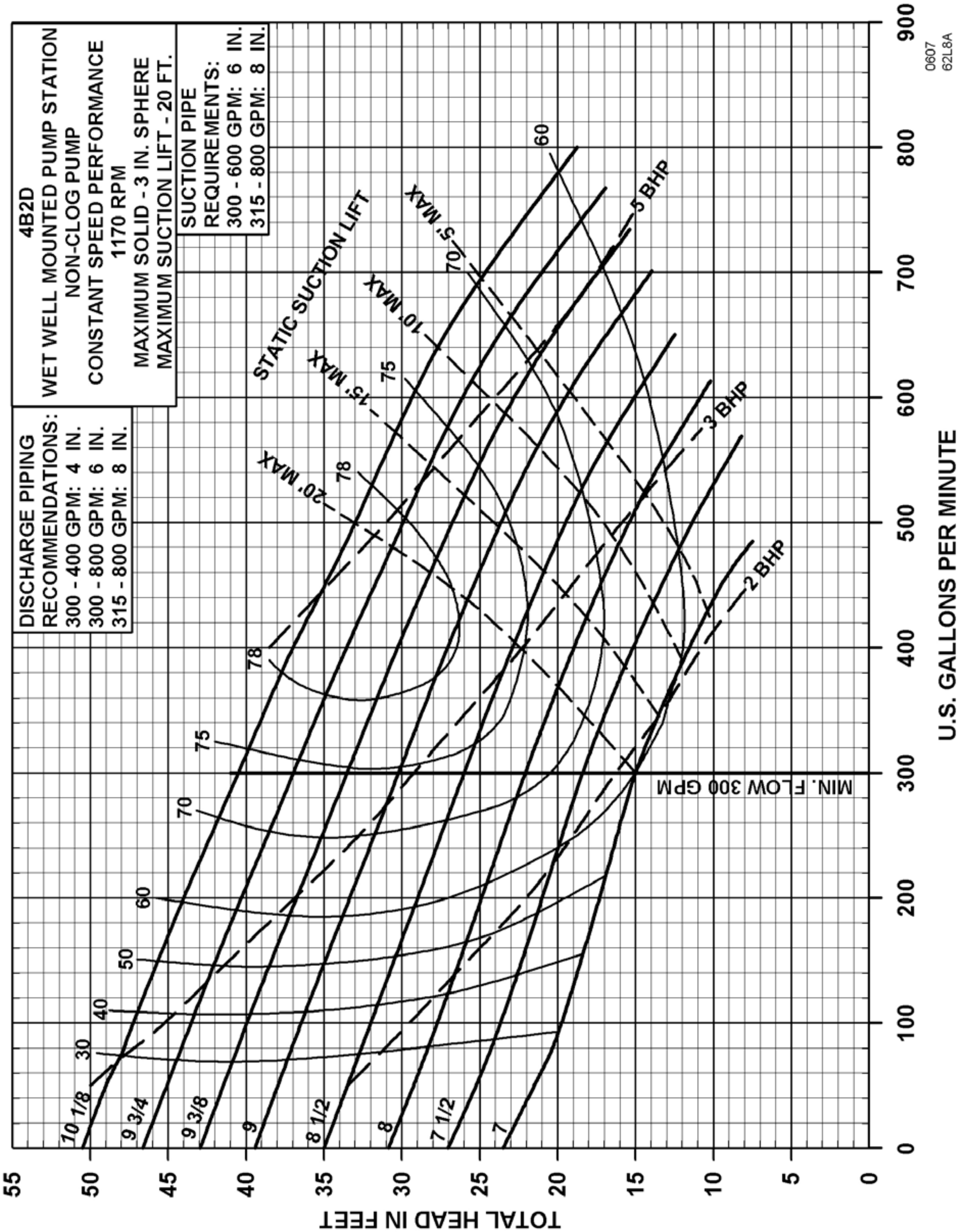
Vacuum Primed Pump
Performance Curve 62L9
Constant Speed
Non-Clog Pump
4B2D – 1760 RPM
July, 2012



ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L8
Constant Speed
Non-Clog Pump
4B2D – 1170 RPM
July, 2012

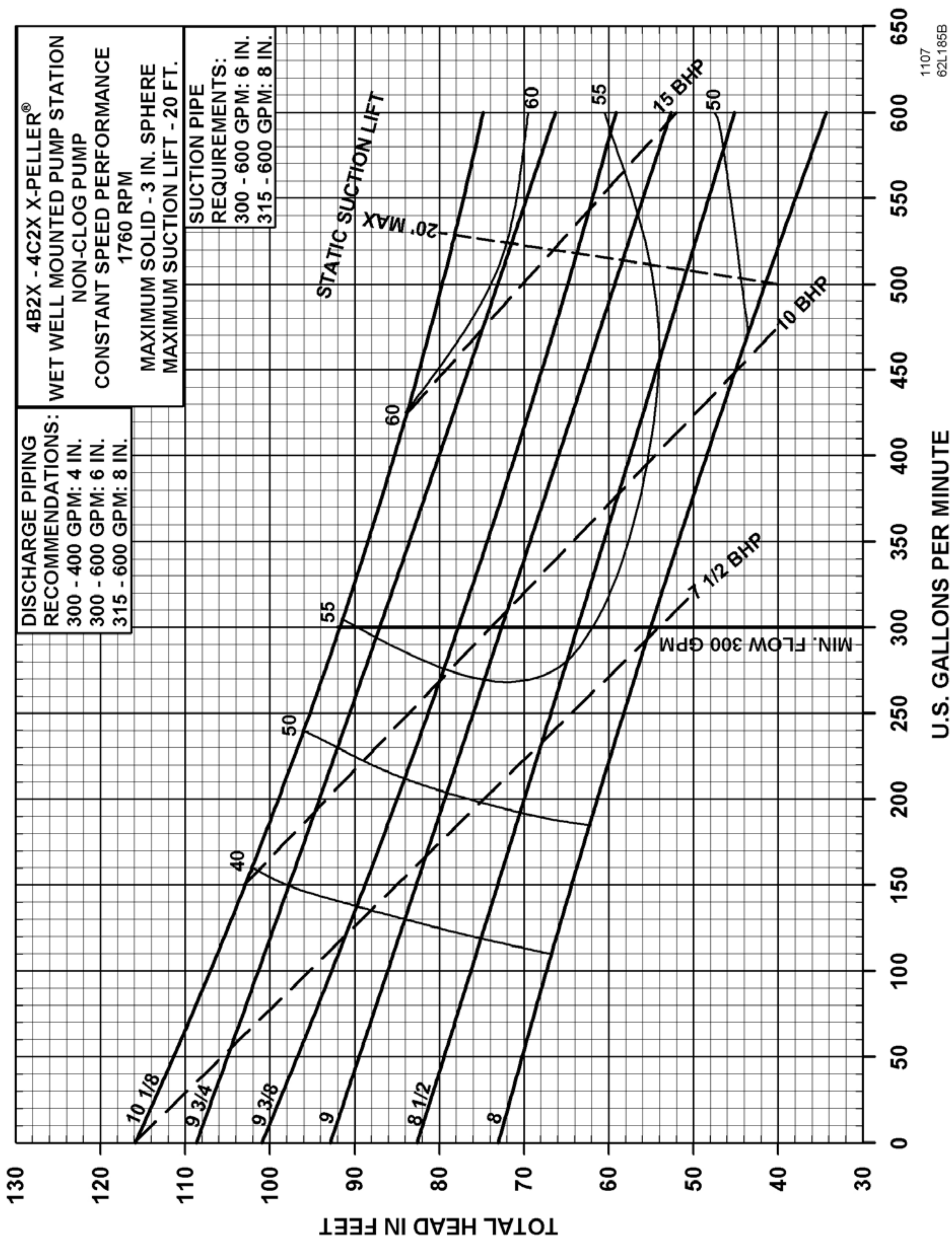


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

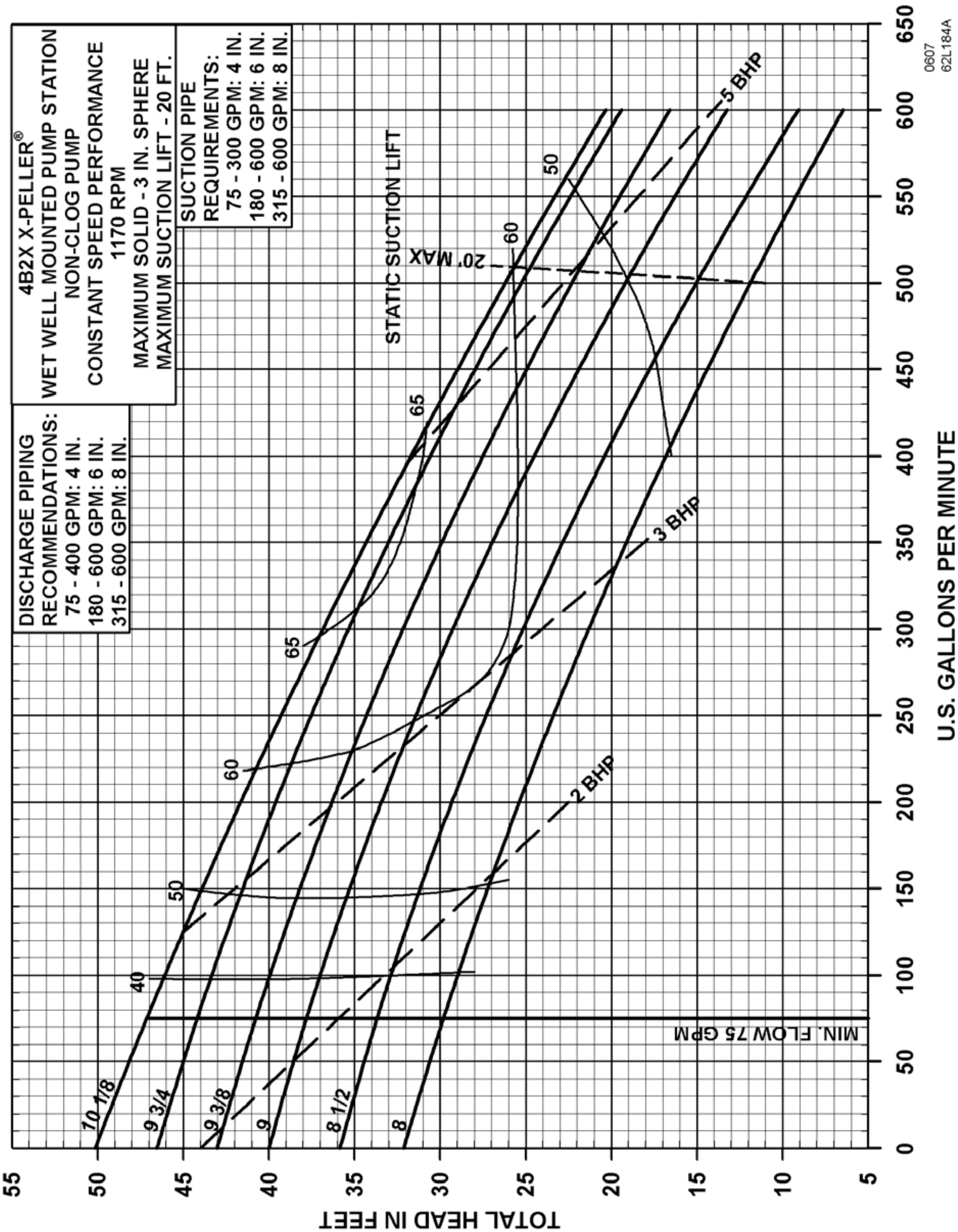
Wet Well Mounted Pump Station
Performance Curve 62L185
Constant Speed
Non-Clog Pump
X-PELLER® Impeller
4B2X / 4C2X – 1760 RPM
July, 2012



ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Wet Well Mounted Pump Station
Performance Curve 62L184
Constant Speed
Non-Clog Pump
X-PELLER® Impeller
4B2X – 1170 RPM
July, 2012

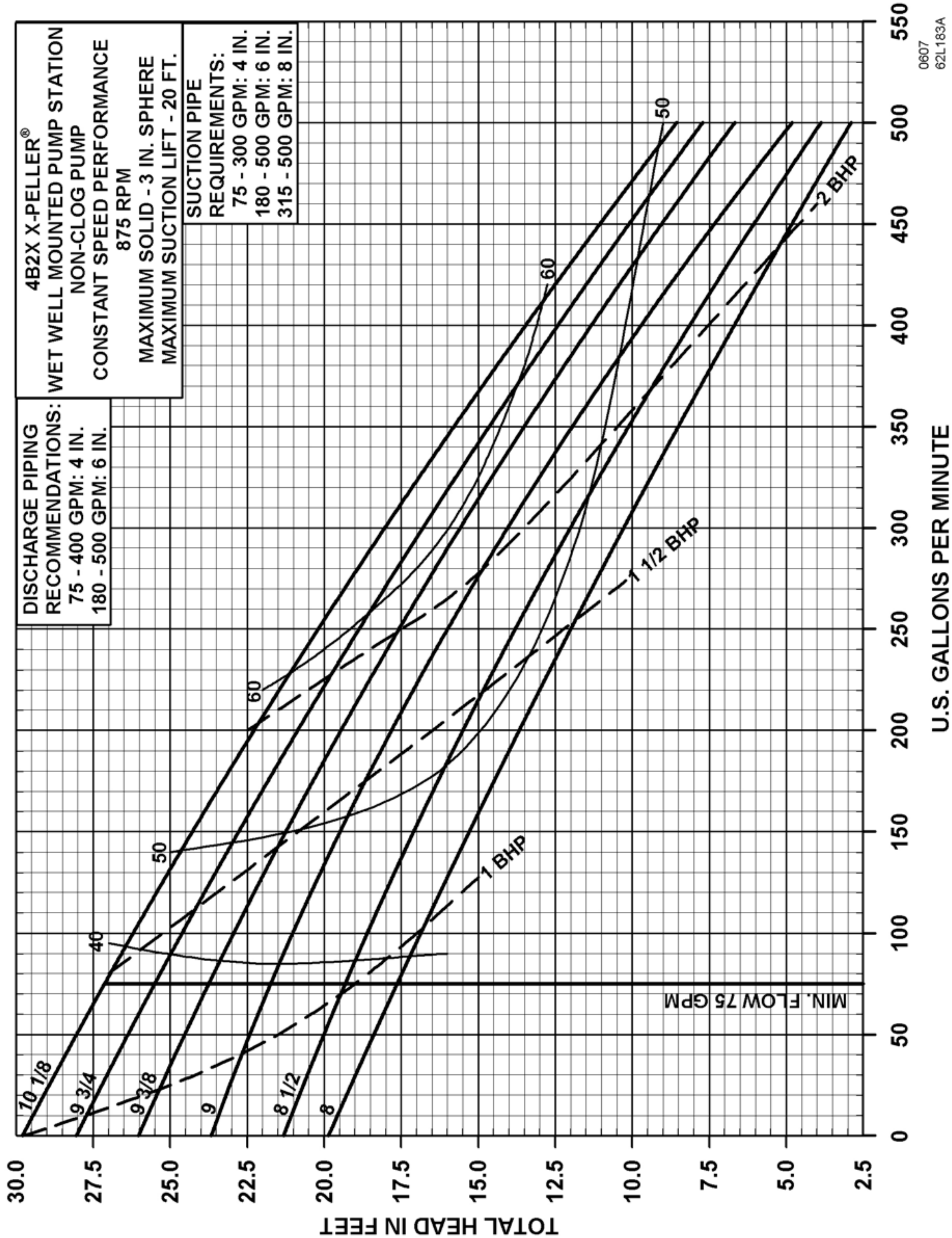


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Wet Well Mounted Pump Station
Performance Curve 62L183
Constant Speed
Non-Clog Pump
X-PELLER® Impeller
4B2X – 875 RPM
July, 2012



ENGINEERING DATA

Smith &
Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Pump Assembly Drawing
4B3B
Drawing 87B456
July, 2012

COMMON BILL OF MATERIAL

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
1	1	EA	60A110		SEAL HOLDER GASKET QUAD RING		
2	1	EA	60A12		IMPELLER BOLT		
3	1	EA	60A20		IMPELLER WASHER		
4	1	EA	60A28		VOLUTE GASKET		
5	1	EA	60A30		SPRING		
6	1	EA	60A32		ROTATING CERAMIC SEAL		
7	1	EA	60A36		STATIONARY CARBON SEAL		
8	1	EA	60A38		QUAD RING		
9	1	EA	60A39		"O" RING		
13	1	EA	87B2		SEAL HOLDER		
15	1	EA	60B165D		MOTOR ADAPTER MODIFICATION		
16	6	EA	6L59BC		CAPSCREW – SS	5/16"–18 X 1"	
18	4	EA	6L20DC		CAPSCREW	3/8"–16 X 1"	
19	2	EA	1L69B		PIPE PLUG	1/4"	
33	8	EA	6L20HD		CAPSCREW	5/8"–11 X 1 1/4"	
34	8	EA	6L229L		WASHER, FLAT – REDUCED O.D.	5/8"	

4" SUCTION

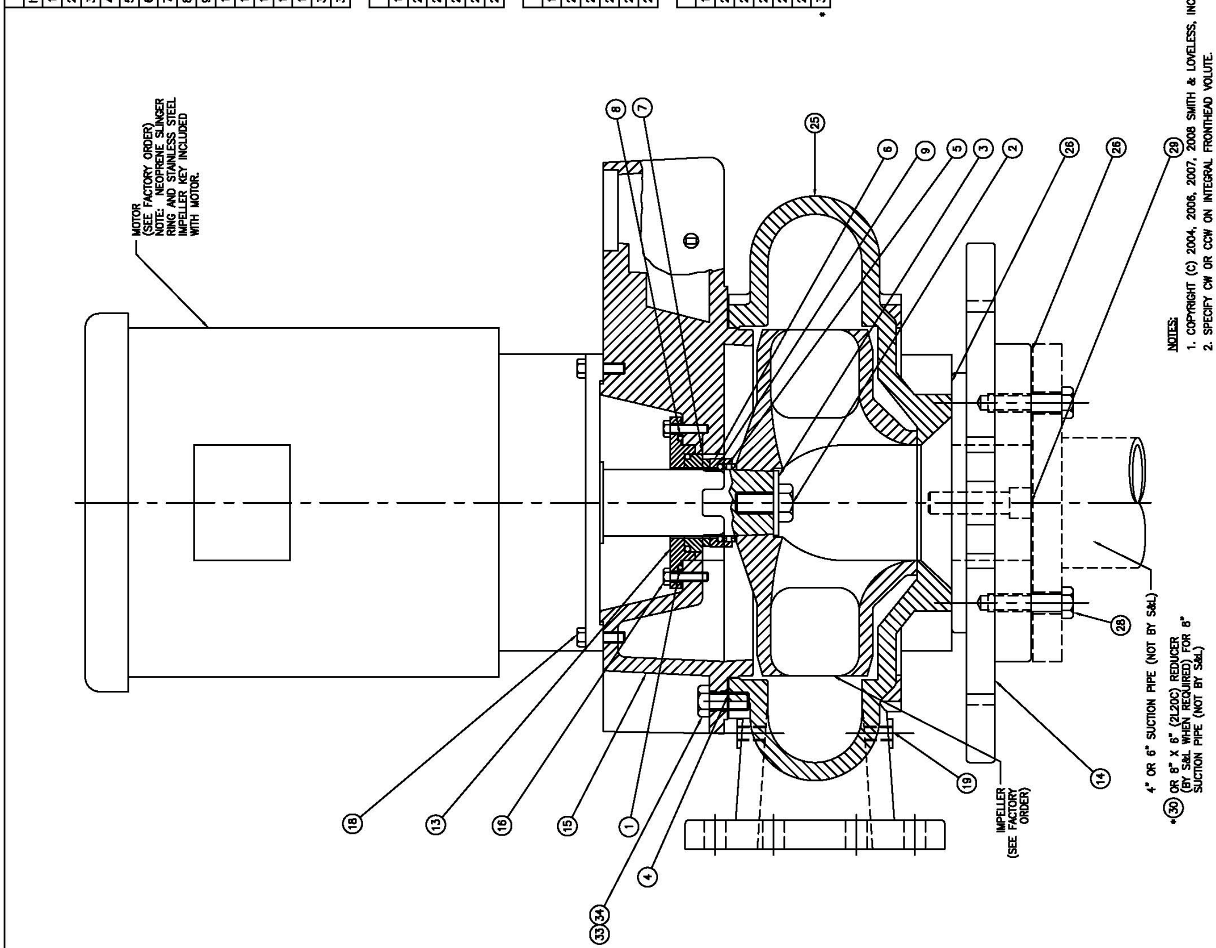
Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
14	1	EA	87B239		ADAPTER		
25A	1	EA	87D310A		INTEGRAL FRONTHEAD VOLUTE – CCW	4"	
25B	1	EA	87D310B		INTEGRAL FRONTHEAD VOLUTE – CW	4"	
26	2	EA	11L1AA		GASKET	4"	
28	8	EA	6L20HF		CAPSCREW	5/8"–11 X 1 3/4"	
29	8	EA	6L178B		CAPSCREW, SOCKET HEAD	5/8"–11 X 2 3/4"	

6" SUCTION

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
14	1	EA	87B241		ADAPTER		
25A	1	EA	87D311A		INTEGRAL FRONTHEAD VOLUTE – CCW	6"	
25B	1	EA	87D311B		INTEGRAL FRONTHEAD VOLUTE – CW	6"	
26	2	EA	11L1CA		GASKET	6"	
28	8	EA	6L20JH		CAPSCREW	3/4"–10 X 2 1/4"	
29	8	EA	6L178F		CAPSCREW, SOCKET HEAD	3/4"–10 X 2 3/4"	

8" SUCTION

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
14	1	EA	87B241		ADAPTER		
25A	1	EA	87D311A		INTEGRAL FRONTHEAD VOLUTE – CCW	6"	
25B	1	EA	87D311B		INTEGRAL FRONTHEAD VOLUTE – CW	6"	
26	2	EA	11L1CA		GASKET	6"	
28	8	EA	6L20JH		CAPSCREW	3/4"–10 X 2 1/4"	
29	8	EA	6L178F		CAPSCREW, SOCKET HEAD	3/4"–10 X 2 3/4"	
•30	1	EA	2L20C		REDUCER	8" X 6"	



NOTES:
1. COPYRIGHT (C) 2004, 2006, 2007, 2008 SMITH & LOVELESS, INC.
2. SPECIFY CW OR CCW ON INTEGRAL FRONTHEAD VOLUTE.

87B456/D

SHEET 1 OF 1

LET	ECN NO	DATE	BY APP'D
D	N2007-71	1/2008	ADB JK
C	N2007-72	12/2007	FRED RGD
B	N2007-67	12/2007	RGD RSM
A	N2006-60	6/2006	RGD FT

ORIGINAL ISSUE N2004-29

DRAWN BY: JRB — DATE: 5/27/2004
CHECKED BY: RGD — DATE: 6/2004
APPROVED BY: FT — DATE: 6/2004
SCALE: NTS — CODE:

ALLOWABLE TOLERANCES: FRACTIONS – ; DECIMALS – ; ANGLES –

FOR
PUMP ASSEMBLY
4B3B

SIZE — U/M EA — WT.
FILE NAME \SUB\87B456D — PLOT SCALE 1=2.667
SERIAL NO — DWG NO 87B456 — REV D

Smith & Loveless,Inc.

ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Pump Assembly Drawing
4C3B
Drawing 87B457
July, 2012

COMMON BILL OF MATERIAL

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
1	1	EA	60A111		SEAL HOLDER GASKET QUAD RING		
2	1	EA	60A12		IMPELLER BOLT		
3	1	EA	60A20		IMPELLER WASHER		
4	1	EA	60A28		VOLUTE GASKET		
5	1	EA	60A31		SPRING		
6	1	EA	60A33		ROTATING CERAMIC SEAL		
7	1	EA	60A37		STATIONARY CARBON SEAL		
8	1	EA	60A40		QUAD RING		
9	1	EA	60A41		"O" RING		
13	1	EA	87B19		SEAL HOLDER		
15	1	EA	60B165E		MOTOR ADAPTER MODIFICATION		
* 15	1	EA	60B165F		MOTOR ADAPTER MODIFICATION		
16	6	EA	6L59BC		CAPSCREW – SS	5/16"–18 X 1"	
* 18	4	EA	6L20DE		CAPSCREW	3/8"–16 X 1 1/2"	
18	4	EA	6L20HE		CAPSCREW	5/8"–11 X 1 1/2"	
19	2	EA	1L69B		PIPE PLUG	1/4"	
33	8	EA	6L20HD		CAPSCREW	5/8"–11 X 1 1/4	
34	8	EA	6L229L		WASHER, FLAT – REDUCED O.D.	5/8"	

4" SUCTION

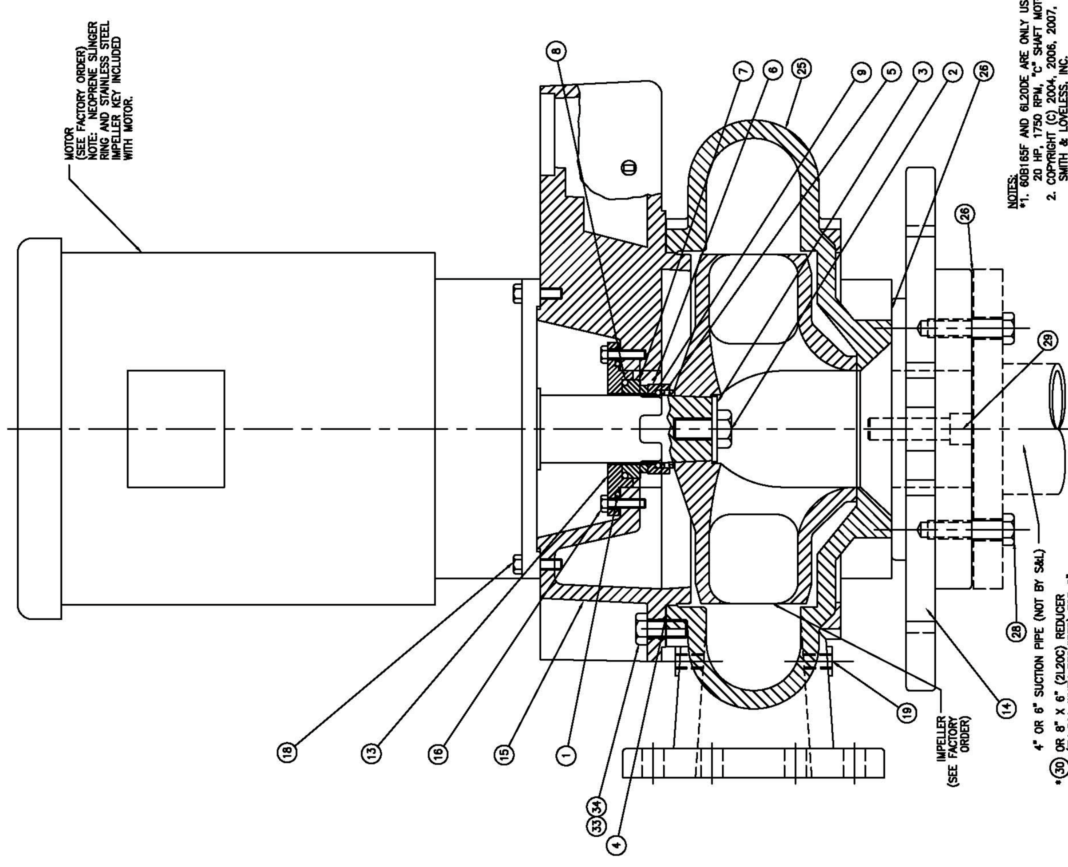
Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
14	1	EA	87B239		ADAPTER		
25A	1	EA	87D310A		INTEGRAL FRONTHEAD VOLUTE – CCW	4"	
25B	1	EA	87D310B		INTEGRAL FRONTHEAD VOLUTE – CW	4"	
26	2	EA	11L1AA		GASKET	4"	
28	8	EA	6L20HF		CAPSCREW	5/8"–11 X 1 3/4"	
29	8	EA	6L178B		CAPSCREW, SOCKET HEAD	5/8"–11 X 2 3/4"	

6" SUCTION

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
14	1	EA	87B241		ADAPTER		
25A	1	EA	87D311A		INTEGRAL FRONTHEAD VOLUTE – CCW	6"	
25B	1	EA	87D311B		INTEGRAL FRONTHEAD VOLUTE – CW	6"	
26	2	EA	11L1CA		GASKET	6"	
28	8	EA	6L20JH		CAPSCREW	3/4"–10 X 2 1/4"	
29	8	EA	6L178F		CAPSCREW, SOCKET HEAD	3/4"–10 X 2 3/4"	

8" SUCTION

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
14	1	EA	87B241		ADAPTER		
25A	1	EA	87D311A		INTEGRAL FRONTHEAD VOLUTE – CCW	6"	
25B	1	EA	87D311B		INTEGRAL FRONTHEAD VOLUTE – CW	6"	
26	2	EA	11L1CA		GASKET	6"	
28	8	EA	6L20JH		CAPSCREW	3/4"–10 X 2 1/4"	
29	8	EA	6L178F		CAPSCREW, SOCKET HEAD	3/4"–10 X 2 3/4"	
* 30	1	EA	2L20C		REDUCER	8" X 6"	



NOTES:
*1. 60B165F AND 6L20DE ARE ONLY USED WITH 20 HP, 1750 RPM, "C" SHAFT MOTORS.
2. COPYRIGHT (C) 2004, 2006, 2007, 2008 SMITH & LOVELESS, INC.
3. SPECIFY CW OR CCW INTEGRAL FRONTHEAD VOLUTE.

SHEET 1 OF 1

87B457/D

LET	ECN NO	DATE	BY APP'D
D	N2007-71	1/2008	ADB / JK
C	N2007-72	12/2007	FRED / RGD
B	N2007-67	12/2007	RGD / RSM
A	N2006-60	6/2006	RGD / FT
ORIGINAL ISSUE	N2004-29		

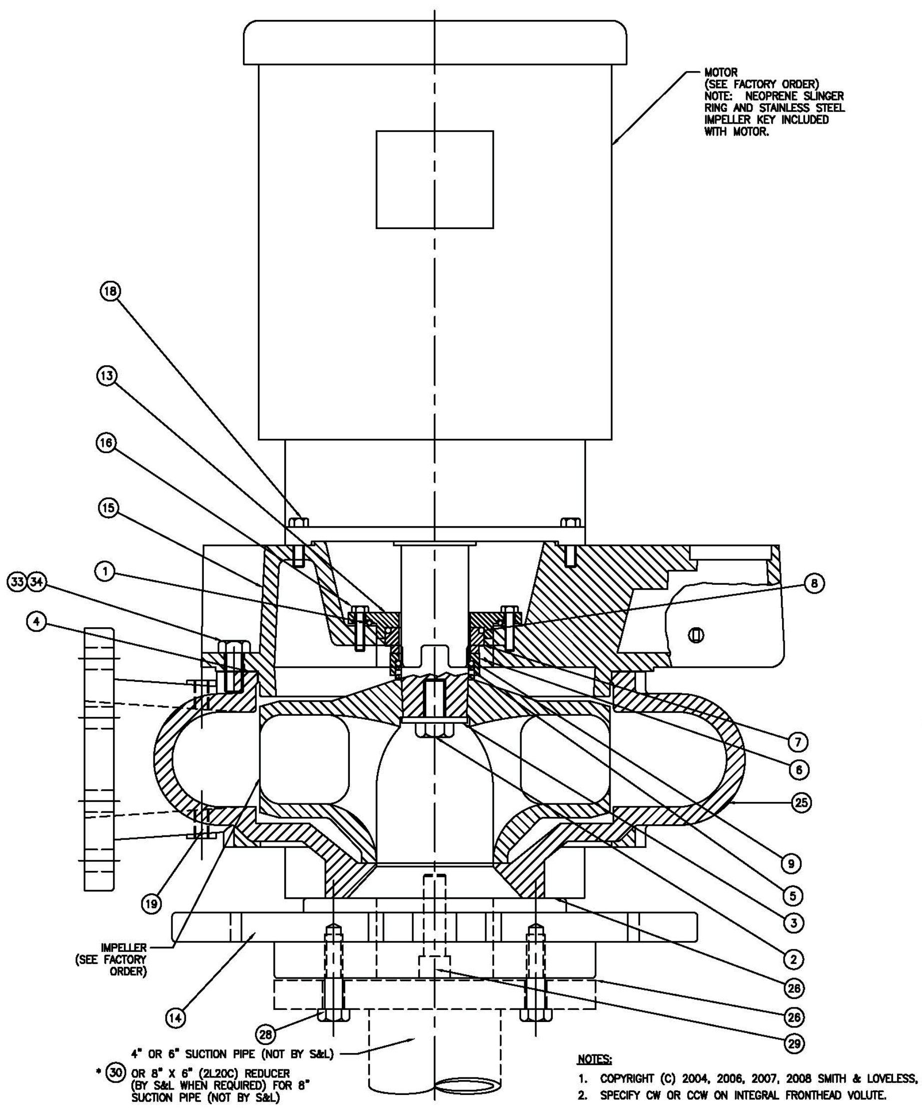
DRAWN BY: JRB — DATE: 5/28/2004
CHECKED BY: RGD — DATE: 6/2004
APPROVED BY: FT — DATE: 6/2004
SCALE: NTS — CODE: -
ALLOWABLE TOLERANCES: FRACTIONS -; DECIMALS -; ANGLES -
FOR: PUMP ASSEMBLY 4C3B
SIZE — U/M EA — WT.
FILE NAME \SUB\87B457D — PLOT SCALE 1=2.667
SERIAL NO — DWG NO 87B457 — REV D

Smith & Loveless, Inc.

ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Pump Assembly Drawing
4D3B
Drawing 87B458
July, 2012



NOTES:
1. COPYRIGHT (C) 2004, 2006, 2007, 2008 SMITH & LOVELESS, INC.
2. SPECIFY CW OR CCW ON INTEGRAL FRONTHEAD VOLUTE.

COMMON BILL OF MATERIAL

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
1	1	EA	60A461		SEAL HOLDER GASKET QUAD RING		
2	1	EA	60A87		IMPELLER BOLT		
3	1	EA	60A86		IMPELLER WASHER		
4	1	EA	60A28		VOLUTE GASKET		
5	1	EA	60A55		SPRING		
6	1	EA	60A85		ROTATING CERAMIC SEAL		
7	1	EA	60A52		STATIONARY CARBON SEAL		
8	1	EA	60A54		QUAD RING		
9	1	EA	60A53		"O" RING		
13	1	EA	87B73		SEAL HOLDER		
15	1	EA	60B165M		MOTOR ADAPTER MODIFICATION		
16	6	EA	6L59EC		CAPSCREW – SS	1/2"–13 X 1"	
18	4	EA	6L20HE		CAPSCREW	5/8"–11 X 1 1/2"	
19	2	EA	1L69B		PIPE PLUG	1/4"	
33	8	EA	6L20HD		CAPSCREW	5/8"–11 X 1 1/4"	
34	8	EA	6L229L		WASHER, FLAT – REDUCED O.D.	5/8"	
					4" SUCTION		
14	1	EA	87B239		ADAPTER		
25A	1	EA	87D310A		INTEGRAL FRONTHEAD VOLUTE – CCW	4"	
25B	1	EA	87D310B		INTEGRAL FRONTHEAD VOLUTE – CW	4"	
26	2	EA	11L1AA		GASKET	4"	
28	8	EA	6L20HF		CAPSCREW	5/8"–11 X 1 3/4"	
29	8	EA	6L178B		CAPSCREW, SOCKET HEAD	5/8"–11 X 2 3/4"	
					6" SUCTION		
14	1	EA	87B241		ADAPTER		
25A	1	EA	87D311A		INTEGRAL FRONTHEAD VOLUTE – CCW	6"	
25B	1	EA	87D311B		INTEGRAL FRONTHEAD VOLUTE – CW	6"	
26	2	EA	11L1CA		GASKET	6"	
28	8	EA	6L20JH		CAPSCREW	3/4"–10 X 2 1/4"	
29	8	EA	6L178F		CAPSCREW, SOCKET HEAD	3/4"–10 X 2 3/4"	
					8" SUCTION		
14	1	EA	87B241		ADAPTER		
25A	1	EA	87D311A		INTEGRAL FRONTHEAD VOLUTE – CCW	6"	
25B	1	EA	87D311B		INTEGRAL FRONTHEAD VOLUTE – CW	6"	
26	2	EA	11L1CA		GASKET	6"	
28	8	EA	6L20JH		CAPSCREW	3/4"–10 X 2 1/4"	
29	8	EA	6L178F		CAPSCREW, SOCKET HEAD	3/4"–10 X 2 3/4"	
* 30	1	EA	2L20C		REDUCER	8" X 6"	

87B458/D

LET	ECN NO	DATE	BY / APP'D
D	N2007-71	1/2008	ADB / JK
C	N2007-72	12/2007	FRED / RGD
B	N2007-67	12/2007	RGD / RSM
A	N2006-60	1/2006	RGD / FT

DRAWN BY: JRB	DATE: 5/28/2004	ALLOWABLE TOLERANCES
CHECKED BY: RGD	DATE: 6/2004	FRACTIONS –
APPROVED BY: FT	DATE: 6/2004	DECIMALS –
SCALE: NTS	CODE:	ANGLES –

FOR: PUMP ASSEMBLY 4D3B
SIZE | U/M EA | WT.
FILE NAME \SUB\87B458D | PLOT SCALE 1=2.667
ORIGINAL ISSUE N2004–29 | © Smith & Loveless, Inc. 2004,05,07,08 | SERIAL NO | DWG NO 87B458 | REV D

SHEET 1 OF 1

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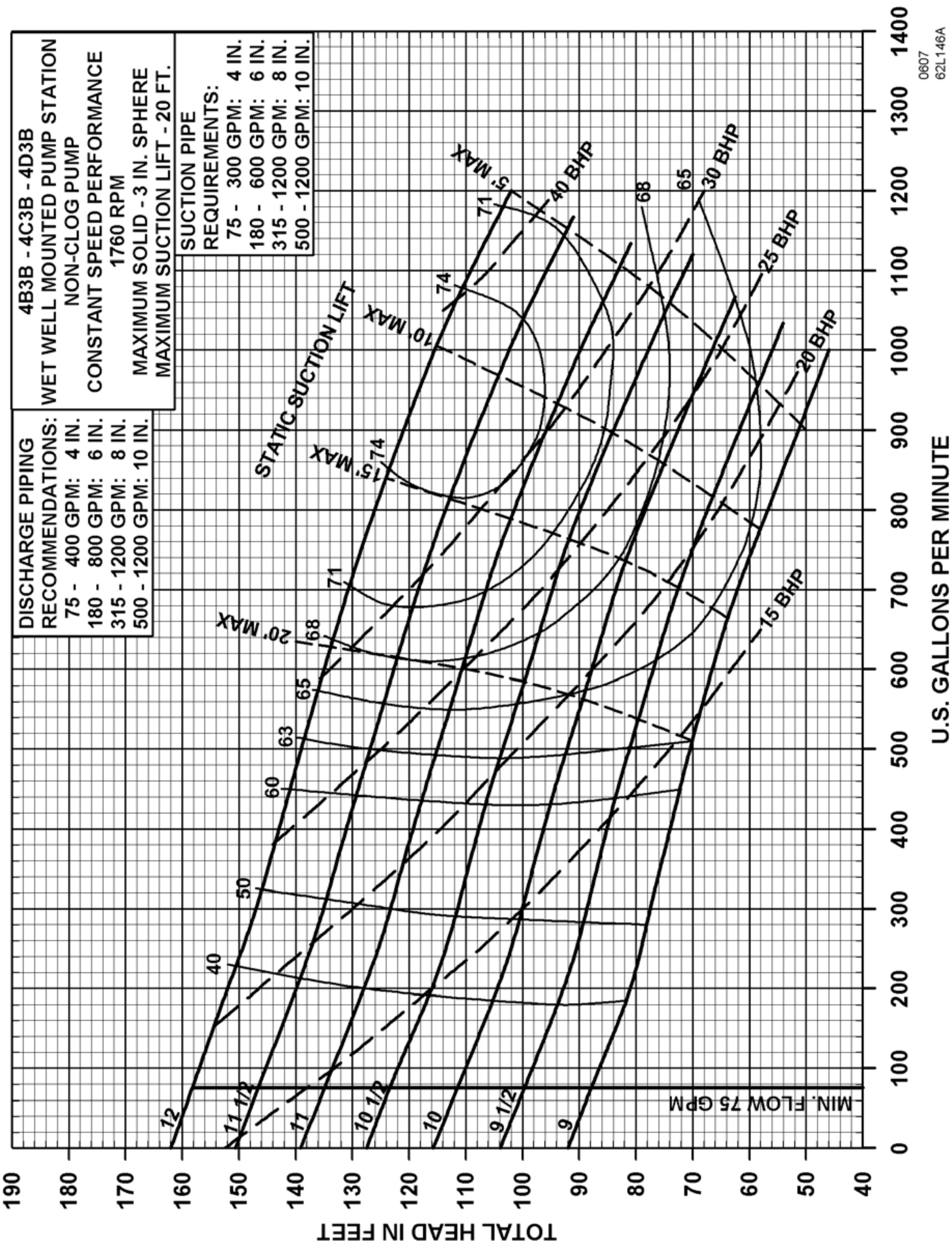
Smith & Loveless, Inc.

ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L146
Constant Speed
Non-Clog Pump
4B3B / 4C3B / 4D3B – 1760 RPM
July, 2012

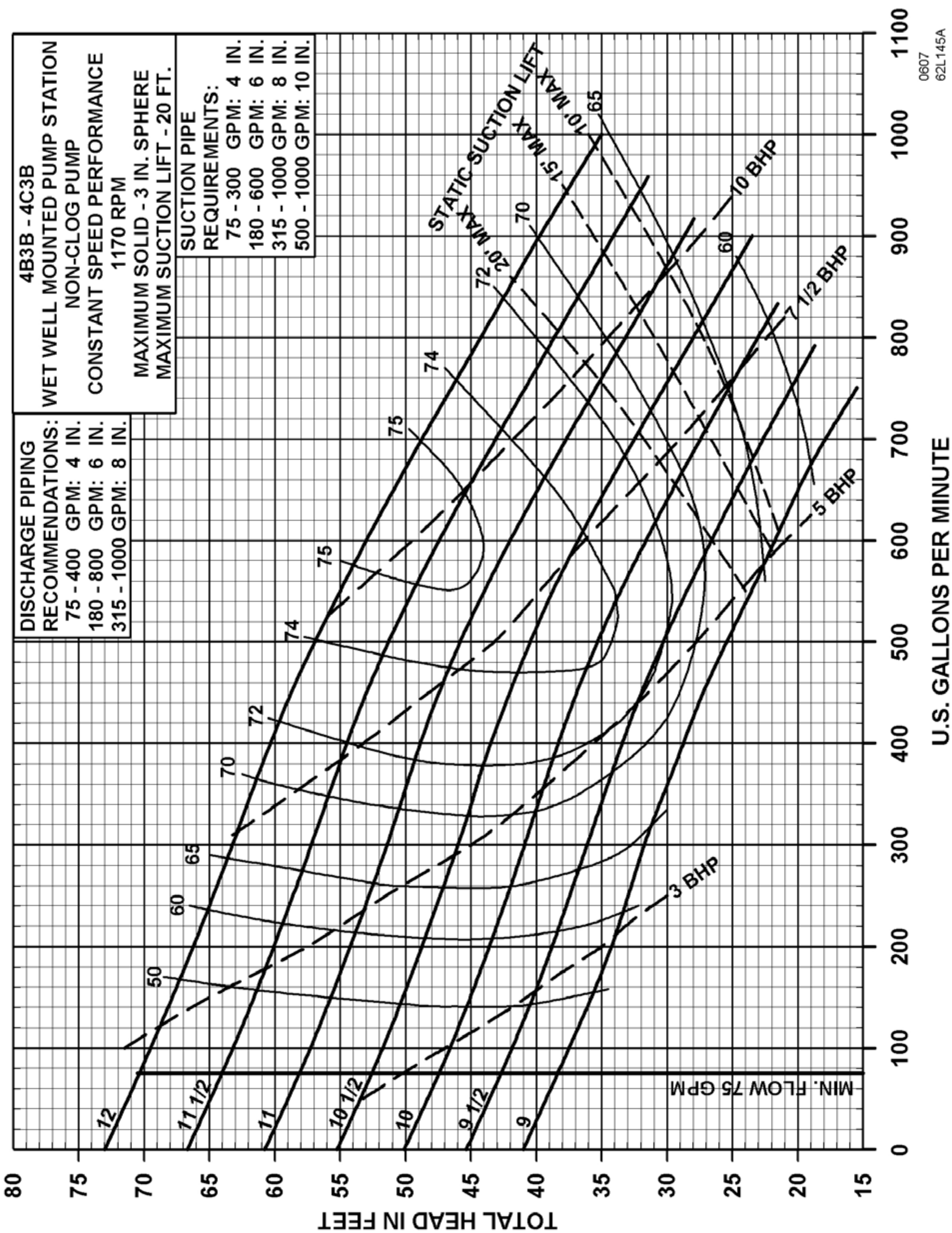


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L145
Constant Speed
Non-Clog Pump
4B3B / 4C3B – 1170 RPM
July, 2012



ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Pump Assembly Drawing
4D4B
Drawing 87B646
July, 2012

BILL OF MATERIAL

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
1	1	EA	60A112		SEAL HOLDER GASKET QUAD RING		
2	1	EA	60A87		IMPELLER BOLT		
3	1	EA	60A86		IMPELLER WASHER		
4	2	EA	60A106B		VOLUTE GASKET		
5	1	EA	60A55		SPRING		
6	1	EA	60A85		ROTATING CERAMIC SEAL		
7	1	EA	60A52		STATIONARY CARBON SEAL		
8	1	EA	60A54		QUAD RING		
9	1	EA	60A53		"O" RING		
13	1	EA	87B105		SEAL HOLDER		
14	1	EA	60D252		VOLUTE		
15	1	EA	60B165Q		MOTOR ADAPTER MODIFICATION		
16	6	EA	6L59EC		CAPSCREW, SS	1/2"-13 x 1"	
18	4	EA	6L20HE		CAPSCREW	5/8"-11 x 1 1/2"	
19	8	EA	6L20HD		CAPSCREW	5/8"-11 X 1 1/4"	
24	1	EA	60B124		FRONTHEAD	6"	
25	1	EA	11L1C		GASKET	6"	
26	8	EA	6L20HF		CAPSCREW	5/8"-11 X 1 3/4"	

NOTES:
1. COPYRIGHT (C) 2006, 2008 SMITH & LOVELESS, INC.

87B646/A

PUMP ASSEMBLY 4D4B

DRAWN BY: R. DIEHM	DATE: 11/2005
CHECKED BY: BFO	DATE: 11/2005
APPROVED BY: FT	DATE: 11/2005
SCALE: NTS	CODE: -
A N2007-71 1/2009	ECN NO / DATE / BY / APPV'D
ORIGINAL ISSUE N2007-7	
FILE NAME \SUB\87B646A	SIZE
U/M EA	WT.
PLOT SCALE 1=2.667	DWG NO 87B646 REV A

ALLOWABLE TOLERANCES: FRACTIONS -, DECIMALS -, ANGLES -

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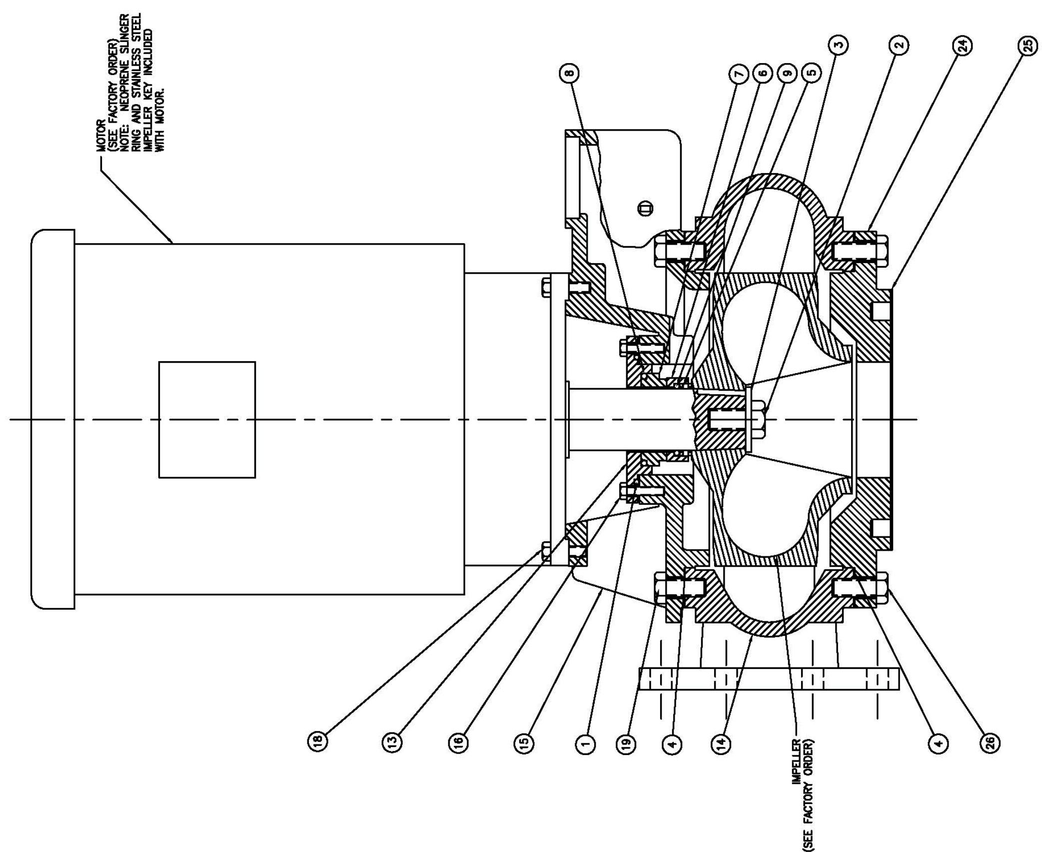
Smith & Loveless, Inc.

SHEET 1 OF 1

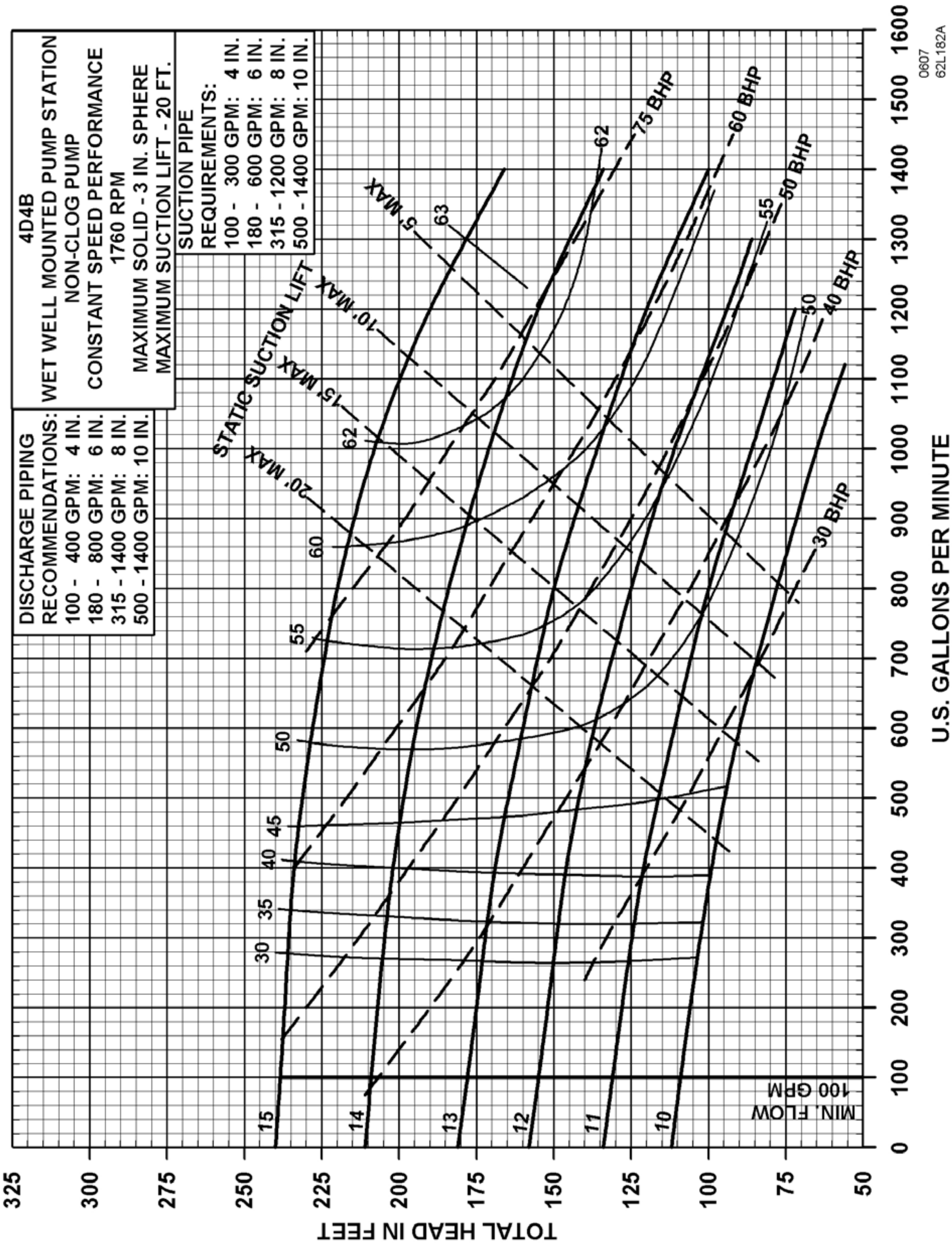


ENGINEERING DATA

Smith &
Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L182
Constant Speed
Non-Clog Pump
4D4B – 1760 RPM
July, 2012



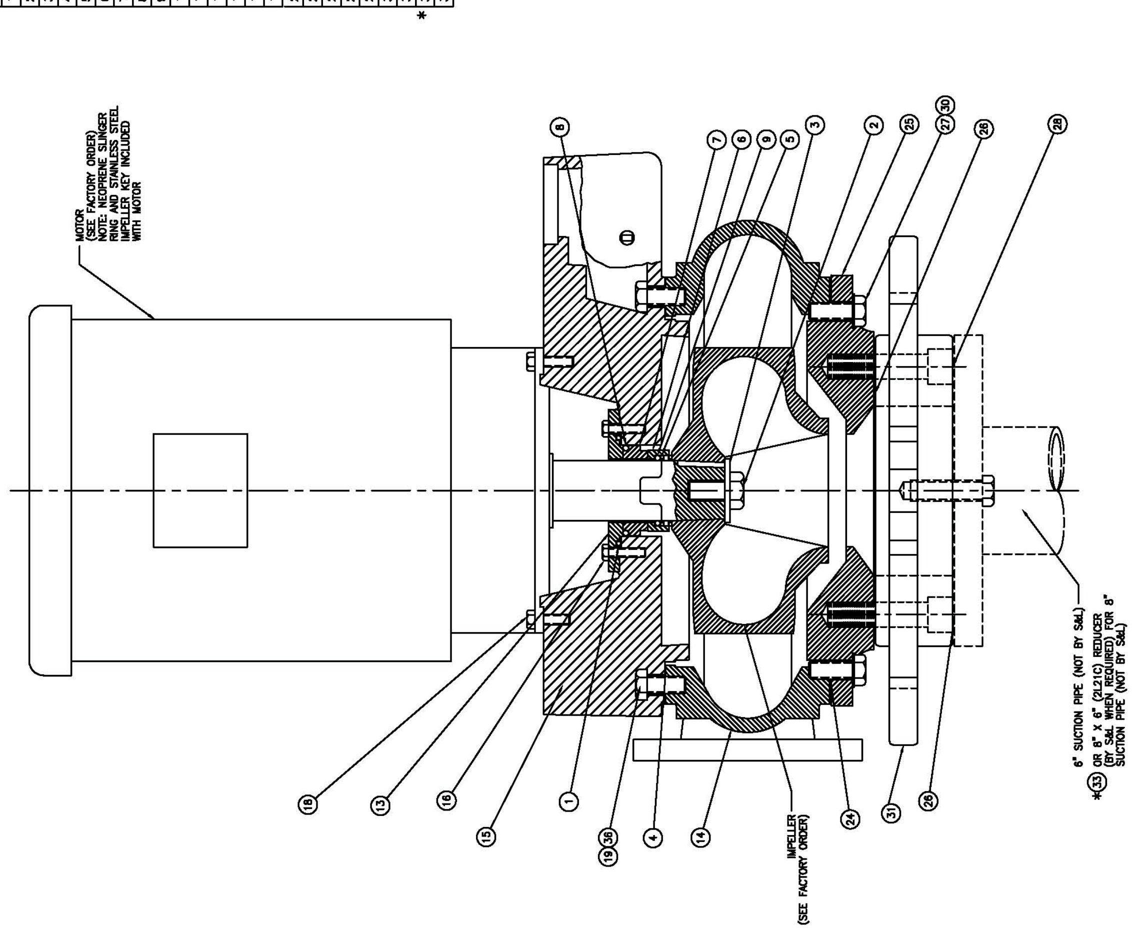
ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Pump Assembly Drawing
6B3_
Drawing 87B467
July, 2012

COMMON BILL OF MATERIAL

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
1	1	EA	60A110		SEAL HOLDER GASKET QUAD RING		
2	1	EA	60A12		IMPELLER BOLT		
3	1	EA	60A20		IMPELLER WASHER		
4	1	EA	60A28		VOLUTE GASKET		
5	1	EA	60A30		SPRING		
6	1	EA	60A32		ROTATING CERAMIC SEAL		
7	1	EA	60A36		STATIONARY CARBON SEAL		
8	1	EA	60A38		QUAD RING		
9	1	EA	60A39		"O" RING		
13	1	EA	87B2		SEAL HOLDER		
14	1	EA	60D35		VOLUTE		
15	1	EA	60B165D		MOTOR ADAPTER MODIFICATION		
16	6	EA	6L59BC		CAPSCREW – SS	5/16"–18 X 1"	
18	4	EA	6L20DC		CAPSCREW	3/8"–16 X 1"	
19	8	EA	6L20HD		CAPSCREW	5/8"–11 X 1 1/4"	
24	2	EA	60A29		VOLUTE GASKET		
25	1	EA	60C88		FRONTHEAD	6"	
26	2	EA	11L1CA		GASKET	6"	
27	8	EA	6L20HE		CAPSCREW	5/8"–11 X 1 1/2"	
28	8	EA	6L178F		CAPSCREW, SOCKET HEAD	3/4"–10 X 2 3/4"	
30	8	EA	6L61L		WASHER, FLAT	5/8"	
31	1	EA	87B241		MOUNTING ADAPTER		
* 33	1	EA	2L21C		REDUCER	8" X 6"	
36	8	EA	6L229L		WASHER, FLAT – REDUCED O.D.	5/8"	

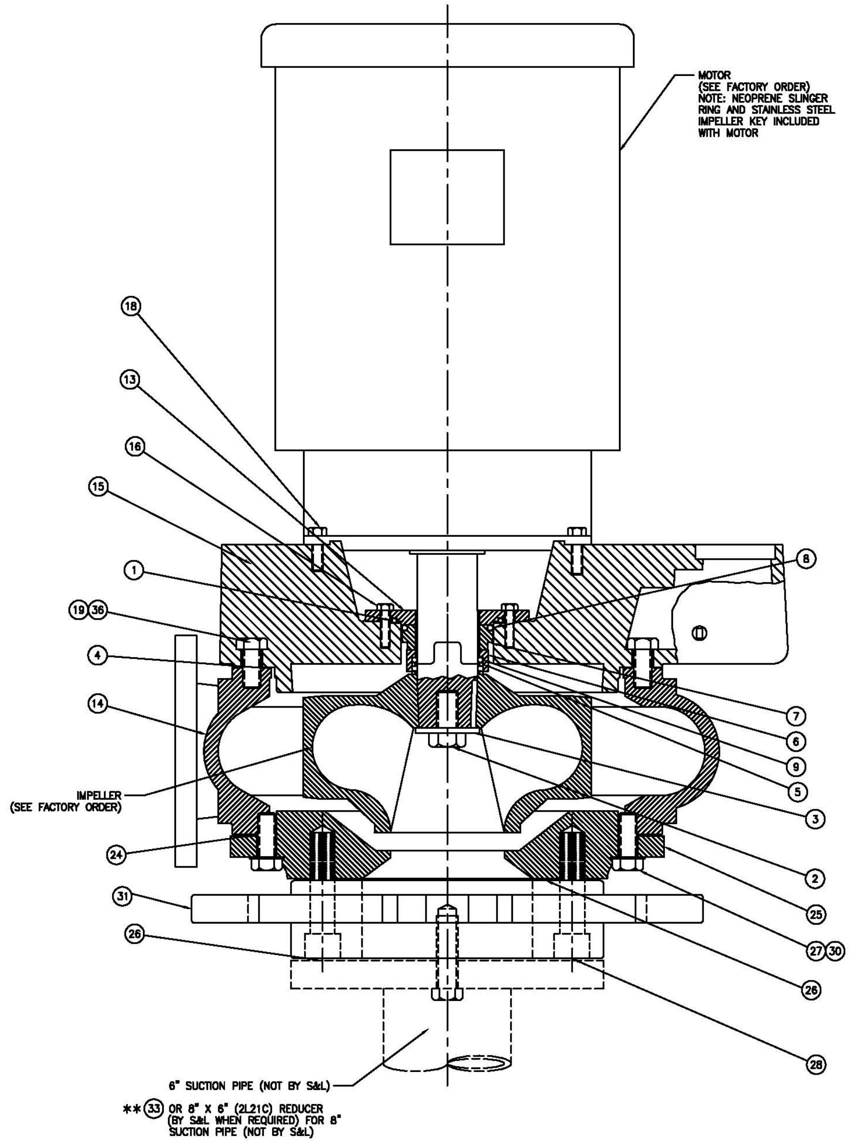


NOTE:
1. COPYRIGHT (C) 2004, 06, 07, 08, 12 SMITH & LOVELESS, INC.

87B467/E

LET	ECN NO	DATE	BY / APPV'D
E	N2011-14	1/2012	GBB / RD
D	N2007-71	1/2008	ADB / JK
C	N2007-72	12/2007	FRED / RGD
B	N2007-67	12/2007	RGD / RSM
A	N2006-60	6/2006	RGD / FT
ORIGINAL ISSUE	N2004-29		

DRAWN BY: JRB DATE: 6/1/2004
CHECKED BY: RGD DATE: 6/2004
APPROVED BY: FT DATE: 6/2004
SCALE: NTS CODE:
ALLOWABLE TOLERANCES: FRACTIONS – DECIMALS – ANGLES
FOR: PUMP ASSEMBLY 6B3_
SIZE U/M EA WT.
FILE NAME 87B467E.dwg PLOT SCALE 1=2.667
DWG NO 87B467 REV E
SHEET 1 OF 1



COMMON BILL OF MATERIAL

	Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
	1	1	EA	60A111		SEAL HOLDER GASKET QUAD RING		
	2	1	EA	60A12		IMPELLER BOLT		
	3	1	EA	60A20		IMPELLER WASHER		
	4	1	EA	60A28		VOLUTE GASKET		
	5	1	EA	60A31		SPRING		
	6	1	EA	60A33		ROTATING CERAMIC SEAL		
	7	1	EA	60A37		STATIONARY CARBON SEAL		
	8	1	EA	60A40		QUAD RING		
	9	1	EA	60A41		"O" RING		
	13	1	EA	87B19		SEAL HOLDER		
	14	1	EA	60D35		VOLUTE		
	15	1	EA	60B165E		MOTOR ADAPTER MODIFICATION		
*	15	1	EA	60B165F		MOTOR ADAPTER MODIFICATION		
	16	6	EA	6L59BC		CAPSCREW – SS	5/16"–18 X 1"	
*	18	4	EA	6L20DE		CAPSCREW	3/8"–11 X 1 1/2"	
	18	4	EA	6L20HE		CAPSCREW	5/8"–11 X 1 1/2"	
	19	8	EA	6L20HD		CAPSCREW	5/8"–11 X 1 1/4"	
	24	2	EA	60A29		VOLUTE GASKET		
	25	1	EA	60C88		FRONTHEAD	6"	
	26	2	EA	11L1CA		GASKET	6"	
	27	8	EA	6L20HE		CAPSCREW	5/8"–11 X 1 1/2"	
	28	8	EA	6L178F		CAPSCREW, SOCKET HEAD	3/4"–10 X 2 3/4"	
	30	8	EA	6L61L		WASHER, FLAT	5/8"	
	31	1	EA	87B241		MOUNTING ADAPTER		
**	33	1	EA	2L21C		REDUCER	8" X 6"	
	36	8	EA	6L229L		WASHER, FLAT – REDUCED O.D.	5/8"	

NOTE:
* 1. 60B165F AND 6L20DE ARE ONLY USED WITH 20 HP, 1750 RPM, "C" SHAFT MOTORS.
2. COPYRIGHT (C) 2004, 06, 07, 08, 12 SMITH & LOVELESS, INC.

87B468/E

LET	ECN NO	DATE	BY APP'D
E	N2011–14	1/2012	GBB RD
D	N2007–71	1/2008	ADB JK
C	N2007–72	12/2007	FRED RGD
B	N2007–67	12/2007	RGD RSM
A	N2006–60	6/2006	RGD FT
ORIGINAL ISSUE	N2004–29		

DRAWN BY: JRB — DATE: 6/1/2004
CHECKED BY: RGD — DATE: 6/2004
APPROVED BY: FT — DATE: 6/2004
SCALE: NTS — CODE: –
ALLOWABLE TOLERANCES: FRACTIONS – DECIMALS – ANGLES –

FOR: PUMP ASSEMBLY 6C3_

SIZE — U/M EA — WT.
FILE NAME 87B468E.dwg — PLOT SCALE 1=2.667
SERIAL NO — DWG NO 87B468 — REV E

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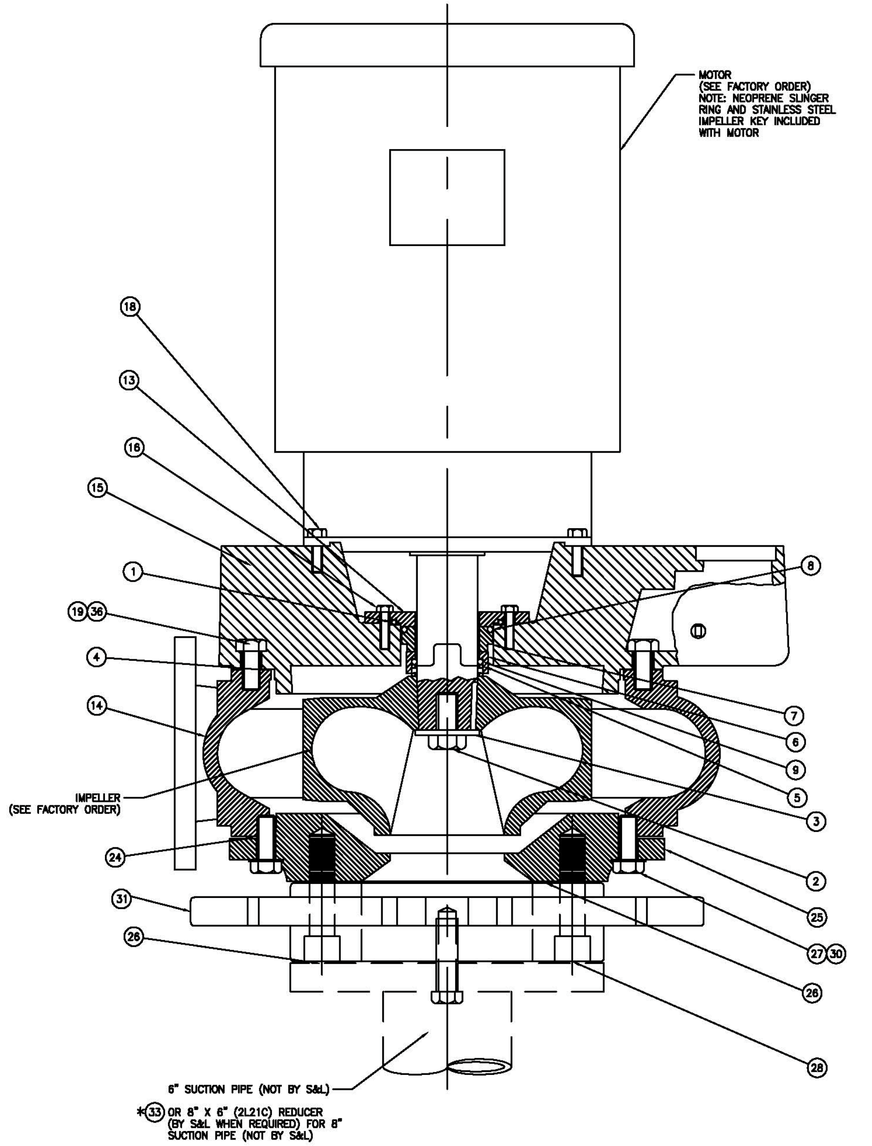
Smith & Loveless, Inc.

SHEET 1 OF 1

ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Pump Assembly Drawing
6D3_
Drawing 87B469
July, 2012



BILL OF MATERIAL

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
1	1	EA	60A146		SEAL HOLDER GASKET QUAD RING		
2	1	EA	60A87		IMPELLER BOLT		
3	1	EA	60A86		IMPELLER WASHER		
4	1	EA	60A28		VOLUTE GASKET		
5	1	EA	60A55		SPRING		
6	1	EA	60A85		ROTATING CERAMIC SEAL		
7	1	EA	60A52		STATIONARY CARBON SEAL		
8	1	EA	60A54		QUAD RING		
9	1	EA	60A53		"O" RING		
13	1	EA	87B73		SEAL HOLDER		
14	1	EA	60D35		VOLUTE		
15	1	EA	60B165M		MOTOR ADAPTER MODIFICATION		
16	6	EA	6L59EC		CAPSCREW – SS	1/2"-13 x 1"	
18	4	EA	6L20HE		CAPSCREW	5/8"-11 X 1 1/2"	
19	8	EA	6L20HD		CAPSCREW	5/8"-11 X 1 1/4"	
24	2	EA	60A29		VOLUTE GASKET		
25	1	EA	60C88		FRONTHEAD	6"	
26	2	EA	11L1CA		GASKET	6"	
27	8	EA	6L20HE		CAPSCREW	5/8"-11 X 1 1/2"	
28	8	EA	6L178F		CAPSCREW, SOCKET HEAD	3/4"-10 X 2 3/4"	
30	8	EA	6L61L		WASHER, FLAT	5/8"	
31	1	EA	87B241		MOUNTING ADAPTER		
* 33	1	EA	2L21C		REDUCER	8" X 6"	
36	8	EA	6L229L		WASHER, FLAT – REDUCED O.D.	5/8"	

NOTE:
1. COPYRIGHT (C) 2004, 05, 06, 07, 08, 12 SMITH & LOVELESS, INC.

87B469/F

LET	ECN NO	DATE	BY APP'D
E	N2007-71	1/2008	ADB JK
D	N2007-72	12/2007	FRED RGD
C	N2007-67	12/2007	RGD RSM
B	N2006-60	6/2006	RGD FT
F	N2011-14	1/2012	GBB RO

ORIGINAL ISSUE N2004-29

DRAWN BY: JRB — DATE: 6/1/2004
CHECKED BY: RGD — DATE: 6/2004
APPROVED BY: FT — DATE: 6/2004
SCALE: NTS — CODE:
ALLOWABLE TOLERANCES: FRACTIONS –, DECIMALS –, ANGLES –

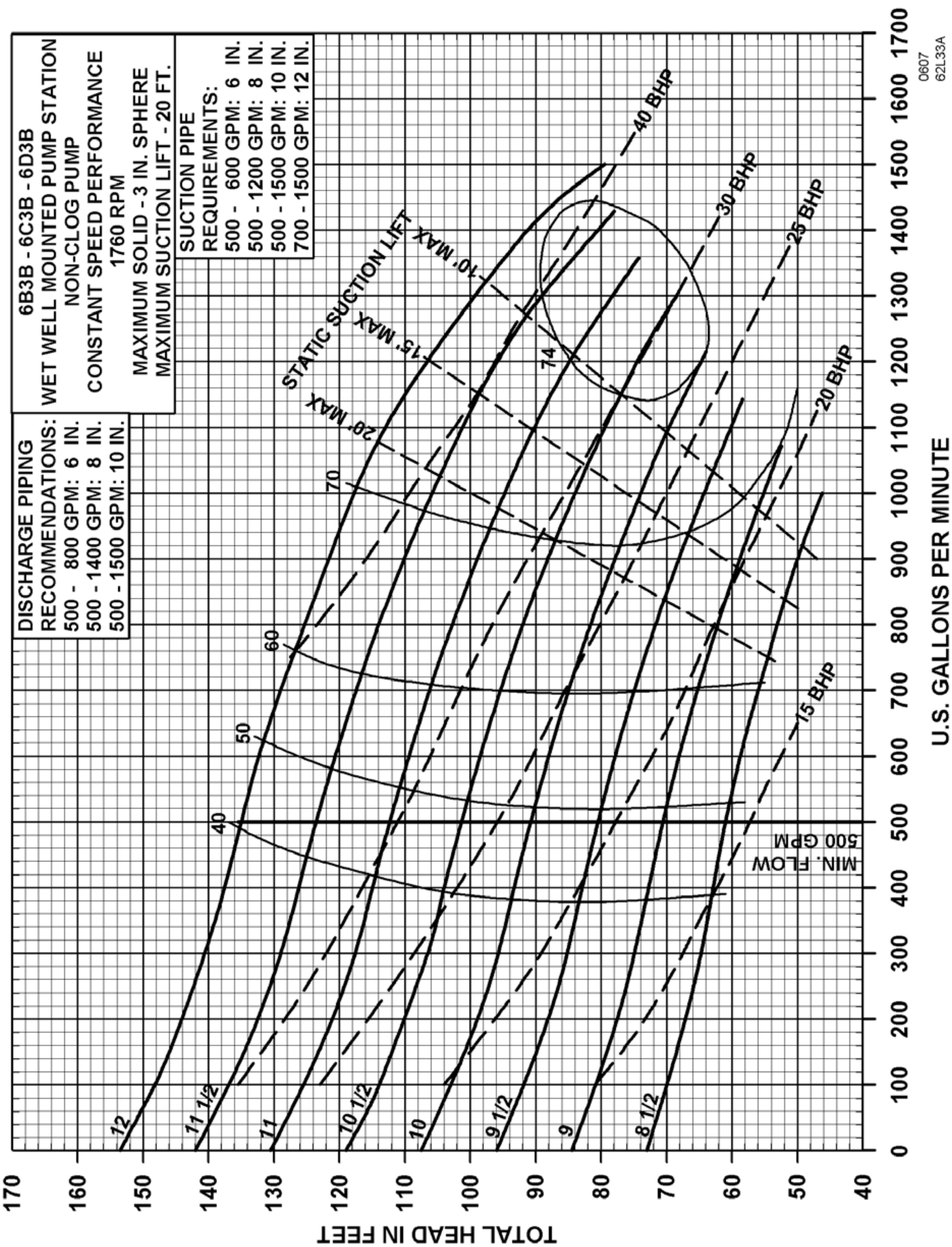
FOR: PUMP ASSEMBLY 6D3_
SIZE — U/M EA — WT.
FILE NAME 87B469F.dwg — PLOT SCALE 1=2.667
SERIAL NO — DWG NO 87B469 — REV F
Smith & Loveless, Inc.

SHEET 1 OF 1

ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L33
Constant Speed
Non-Clog Pump
6B3B / 6C3B / 6D3B – 1760 RPM
July, 2012

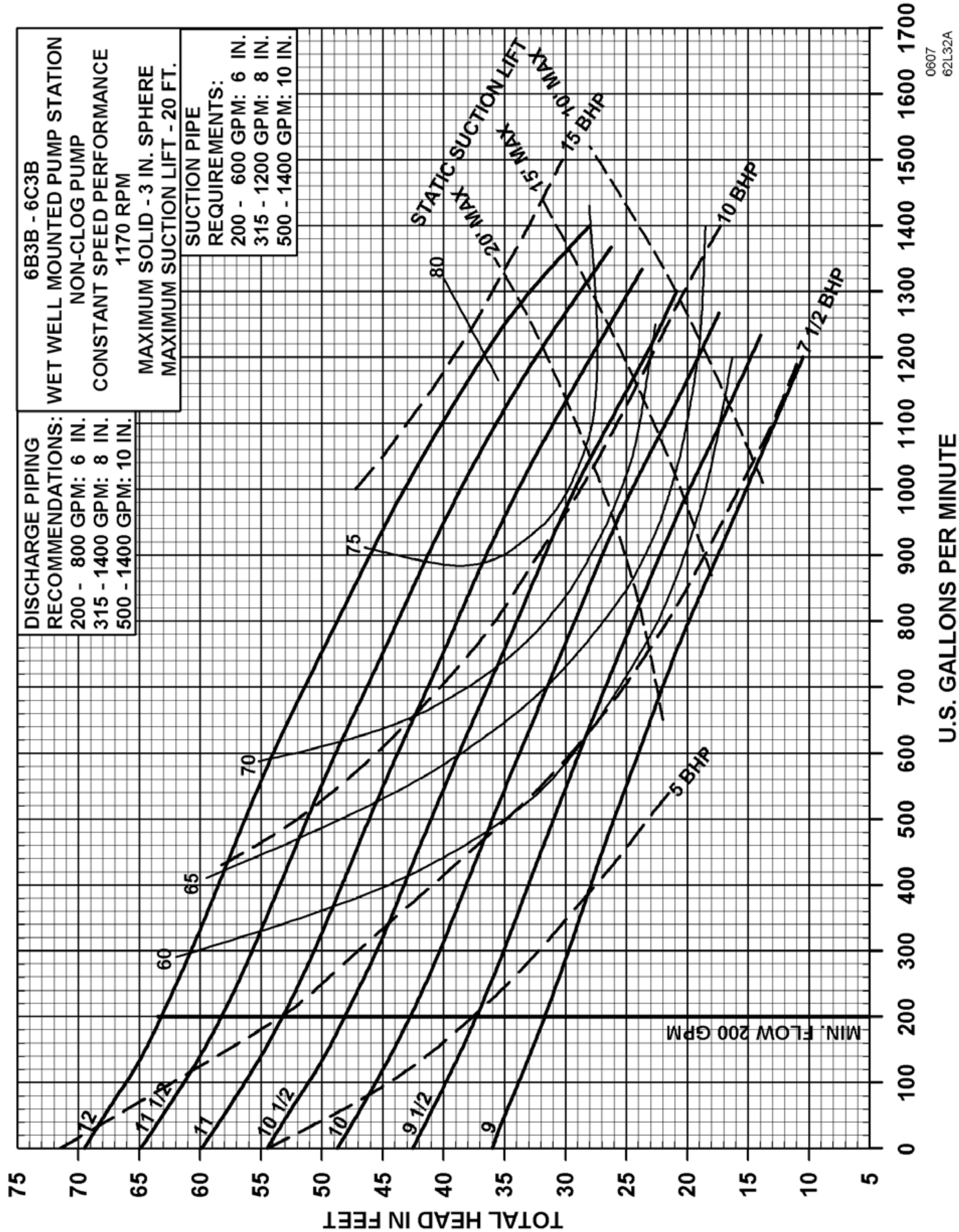


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L32
Constant Speed
Non-Clog Pump
6B3B / 6C3B – 1170 RPM
July, 2012

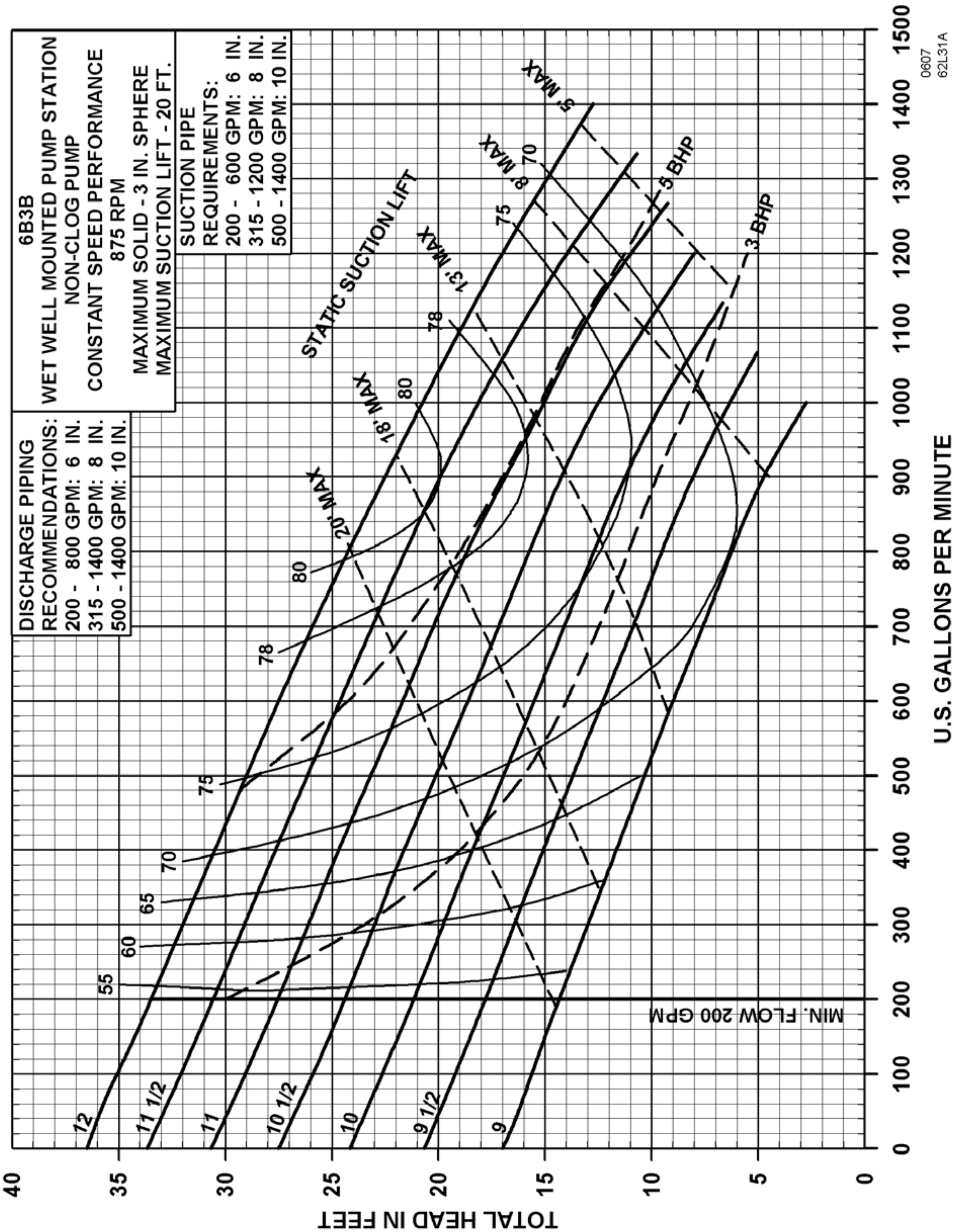


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L31
Constant Speed
Non-Clog Pump
6B3B – 875 RPM
July, 2012

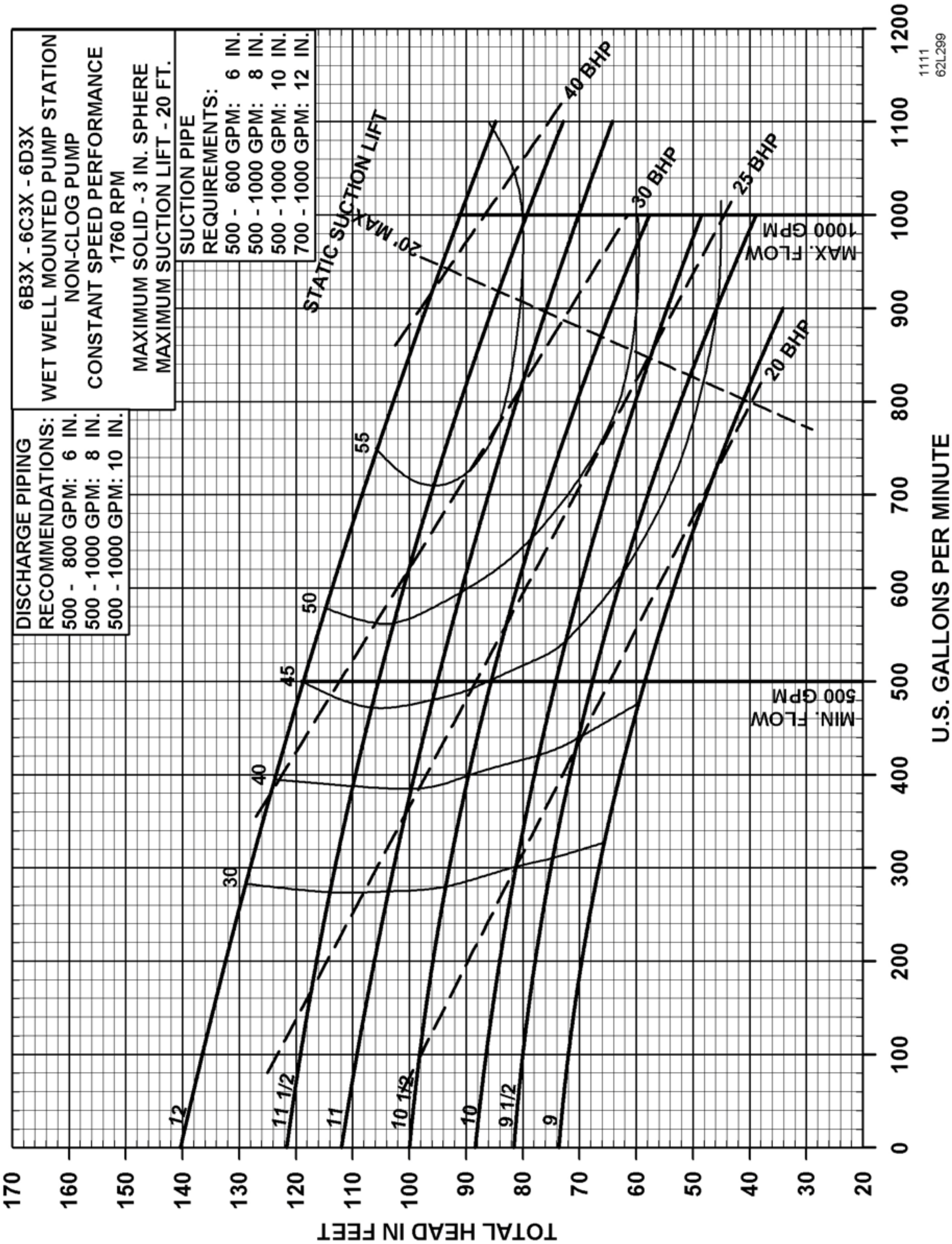


ENGINEERING DATA

Smith &
Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L299
Constant Speed
Non-Clog Pump
6B3X / 6C3X / 6D3X – 1760 RPM
July, 2012

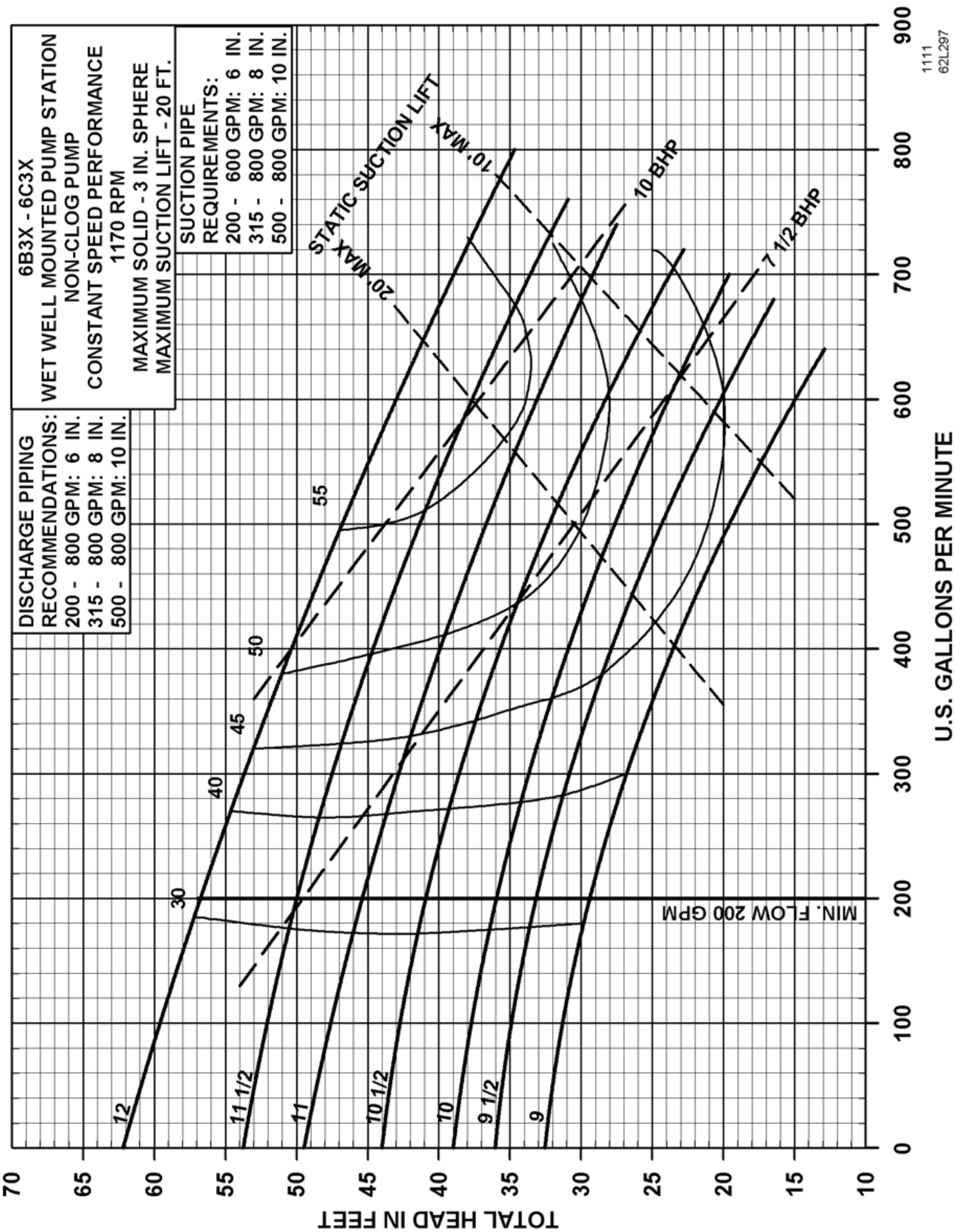


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L297
Constant Speed
Non-Clog Pump
6B3X / 6C3X – 1170 RPM
July, 2012

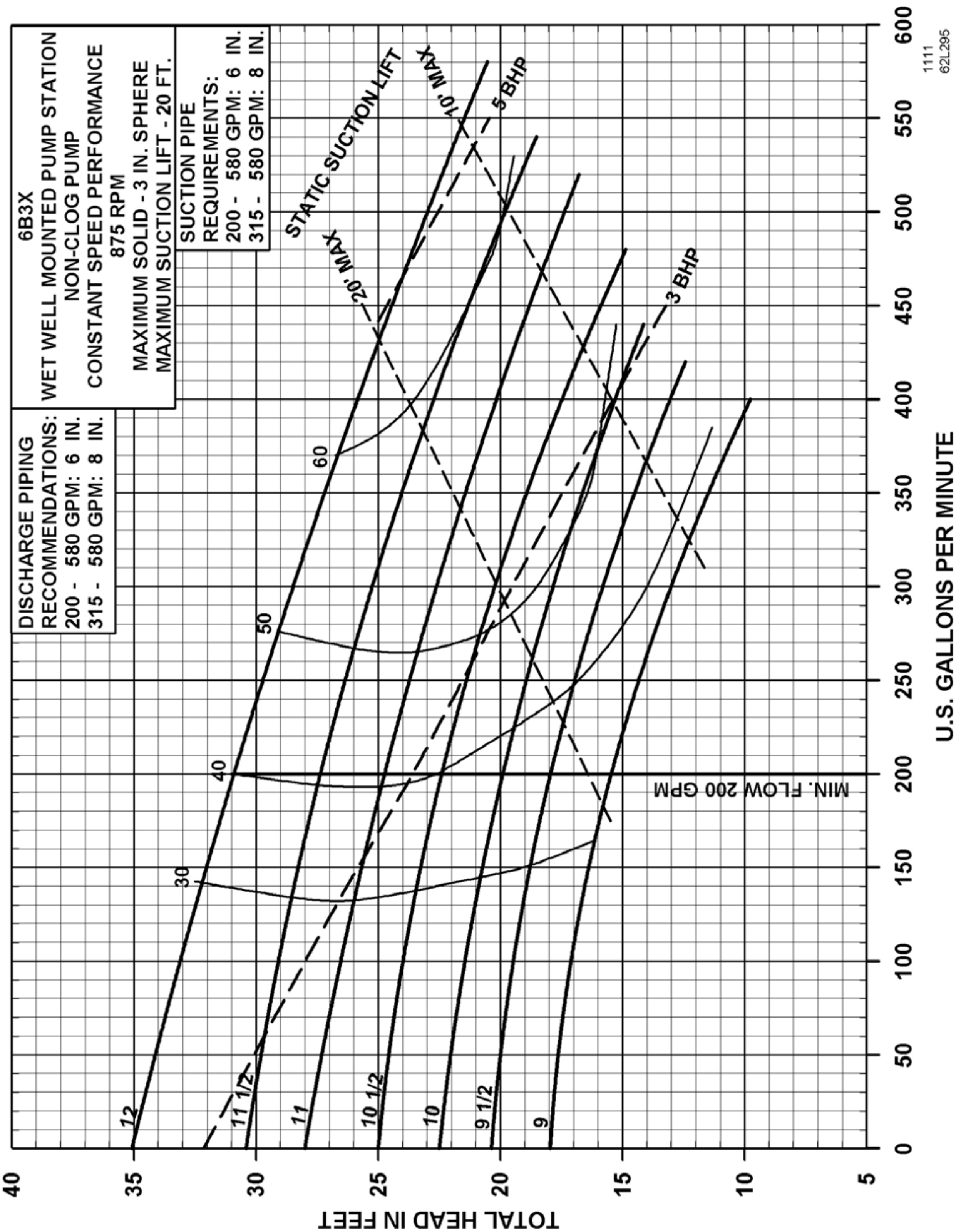


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L295
Constant Speed
Non-Clog Pump
6B3X – 875 RPM
July, 2012

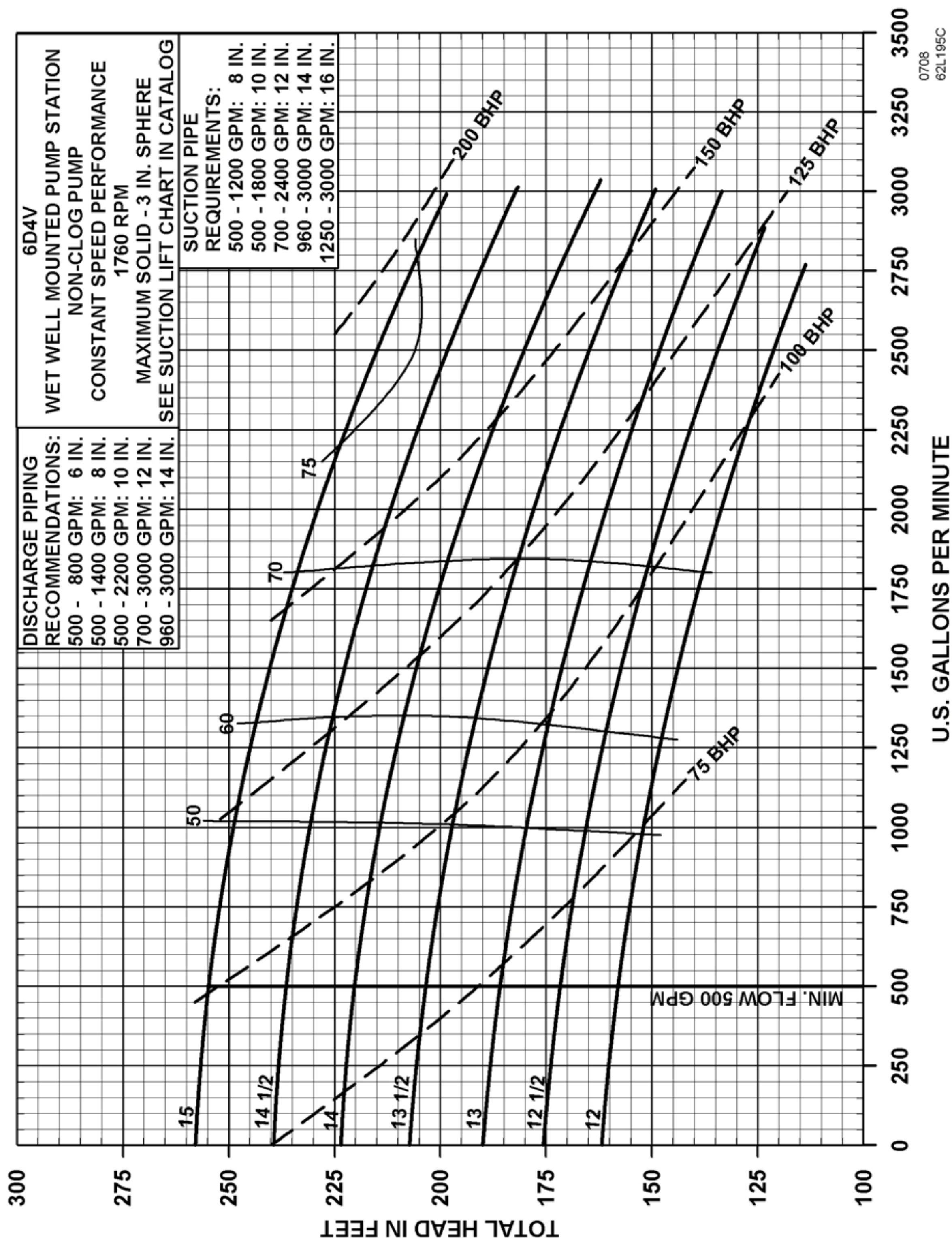


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L195
Constant Speed
Non-Clog Pump
6D4V – 1760 RPM
July, 2012

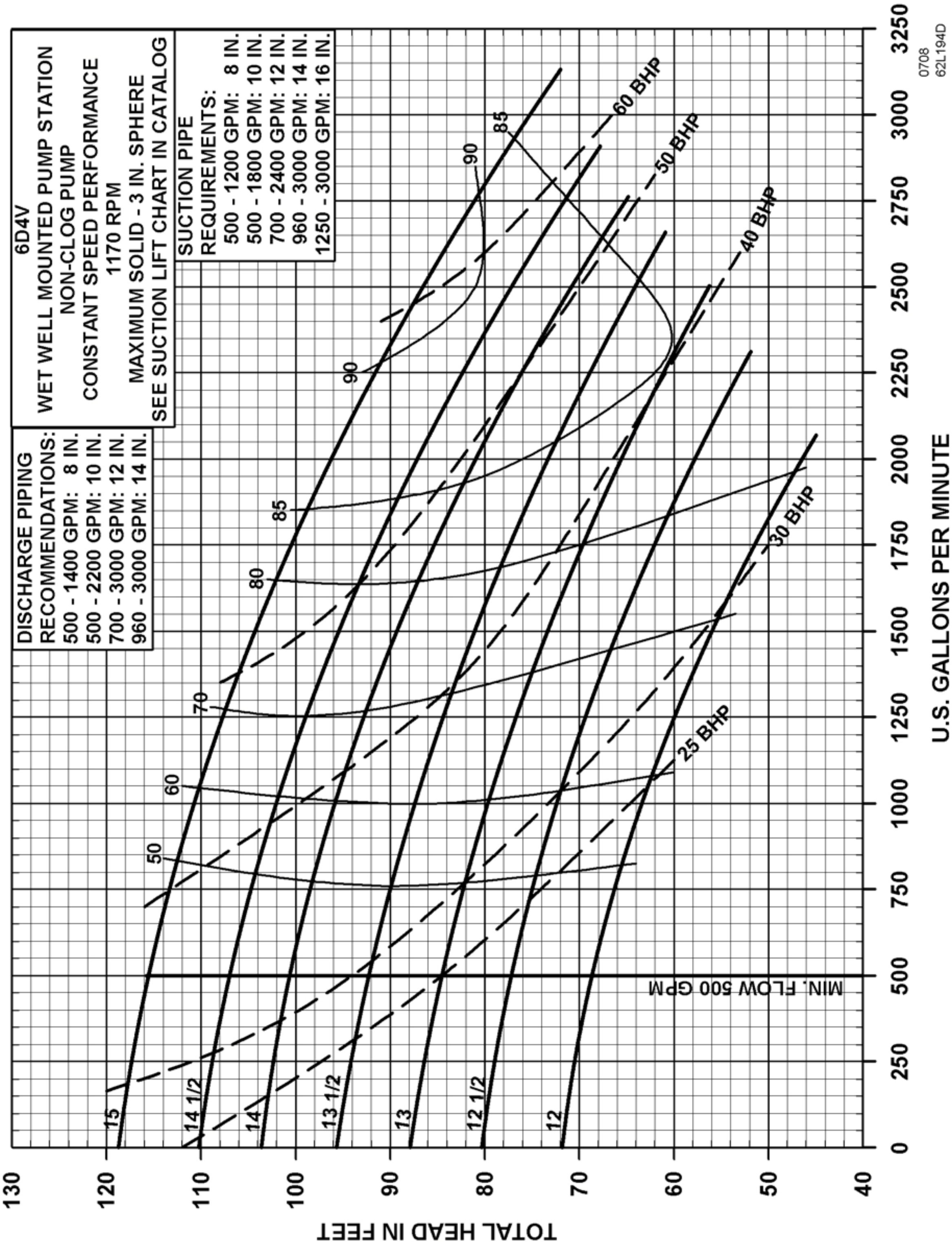


ENGINEERING DATA

Smith &
Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

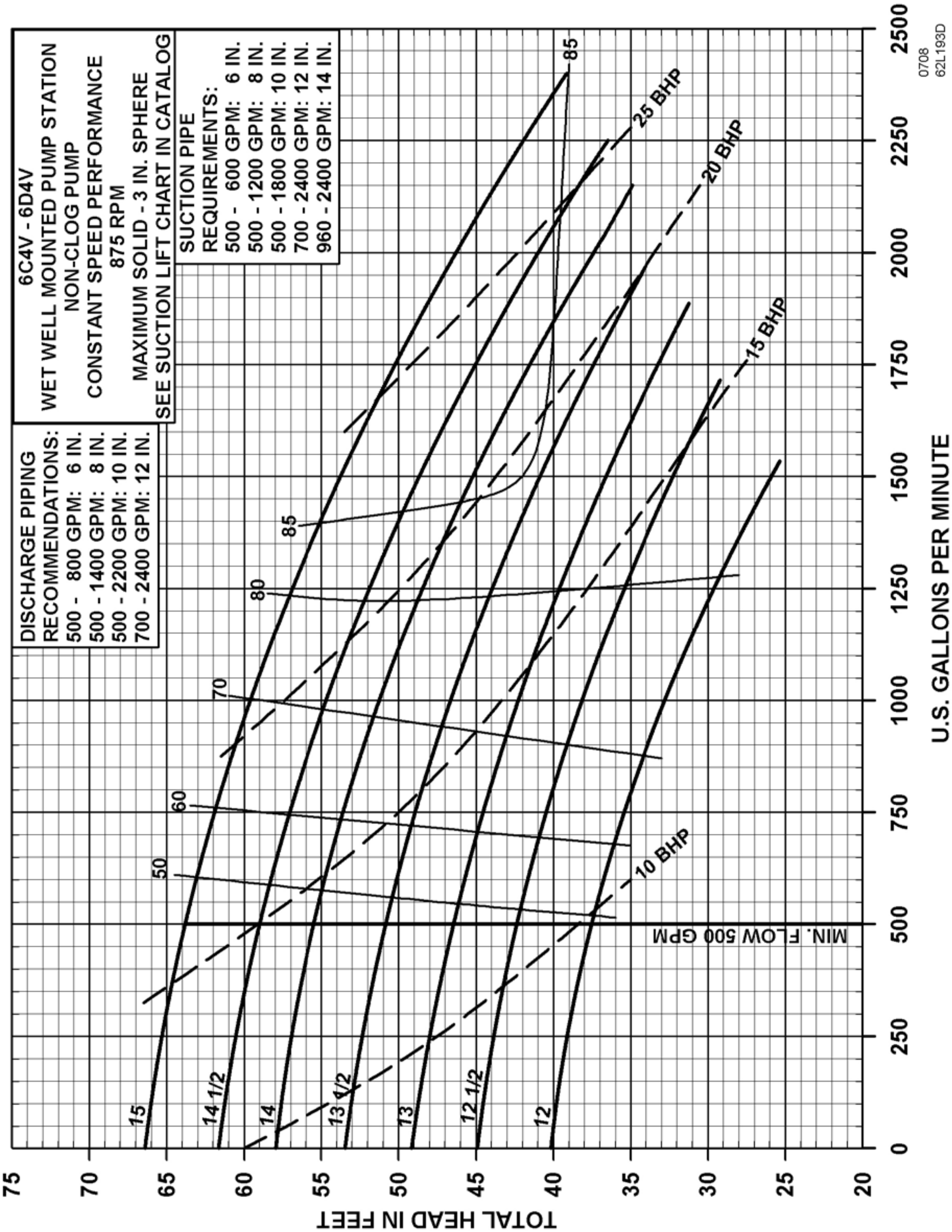
Vacuum Primed Pump
Performance Curve 62L194
Constant Speed
Non-Clog Pump
6D4V – 1170 RPM
July, 2012



ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L193
Constant Speed
Non-Clog Pump
6C4V / 6D4V – 875 RPM
July, 2012



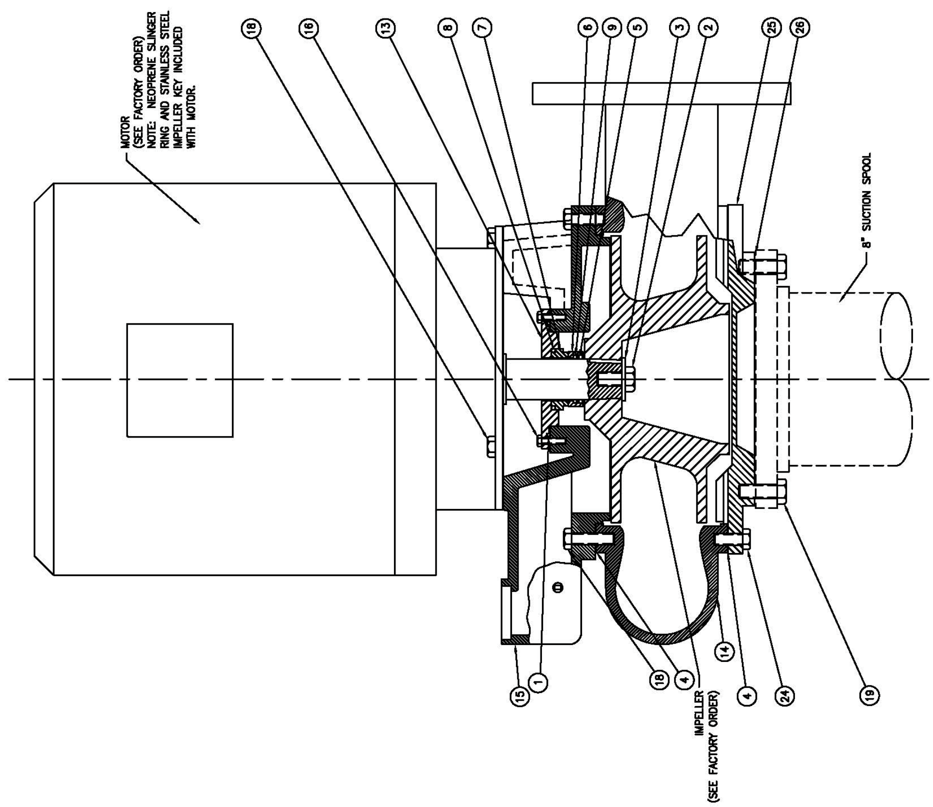
ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Pump Assembly Drawing
8D4D
Drawing 87B463
July, 2012

BILL OF MATERIAL

Item	Qty	UM	Part Number	Raw Matl	Description	Size	Wt Ea
1	1	EA	60A146		SEAL HOLDER GASKET QUAD RING		
2	1	EA	60A87		IMPELLER BOLT		
3	1	EA	60A86		IMPELLER WASHER		
4	2	EA	60A88		VOLUTE GASKET		
5	1	EA	60A55		SPRING		
6	1	EA	60A85		ROTATING CERAMIC SEAL		
7	1	EA	60A52		STATIONARY CARBON SEAL		
8	1	EA	60A54		QUAD RING		
9	1	EA	60A53		"O" RING		
13	1	EA	87B105		SEAL HOLDER		
14	1	EA	60D211		VOLUTE		
15	1	EA	60B165P		MOTOR ADAPTER MODIFICATION		
16	6	EA	6L59ED		CAPSCREW, SS	1/2"-13 x 1 1/4"	
18	19	EA	6L20HF		CAPSCREW	5/8"-11 X 1 3/4"	
19	8	EA	6L20JG		CAPSCREW	3/4"-10 x 2"	
24	16	EA	6L20HE		CAPSCREW	5/8"-11 X 1 1/2"	
25	1	EA	60C155		FRONTHEAD		
26	1	EA	11L1D		GASKET		



NOTE:

1. COPYRIGHT (C) 2004, 2005, 2006, 2007, 2008 SMITH & LOVELESS, INC.

87B463/D

LET	ECN NO	DATE	BY / APPV'D
D	N2007-71	10/2008	ADB / JK
C	N2007-67	12/2007	RGD / RSM
B	N2006-60	6/2006	RGD / FT
A	N2005-37	6/2005	RGD / ARW
ORIGINAL ISSUE	N2004-29		

DRAWN BY: JRB — DATE: 5/28/2004
CHECKED BY: RGD — DATE: 6/2004
APPROVED BY: FT — DATE: 6/2004
SCALE: NTS — CODE: -
ALLOWABLE TOLERANCES — FRACTIONS: - — DECIMALS: - — ANGLES: -

FOR: PUMP ASSEMBLY 8D4D

SIZE — U/M EA — WT.
FILE NAME \SUB\87B463D — PLOT SCALE 1=4.000
SERIAL NO — DWG NO 87B463 — REV D

SHEET 1 OF 1

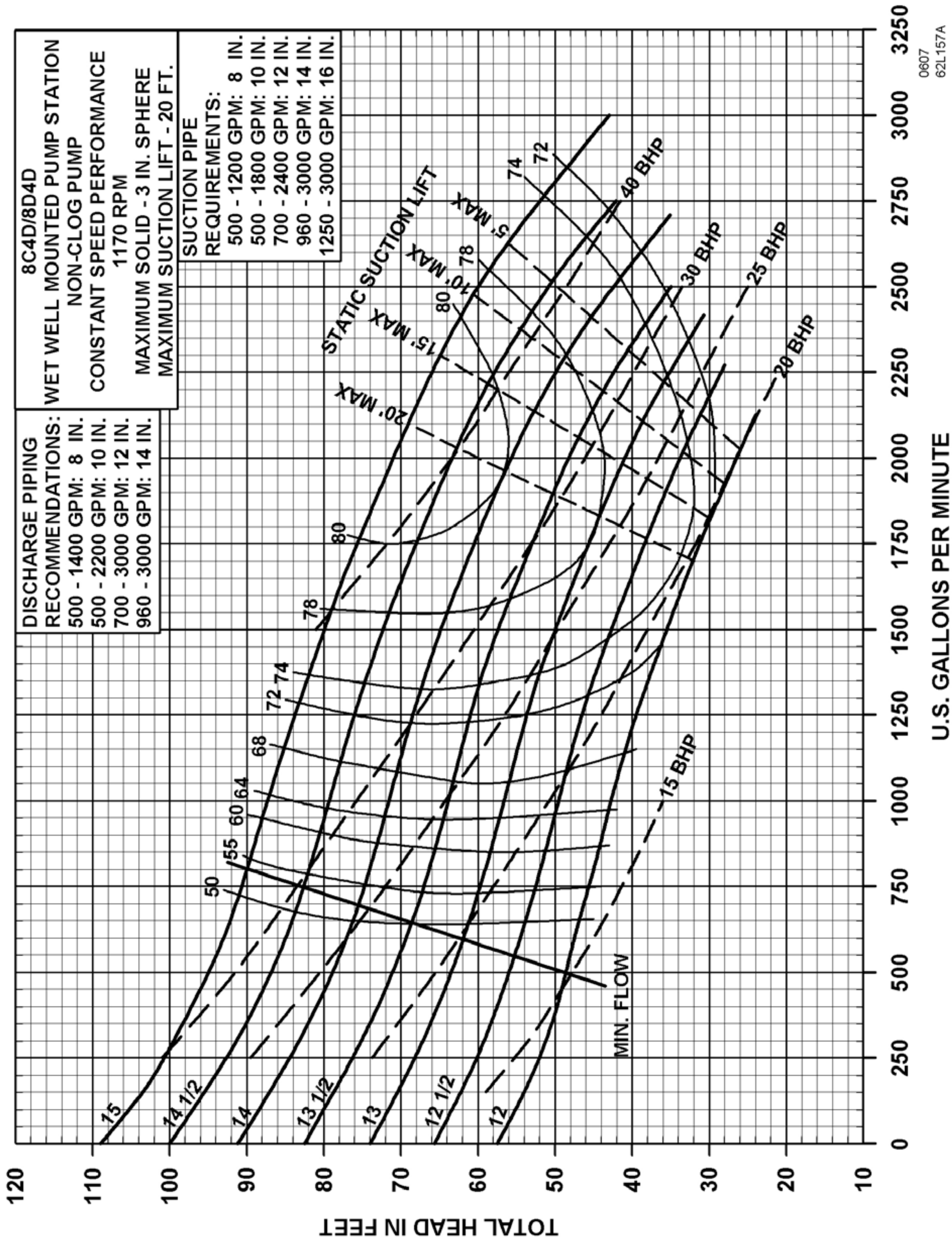
Smith & Loveless, Inc.

ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

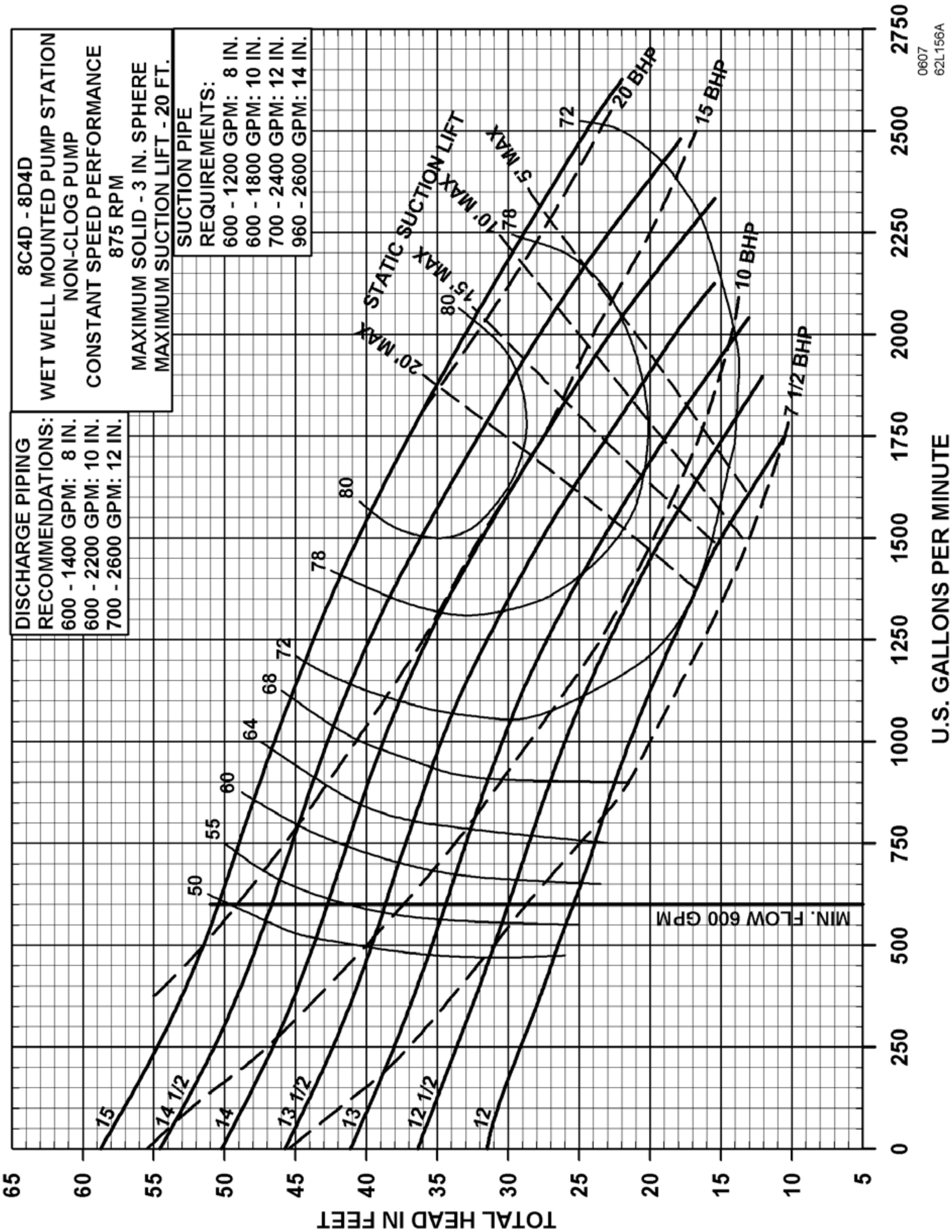
Vacuum Primed Pump
Performance Curve 62L157
Constant Speed
Non-Clog Pump
8C4D / 8D4D – 1170 RPM
July, 2012



ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L156
Constant Speed
Non-Clog Pump
8C4D / 8D4D – 875 RPM
July, 2012

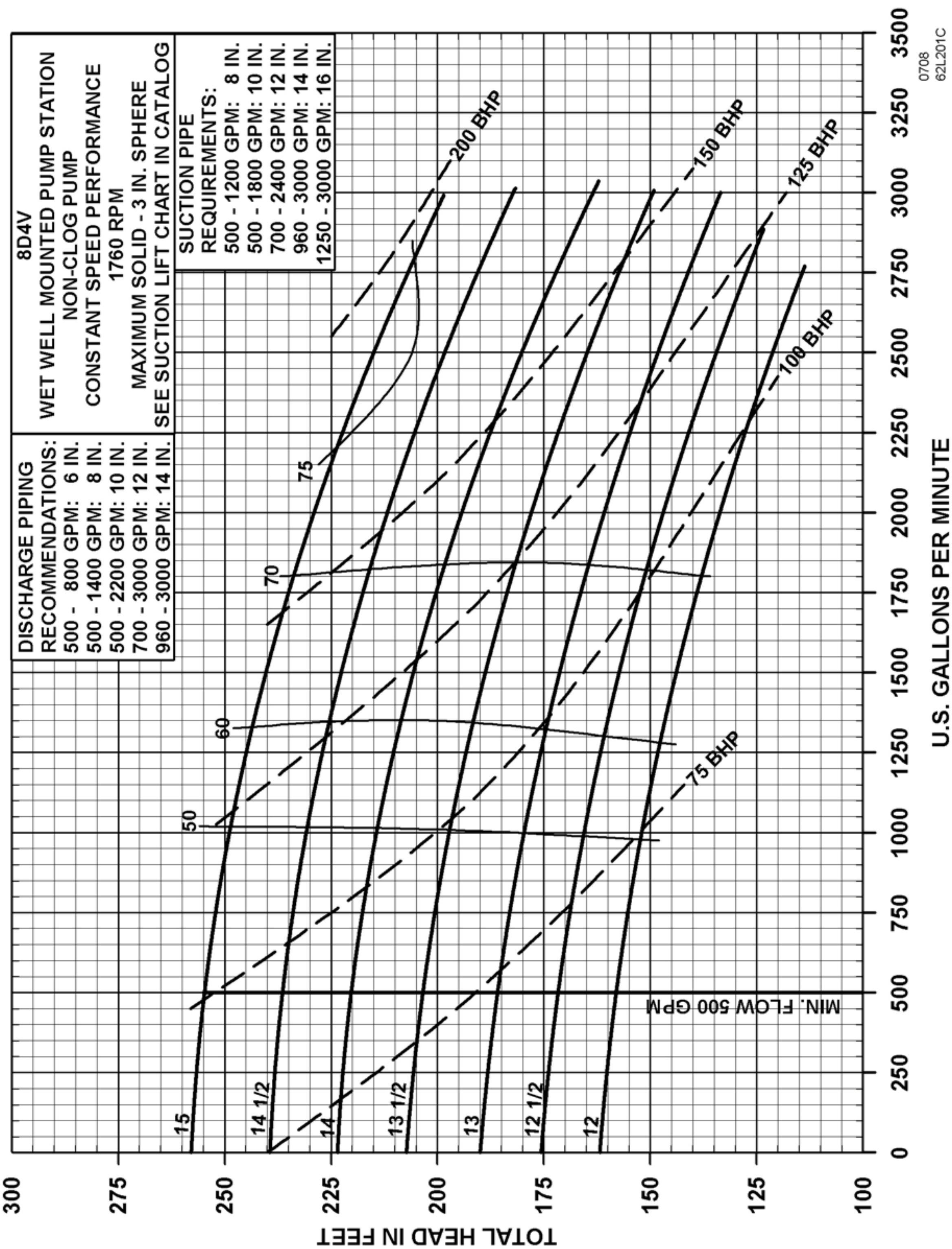


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L201
Constant Speed
Non-Clog Pump
8D4V – 1760 RPM
July, 2012

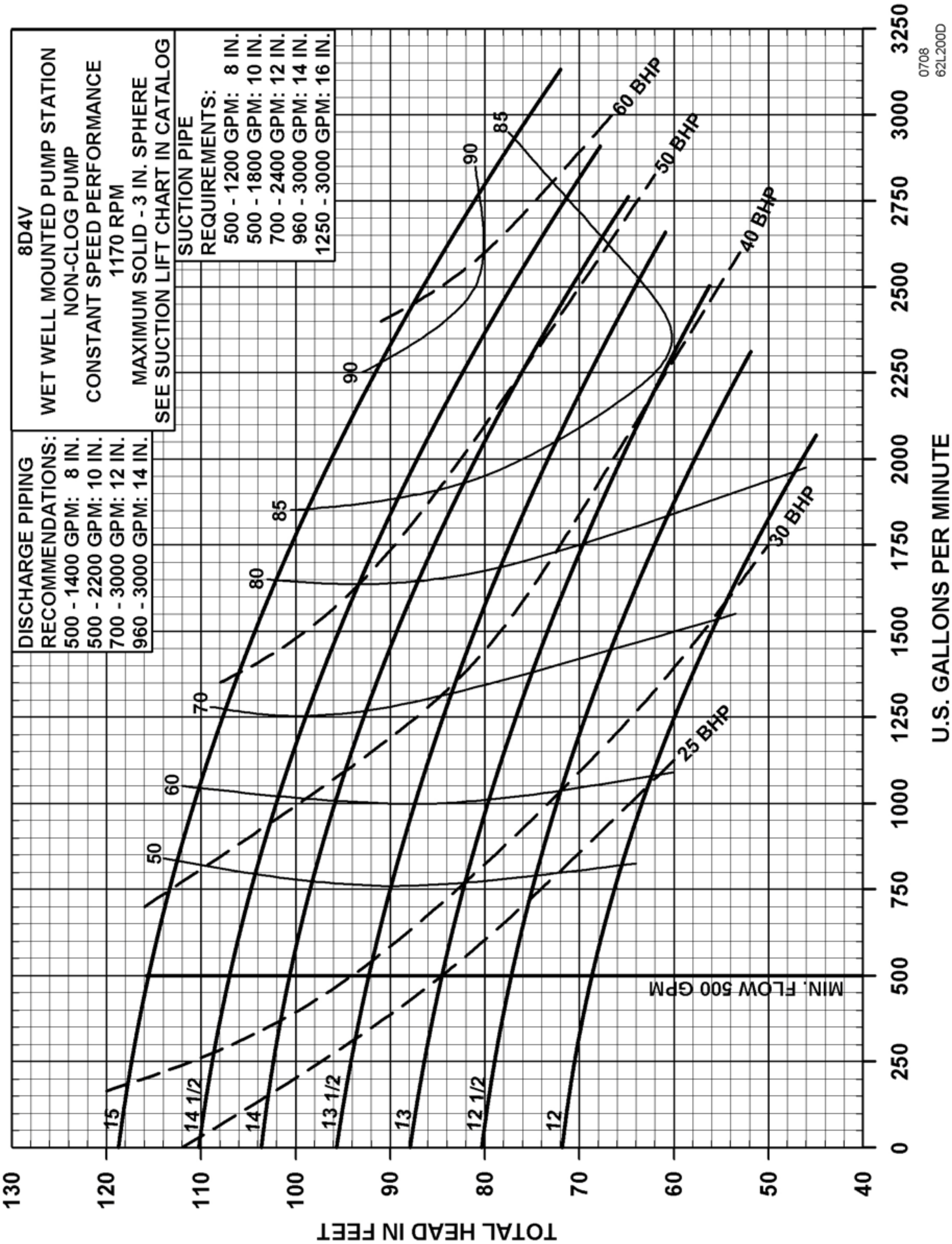


ENGINEERING DATA

Smith &
Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L200
Constant Speed
Non-Clog Pump
8D4V – 1170 RPM
July, 2012

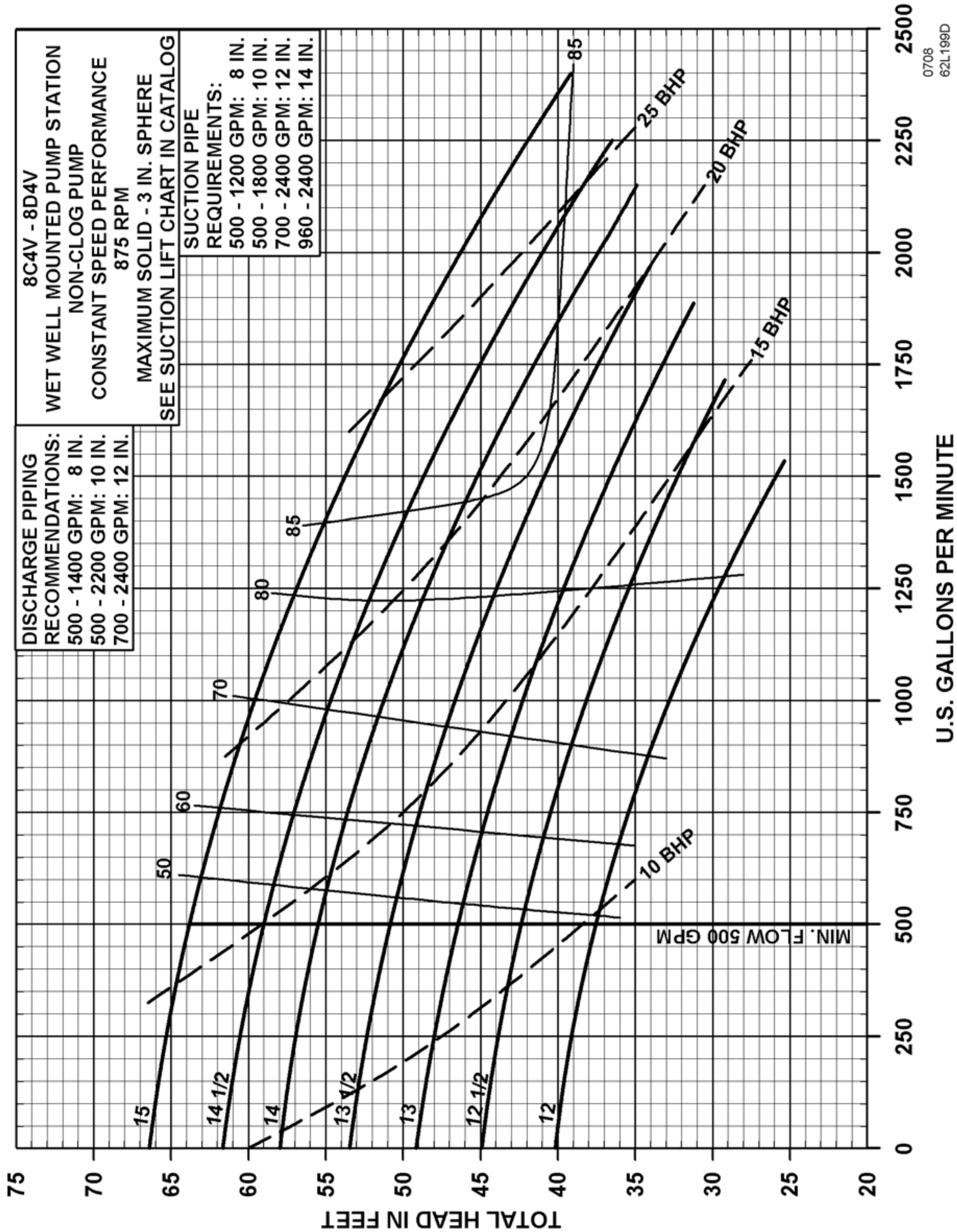


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

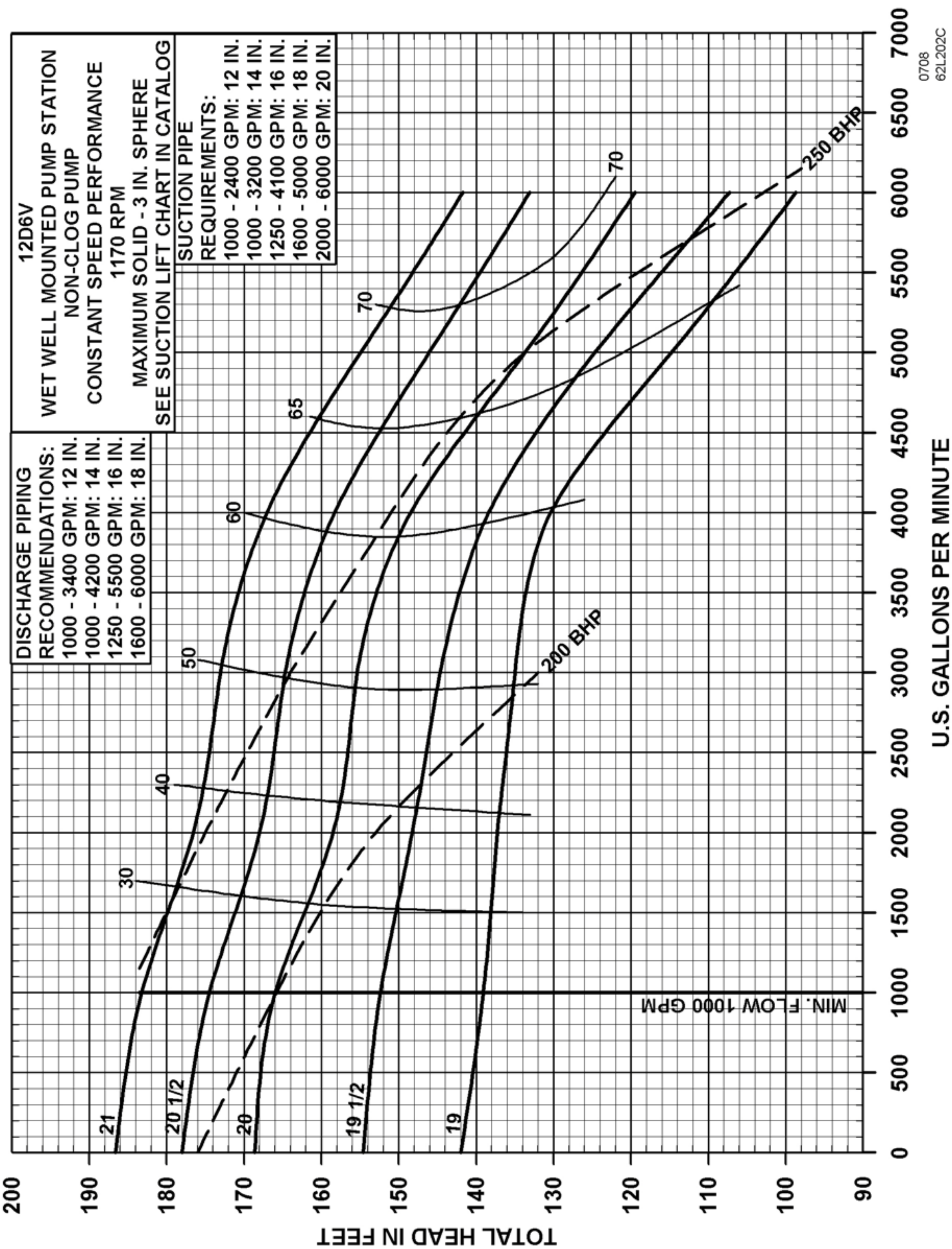
Vacuum Prime Pump
Performance Curve 62L199
Constant Speed
Non-Clog Pump
8C4V / 8D4V – 875 RPM
July, 2012



ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L202
Constant Speed
Non-Clog Pump
12D6V – 1170 RPM
July, 2012

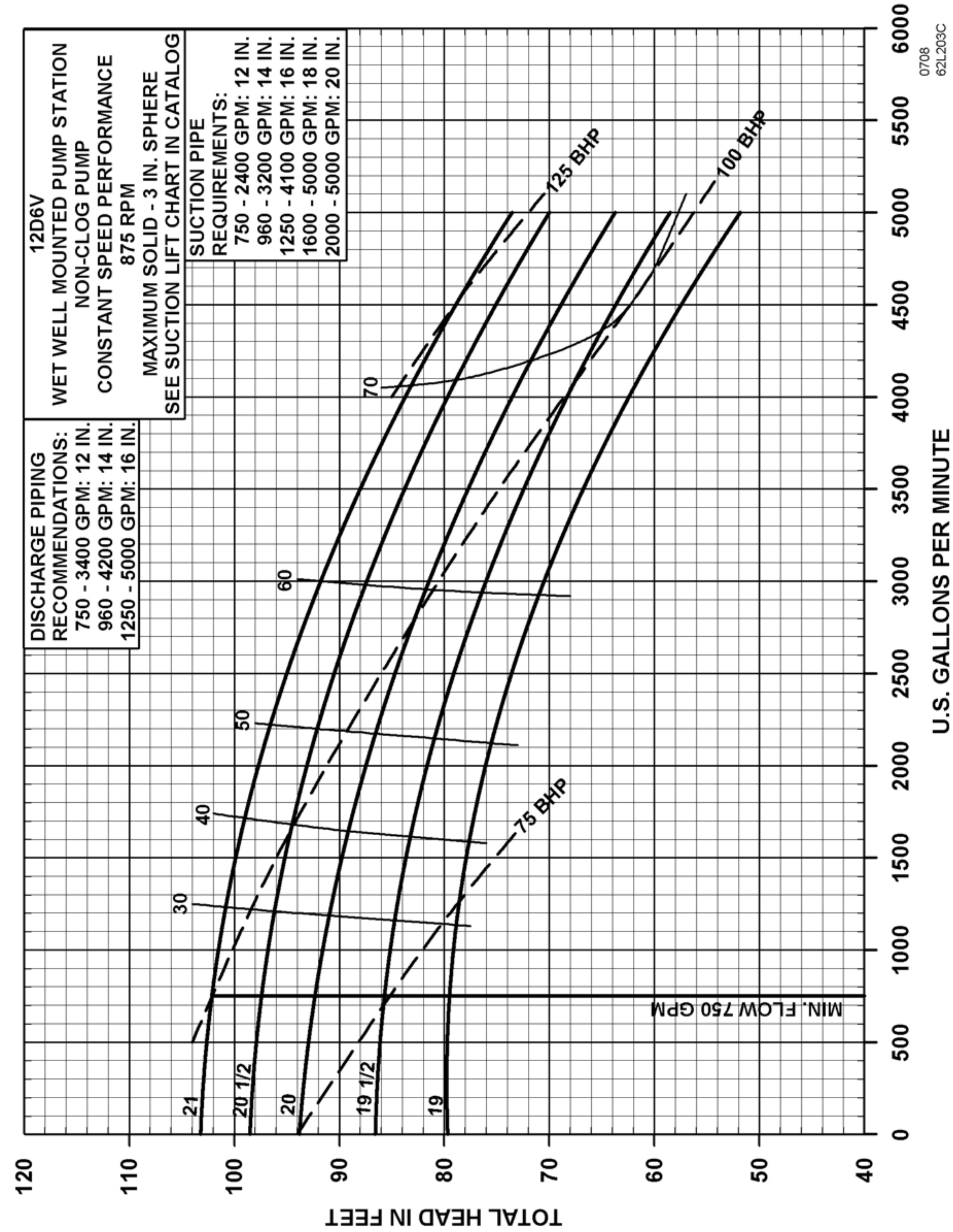


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

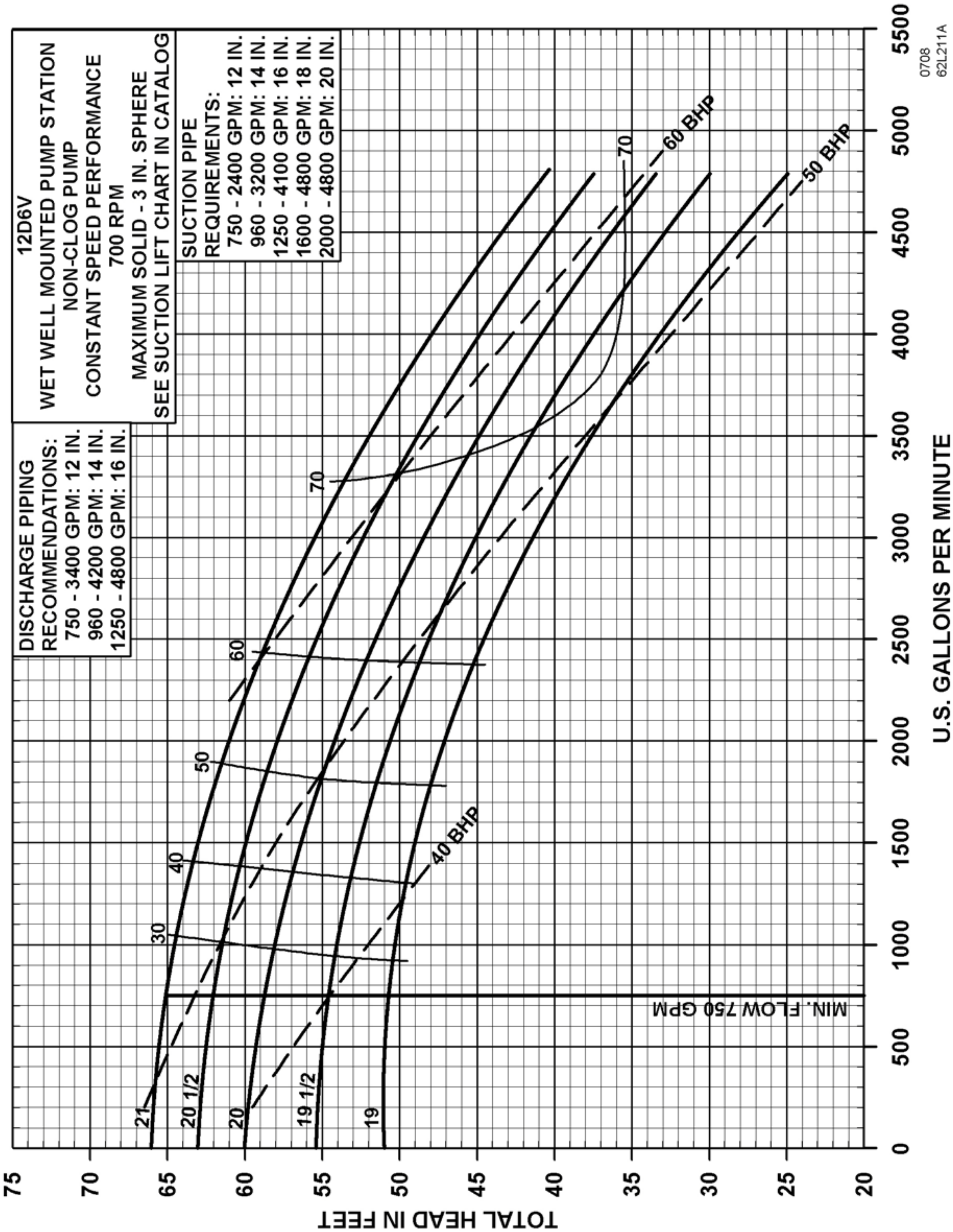
Vacuum Primed Pump
Performance Curve 62L203
Constant Speed
Non-Clog Pump
12D6V – 875 RPM
July, 2012



ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

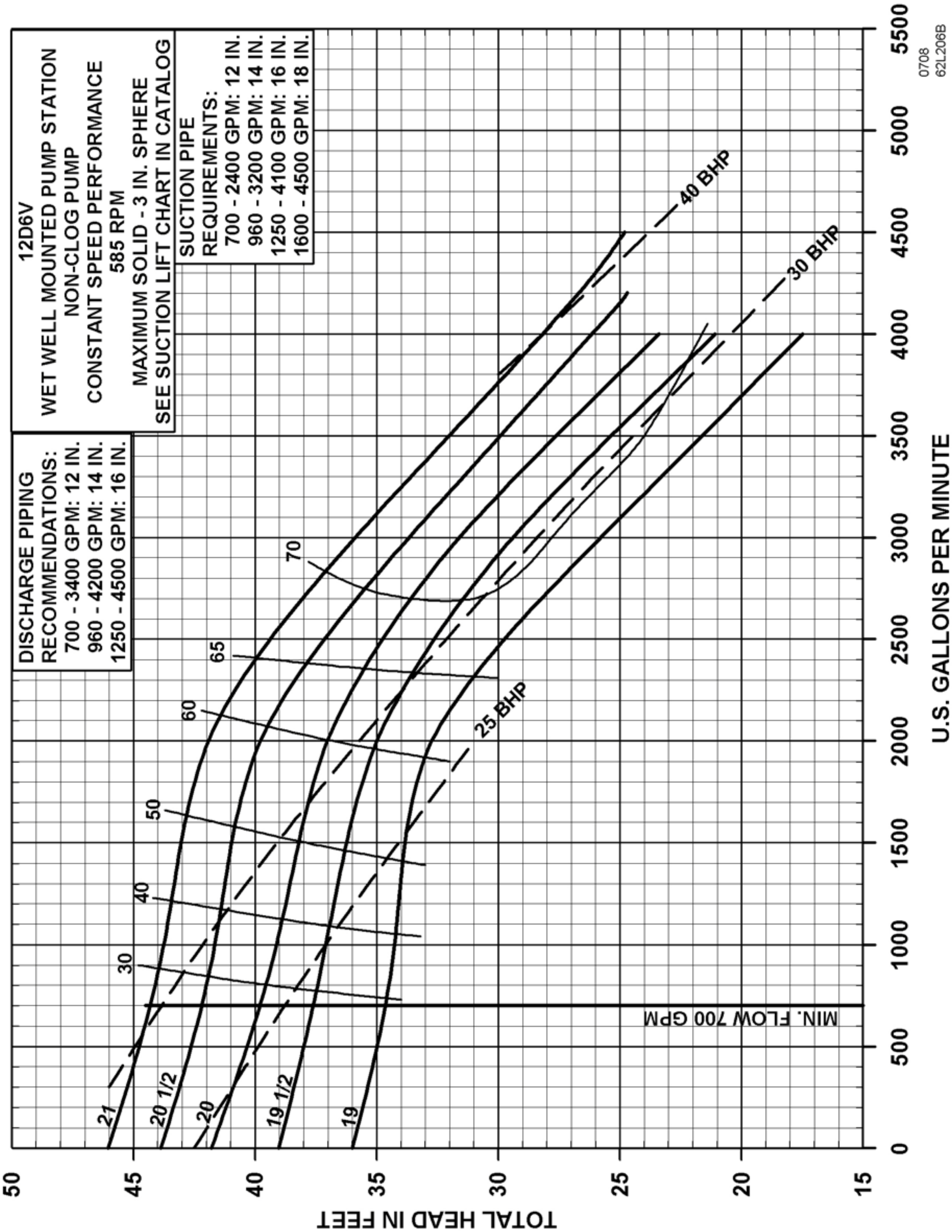
Vacuum Primed Pump
Performance Curve 62L211
Constant Speed
Non-Clog Pump
12D6V – 700 RPM
July, 2012



ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L206
Constant Speed
Non-Clog Pump
12D6V – 585 RPM
July, 2012

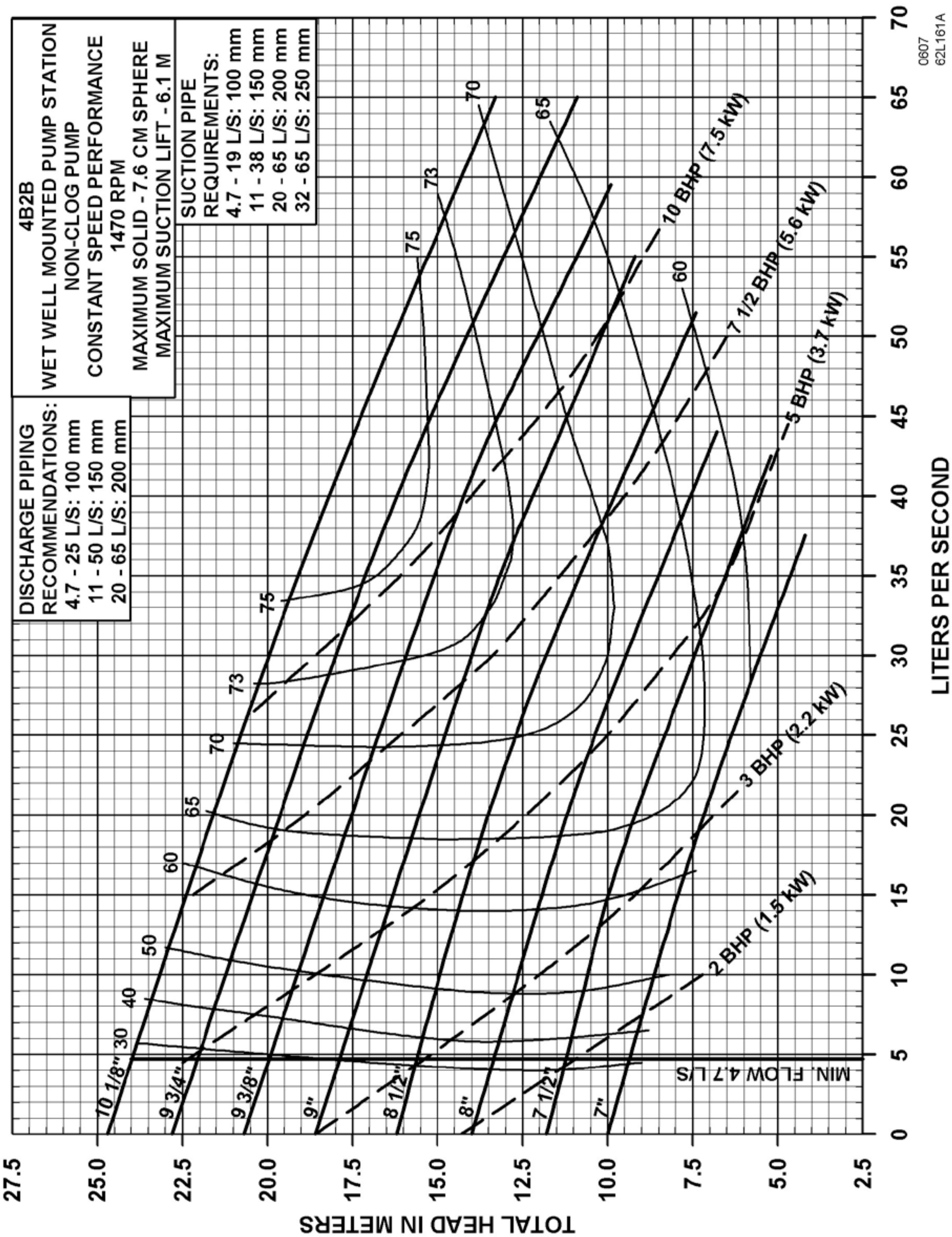


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L161
Constant Speed
Non-Clog Pump
4B2B – 1470 RPM
July, 2012

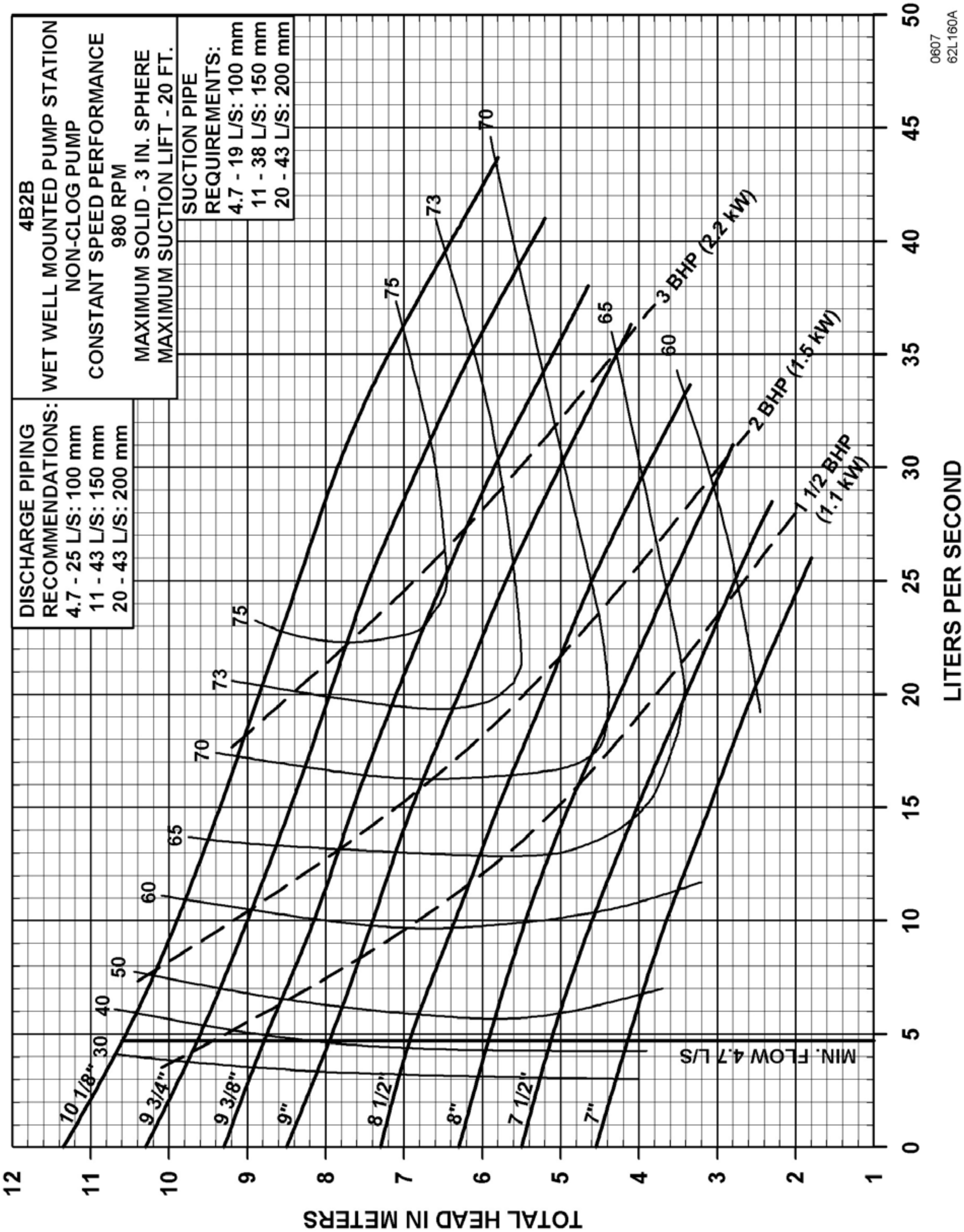


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

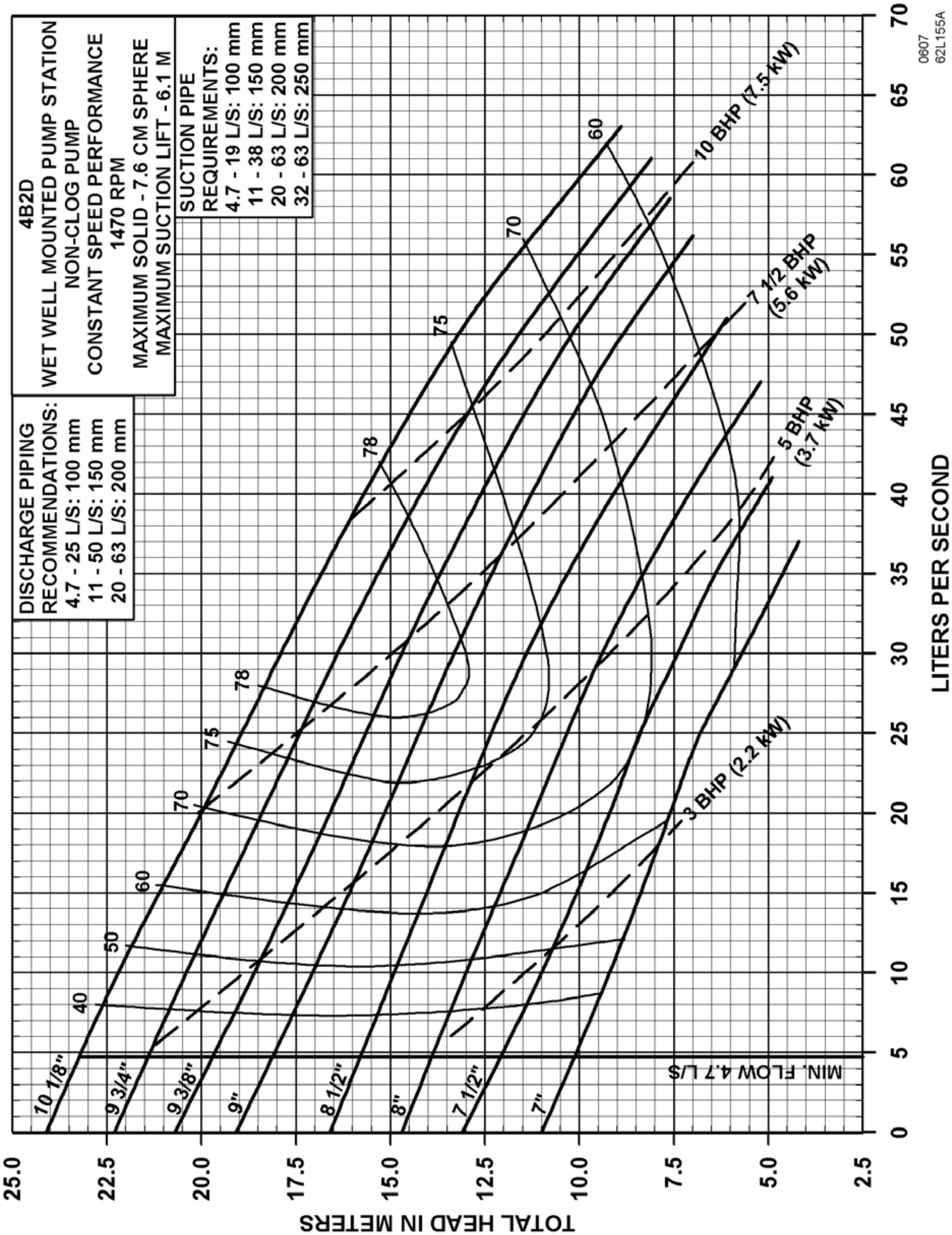
Vacuum Primed Pump
Performance Curve 62L160
Constant Speed
Non-Clog Pump
4B2B – 980 RPM
July, 2012



ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L155
Constant Speed
Non-Clog Pump
4B2D – 1470 RPM
July, 2012

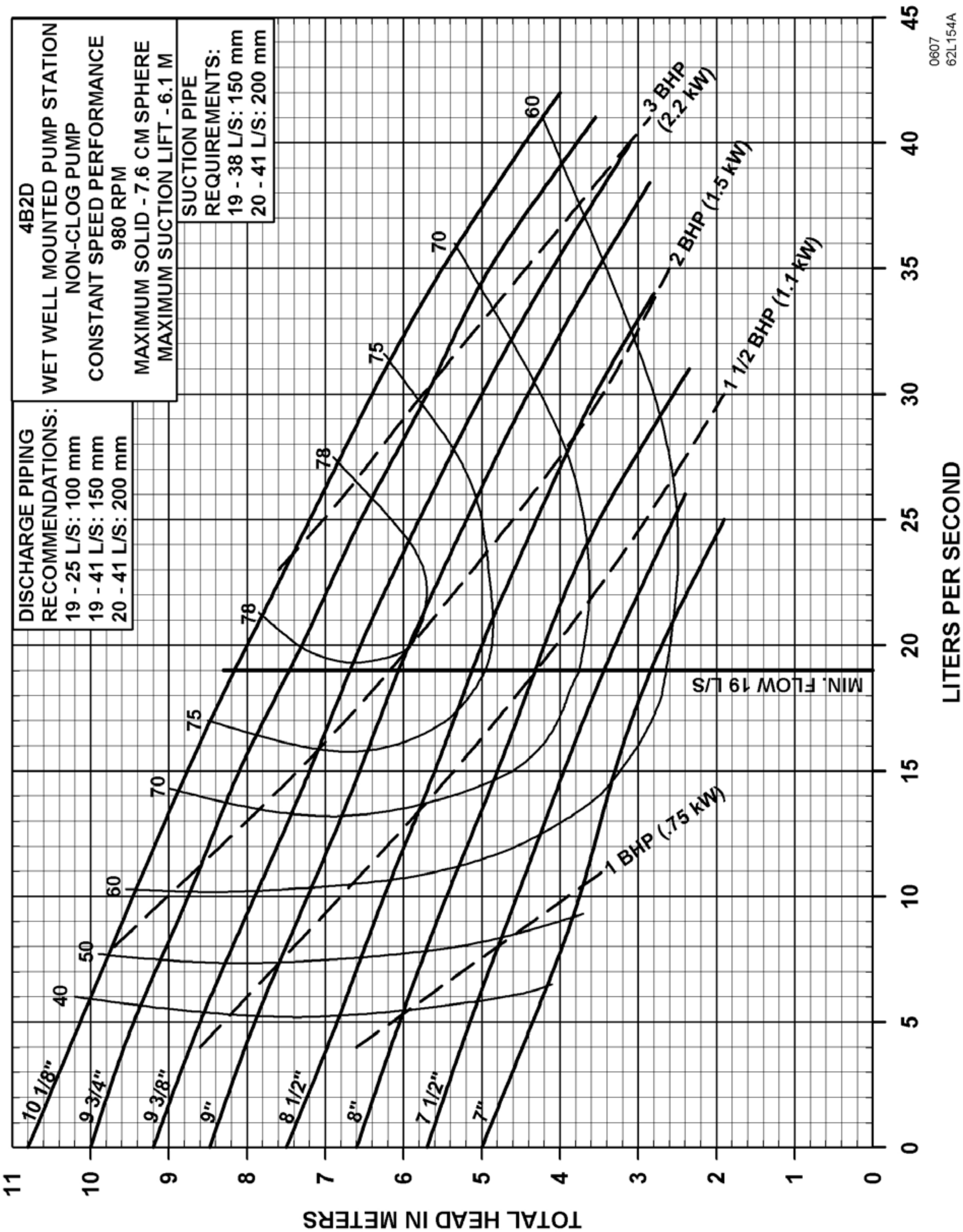


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L154
Constant Speed
Non-Clog Pump
4B2D – 980 RPM
July, 2012

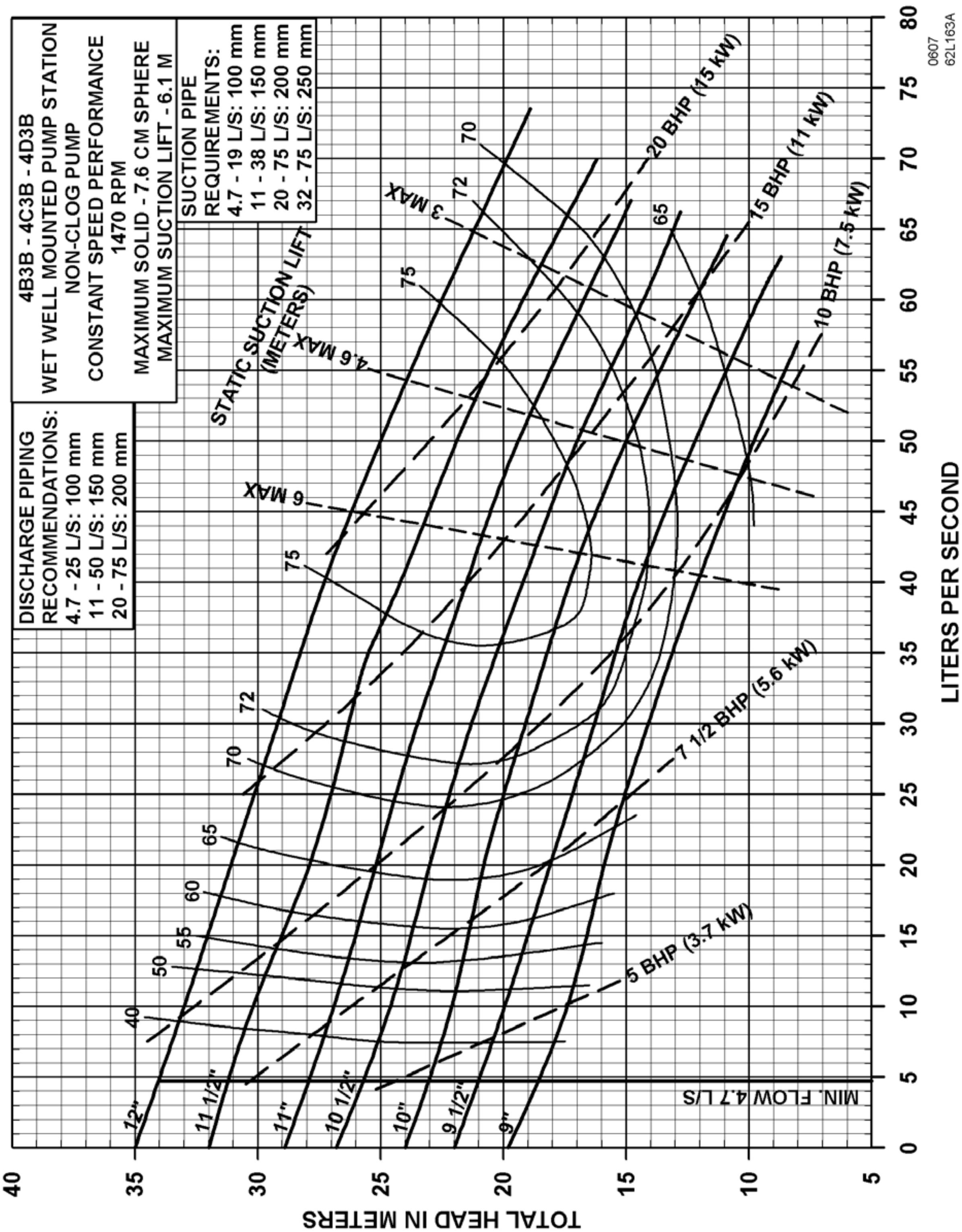


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L163
Constant Speed
Non-Clog Pump
4B3B / 4C3B / 4D3B – 1470 RPM
July, 2012

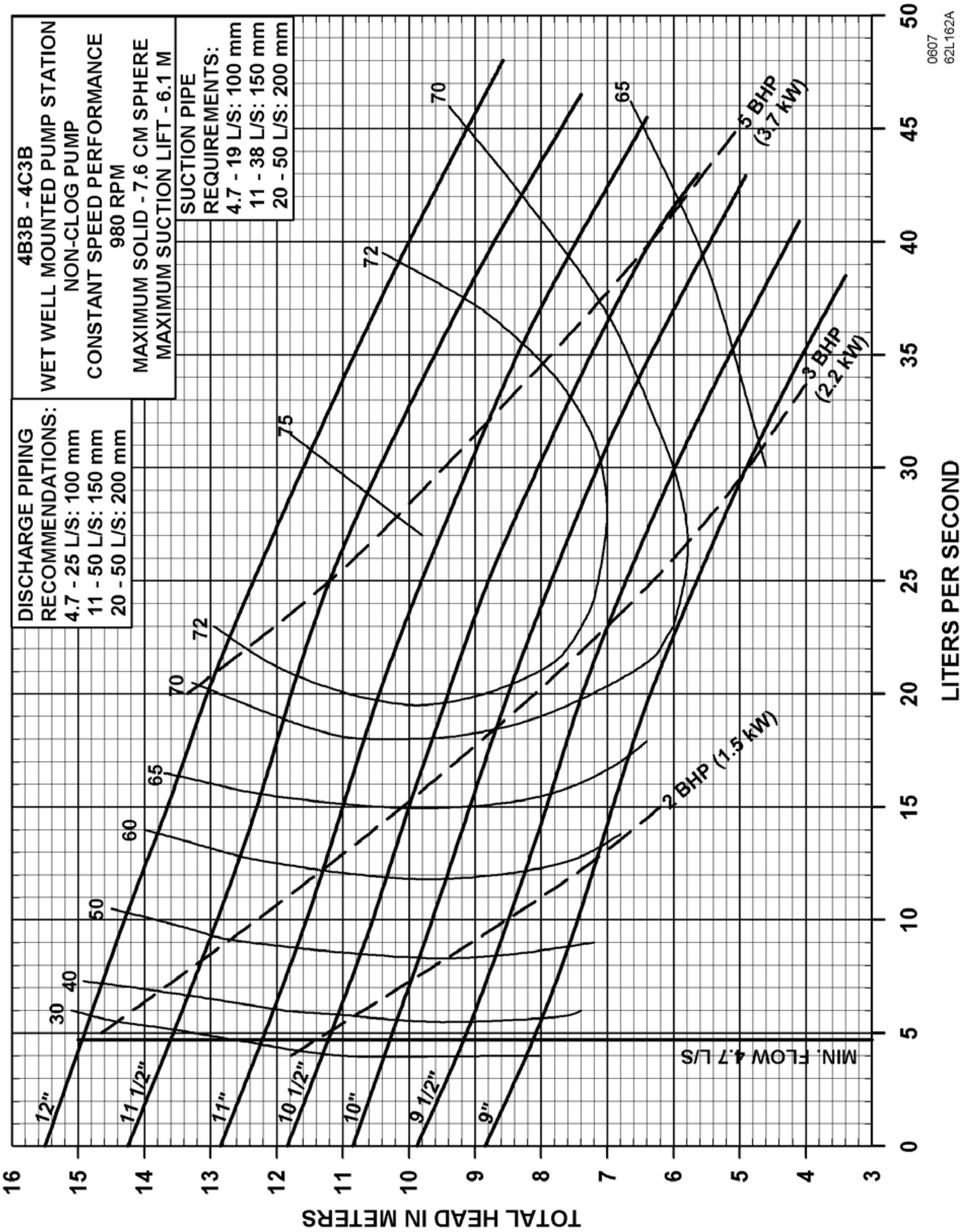


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L162
Constant Speed
Non-Clog Pump
4B3B / 4C3B – 980 RPM
July, 2012

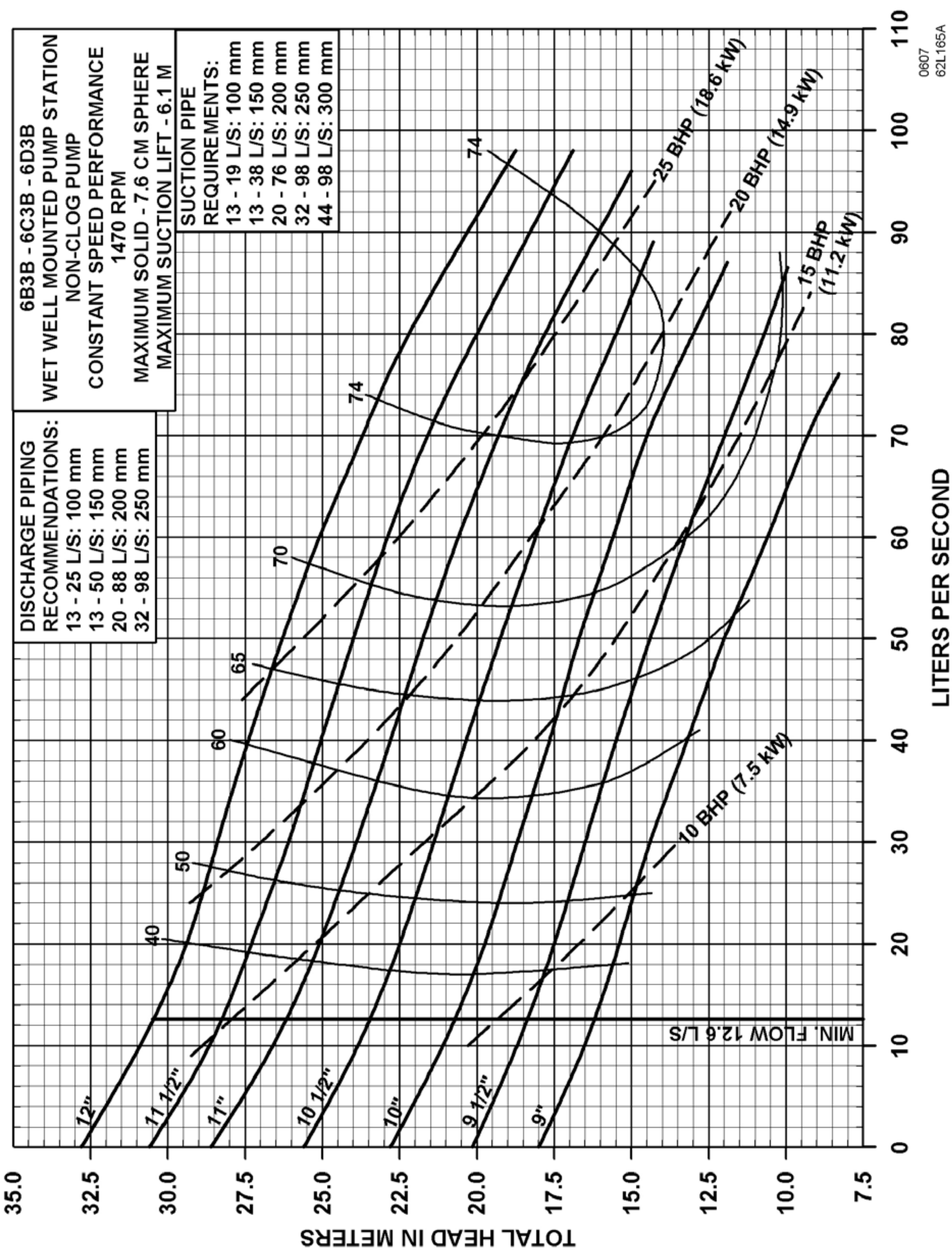


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L165
Constant Speed
Non-Clog Pump
6B3B / 6C3B / 6D3B – 1470 RPM
July, 2012

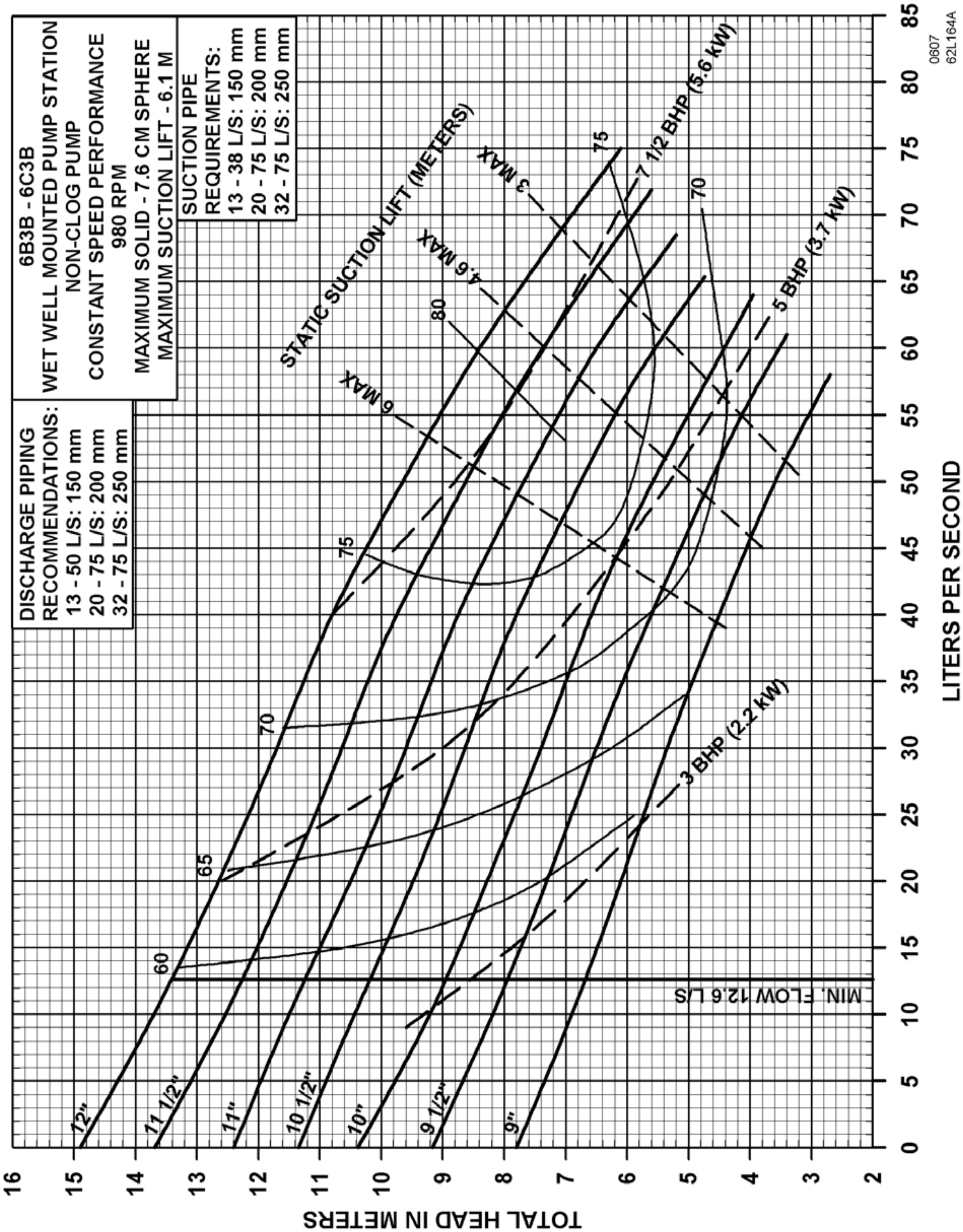


ENGINEERING DATA

Smith & Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump
Performance Curve 62L164
Constant Speed
Non-Clog Pump
6B3B / 6C3B – 980 RPM
July, 2012

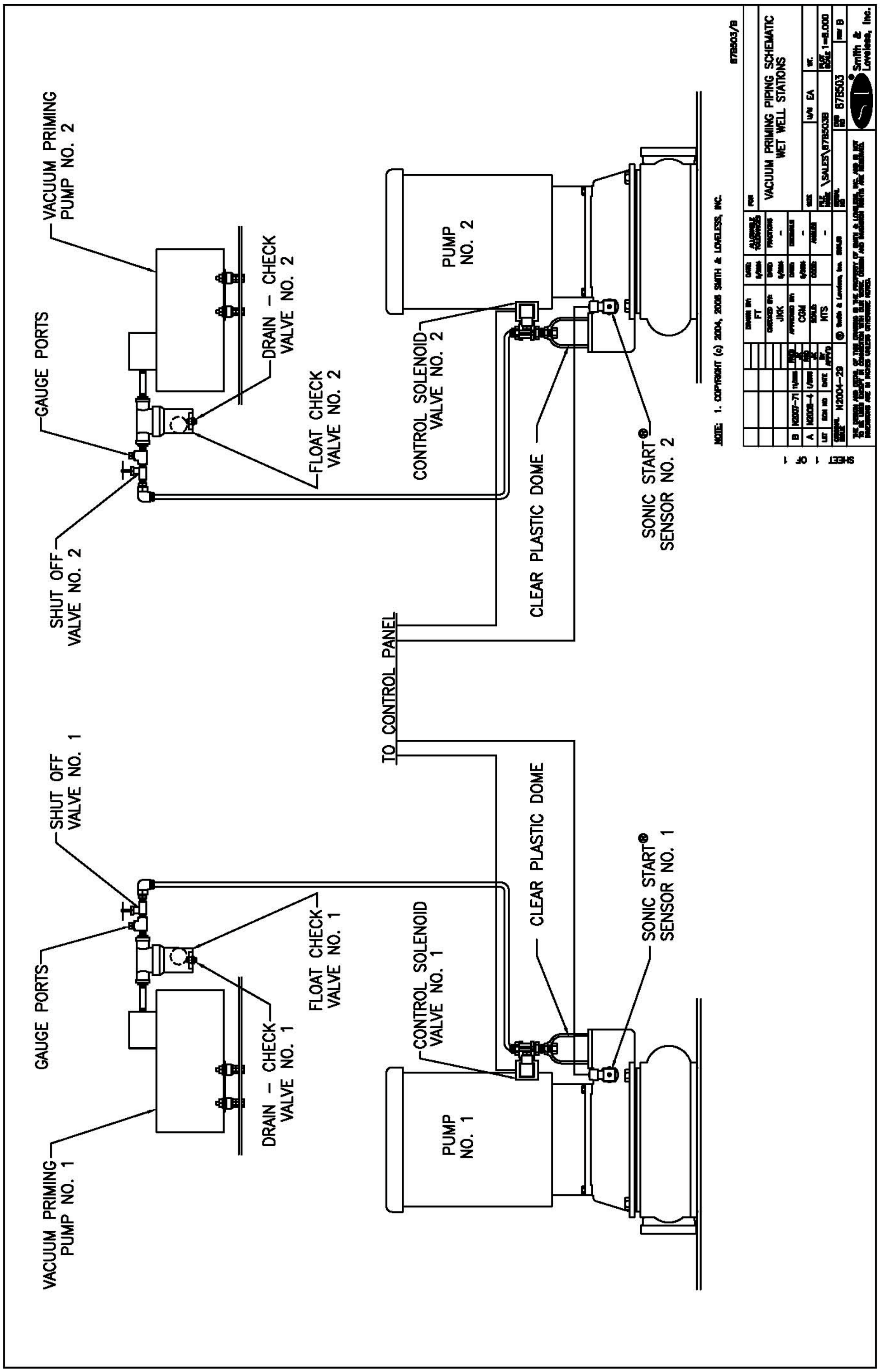


ENGINEERING DATA

Smith &
Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Priming Diagram
Vacuum Primed Pump Station
Drawing 87B503
July, 2012



ENGINEERING DATA

Smith &
Loveless, Inc.®

14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Priming Diagram
Vacuum Primed Pump Station
Drawing 87B504
July, 2012