PUMPSET MANUAL
MV150iC

Sykes Group Pty Ltd

Customer:
Reference: **WO23443**

TABLE OF CONTENTS

1 INTRODUCTION

Congratulations on the purchase of your new Sykes Pump.

With Sykes' established quality control systems you can be assured your pump was manufactured with a high level of control and has undergone extensive testing on Sykes' certified test facility.

Sykes are pleased to offer a 12 month warranty on your new pump. As with all warranties, Sykes' warranty is subject to regular maintenance as per the pump manual. To ensure your warranty is maintained, make sure your pump is regularly serviced. Sykes offer maintenance and repairs on our entire range and are able to offer regular service agreements if required.

Sykes provide local service through a highly trained network of branches and are able to meet your service and spare parts requirements around the clock. For spare parts or service enquiries contact Sykes spare parts direct on 1800 131 950. Turnaround on parts is rapid with Sykes customer service ready to meet your needs 24 hours a day with spare parts located at branches Australia wide and around the globe.

Sykes also offer onsite application assistance and training to ensure your pump is running at its optimum performance. Our Sykes trained staff will assess your application and help to set up optimum operating settings which will help to reduce unnecessary wear and tear on the pump whilst ensuring the pump is operating at its most efficient duty point.

Should you have any after sales issues, please do not hesitate to contact your local Sykes branch or contact Sykes' After Sales Service on 02 4954 3333.

2 CUSTOMER SPECIFICATION

General Unit Information

Customer	
Sykes Job Number	WO23443
Sykes Serial Number	10MV150iC23443
Plant Number	-

Pump Information

Pump Type	MV150iC
Pump Size	150mm x 150mm
Pumpend Serial Number	0922542-3
Impeller Diameter	Ø255mm

Engine Information

Engine Make	Deutz F3L912
Engine Serial Number	08825109
Tacho Serial Number	-

Electric Motor Information

Motor Make	-
Motor Serial Number	-

Chassis Information

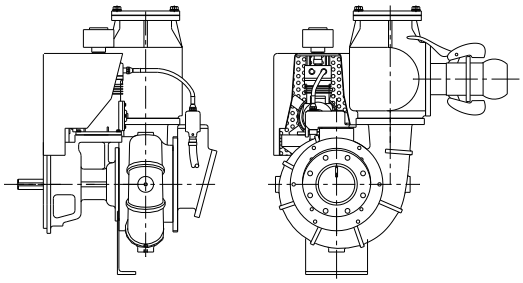
Dry Weight	1450 KG
Wet Weight	1520 KG
Fuel Capacity	80 LTRS

Trailer Information

VIN Number	6T9T26V9780EXJ003
Tyre Type	-
Axle Set Up	-

3 TECHNICAL DATA SHEET

MV150iC Olympic Diesel Drive Compressor Prime Pump

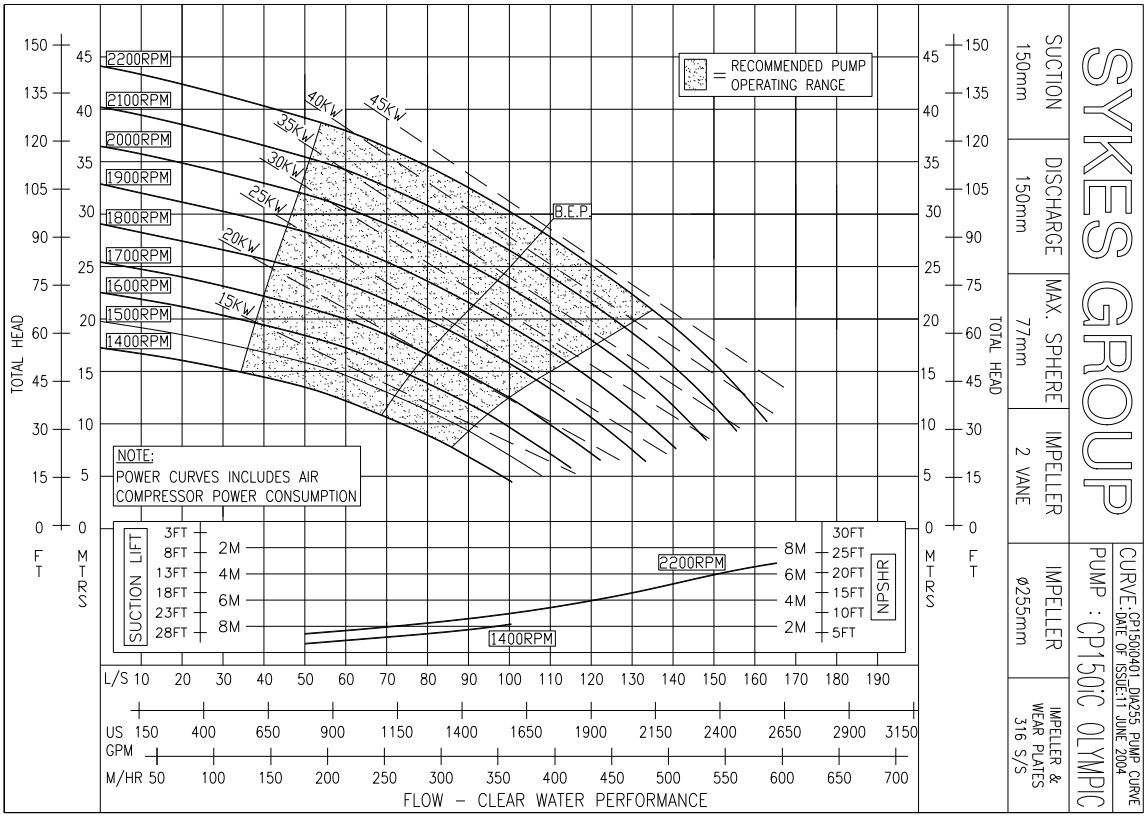


MATERIALS OF CONSTRUCTION

Pump Casing:	SG Iron AS1831 Grade 400/12
Suction Cover:	SG Iron AS1831 Grade 400/12
Tee Piece:	SG Iron AS1831 Grade 400/12
Bearing Bracket:	SG Iron AS1831 Grade 400/12
Pump Shaft:	431 Stainless Steel
Impeller:	316 Stainless Steel
Wear Plates:	316 Stainless Steel
Air Injector:	316 Stainless Steel
Mechanical Seal:	Silicon Carbide / Silicon Carbide
Non Return Valve	150mm Flapper or Ball Style NRV
Compressor Pulley:	Tooth Belt ½" Heavy Pitch - 36H150
Drive Pulley:	Tooth Belt ½" Heavy Pitch - 28H150
Belt Section:	Timing Belt - 390H150
Compressor Details:	Bendix 2W 440 R Twin-in-line cylinders 75mm x 50mm stroke, air cooled 15cfm (410L/min) at 1000rpm Lubrication from engine oil system.
Ejector Details:	Jet: 23-0568-2016 Nozzle: 23-0571-2016

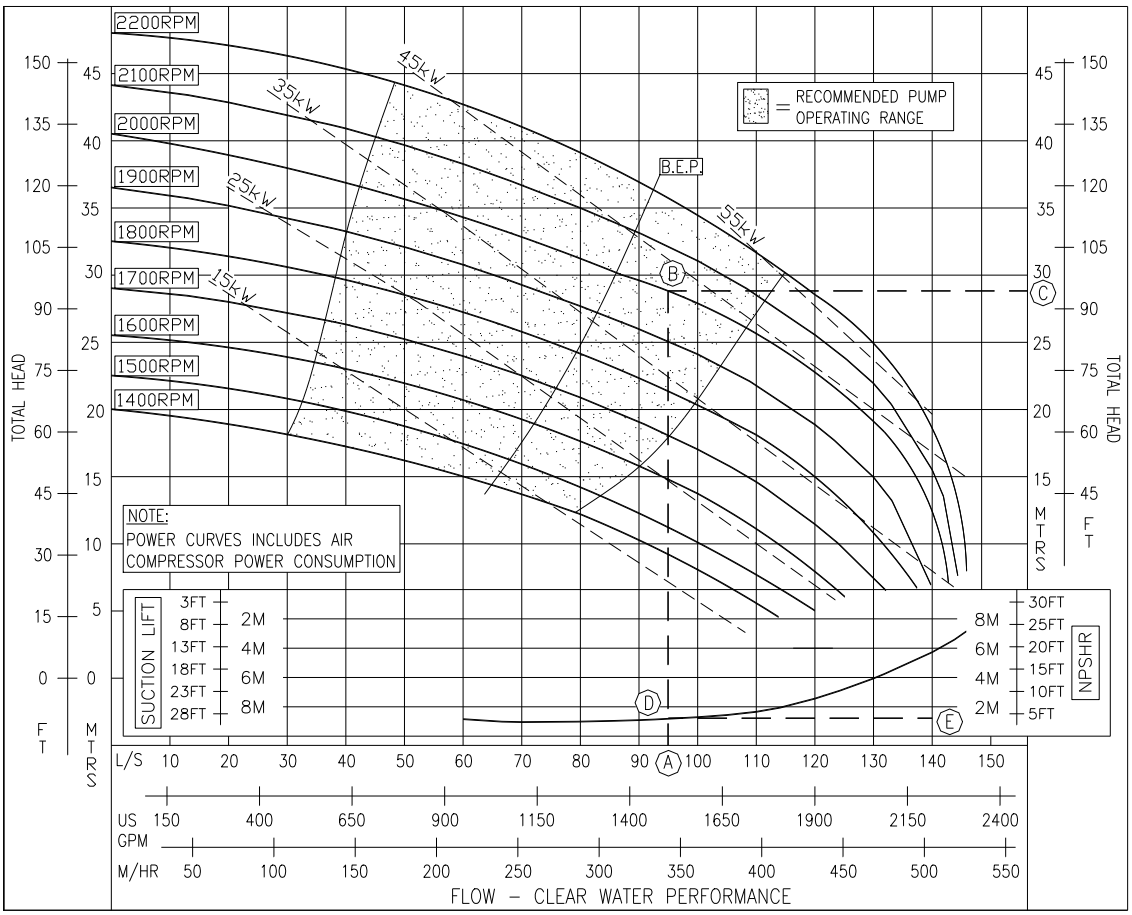
DESIGN DETAILS

Pump Designation:	MV150i Olympic
Pump Description:	Centrifugal Single Stage, Volute Type, 2 Bladed Fully Open Impeller.
Suction Flange:	150mm Table 'D'
Delivery Flange:	150mm Slotted Table 'D' or 'E'
Nominal Casing Thickness:	16mm
Nominal Shaft Diameter:	40mm
Impeller Eye Diameter:	161mm
Maximum Impeller O.D.:	255mm
Minimum Impeller O.D.:	255mm
Solids Handling Size:	77mm
Operating Speed:	MIN: 1400rpm MAX: 2200rpm
Maximum Head:	44m
Maximum Capacity:	162l/s
Bearing Sizes:	*Drive End:* 33111Q Tapered Roller *Pump End:* 33111Q Tapered Roller
Bearing Lubrication:	Grease Lubrication Multi Lube Lithium Grease EP Additives NLGI #2 or Equivalent



4 HOW TO READ A PERFORMANCE CURVE

4.1 Example Sykes' CP150 Pump Curve



The lines sloping downwards from left to right represent the varying quantities of liquid delivered by the pump with variations in head. The intersection of this line at 2000rpm with the zero flow line shows the shut off head (41m) of pressure developed by the pump.

Total Dynamic Head (m) = Static Suction lift (m) + Static Discharge Head (m) + Friction Head (m)

Where:

Static Suction Lift:	Difference in elevation between liquid level of the suction and the centre line of the pump.
Static Discharge Head:	Difference in elevation between liquid levels of the centre line of the pump and the discharge.
Friction Head:	Equivalent head necessary to overcome friction on the interior surfaces of the pipework system including all valves, bends and fittings.

Duty Point: A pump operating at **95l/s at 29m (Total Dynamic Head)**.

1) Draw a line upwards from Flow (x-axis) at 95l/s (point A).

2) Draw a line across from Total Head (y-axis) at 29m (point C)

3) Where the vertical line of 95l/s intersects the horizontal line of 29m (point B) determines the pump rpm speed and power required at this duty.

4) ∴ Pump Speed Curve = **2000rpm.**

5) ∴ Power Requirement = **45kW** to run the whole of the 2000rpm curve.

6) To obtain NPSHR (Net Positive Suction Head Required), draw a line across from where the vertical line of the 95l/s intersects the NPSHR curve (point D).

7) ∴ NPSHR = **1.1m** (point E).

8) Dynamic Suction Lift Available (DSLA)

DSLA = Atmosphere (m) – Velocity Head (allow 1m) – NPSHR (m)

= 10.3m – 1m –1.1m

= **8.2m**

To determine the actual dynamic lift of pump, it is recommended to fit a vacuum gauge on the suction side of the pump to obtain a vacuum reading. The vacuum gauge, for this example, should read no more than 80.4kPa (8.2m). If the vacuum gauge reading is greater than 80.4kPa then the pump will experience cavitation.

Note:
To ensure minimal losses to the total suction lift:

- *Keep suction pipes as short and straight as possible.*
- *Eliminate all possibility of air pockets being trapped in suction pipework.*
- *When choosing foot valves, strainers, bends etc, select those, which will provide minimal restriction to the flow.*
- *The diameter of the suction pipe should be equal in diameter to the pump inlet connection.*
- *It is recommended to fit eccentric reducer in conjunction with pipe diameters larger than the pump inlet to avoid the possibility of air pockets in the suction pipework.*

4.2 Generalisations

(1) Flow (l/s) decreases, as Total Head (m) increases.

(2) Flow (l/s) increases, Power used increases.

It is **not** recommended to operate the pump outside the recommended pump operating range. To operate outside this area will lead to cavitation, vibration and non-uniform radial forces present in the pump. This drastically reduces the operating life of the mechanical seal, bearings and efficiency of the pump. In addition, the pump alignment will also be adversely effected due to excessive vibration. All this will result in an increase of maintenance cost of the pump.

4.3 Radial Thrust

When a pump is operated at its best efficiency flow rate the velocities and hence the pressures acting on the impeller are uniform around the volute. This is shown in *Figure – A*.

At flow rates other than best efficiency point, the pressure distribution is no longer uniform. At reduced flow rates, the pressures increase spirally towards the cutwater resulting in a radial reaction F as shown *Figure – B*.

This will lead to the following operating problems:

- Low efficiency of pump.
- Noise vibration, reduced life of pump.
- Increased radial loads on bearings due to unbalanced volute pressures.
- Temperature rise due to dissipated energy created by low efficiency.

A similar situation exists at flow rates beyond best efficiency flow rates, with an approximate opposite (in direction) reaction.
This also will lead to similar problems associated with the reduced flow rates with an addition of poor suction performance (high NPSHR).

Figure – C shows typical variation of radial thrust with flow rate.

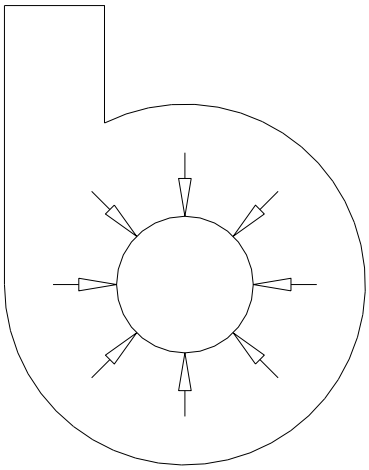


Figure A – 100% Best Efficiency Flow

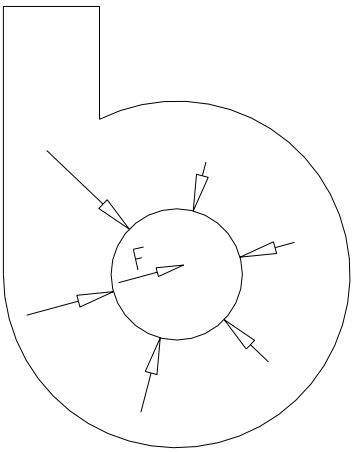


Figure B – Reduced Flow

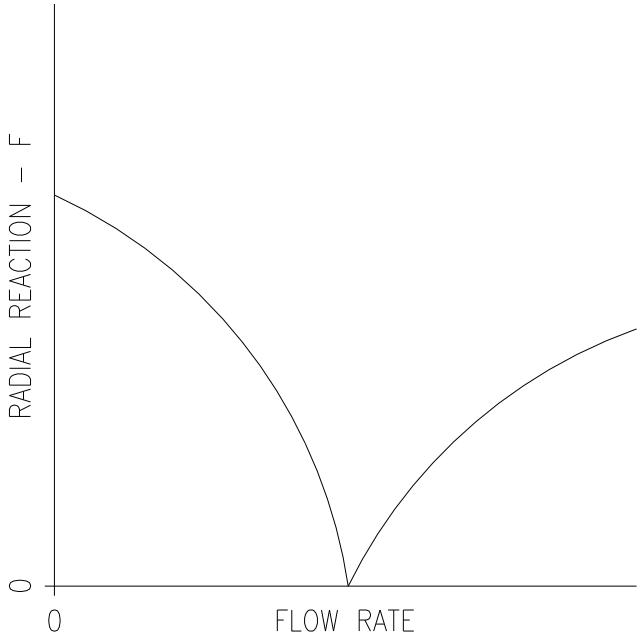


Figure C – Radial Thrust

4.4 Cavitation

If the Net Positive Head Available of the pump is less than the Net Positive Head Required, the pumpend liquid will vaporize in the region of the impeller eye i.e. where the local pressure is less then the vapour pressure.
In this region, the fluid will consist of a liquid plus vapour cavities. This can, in the extreme, result in the formation of a vapour lock and the prevention of the fluid entering the impeller.
This phenomenon is called ‘cavitation’. The cavitation cycle comprises therefore of two phase changes; one from liquid to vapour during the initiation and the other from vapour back to liquid during cavity collapse.

Cavitation may be caused by excessive suction lift, insufficient NPSHA or operation at too high a speed. The resulting effects include:

(1) Pitting of material surfaces due to the continual hammering action of the collapsing vapour cavities.

(2) Significant reduction of performance due to vapour formation.

(3) The crackling noise (like gravel going through the pump) caused by vapour cavity collapse.

Severe cavitation usually results in excessive noise, vibration and damage to pump, whereas mild cavitation may produce nothing more than a small reduction in pump efficiency and moderate wear of pump components.

5 RISK ASSESSMENT GUIDE

The following RISK CLASSIFICATION table should be used to assess the degree of risk presented by hazardous situations identified when carrying out the assessment.

Consider:

Electrical	Thermal	Noise	Mechanical	Gravity
Pressure	Chemical	Radiant	Biochemical	

The numbers indicate how important it is to do something.

1 = Top priority – do something immediately

6 = Low priority – do something when possible

The table does not provide for control actions to be taken to minimise the risk and it is very important that these are documented, along with time frame and responsibilities.

How severely could it hurt someone or how ill could it make someone	**How likely is it to happen?**			
	(A) VERY LIKELY *could happen any time*	***(B) LIKELY*** *could happen sometime*	**(C) UNLIKELY** *could happen but very rarely*	***(D) VERY UNLIKELY*** *could happen but probably never will*
(1) *Kill or cause permanent disability or ill health*	***1***	***1***	***2***	***3***
(2) *Long term illness or serious injury*	***1***	***2***	***3***	***4***
(3) *Medical attention and several days off work*	***2***	***3***	***4***	***5***
(4) *First aid needed*	***3***	***4***	***5***	***6***

6 RISK ASSESSMENT – MV150i

No.	Activity	Hazard & Type of Injury Risk	Likelihood	Consequence	Risk Rating	Eliminate / Reduce / Control the risk by
1	Lifting of Pumpset by single point lifting frame	Excessive lateral movement of unit - crushing	B	1	1	• Only qualified personnel to use lifting equipment • Hoisting acceleration should not exceed 0.4m/sec^2 • Ensure lifting equipment is in good condition • Keep all personnel away from Pumpset when it is suspended • Do not lift Pumpset by any other method than the central lifting eye • Do not lift in extreme weather conditions • Stop & think • Correct PPE
2	Setting up the Pumpset	Slips, trips, strain, sprains and pinch points	B	3	3	• Wear correct PPE • Stop and think • Inspect area to ensure safe working conditions • Set up on level ground • Communicate with personnel located/working in vicinity of Pumpset • Clean up any spillages causing trip hazards • Do not operate Pumpset in known unsafe conditions • Do not use Pumpset in any classification of hazardous environment unless it has been specifically designed to do so • Do not operate within a confined space
3	Operation of Pumpset	Excessive Noise – hearing loss	B	2	2	• Wear hearing protection at all times when working or operating around the Pumpset • Stop & think

No.	Activity	Hazard & Type of Injury Risk	Likelihood	Consequence	Risk Rating	Eliminate / Reduce / Control the risk by
	Operation of Pumpset	Boom movement (Suction Hose Boom) – pinch points & crushing	B	2	2	• Wear correct PPE • Stop & think • Do not operate Pumpset in known unsafe conditions • Do not use Pumpset in any classification of hazardous environment unless it has been specifically designed to do so • Do not operate within a confined space • Keep all personnel away from Pumpset when boom is tilted, raised or lowered • Do not move Pumpset whilst operating the boom • Ensure boom lifting equipment is in good condition • Do not operate Boom in known unsafe conditions • Communicate with personnel located/working in vicinity of Pumpset
	Operation of Pumpset	Running engine & Pump Unit – moving parts, hot pump parts, hot exhaust and manifolds on engine – possible burns, pinch points, cuts and abrasions	B	3	3	• Wear correct PPE • Stop & think • Educate employees of burn hazards on engines • Keep access door on enclosures closed and locked when not required to be open • Ensure that the engine is operated only from the control panel or from the operator's position by one person only • Keep hands, arms, long hair, loose clothing and jewelry away from pulleys, belts and other moving parts • Do not remove any safety guards or panel

No.	Activity	Hazard & Type of Injury Risk	Likelihood	Consequence	Risk Rating	Eliminate / Reduce / Control the risk by
	Operation of Pumpset	Hydraulic, fuel, grease, oil, radiator coolant, water pressure, movement of pump water hose and battery electrolyte leaks – environmental pollution, poisoning, burns & skin irritation	B	3	3	• Stop & think • Wear correct PPE • Check all hoses for cracks and leaks • Check that all covers and caps are secure on alternator, cooling fan/radiator, engine & fuel tank • Ensure spillages are contained • MSDS available for all items used in Pumpset • Educate employees of burn hazards
	Operation of Pumpset	Possible electrocution – electric shock and burns	B	1	1	• Wear correct PPE • Stop & think • Only Authorised Personnel to work on electrical equipment • Check all conduits for splits, bare wires or unsecured conduit fitting prior to operation of Pumpset • Check all circuit breaker boards are secure and sealed • Check all guards covering electrical section are secured correctly • Do not attempt to connect or disconnect load while standing in water or on wet or soggy ground • Ensure all electrical power is isolated from electrical equipment being serviced • Keep all electrical equipment clean and dry • Keep terminals clean and tight • Test earth leakage equipment regularly • Ensure correct fire extinguisher is available

No.	Activity	Hazard & Type of Injury Risk	Likelihood	Consequence	Risk Rating	Eliminate / Reduce / Control the risk by
	Operation of Pumpset	Possible fire and explosion – burns, bodily injuries and possible death	B	1	1	• Wear correct PPE • Stop & think • Ensure correct fire extinguisher is available • Do not refill the fuel tank while engine is running • Never store oily rags in metal covered containers • Do not smoke or allow sparks, flames or other sources of ignition around fuel or batteries • To avoid arcing keep grounded conductive objects, such as tools, away from exposed live electrical parts, such as terminals • Do not operate the Pumpset system with any known leaks in the fuel system • Open exhaust system drain plugs after repeated failed start attempts
4	Maintenance - Battery charging	Possible explosion – burns and bodily injuries	B	1	1	• Wear correct PPE • Stop & think • Correctly isolate equipment • Do not smoke or allow sparks, flames or other sources of ignition around batteries • To avoid arcing keep grounded conductive objects, such as tools, away from exposed live electrical parts, such as terminals • When disconnecting battery disconnect the negative battery terminal first • When reconnecting battery connect the negative battery terminal last • Ensure adequate ventilation • Turn off power or disconnect the power to the battery charger before making or breaking connections with the battery

No.	Activity	Hazard & Type of Injury Risk	Likelihood	Consequence	Risk Rating	Eliminate / Reduce / Control the risk by
	Maintenance - Electrical	Possible electrocution – electric shock and burns	B	1	1	• Wear correct PPE • Stop & think • Correctly isolate equipment • Only Authorised Personnel to work on electrical equipment • Do not attempt to connect or disconnect load while standing in water or on wet or soggy ground • Ensure all electrical power is isolated from electrical equipment being serviced • Keep all electrical equipment clean and dry • Keep terminals clean and tight • Test earth leakage equipment regularly • Ensure correct fire extinguisher is available
	Maintenance – refilling fuel tank	Fuel leaks – environmental pollution, poisoning, burns & skin irritation	B	3	3	• Stop & think • Wear correct PPE • Correctly isolate equipment • Check all hoses and fittings for cracks and leaks • Ensure spillages are contained • MSDS available for fuel used in lighting tower • Educate employees of burn hazards

No.	Activity	Hazard & Type of Injury Risk	Likelihood	Consequence	Risk Rating	Eliminate / Reduce / Control the risk by
	Maintenance - mechanical	Engine, hydraulic pump and centrifugal pumpend maintenance – explosion, burns, pinch points, skin irritation	B	2	2	• Stop & think • Wear correct PPE • Correctly isolate equipment • MSDS available for items used in Pumpset • Ensure spillages are contained • Check all hoses and fittings for cracks and leaks • Correctly de-energise hydraulic system • Ensure guarding is in place and secure after maintenance is finished • Do not remove the radiator filler cap until the coolant has cooled. Then loosen the cap slowly to relieve any excess pressure before removing the cap completely • Educate employees on hazards of hot coolant and oil under pressure • Educate employees of burn hazards • Ensure correct fire extinguisher is available

7 AS2417-2001 GRADE 2 ACCEPTANCE TEST

Sykes Group tests all their manufactured pumps to meet AS2417-2001 Grade 2 standard. This standard outlines the acceptable performance parameters whilst testing / collecting pump hydraulic performance data.

Please note that all performance test equipment at Sykes Head Office testing facility is certified to meet relevant standards.

Pump Test performed to meet AS2417 – 2001 (ISO 9906: 1999 (E))
Rotodynamic pumps – Hydraulic performance acceptance tests – Grade 2.

Permissible amplitude of fluctuations as a percentage of mean value of quantity being measured

Flow Rate	±6%
Pump Total Head	±6%
Speed of Rotation	±2%

Permissible values of overall measurement uncertainties

Flow Rate	±3.5%
Pump Total Head	±5.5%
Speed of Rotation	±2%

Values of tolerance factors

Because of manufacturing uncertainties during completion, geometrical deviations from the drawings are given at every pump. Tolerances shall be allowed, including the possible deviations in operating dates between the tested pump and a pump without any manufacturing uncertainties.

Flow Rate	±8%
Pump Total Head	±5%
Pump Efficiency	-5%

NPSH3

NPSH required for a drop of 3% of the total head of the first stage of the pump as a standard base for use in performance curves.

NPSHR

Minimum NPSH given by the manufacturer for a pump achieving a specified performance at a specified flow rate, speed and pumped liquid (occurrence of visible cavitation, increase of noise and vibration due to cavitation, beginning of head or efficiency drop, head or efficiency drop of a give amount, limitation of cavitation erosion).

Tolerance factor for NPSHR

The maximum permissible value of the difference between measured and guaranteed NPSHR;

Grade 2: NSPHR = +6% or NPSHR = +0.3m (whichever is greater)

8 SITE COMMISIONING PROCEDURE

Customer Name: _____

Customer Representative: _____

Sykes Representative: _____

Pump Type: _____

Pump Serial Number: _____

Date of Commissioning: _____

Form: WP-04

Revision: 3

Date Issued: 28 September 2004

Commission Completed Satisfactory: YES NO

Customer Representative Sign: _____

Sykes Representative Sign: _____

Date: _____

8.1 Delivery Inspection

		Satisfactory	
		Yes	**No**
A	Pump and associated equipment has been supplied in full and in operational condition		

Defects		**Action Taken**	**Comments**	**Date**

8.2 Installation and Set Up

8.2.1 General Set Up

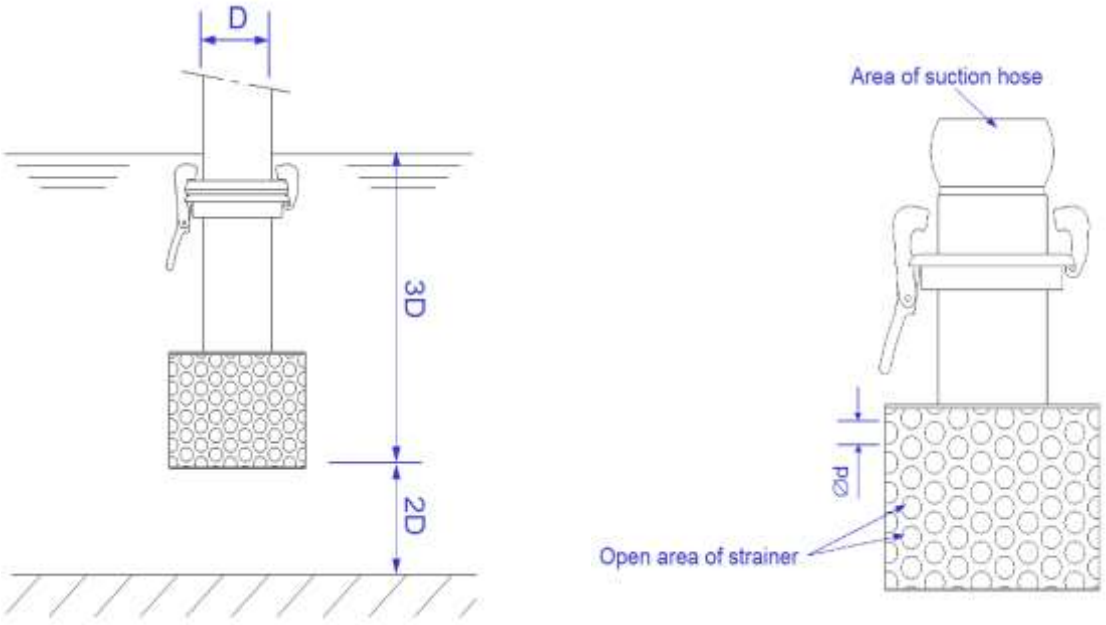
		Satisfactory	
		Yes	**No**
A	Ensure pumpset is suitable selected to match required duty		
B	Pumpset is level and on firm ground		
C	Pumpset and associated equipment is accessible by service vehicles		
D	Site risk assessment has been carried out		

Defects		**Action Taken**	**Comments**	**Date**

8.3 Suction Hose Set Up

		Satisfactory	
		Yes	**No**
A	Hose is non collapsible type, free of kinks and internal blockages		
B	Hose size at least to be equal or larger than pump inlet size		
C	Hose set up to be short and straight as possible		
D	No elbow fitted directly to pump inlet		
E	No undulating suction hose set up (i.e. no possibility of trapped air in suction hose set up)		
F	No excessive static suction lift		
G	Strainer hole size to be less than pump solids handling capability		
H	Strainer position to avoid air intake and clogging due to silt / mud etc. from floor of tank / pond / dam etc.		
I	Strainer open area to be at least four times the area of the suction hose		
J	No foot valve in suction hose set up, please contact Sykes for assistance.		

Defects		**Action Taken**	**Comments**	**Date**

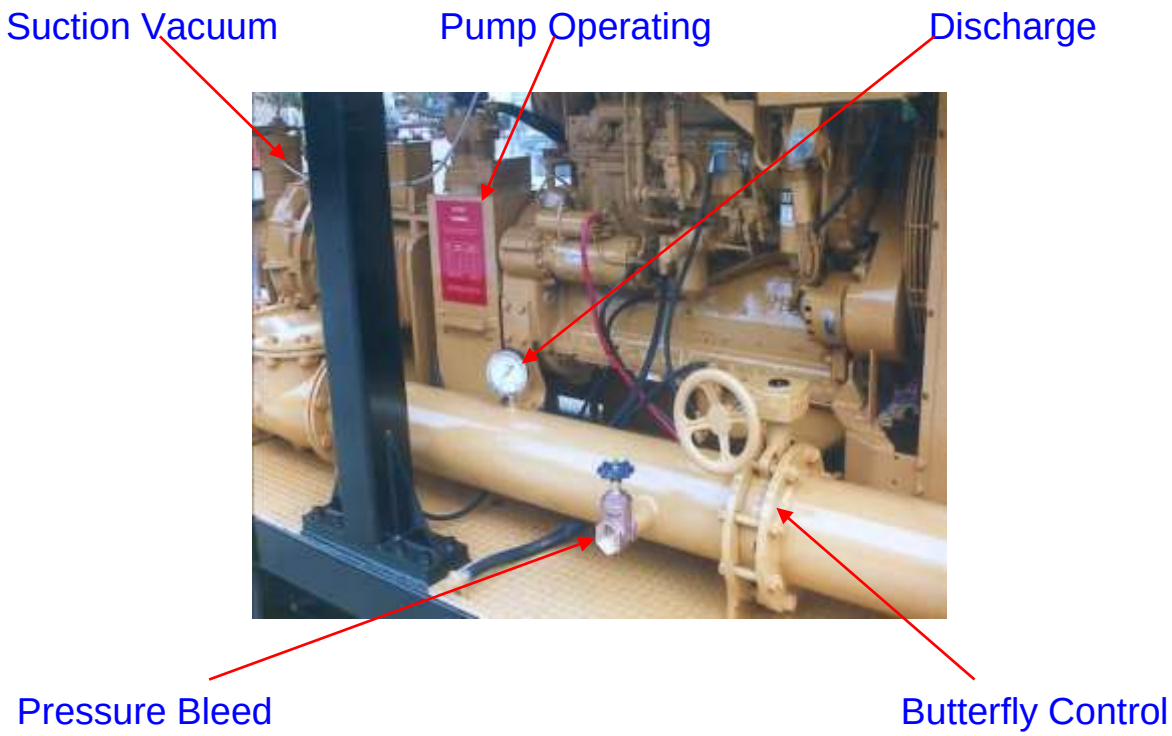


Recommended Suction Strainer Set Up

8.4 Discharge Hose / Pipe Set Up

		Satisfactory	
		Yes	**No**
A	Hose diameter at least the same diameter as pump outlet		
B	Correctly rated discharge hose and fittings (non return valves, gearbox butterfly valves etc)		
C	Control valve has fine adjustment capabilities and is designed for throttling conditions		
D	Pressure gauge fitted in discharge pipe work as close as possible to pump outlet		
E	Suitable rated pressure bleed valve		
F	Free from air leaks, kinks and internal blockages		
G	Discharge hose straight and short as possible		

Defects		**Action Taken**	**Comments**	**Date**



Recommended Pump Set Up

8.5 Pre-Start Checks

		Satisfactory	
		Yes	**No**
A	Operator familiar with pumpset stop / start operating procedures		
B	Condition and level of all lubricants, coolants and fuels (if required, refer to motor / pump manuals for additional assistance)		
C	All moving parts and rotating parts are adequately guarded		
D	Discharge isolation control valves are fully open for initial prime and pump operating stages		
E	If unit is belt drive check for belt alignment and tension		
F	If drive is an electric motor direction of rotation shall be checked prior to start up. It is recommended that the pump / electric motor coupling be disconnected for this check.		

Defects		**Action Taken**	**Comments**	**Date**

8.6 Starting Procedure

		Satisfactory	
		Yes	**No**
A	Check and inspect for undue noise, vibration and misalignment on initial start up		
B	For diesel drive, start engine at idle speed and check operation of all gauges. Slowly increase engine speed during pump priming process		
C	Once pump is primed, increase and set engine speed to match required pump duty. The setting of a control discharge valve may be necessary to meet minimum operating speed of the engine		
D	On a pumpset that is driven by an electric motor with a fixed speed a discharge control valve may be required to regulate the pump to operate within the pump's recommended operating range		
E	Monitor pumpset for a period of time. Operator should observe and monitor; - bearing temperatures - mechanical seal coolant level - mechanical seal coolant contamination - pump discharge & suction pressure - pump system leaks - Engine temperatures, pressures, emissions and gauges		

Defects		**Action Taken**	**Comments**	**Date**

9 AUTOMATIC PRIMING NRV FUNCTION

Sykes Automatic Self Priming Pump are supplied complete with discharge check valves as a part of the pump priming system.

The primary function of the check valve is for sealing the discharge side of the pump during the automatic priming process.

Whilst this check valve is rated for maximum pump performance it is not intended to be used as the discharge system non return valve.

Sykes recommend that a suitable system non return valve be installed as part of the discharge pipe work.

10 PUMP OPERATING INSTRUCTIONS

10.1 Description of Pump Unit

The pump is basically a simple end suction pump which has a completely automatic priming system built into the design. This enables the pump to self-prime from a completely dry condition even with a long suction line. No liquid of any nature is required to prime the pump and therefore in temporary dry trench conditions the pump will 'snore' until such time as liquid is available.

It can handle unscreened sewage, trade effluents, thick slurries and solids up to a normal limitation of 77mm.

The impeller is fully open two bladed, 316 Stainless Steel construction, with shaft of 431stainless steel.

The pump body is SG iron construction fitted with Stainless Steel wear plates secured by high tensile steel screws.

The mechanical seal is fitted externally to the pump in its own self-contained oil. It is leak tight and suitable for sewage and sludges; using silicon carbide faces. Pump out vanes on the impeller ensure the seal is lightly loaded and not contaminated by the main solid content.

The pump unit is supported off a SAE 4 engine flange through a heavy-duty SG iron adaptor bracket.

Guards are fitted as standard to all moving parts.

Suction flange 150mm Table 'D'.

Delivery flange slotted 150mm Table 'D' & 'E'.

Note
If your MV150i pumpset has been mounted on a trailer chassis, it is recommended that after approximately 5 km of travel that all wheel nuts be inspected and re-tightened.

10.2 Procedure Prior to Pump Start Up

The pump should be placed on a level area of ground**.**

In order to put the pump to work the following procedure should be undertaken.

1. Ensure that the pump turns freely.

2. Ensure bearings are adequately lubricated.

3. Check pump runs without excessive noise, heat or vibration.

4. Position hoses to avoid unnecessary stress. Sharp bends should be eliminated and protective measures taken where hoses are exposed to abrasive surfaces. Collapsible type hoses MUST NOT be used on the suction side of the pump.

5. For diesel prime movers:-
   Check engine fuel supply level and top up if necessary.
   (The fuel tank is built into the chassis).

6. Check engine oil level on dipstick and top up with recommended oil if necessary.

The pump will prime automatically once the suction hose intake is submerged.

Note
For engine starting instructions or starting difficulties, refer to the manufacturer's handbook.

10.3 Failure to Prime Pump

10.3.1 Air Leaks

To test for air leaks, disconnect suction hose from pump and blank off suction entry. If the vacuum gauge registers a satisfactory reading, i.e. 9.14 metres, the leak will be in the suction hose. Re-couple hose to pump; remove intake and blank-off entry to hose. It should then be possible to locate leak.
If the air leak is in the pump:-

a) Check that all drain plugs are screwed tightly in position

b) Remove NRV Inspection cover and make sure that the valve is seating correctly.

10.4 Pump Dynamic Test

1. Before starting the engine, check that the shaft, pulleys and belt are free to rotate with the guards in position.

2. Start pump and run completely dry for a minimum period of 10 minutes (initial run up speed at 900rpm increasing during test to 1100rpm). During this period, generally check and observe for any unusual vibrations, overheating, fuel, oil or air leaks.

3. These faults must be rectified immediately to prevent a possible engine seizure.

4. After the dry running period, check that the pump unit will raise a minimum vacuum of 0.81bar (24 inches mercury).

Special Note
Consult engine manufacturers handbook for oil, fuel, speed control and stop details.

10.5 Ejector Test

10.5.1 Dri-Prime Ejector Pack Assembly

1. Check ejector and jet sizes:
   Nozzle: 23-0571-2016
   Jet: 23-0568-2016

2. Clean the jet and nozzle with paraffin or similar cleaner. On no account should stiff wire be used as this will enlarge the bores.

3. Check the nozzle and jet bores for any sharp edges, burrs or rough surfaces. If damaged and no replacement is readily available, smooth and polish as well as possible to original form.

4. Alignment of jet and nozzle is important but this is preset by machining tolerances.

5. Assemble ejector unit and check performance on test unit. Operation Air Pressure: 40 psi approximately. Minimum Pass Vacuum: 24" Mercury (27.24ft)

6. A satisfactory arrangement for carrying out the performance test on the ejector unit is a plate fitted with a vacuum gauge as illustrated.

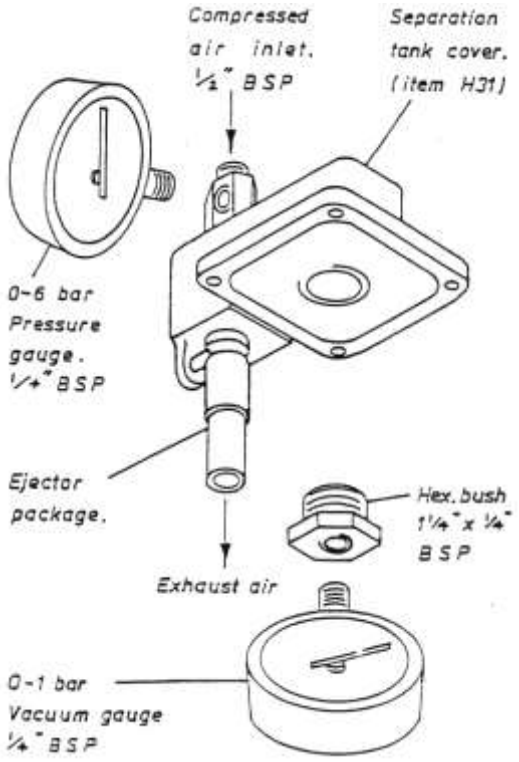


Figure 1 – Ejector Exploded Assembly Drawing

11 PUMP MAINTENANCE INSTRUCTIONS

11.1 Pump Maintenance Schedule

		Daily	250 hours 3 Months	500 hours 6 months	750 hours 9 months	1,000 hours 12 months	6,000 hours 3 years	As Required
	Pump end							
1	Check for mechanical seal leaks							
2	Change mechanical seal oil							
3	Change mechanical seal							
4	Check coupling alignment & condition							
5	Change pump coupling rubber/s							
6	Check/Adjust wet end clearances							
7	Change pump wet parts, impeller / wear plates							
8	Check bearing temperature							
9	Check bearing end float							
10	Replace pump shaft bearings							
11	Check pump shaft seals							
12	Change pump shaft seals							
13	Check impeller for visual blockages							
14	Replace volute							
	Priming System Compressor							
1	Change compressor air filter							
2	Check compressor air hose							
3	Check/Clean priming tee filter							
4	Change priming tee filter							
5	Check priming tee ball/seat							
6	Change priming tee ball							
7	Check/clean priming tee jet/nozzle							
8	Change priming tee jet/nozzle							
9	Check compressor drive belt							
10	Replace compressor drive belt							
11	Check compressor performance							
12	Change compressor air							
	Ancillaries							
1	Check non return valve							
2	Change non return valve seat/flap							
3	Check vacuum gauge							
4	Change vacuum gauge							
5	Check pressure gauge							
6	Change pressure gauge							
7	Check gear box butterfly valve							
8	Change gear box butterfly valve							
9	Check all oil, water and air hose's condition							
10	Check condition of hose coupling o-rings							
11	Check for all mounting bolts, skid, chassis							
12	Check shut down operations engine and pump							
13	All guarding							
14	For diesel servicing and panel operational checks.	See relevant manuals.						

= Daily Check

= Minor Service

= Major Service

= As Required

Notes:

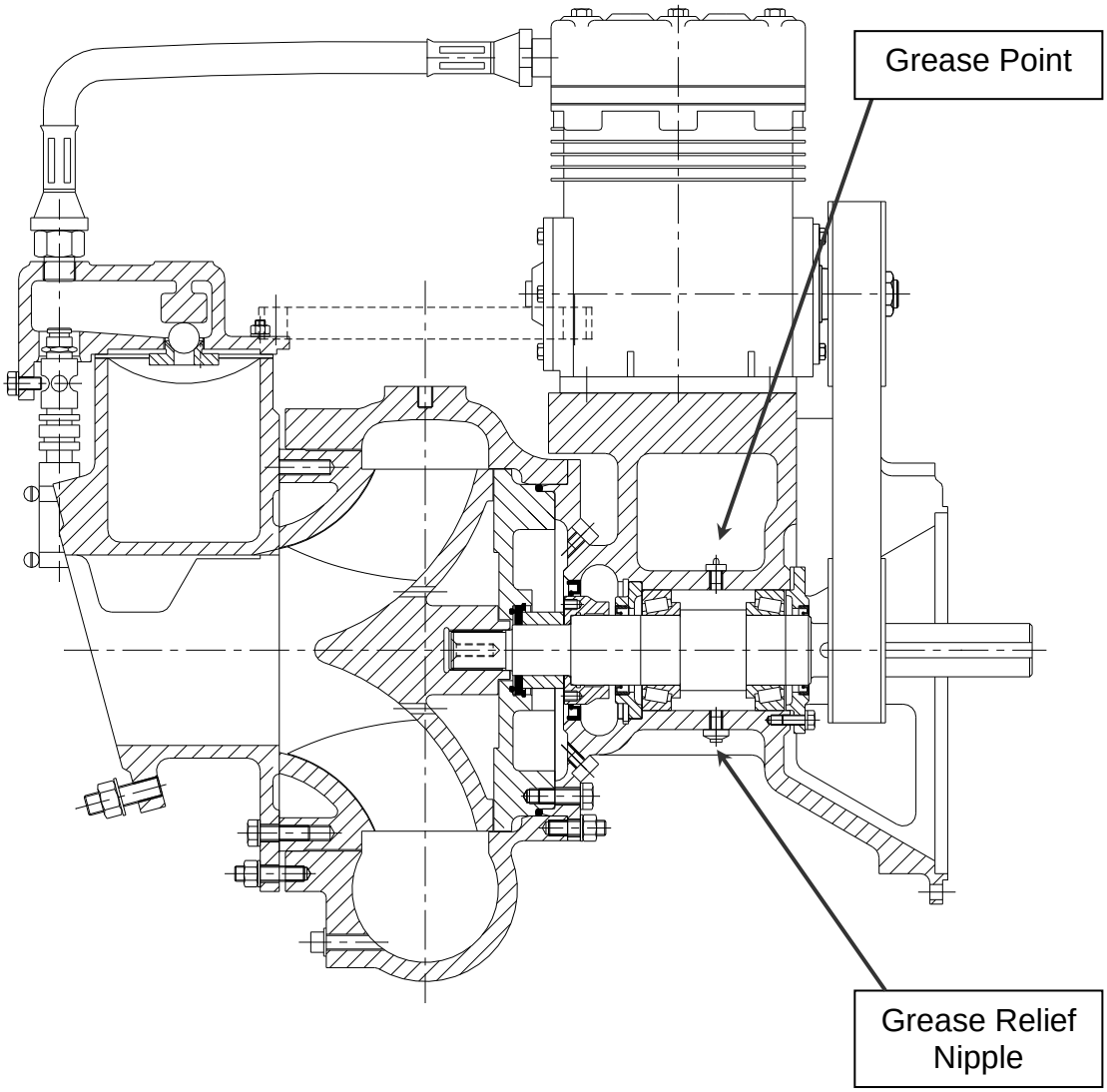
1 Ancillaries are not included in major service schedule / pricing, please contact Sykes for assistance

2 Please refer to Service Schedule for detailed parts, service checks and labour information

3 Follow minor and major schedules outlined in Sykes Service Schedule. Use the service hours or calendar time, whichever occurs first, in order to determine the maintenance intervals.

4 If the pump is operated in ambient temperatures below -18^{0}C or above 38^{0}C and / or under severe conditions, perform maintenance at shorter intervals. Severe services includes the following conditions; high temperatures, continuous high loads, vibration and dusty conditions.

Grease Lubrication Schedule – CP150i



Notes:

1. Single point grease point to grease 2 off 33111 bearings
2. Single point grease relief nipple
3. Grease relief nipple set at 3 - 5 psi
4. Grease Specification: Multi Lube Lithium Grease EP Additives NLGI #2

Operating Conditions:	
Ambient Temperature	20 ^{0}C
Humidity / Dust	Moderate
Vibration	Moderate
Load	Moderate

Bearings 33111 (2 off)		**Quantity of Grease required at 250 Hour Intervals**
Speed	1400 rpm	5.2 grams
Bearing Temperature	44 ^{0}C	
Speed	1500 rpm	5.2 grams
Bearing Temperature	46 ^{0}C	
Speed	1600 rpm	5.6 grams
Bearing Temperature	44 ^{0}C	
Speed	1700 rpm	7.0 grams
Bearing Temperature	48 ^{0}C	
Speed	1800 rpm	8.4 grams
Bearing Temperature	50 ^{0}C	
Speed	1900 rpm	9.4 grams
Bearing Temperature	52 ^{0}C	
Speed	2000 rpm	9.6 grams
Bearing Temperature	54 ^{0}C	
Speed	2100 rpm	10.0 grams
Bearing Temperature	56 ^{0}C	
Speed	2200 rpm	10.4 grams
Bearing Temperature	60 ^{0}C	

!WARNING!

Use this re-greasing schedule as a guide only.
Re-greasing quantities will change due to variances in Operating Conditions.

For re-greasing schedules to suit particular Operating Conditions please contact Sykes for assistance.

Operating Conditions:	
Ambient Temperature	40 ^{0}C
Humidity / Dust	High
Vibration	High
Load	Heavy

Bearings 33111 (2 off)		**Quantity of Grease required at 250 Hour Intervals**
Speed	1400 rpm	10.4 grams
Bearing Temperature	52 ^{0}C	
Speed	1500 rpm	16.0 grams
Bearing Temperature	54 ^{0}C	
Speed	1600 rpm	16.8 grams
Bearing Temperature	56 ^{0}C	
Speed	1700 rpm	21.2 grams
Bearing Temperature	58 ^{0}C	
Speed	1800 rpm	25.4 grams
Bearing Temperature	60 ^{0}C	
Speed	1900 rpm	25.8 grams
Bearing Temperature	62 ^{0}C	
Speed	2000 rpm	26.0 grams
Bearing Temperature	64 ^{0}C	
Speed	2100 rpm	26.6 grams
Bearing Temperature	66 ^{0}C	
Speed	2200 rpm	28.0 grams
Bearing Temperature	70 ^{0}C	

!WARNING!

Use this re-greasing schedule as a guide only.
Re-greasing quantities will change due to variances in Operating Conditions.

For re-greasing schedules to suit particular Operating Conditions please contact Sykes for assistance.

11.2 General Pump Inspection Procedure

1. Drain the water from the pump and the non-return valve.

2. Remove the non-return valve and inspect the ball and seat for wear.

3. Drain the oil from the engine and the pump.

4. Dismantle the pump end completely.

5. If the oil seal has scored the collar, it may be pushed in 2mm to seal on an unscored area of the sleeve. Ensure that the oil seal is positioned squarely and that it is less than 8mm from the machined face of the adaptor.

6. Worn seal faces may be reclaimed by lapping faces to a surface finish of 3 sodium light bands. Note that the stationary seat was originally lapped both sides and may be reversed in the wearplate.

7. Check that the shaft rotates freely and has an end float less than 0.2mm.

8. Clean and inspect all components and renew where necessary. Do not use abrasive materials or solutions to clean the ejector assembly. Renew all nitrile seals.

9. Reassemble the complete pump end and non-return valve (refer to enclosed Fitting Instructions).

10. Drain the fuel tank.

11. Detach fuel, oil and air hoses. Clean and ensure that they are not blocked. Test the relief valves (at 3 to 5 psi, and AC78 at 90 to 100 psi).

12. Check pulley alignment and belt condition. Check the security of pulleys and flexible couplings.

13. Reassemble the complete unit.

11.3 Pump Assembly Instructions

11.3.1 *Pump Bearing Engine Adaptor*

1. Ensure all items are free from burrs and rust.

2. Clean out all casting sand from the recess in the adaptor.

3. Check that all items are clean and free from foreign matter and that the bearings rotate freely.

4. Assemble the bearings and press them onto the shaft ensuring that the tapers are correctly orientated.

5. Remove the outer race from the pump end bearings and press it 10mm into the adaptor from the pump end.

6. Insert the lip seals into the bearing covers, than smear them with grease. Fit cover and press it fully into the adaptor. Secure with circlip.

7. Assemble the shaft and bearings into the adaptor.

8. Fit the rear bearing cover with fasteners. To ensure alignment, the screws should each be rotated a quarter turn in sequence. When the shaft becomes difficult to rotate, measure the gap between the face of the cover and adaptor, with a feeler gauge. Remove the cover and refit with shims having a total thickness slightly in excess of the gap measurement. Secure the screws and ensure that the shaft rotates freely and has an end float less than 0.2mm.

9. Check that the plug has a 1.6 diameter hole and that the relief valve is set to 3-5psi before fitting to adaptor. Fit items grease nipple & 3/8” BSP plug to the adaptor.

10. Press the lip seal squarely into the adaptor.

11. Fill the bearing housing with 0.2 litres of Shell Alvania RA grease.

12. Items set screws, lockwashers & keysteel should be fitted when assembling to the engine.

11.3.2 *Centrifugal Pump*

1. Ensure all items are free from burrs and rust.

2. Visually check for porosity and blowholes in the castings and clean out all the casting sand and swarf from the hollow in the separation tank cover.

3. Ensure that all items are clean and that the seal faces are free from score or wear marks.

4. Fit O-ring to the shaft collar.

5. Fit the collar over the shaft and ensure that the lip seal is correctly positioned over it.

6. To fit the tight fitting synthetic rubber friction ring in the seal onto the shaft apply light oil or swarfega to the inside diameter of the friction ring and to the outside diameter of the shaft. Do not use heavy grease, silicon or P.T.F.E. based lubricant. Ensure that the seal is hard against the shoulder on the collar and that the spring can be compressed. Locate the seal rotating face into the seal.

7. Locate the O-ring and the seal seat, into the rear wearplate. Place the seat into the wearplate and fit the circlip. Ensure that the seat is secure. Apply non-adhesive sealant (e.g. Boss white non-adhesive Hermatite or Locktite hydraulic sealant) to the back face of the wearplate and secure it into the adaptor with fasteners.

8. Apply 'Copperslip' to the threads on the shaft. Fit shims having a total thickness of 2mm and the impeller, remove shims, and then refit with shims having a total thickness of 2.5mm minus the gap measurement. Fit the impeller and check that the gap behind it is between 0.3mm and 0.6mm and that the impeller rotates freely.

9. Locate the O-ring onto the wearplate.

10. Fit studs to the body. The longer studs should be in the lower holes.

11. Fit the front wearplate onto the front cover and secure with fasteners.

12. Assemble the body onto the adaptor carefully so as not to dislodge the O-ring then secure with fasteners.

13. Assemble front cover to pump body. Secure tightly using fasteners until the front wearplate and the impeller are just touching. Measure the gap between the mating surface of the pump body and the front cover.

14. Joints having a thickness of this gap measurement plus 0.5mm should be fitted between the pump body and front cover. After fitting joints secure the pump body and the front cover with fasteners.

15. Check that the gap between the front wear plate and the impeller is between 0.3mm and 0.6mm and the impeller rotates freely.

16. Fit fasteners.

17. If pump units are to remain unused for a long time all adjacent clearance surfaces should be sprayed with a coating of 'Molyprotectoslip' to prevent rust or seizure.

11.3.3 Ejector Package

1. Check that all items are clean and free from burrs. The jet and nozzle should only be cleaned with paraffin or similar cleaner. Wire should not be used as this will enlarge the bores.

2. Do not use excessive jointing compound when fitting these items and ensure that it does not enter the bores. This may cause a blockage in the ejector.

3. Fit, in their grooves, o-ring onto jet and o-ring onto nozzle.

4. Screw by hand, the jet and the nozzle to the collar.

5. Release the location screw and insert the assembly into the separation tank cover, than re-tighten the screw so that it locates in the groove on the nozzle.

6. Screw the jet sleeve by hand into the separation tank cover. A spanner should only be used for the final quarter turn.

7. Place the ball in the separation tank cover, then secure ball seat.

8. Fit the separation tank cover to the pump body with gasket filters and fasteners.

9. Push the exhaust hose onto the nozzle. Fasten using clamp.

10. Push air muffler into the exhaust hose. Fasten using clamp.

11.3.4 Mechanical Seal

1. Drain water from pump and non-return valve.

2. Drain oil from mechanical seal cavity.

3. Remove the front cover, impeller and rear wear plate allowing direct access to the mechanical seal.

4. Remove mechanical seal and sleeve assembly, check oil seal has not been damaged or the adjacent sleeve scored.

5. Renew where necessary ensuring that oil seal is replaced squarely in it's housing.

6. To renew the mechanical seal, remove shaft collar complete with mechanical seal unit. If the mechanical seal unit is in good condition it may only be necessary to remove carbide rotating face from the mechanical seal unit.
   Please Note; before fitting a complete new seal assembly ensure that all sharp edges are removed and all working faces are clean and free from any foreign matter.

7. Apply light oil to the shaft / sleeve an o-ring (item 7).
   Please note: do not use heavy grease, silicon based or P.T.F.E. lubricant.

8. Ensure grub screws (item 8) are not protruding beyond the inside diameter of the mechanical seal retainer (item 5).

9. Check mechanical seal face is clean and free of debris (item 2 & 3).

10. Ensure the mechanical seal unit is pressed squarely and evenly over the shaft. Make sure it is home hard against the shaft collar shoulder.

11. Tighten grub screws (item 8) evenly to secure mechanical seal in position.

12. Check pump rear wear plate for burrs and sharp edges. Lubricate seat o-ring (item 9) and position in rear wear plate o-ring groove.

13. Check mechanical seal seat (item 1) is clean and free of debris. Locate in rear wear plate and secure with circlip (item 10).

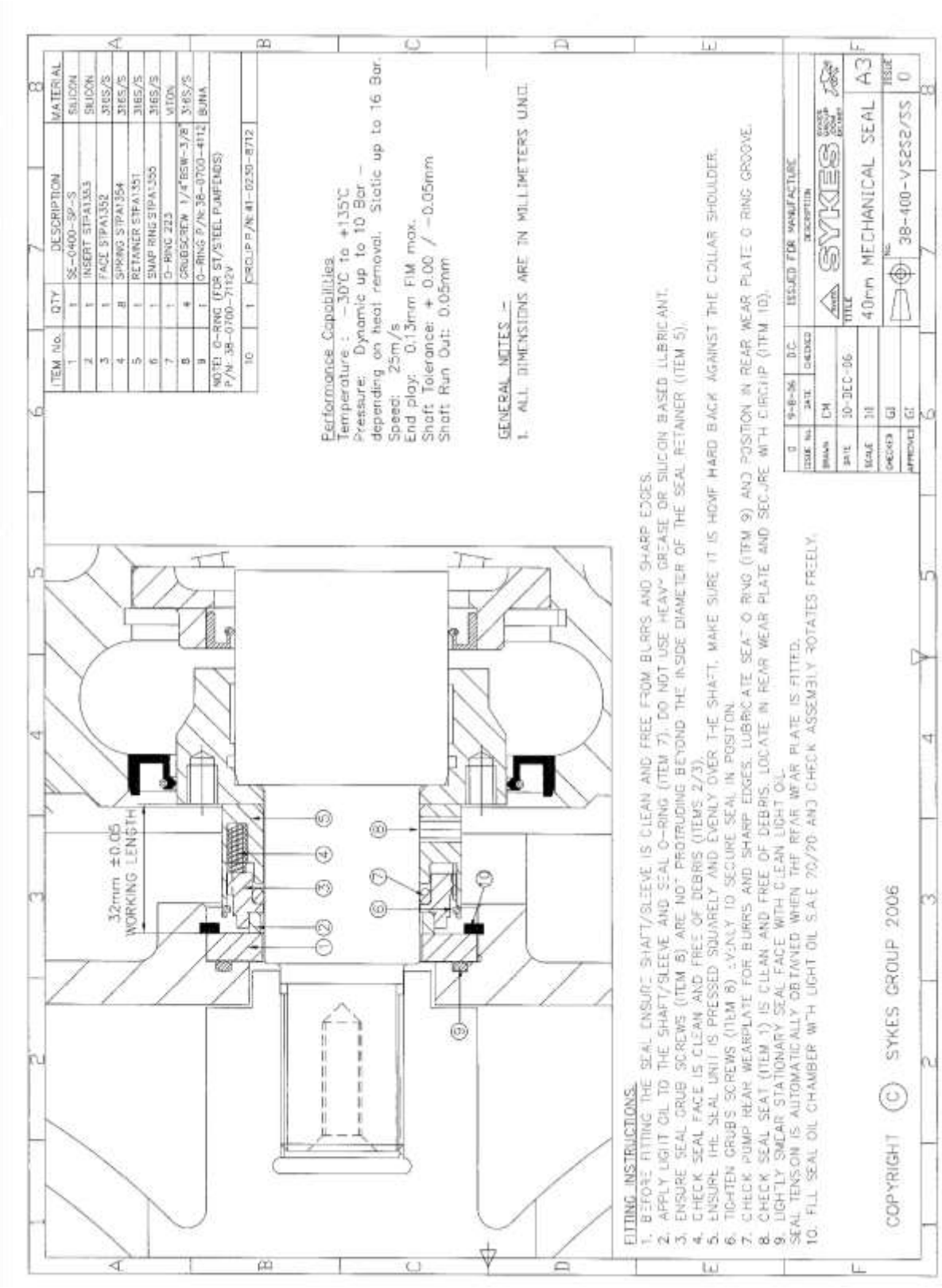
14. Lightly smear stationary mechanical seal face with clean light oil.

15. Fit rear wear plate carrying the seal static face using a non-adhesive sealant on rear face of wear plate. Seal tension is automatically obtained when the wear plate and impeller are re-fitted.

16. Ensure rear impeller clearance is between 0.50mm and 0.65mm.

17. Fill oil chamber with SAE 20/20 grade of oil and check assembly rotates freely.

18. Rebuild pump casing assembly onto adaptor.



11.3.5 Non Return Valve Inspection Procedure

1. Ensure that all items are clean and free from burrs.
2. Visually check for porosity and blow holes in the castings and for scores or chaffing of the valve ball and seat.
3. Fit studs into the body.
4. Fit drain plug and locate the valve seat onto the body.
5. Clean the delivery flange on the pump body and secure the valve to it with fasteners.
6. Insert ball then fit o-ring and cover with fasteners.

11.3.6 Engine / Pump Coupling

Installation Procedure

1. The outer toothed aluminium ring is bolted (bolt complete with supplied flat washer (refer to **Photo 1**)) to engine flywheel (refer to **Photo 2 & 3**) with tightening torque as per below listed information;

T_{A2} Schraubenanzugsmomente am Flansch
Bauformen: SB, SC, SD, SBE, SCE, SDE

T_{A2} Tightening torques of bolts on flywheel flange
Types: SB, SC, SD, SBE, SCE, SDE

SAE		SAE		6½	7½	8	10	11½	14	16	18	21	24
metrisch	Schrauben	metric	bolts	M 8	M 8	M 10	M 10	M 10	M 12	M 12	M 16	M 16	M 18
8.8	T_{A2} (Nm)	8.8	T_{A2} (Nm)	23	23	46	46	46	79	79	195	195	245
Zoll	Schrauben	Inch	bolts	$^5/_{16}$-18	$^5/_{16}$-18	$^3/_8$-16	$^3/_8$-16	$^3/_8$-16	½-13	½-13	$^5/_8$-11	$^5/_8$-11	¾-10
T	T_{A2} (Nm) (inch-lbs.)		T_{A2} (Nm)	25	25	40	40	40	110	110	195	205	375
			(inch-lbs.)	220	220	360	360	360	960	960	1800	1800	3300

Please note that the bolts must be tightened alternately (diagonal opposites) in several steps until they have all reached the correct tightening torque. Finally the tightening torque of all bolts must be checked all around.

2. Measure from engine bell housing to aluminium ring.

3. Install shaft key.

4. Slide driven hub onto shaft.

5. Fit vulcanised ring (rubber disc) with cap screws (supplied with coupling (refer to **Photo 4**)) without washers.

6. Measure from pump engine adaptor flange to vulcanised ring so that vulcanised ring locates centrally in aluminium ring (refer to **Photo 5 & 6**) when assembled.

7. Tighten cap screws slightly.

8. Re-check measurement and adjust if necessary.

9. Torque cap screws (refer to **Photo 7 & 8**);

T_{A1} Schraubenanzugsmomente an der Nabe
Bauformen: SB, SC, SD
T_{A1} Tightening torque of bolts on the inner hub
Types: SB, SC, SD

Kupplungs Größe	coupling size	120 SB	240 SB	400 SB Konusnabe	800 SB 1200 SB	1600 SB 2400 SB	2600 SC 2800 SC 3500 SC	4000 SC 5000 SC 6000 SC 7000 SC	4000 SD	8000 SC 1000 SC	12000 SC 18000 SC	8000 SD 10000 SD	12000 SD 18000 SD
Schrauben ISO 4762	bolts ISO 4762	M 6x20 8.8	M 8x20 8.8	M 8x20 8.8	M 10x20 8.8	M12x25 8.8	M 16x40 10.9	M 16x40 10.9	M16x55 10.9	M 20x50 10.9	M 20x50 10.9	M 20x80 12.9	M 22x80 10.9
Anzugs-moment T_{A1} (Nm)	tightening torque T_{A1} (Nm)	9,5	23	23	46	79	280	280	280	490	490	700	670
Stückzahl	quantity	6	6	8	8	8	8	12	24	12	24	24	24

Please note that the bolts must be tightened alternately (diagonal opposites) in several steps until they have all reached the correct tightening torque. Finally the tightening torque of all bolts must be checked all around.

10. Re-check measurement.

11. Assemble mating coupling part (pump / engine) ensure that teeth are properly engaged (refer to **Photo 9**).

12. If any issues are encountered during Centamax SB coupling installation contact Supervisor and fill in relevant Quality Action Report.

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

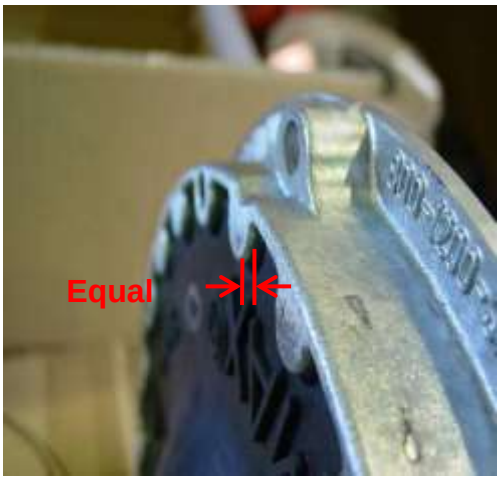


Photo 6

Photo 7

Photo 8

Photo 9

11.4 Air Compressor

11.4.1 Preface

This manual provides the owner with the necessary instructions to maintain its compressor properly, so that the Customer gets the best service from it.
Hence, the owner is requested to go through the contents of the manual & become well acquainted with the instructions herein.

In case any question arises related to the equipment or the manual the customer is requested to contact the aftermarket division of **SYKES GROUP PTY LTD.**

11.4.2 General Description

Application

These compressors are positive displacement type, reciprocating and single acting. The cylinder barrels are air-cooled while the cylinder head is cooled by water circulated from the vehicle engine cooling system.

The salient features of these compressors are robust overhung design crankshaft for reliability & easy maintenance, solid end connecting rods, highly thermal efficient interfolding, totally reliable splash lubrication & force feed lubrication for smooth vibration free operation.

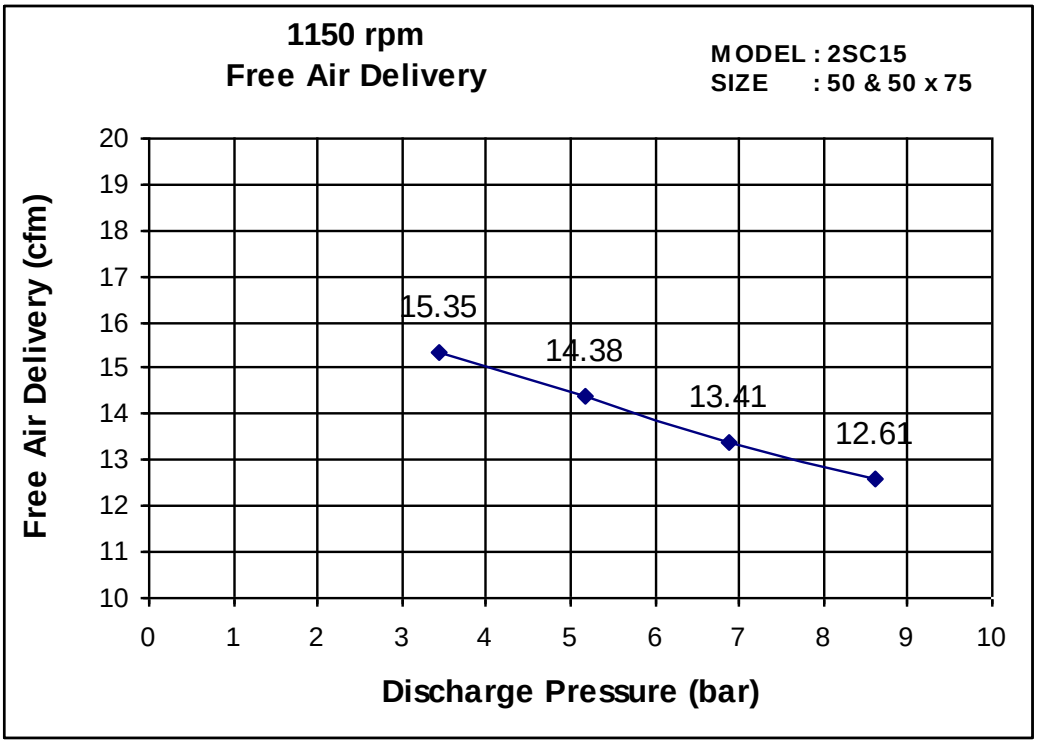
Single Stage Compressor

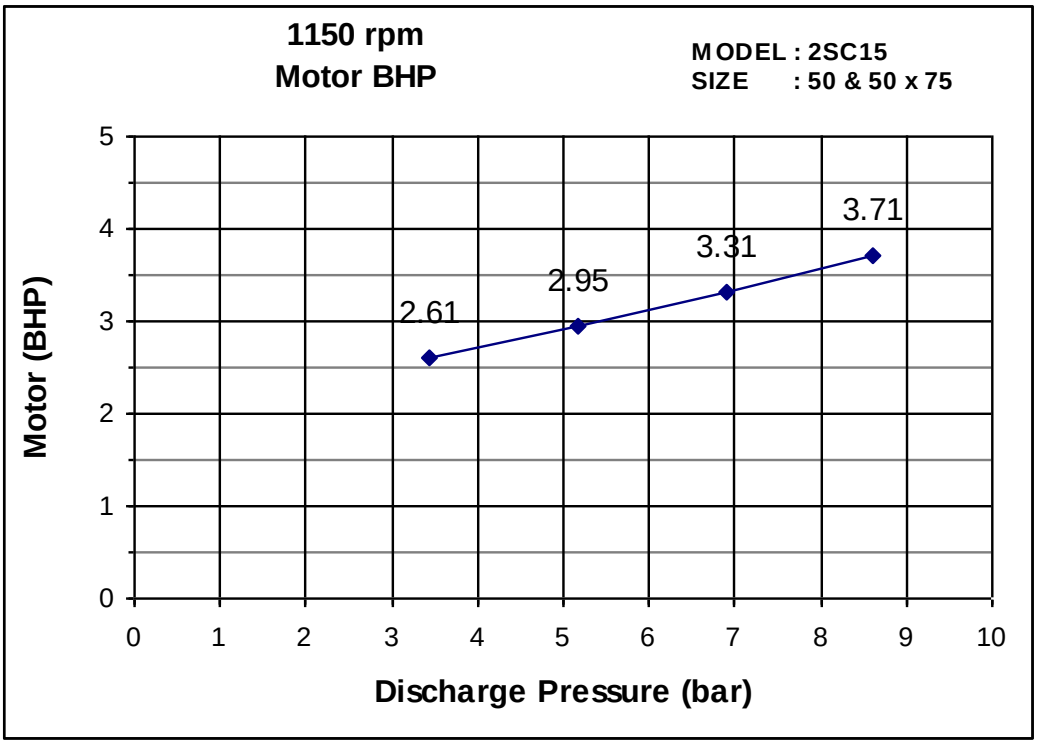
These compressors have cylinders of the same size. The principle of operation is as follows: On the suction stroke of the individual piston, air at atmospheric pressure enters the crankcase/cylinder through the inlet filter and the valve located in airhead. On the compression stroke of the each piston, air is forced out through the valve and passes into a common discharge.

General Specifications

Bore	75 mm
Stroke	50 mm
Swept Volume	37.4 CFM
Maximum Recommended Speed	2400 RPM
Maximum Recommended Delivery Pressure	9bar (130 PSI.)
Operating Temperature Range	-40^0C to $+80^0$C
Maximum Continuous delivery Air Temperature	200^0C
Weight	20 Kg

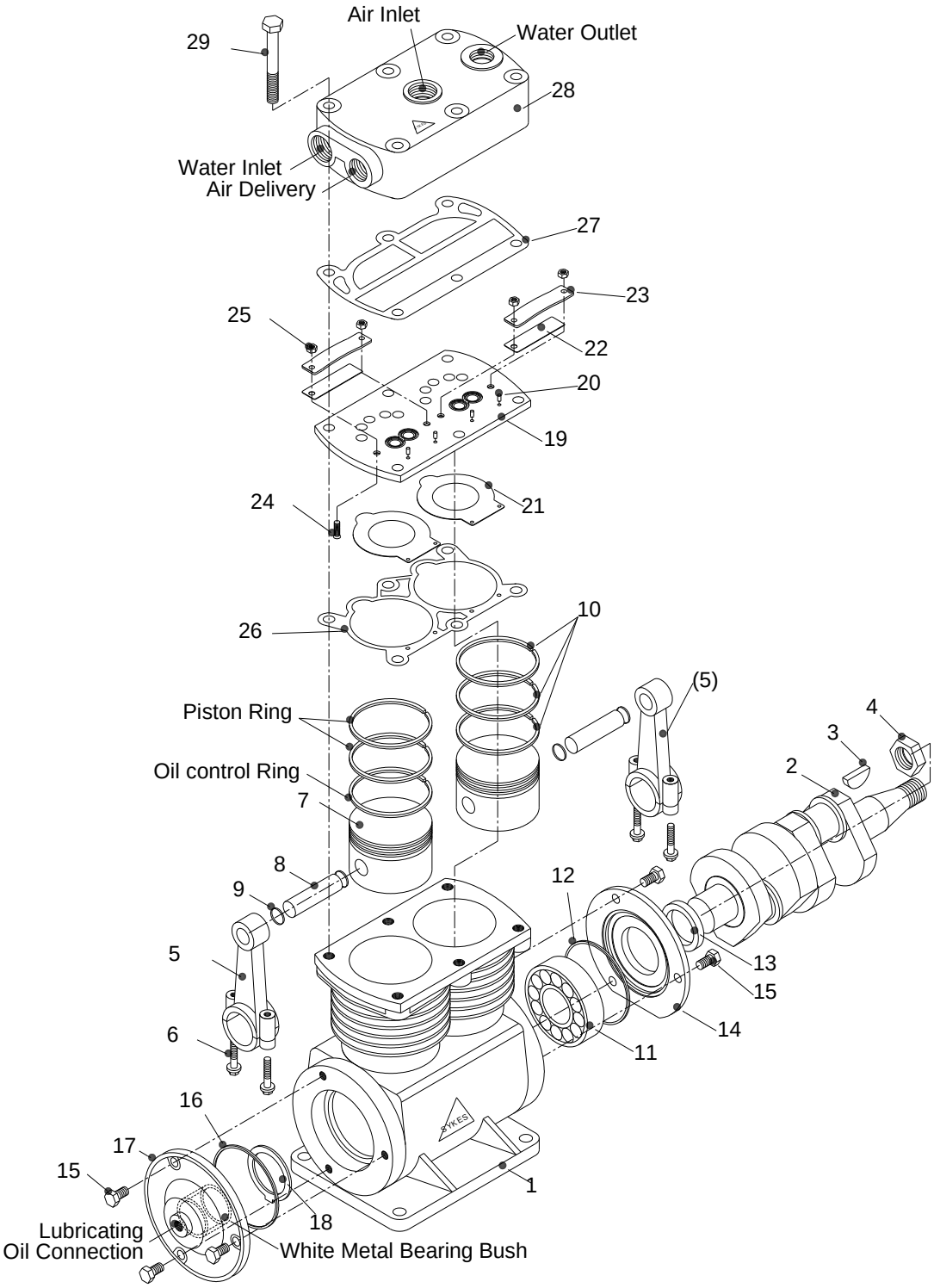
11.4.3 Performance Chart





Performance Chart @ 1150 rpm Model 2SC15

11.4.4 Internal Detail of Compressor



11.4.5 Parts List

SR. NO.	DESCRIPTION	PART NO.	CCN NO.	QTY
1	CYLINDER/CRANKCASE	IAR 0803	71005001	01
2	CRANK SHAFT	IAH 0804	71005002	01
3	CRANK SHAFT KEY	IAF 0832	74005030	01
4	CRANK SHAFT NUT	IAF 0830	74005028	01
5	CONNECTING ROD	IAH 0805	71005003	02
6	ALEN CAP SCREW (M6 x 32LG)	IAF 0806	74005004	04
7	PISTON (STD)	IAH 0807	71005005	02
8	PISTON PIN	IAF 0808	71005006	02
9	PISTON PIN LOCK RING	IAF 0809	74005007	04
10	PISTON RING SET	IAF 0843	71005043	02 SET
11	BEARING	IAF 0814	74005012	01
12	“O” RING (FRONT)	IAF 0827	75005025	01
13	OIL SEAL	IAF 0816	75005014	01
14	BEARING COVER	IAH 0815	71005013	01
15	HEX BOLT (M8 x 20LG)	IAF 0817	74005015	06
16	“O” RING REAR	IAF 0842	75005042	01
17	BUSHING COVER	IAH 0839	71005039	01
18	THRUST WASHER	IAF 0819	74005017	01
19	SPACER PLATE	IAF 0820	71005018	01
20	DOWEL PIN	IAF 0826	74005024	04
21	INLET FINGER VALVE	IAF 0825	74005023	02
22	DISCHARGE VALVE	IAF 0821	72005019	02
23	VALVE STOPPER	IAF 0822	72005020	02
24	FLAT HEAD SCREW (M5)	IAF 0823	74005021	04
25	NUT (M5)	IAF 0824	74005022	04
26	GASKET SPACER PLATE	IAF 0834	75005032	01
27	AIR HEAD GASKET	IAH 0835	75005033	01
28	AIR HEAD	IAR 0833	71005031	01
29	HEX. BOLT (M10)	IAF 0828	74005026	06

11.4.6 Operation

The following instructions should be used by the operator as a guide for the general operation of the compressor. As the operator gains experience with the compressor under actual conditions, a set routine should be established. After a general overhauling or installation of new parts, the operator should be guided by the instructions as though the compressor was new.

Initial Start:

IMPORTANT

It is very important that the intake piping be clean and properly installed. It is essential that this be done after installation or relocation of the compressor and after a long shutdown or new parts installation

Preparation

When the installation of the compressor has been completed in accordance to the instructions given, carry out the following procedure before starting the machine.

1. Clean up the base from vehicle, and remove oil, dirt and dust from the exterior of the compressor.

2. Remove the air head and clean out with safety solvent every portion of the interior and the crankcase oil sump to ensure a clean interior, free from dust and dirt, which may have entered during shipping and installation. Never use waste or a linty cloth to clean the interior of the machine.

The running and finished parts inside the crankcase are covered with a heavy anti-rust compound previous to shipment. It is not necessary to remove this coating before starting the compressor, as it is soluble in the pump lubricating oil.

3. Fill the crankcase to the proper oil level on the oil sight glass with the recommended grade of crankcase lubricating oil. Pour oil over all the bearings, which can be easily reached through the frame or openings. On lubricated units, fill the cylinder lubricator with the recommended grade of air cylinder lubricating oil.

4. Prime the frame lubricating oil pump.

5. On lubricated units each cylinder force feed lubricator line must be disconnected at the point where it is attached to the oil inlet side of the check valve. The lubricator feeds must then be operated manually until all the air is forced out of the lines and oil appears. The lines should now be reconnected

and the lubricator given several additional turns to assure proper lubrication of the cylinder as soon as the compressor is started. Once the compressor is started, the oil lines will remain full of oil and require no further attention.

6. Drain the air intake pipe of any moisture, which may have accumulated. Be sure that the air intake filter if properly installed and protected.

7. Before starting a new compressor be sure you are familiar with the starting and stopping controls, and with the regulation and regulator controlling the load and no-load operation.

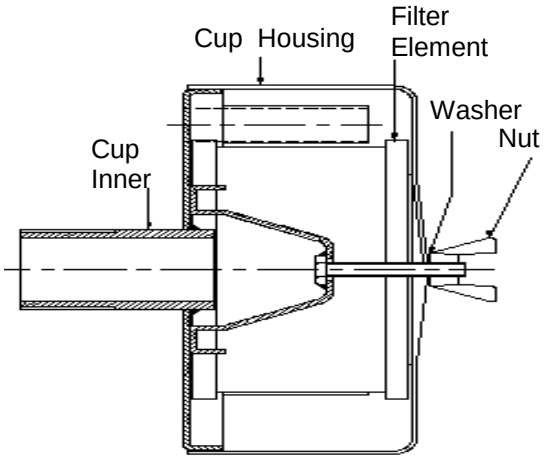
8. Check the machines thoroughly to be sure there are no loose parts and that the machine has not been tampered with since its erection.

9. The compressor lubricating oil is circulated under pressure from the vehicle engine lubricating oil system.

11.4.7 Accessories

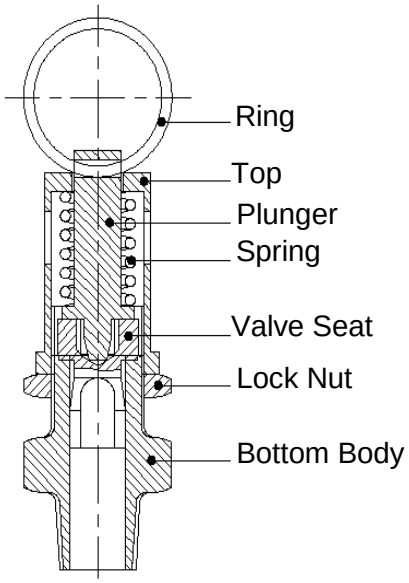
Inlet Air Filter

The air that is drawn into a compressor should be free from dust, dirt and abrasive or gritty particles that could damage cylinders, valves & moving parts. It is the purpose of the inlet filter to remove all such particles from the ambient air, in order to safeguard the performance of the compressor and prevent what might otherwise results in high maintenance costs and needless compressor down time. Suction air filters also helps in reducing the noise level of the compressors.



Safety Valve

Provided as a standard accessory on air head. Safety valve is set to open, when the maximum permissible delivery pressure of the compressor is exceeded, thus protecting compressor.



11.4.8 Piping

Discharge piping is considered to be the piping between the compressor and the system.

The discharge pipe should be of the full size as of the compressor outlet or larger and it should run directly to the system.

The discharge should be as short and direct as possible with long radius elbows, where bends are necessary.

All pipe fittings must be considered for the operating pressure. All pipe joints should be tight and having no leaks in discharge system, leaks will reduce output of the compressor. Leaks are easily located by squirting soap and water solution around all joints and watching for bubbles.

Where a bare compressor is supplied, it is very important to observe the following when installing the piping between the compressor and the system.

1. Never install a shut off valve (such as a gate or globe valve) between the compressor and the system unless a safety valve is put in the piping between the valve and the compressor.

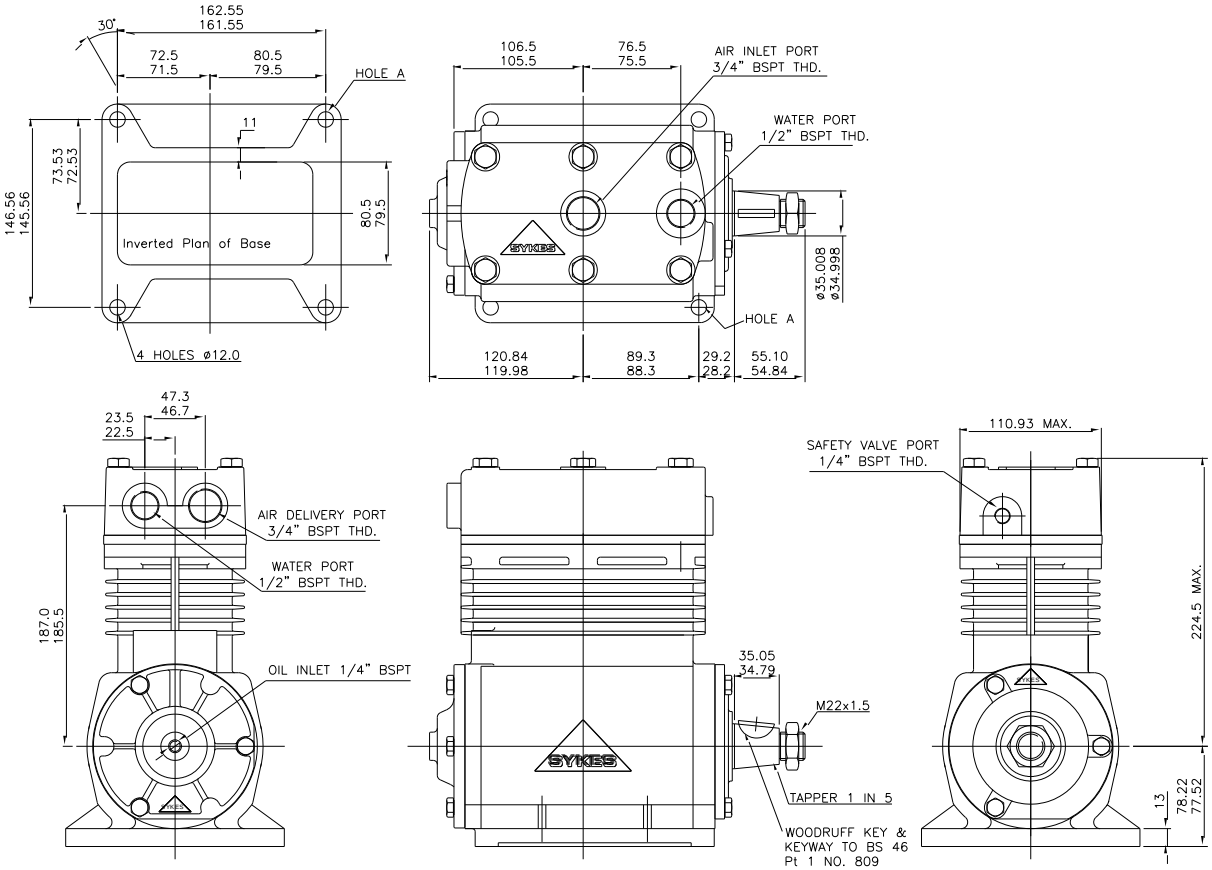
If possible, run the piping down from the compressor discharge to permit condensate to drain into the receiver. If this is not possible, install a “drain leg”. The drain leg should project down from the compressor discharge and be at least 10” long (254 mm). Put a drain valve at the end of this pipe and drain at least weekly, or as often as necessary.

The compressor should be mounted where the maximum air flow will pass over it to help in ensuring that the delivered air temperature does not exceed 220˚C.

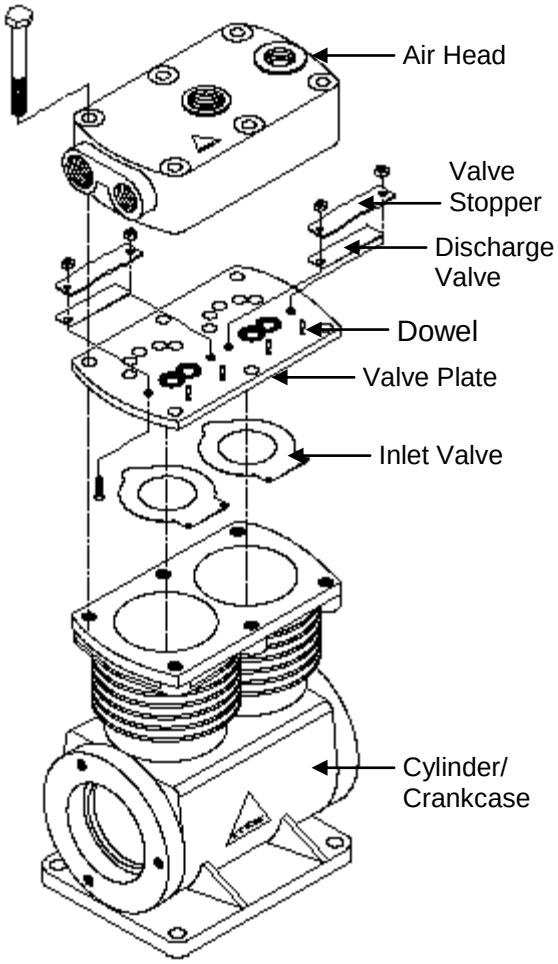
WARNING

DO NOT USE PLASTIC PIPE OR RUBBER HOSE AS DISCHARGE PIPE, AS THEY CAN RESULT IN MECHANICAL FAILURE, PROPERTY DAMAGE & SEVERE INJURY OR DEATH

11.4.9 Installation Dimensions



11.4.10 *Maintenance*



Valve Maintenance

The valves are efficient, durable, reliable and easily serviced. They are readily accessible and may be removed without disturbing piping.

To clean the valves, remove the airhead bolts and take out the head and valve plate from the cylinder. Remove the valves from the valve plate and clean both the valve and valve plate by brushing with a stiff bristle brush (not wire). If necessary, use a non- flammable safety solvent to loosen dirt, oil or carbon deposits.

Handle the valves with care and be careful not to dent or scratch them. While replacing a valve, make sure it will lie flat against the seating surface surrounding the valve slots; otherwise, the valve will leak, resulting in carbonization and reduced compressor output.

Maintenance

Before working on or around air brake systems and components always observe the following precautions:

1) Stop the engine before working on the compressor.
2) Keep hands away from actuator push rods and slack adjusters. They may apply as the system pressure drops.
3) Never connect or disconnect a hose or line containing air pressure. It may whip as air escapes.
4) Never remove a component or pipe plug unless you are certain all system pressure has been depleted.
5) Never exceed recommended air pressure.

6) Always wear safety glasses when working with air pressure. Never look into air jets or direct them at anyone.
7) Never attempt to dismantle a component until you have read and understand recommended procedures.
8) Some units contain powerful springs and injury can result if not properly dismantled.
9) Use only the correct tools and observe all precautions pertaining to the use of these tools.

At Pump services intervals check the compressor for any leakages of water, oil, or air. If the compressor is slow to build up pressure the cylinder head and valve plate may be removed.

The condition of the valve assemblies and the cylinder bores may then be checked and any excessive build up of carbon removed. Service kits of replaceable items are available on request.

Basic Assembly Procedure

1) Place Bearing into the Frame.
2) Insert Crank Shaft from the opposite side of the Bearing.
3) Enclose with the Bushing Cover & Bearing Cover on both sides.
4) Insert the sub assembly of the Piston & Con-Rod on the Crank Shaft from the Upper side of the Body.
5) For all bolts adhere to the table below.

SR. NO.	DESCRIPTION	Torque Setting			
		N.m		*Ft.lbs*	
		Min	***Max***	***Min***	***Max***
6	Con-Rod Bolts	8.1	9.5	6	7
15	Side Cover Bolt	16.3	19.0	12	14
29	Head Cover Bolt	28.5	32.6	21	24

11.4.11 Fitting Instructions – Compressor Assembly

1. Ensure all items are clean and that the hoses are free from foreign matter.

2. Do not use excessive jointing compound (eg. Stag, Neolite, Non-Adhesive Hermatite etc) when fitting these items and ensure that it does not enter the bores. This may cause a blockage in the oil or air lines.

3. Fit gasket to the compressor position on adaptor and secure with fasteners.

4. Secure the compressor pulley to the compressor with the nut and split pin. Remove the taperlock bush from the pump pulley then pass the pulley over the shaft. Ease the belt over the pulleys, and fit the key. Align the pulleys then refit the taperlock bush to the pump pulley and secure it to the shaft.

5. Remove and discard four cylinder head screws from the compressor and ensure the compressed air port is located at the opposite end to fan.

6. Connect the compressed air hose between the compressor and the jet sleeve.

7. Fit the oil pipe fittings to the compressor.

8. Connect air intake fittings.

9. Secure the guard with screws. Ensure that the belt and pulleys are free to rotate.

11.4.12 Compressor Belt Replacement

Timing Belt Procedure

1. Remove pulley guard set screws and pump support nuts and draw pump assembly away from engine flywheel housing

2. Remove old belt and taper lock bush from pump pulley.

3. Ease replacement belt over pulleys, realign pulleys and refit taper lock bush.

4. Check belt tension then refit pump unit onto engine.

5. The compressor tooth belt drive has fixed centres so no adjustment is necessary. The normal operating air pressure is 2.75 - 4.13 bar (40-60psi).

Link Belt Procedure

1 Remove pulley guard and old belt.

2 Place belt around pulleys without creating any tension.

3 Count the number of links and remove 7% (1 in 14).

4 Place belting around pump shaft and link up.

5 Fit around drive pulley and over compressor pulley rotating the drive shaft slowly.

The normal operating air pressure is 2.75 -

12 Pump Diagnostics

12.1 Trouble Shooting Guide

Pump System Problems	Likely Cause
➢ *Pump Does Not Prime*	- Suction lift too great - Inlet of suction pipe insufficiently submerged - Suction inlet or strainer blocked - Excessive amount of air or gas in liquid - Viscosity and / or S.G. of liquid being pumped too high - Suction line not air tight - Suction hose collapsed - Non return valve ball not seating - Mechanical seal / Packing drawing air into pump - Pump's priming system blocked or badly worn - Separation tank cover blocked - Pump's priming hose leaking air - Pump's priming system not delivering sufficient air - Pump's priming system belt drive faulty
➢ *Not Enough Liquid*	- Incorrect engine speed - Discharge head too high - Suction lift too great - Suction inlet or strainer blocked - Suction line not air tight - Suction hose collapsed - Mechanical seal drawing air into pump - Obstruction in pump casing / impeller - Impeller excessively worn - Delivery hose punctured or blocked - Pump not primed - Air pockets in suction line - Inlet of suction pipe insufficiently submerged - Excessive amount of air or gas in liquid

Pump System Problems	Likely Cause
➢ *Not Enough Pressure*	- Speed too low - Excessive amount of air or gas in liquid - Incorrect direction of rotation - Viscosity and / or S.G. of liquid being pumped too high - Impeller Damaged - Impeller out of balance
➢ *Pump Ceases to Deliver Liquid After a Time*	- Suction lift too great - Insufficient water at suction inlet - Suction inlet or strainer blocked - Suction hose collapsed - Excessive air leak in suction line - Mechanical seal / Packing drawing air into pump - Obstruction in pump casing / impeller - Delivery hose punctured or blocked
➢ *Pump Takes Excessive Power*	- Engine speed too high - Obstruction between impeller and casing - Viscosity and / or SG of liquid being pumped too high - Incorrect direction of rotation - Misalignment - Shaft bent
➢ *Pump Leaking at Mechanical Seal Housing*	- Mechanical seal damaged or worn
➢ *Pump Bearings Have Short Life*	- Obstruction in pump casing / impeller - Impeller out of balance - Shaft bent - Shaft running of centre because of worn bearings or misalignment - Misalignment - Bearings worn - Excessive thrust caused by mechanical failure inside pump - Lack of bearing lubrication - Incorrect assembly of stacked bearings, i.e. angular contact ball bearings fitted front-to-front instead of back-to-back - Dirt in bearings - Rusting of bearings from water in housing

Pump System Problems	Likely Cause
➢ *Pump Vibrating or Overheating*	- Engine speed too high - Obstruction in pump casing / impeller - Impeller damaged - Cavitation due to excessive suction lift - Impeller out of balance - Shaft bent - Shaft running of centre because of worn bearings or misalignment - Misalignment - Bearings worn - Pump not primed - Pump or suction pipe not completely filled with water - Inlet of suction pipe insufficiently submerged - Suction or discharge re-circulation in volute - Excessive thrust caused by mechanical failure inside pump - Lack of bearing lubrication - Incorrect assembly of stacked bearings, i.e. angular contact ball bearings fitted front-to-front instead of back-to-back - Dirt in bearings - Rusting of bearings from water in housing

13 PUMP UNIT SUB-ASSEMBLY

H	Volute & Front Cover Separation Tank
MA	Bearing Bracket
EP	Ejector Pack
V	Non Return Ball Valve
AC	Compressor Assembly

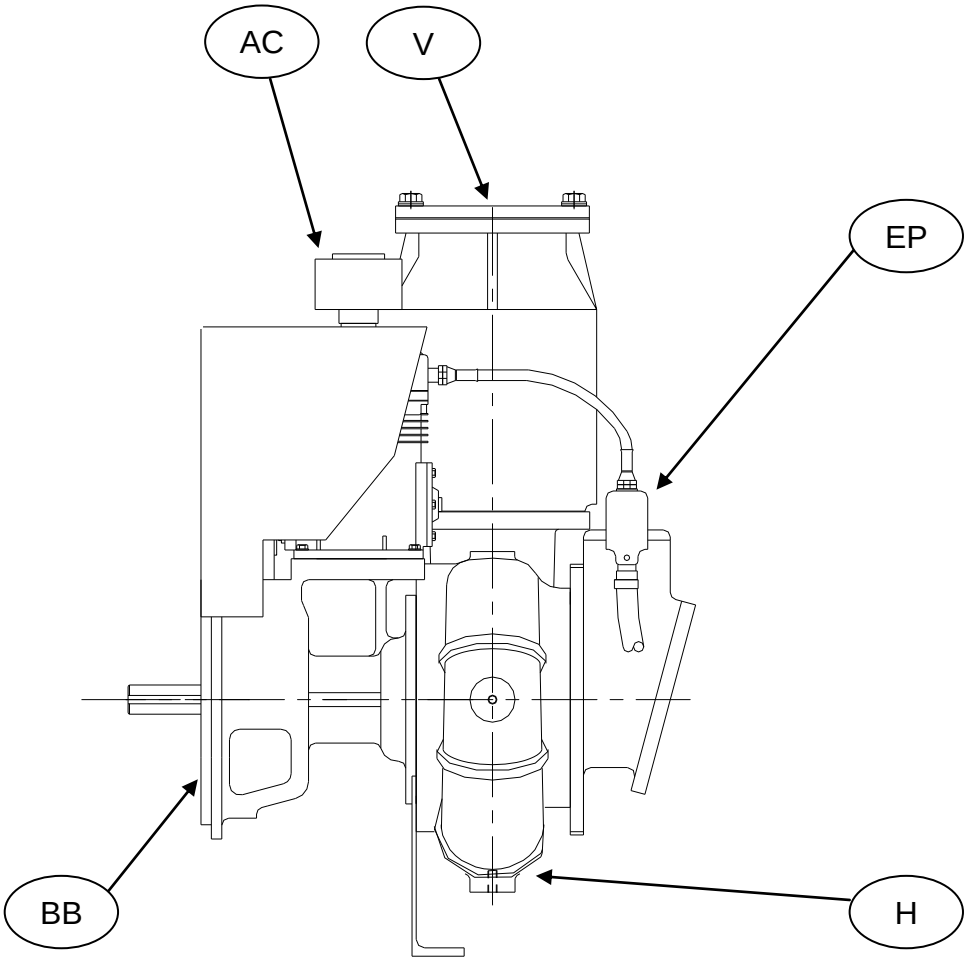


Figure 2 - Typical MV150i Pumpend

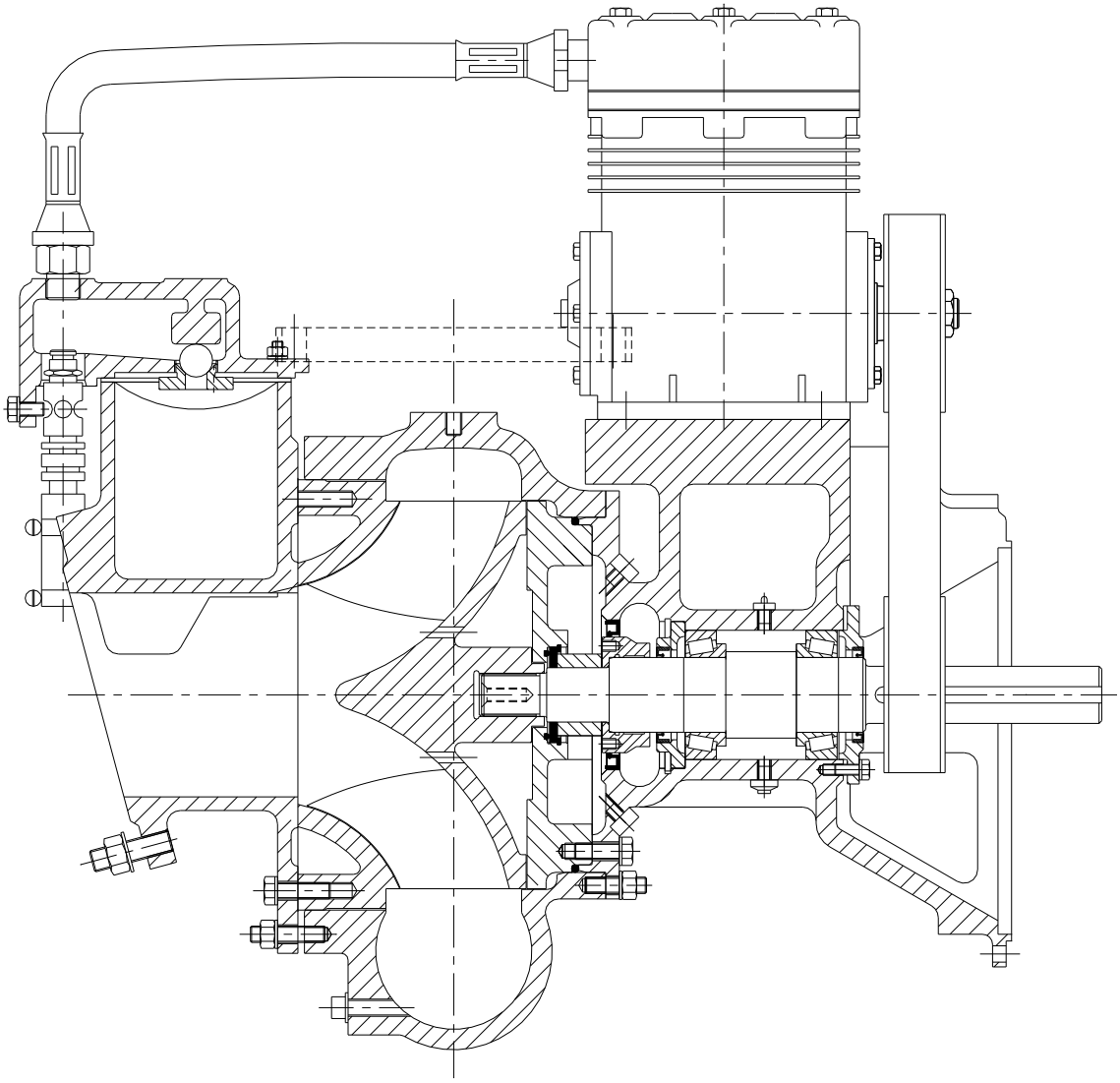


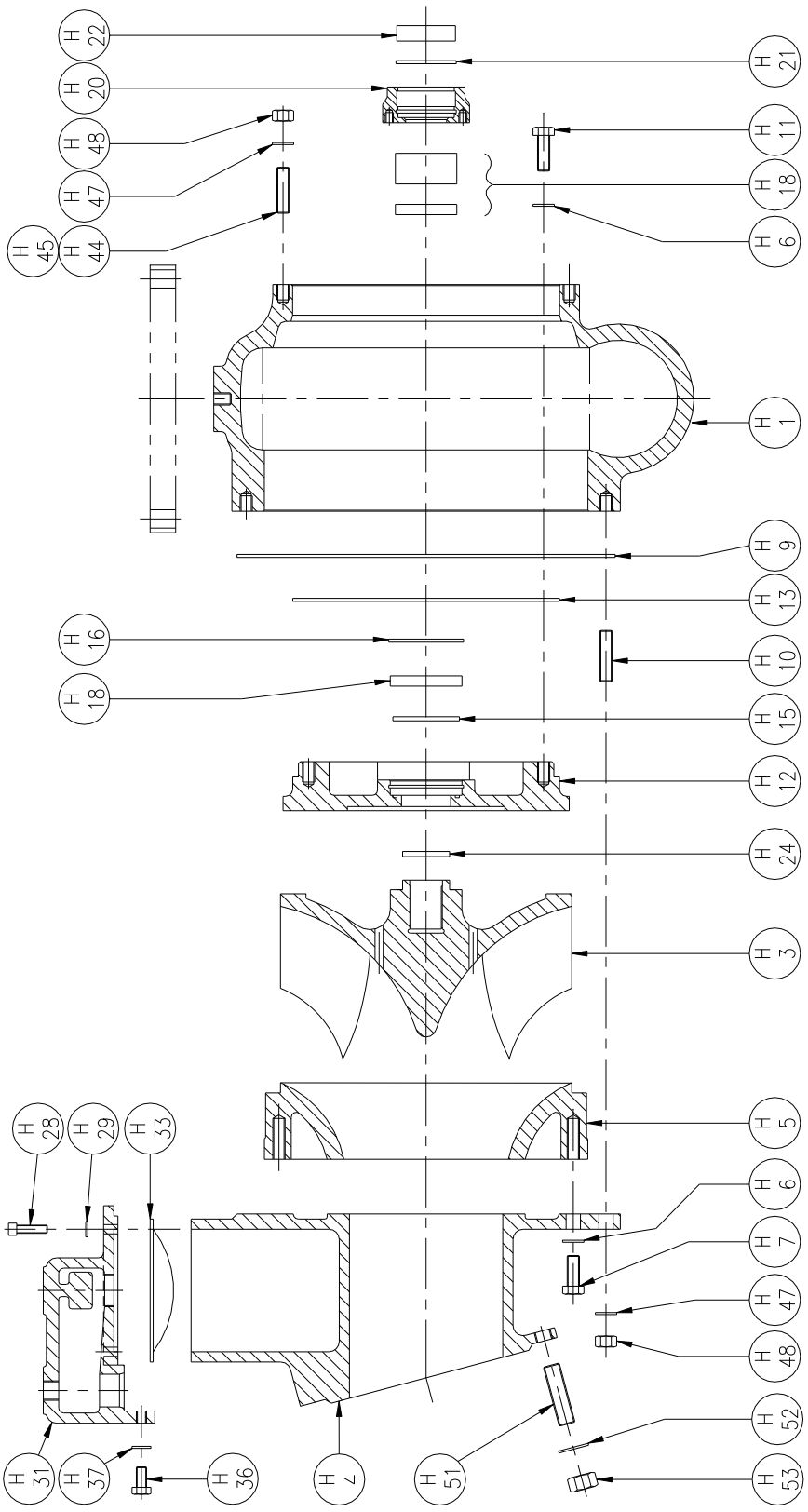
Figure 3 – MV150i General Assembly Drawing

14 PARTS LIST

14.1 Recommended MV150i Pump Spare Parts

Description	Part Number	Quantity
Impeller	CP150I-316-C-255MM	1
Front Wear Plate	CP150FWP-316	1
Rear Wear Plate	12-0284-0115	1
'O' Ring (Seat)	38-0700-4112	1
Joint	38-1034-5413	2
Joint	38-1034-5423	2
Joint	38-1034-5443	2
Sealing Washer SS	38-0785-4412	8
'O' Ring (Sealing Washer SS)	38-0787-4112V	8
Mechanical Seal	38-0400-VS2S2/SS	1
Impeller Shim	36-0646-8913	3
Impeller Shim	36-0646-8923	3
Impeller Shim	36-0646-8933	3
'O' Ring (Rear Wear Plate)	38-1004-4112	1
Circlip (Seat)	41-0230-8712	1
Belt (Compressor)	26-0840-9912	1
Gasket (Compressor)	KX2542/1	1

14.2 Front Cover and Volute Parts List



FRONT COVER AND VOLUTE PARTS LIST			
Illustration number	**Description**	**Part Number**	**Quantity**
H1	Volute (Pump Body)	CP150V-SGI	1
H3	Impeller	CP150I-316-C-255MM	1
H4	Front Cover & Separation Tank	11-0259-0115	1
H5	Wearplate (Front)	CP150FWP-316	1
H6	O-Ring Sealing Washer M12	38-0785-4412	8
	O-Ring OR11x3 Viton	38-0787-4112V	8
H7	Stud M12 x 50		4
H9a	Joint (Body)	38-1034-5413	A/R
H9b	Joint (Body)	38-1034-5423	A/R
H9c	Joint (Body)	38-1034-5443	2
H10	Stud (Body) M12 x 60		6
H11	Stud M12 x 45		4
H12	Wearplate (Rear)	12-0284-0115	1
H13	O-ring (Wearplate)	38-1004-4112	1
H15	O-ring (Seat)	38-0700-4112	1
H16	Circlip (Seat)	41-0230-8712	1
H18	Mechanical Seal	38-0400-VS2S2/SS	1
H20	Shaft Collar	28-0255-3215	1
H21	O-ring (Collar)	38-1036-4112	1
H22	Tolerance Ring	41-0241-6112	1
H24a	Impeller Shim 0.25mm	36-0646-8913	A/R
H24b	Impeller Shim 0.5mm	36-0646-8923	A/R
H24c	Impeller Shim 1.0mm	36-0646-8933	A/R
H28	Skt Hd Capscrew		4
H29	Flat Washer M8		4
H30	N/A		
H31	Separation Tank Cover	21-0230-7915	1
H33	Filter (Separation Tank)	23-0586-9923	1
H36	Setscrew M10 x 20		1
H37	Lockwasher M10		1
H44	Stud (Pump/Adaptor) M12 x 45		4
H45	Stud (Pump/Adaptor) M12 x 55		2
H47	Lockwasher M12		12
H48	Nut M12		12
H51	Stud (Flange) M16 x 60		8
H52	Lockwasher M16		8
H53	Nut M16		8

14.3 Bearing Bracket and Shaft Parts List

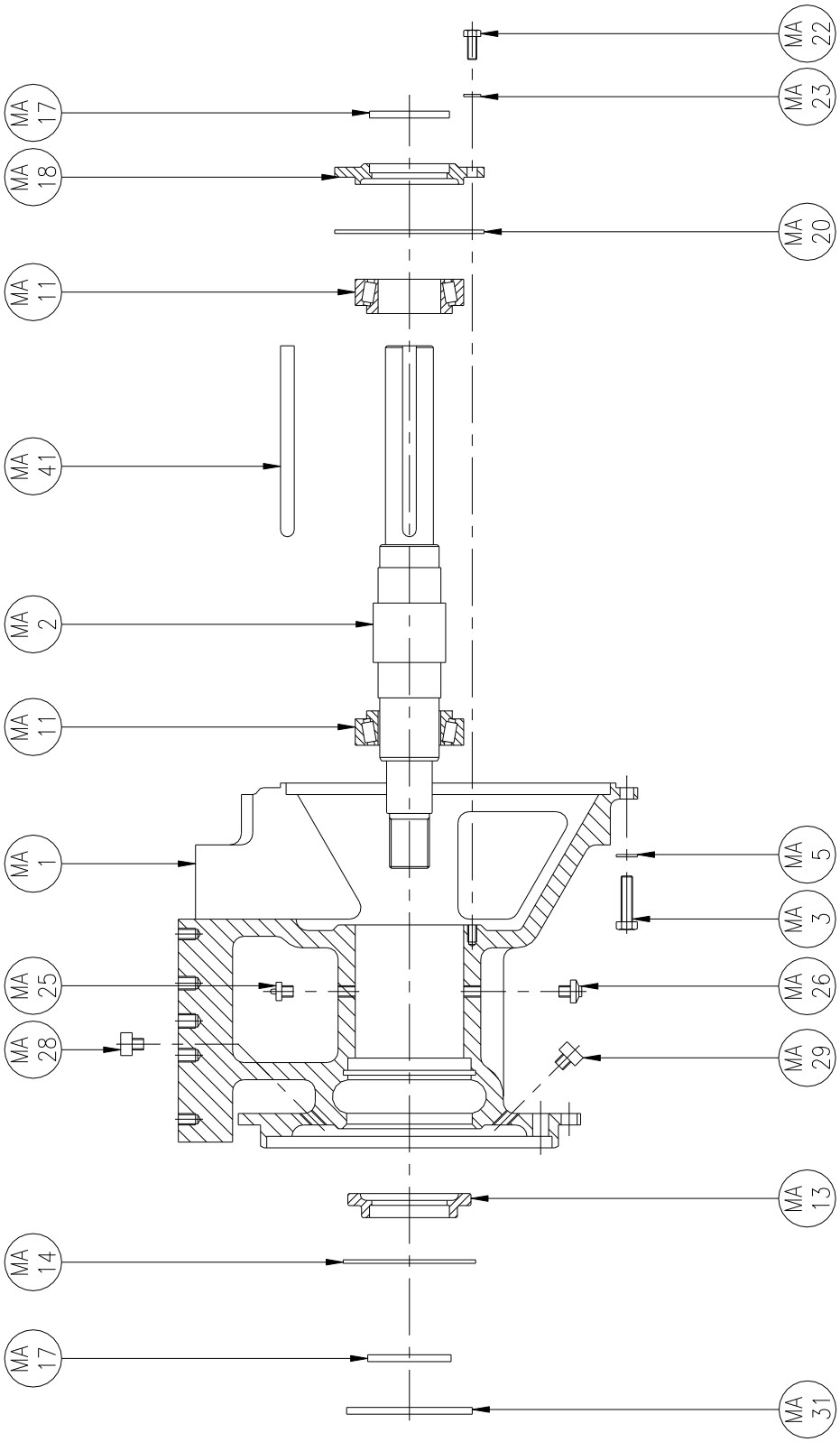


Figure 5 –Bearing Bracket Exploded Assembly Drawing

BEARING BRACKET & SHAFT PARTS LIST			
Illustration Number	**Description**	**Part Number**	**Quantity**
MA1	Engine Adaptor	13-0174-0215	1
MA2	Shaft (* see note below)	16-0400-8011-R4R	1
MA3	Setscrew M10 x 30		9
MA5	Lockwasher 10mm		9
MA11	Taper Roller Bearing	39-0069-9912	2
MA13	Bearing Cover (Front)	13-0172-0915	1
MA14	Circlip	41-0232-8712	1
MA17	Spiroseal	38-0809-4112	2
MA18	Bearing Cover (Rear)	13-0173-0115	1
MA20	Shim (Bearing Cover)	36-0650-9903	A/R
MA20a	Shim (Bearing Cover)	36-0650-9913	A/R
MA20b	Shim (Bearing Cover)	36-0650-9923	A/R
MA20c	Shim (Bearing Cover)	36-0650-9933	A/R
MA20d	Shim (Bearing Cover)	36-0650-9943	A/R
MA22	Setscrew M8 x 25		3
MA23	Lockwasher 8mm		3
MA25	Grease Nipple	51-0003-8112	1
MA26	Relief Valve	51-0010-2012	1
MA28	Plug 3/8" BSP	43-1048-4515	1
MA29	Plug 3/8" BSP		1
MA31	Spiroseal	38-1033-4112	1
MA41	Key		1

**** Note:***
When ordering Shaft state pump engine type so correct type of shaft length can be supplied.

14.4 Ejector Package Parts List

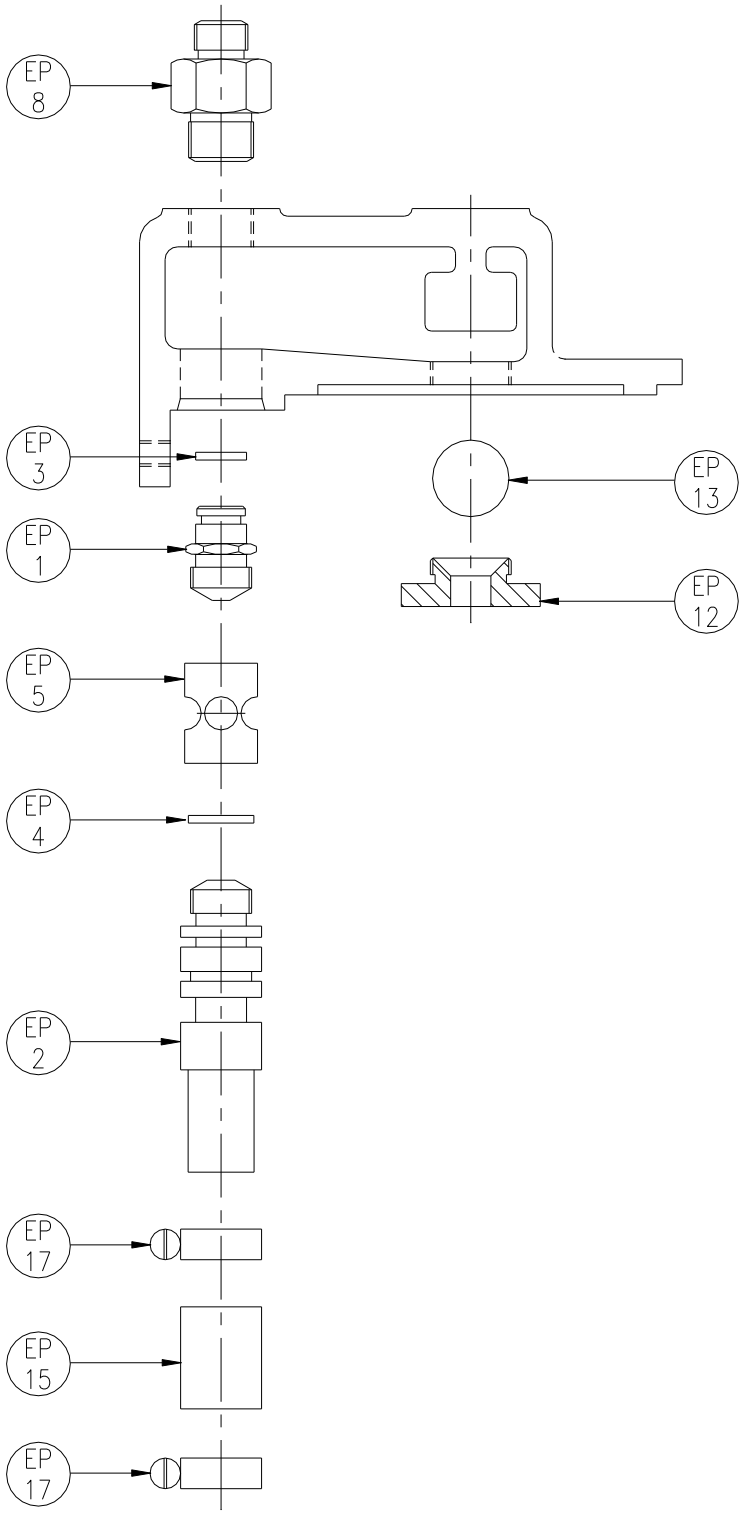
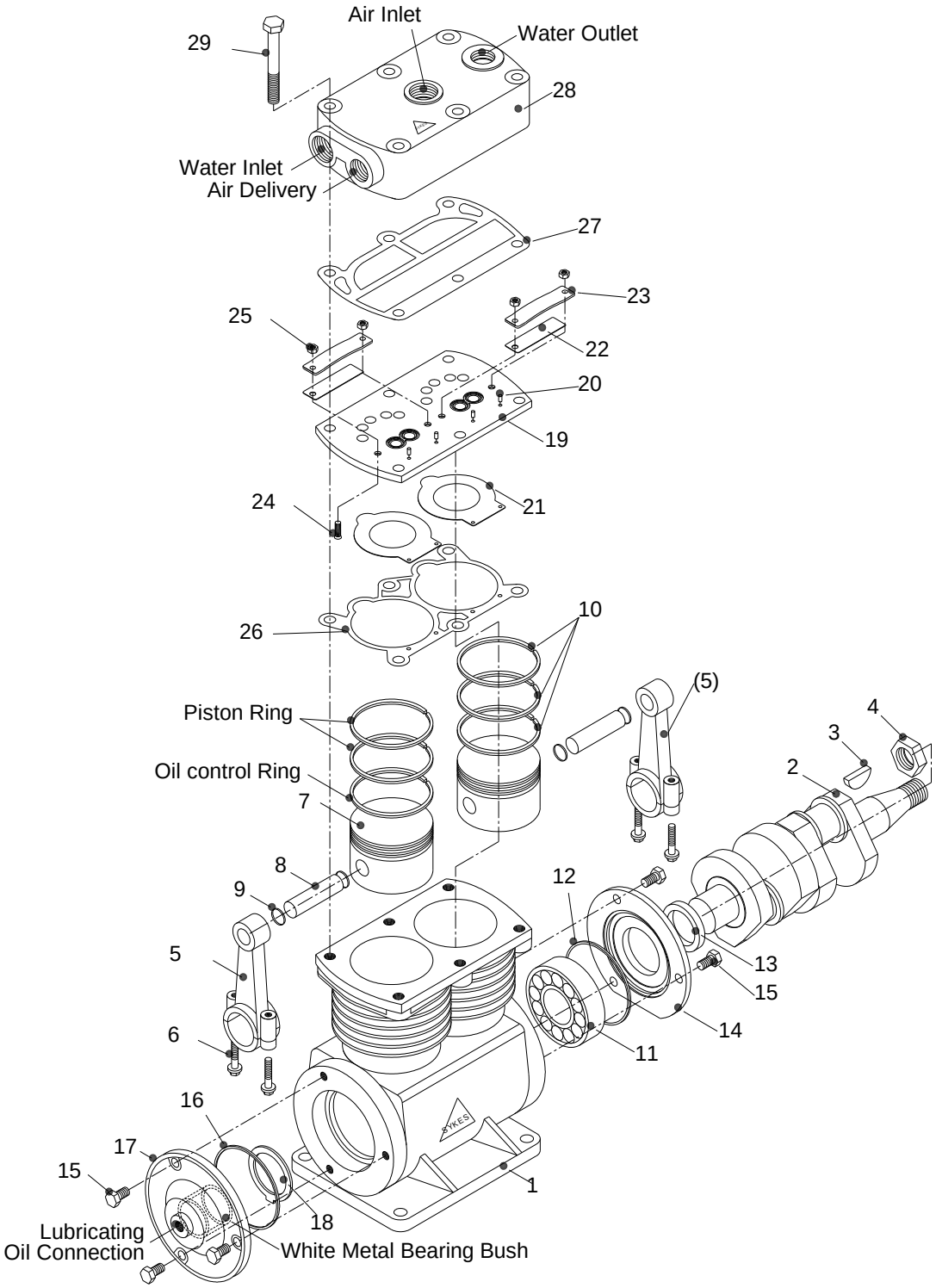


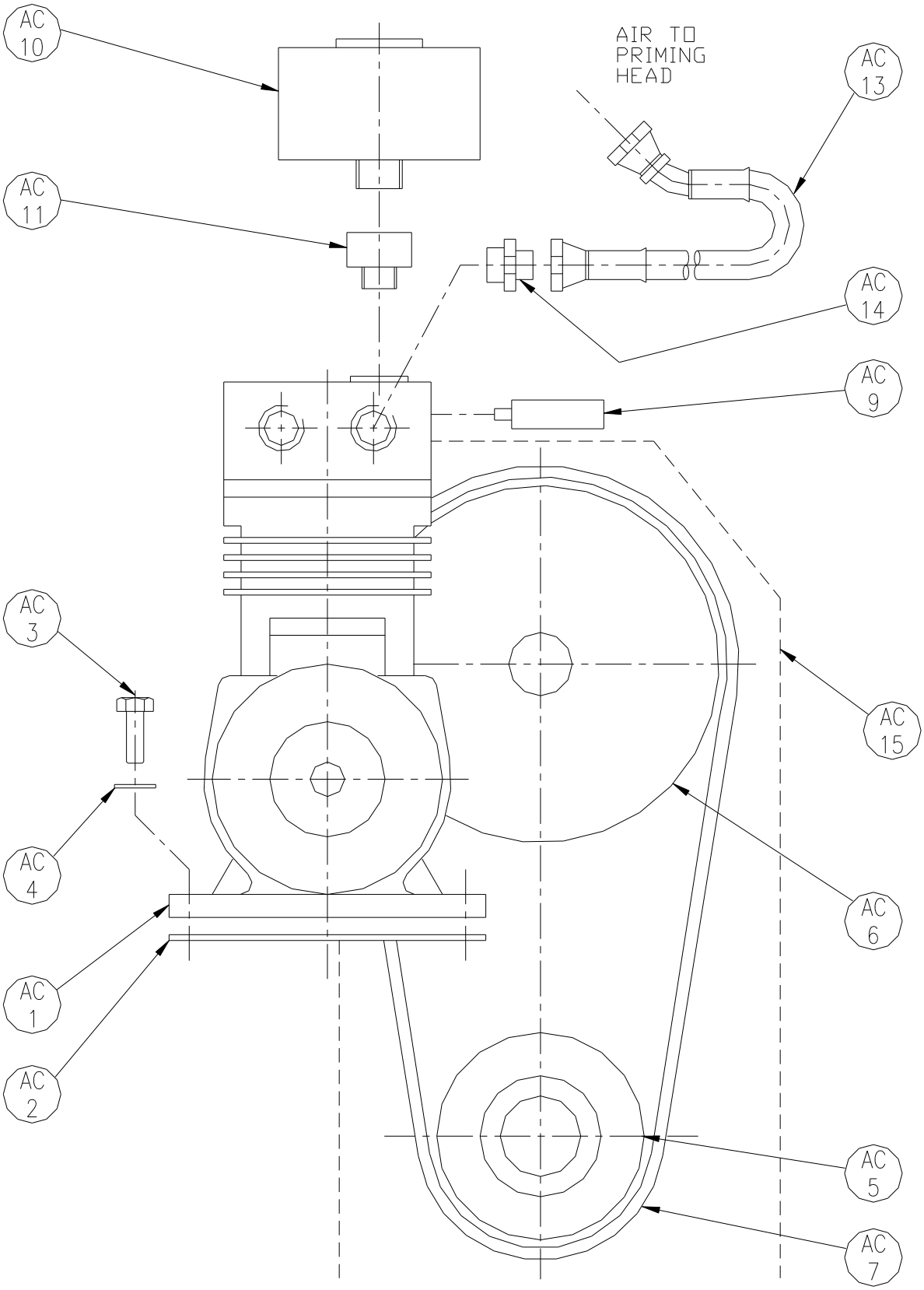
Figure 6 – Ejector Package Exploded Assembly Drawing

EJECTOR PACKAGE PARTS LIST			
Illustration Number	**Description**	**Part Number**	**Quantity**
EP1	Ejector Jet	23-0568-2016	1
EP2	Ejector Nozzle	23-0571-2016	1
EP3	O-ring (Jet)	38-1013-4112	1
EP4	O-ring (Nozzle)	38-1014-4112	1
EP5	Ejector Collar	23-0570-2011	1
EP8	Jet Sleeve	23-0567-2011	1
EP12	Ball Seat	23-0412-2011	1
EP13	Ball	39-0641-4113	1
EP15	Toyo Hose		1
EP17	Hose Clamp		2
	Vacuum Gauge	001-0003	1

14.5 Compressor Parts List



SR. NO.	DESCRIPTION	PART NO.	CCN NO.	QTY
1	CYLINDER/CRANKCASE	IAR 0803	71005001	01
2	CRANK SHAFT	IAH 0804	71005002	01
3	CRANK SHAFT KEY	IAF 0832	74005030	01
4	CRANK SHAFT NUT	IAF 0830	74005028	01
5	CONNECTING ROD	IAH 0805	71005003	02
6	ALEN CAP SCREW (M6 x 32LG)	IAF 0806	74005004	04
7	PISTON (STD)	IAH 0807	71005005	02
8	PISTON PIN	IAF 0808	71005006	02
9	PISTON PIN LOCK RING	IAF 0809	74005007	04
10	PISTON RING SET	IAF 0843	71005043	02 SET
11	BEARING	IAF 0814	74005012	01
12	“O” RING (FRONT)	IAF 0827	75005025	01
13	OIL SEAL	IAF 0816	75005014	01
14	BEARING COVER	IAH 0815	71005013	01
15	HEX BOLT (M8 x 20LG)	IAF 0817	74005015	06
16	“O” RING REAR	IAF 0842	75005042	01
17	BUSHING COVER	IAH 0839	71005039	01
18	THRUST WASHER	IAF 0819	74005017	01
19	SPACER PLATE	IAF 0820	71005018	01
20	DOWEL PIN	IAF 0826	74005024	04
21	INLET FINGER VALVE	IAF 0825	74005023	02
22	DISCHARGE VALVE	IAF 0821	72005019	02
23	VALVE STOPPER	IAF 0822	72005020	02
24	FLAT HEAD SCREW (M5)	IAF 0823	74005021	04
25	NUT (M5)	IAF 0824	74005022	04
26	GASKET SPACER PLATE	IAF 0834	75005032	01
27	AIR HEAD GASKET	IAH 0835	75005033	01
28	AIR HEAD	IAR 0833	71005031	01
29	HEX. BOLT (M10)	IAF 0828	74005026	06



COMPRESSOR ASSEMBLY

COMPRESSOR PARTS LIST

Illustration Number	Description	Part Number	Quantity
AC1	Compressor (Bendix)	49-0523-9915	1
AC2	Gasket	KX2542/1	1
AC3	Stud M10 x 40		4
AC4	Springwasher M10		4
AC5	Pump Pulley c/w TLB	26-0851-9912	1
AC6	Compressor Pulley	26-0724-0243	1
AC7	Belt 38wide x 78 teeth (1/2” Heavy Pitch)	26-0840-9912	1
AC8	Fan Washer	36-0556-8111	1
AC9	Relief Valve	10-0000-0004	1
AC10	Air Cleaner	54-0556-9912	1
AC11	Adaptor (Air Cleaner)	A1212	1
AC13	Compressed Air Hose	42-0000-0004	1
AC14	Nipple ¾” BSP x ½” BSP	N1208H	1
AC15	Pulley/Belt Guard	27-2800-1000	1

14.6 Reflux Box Non Return Valve Parts List

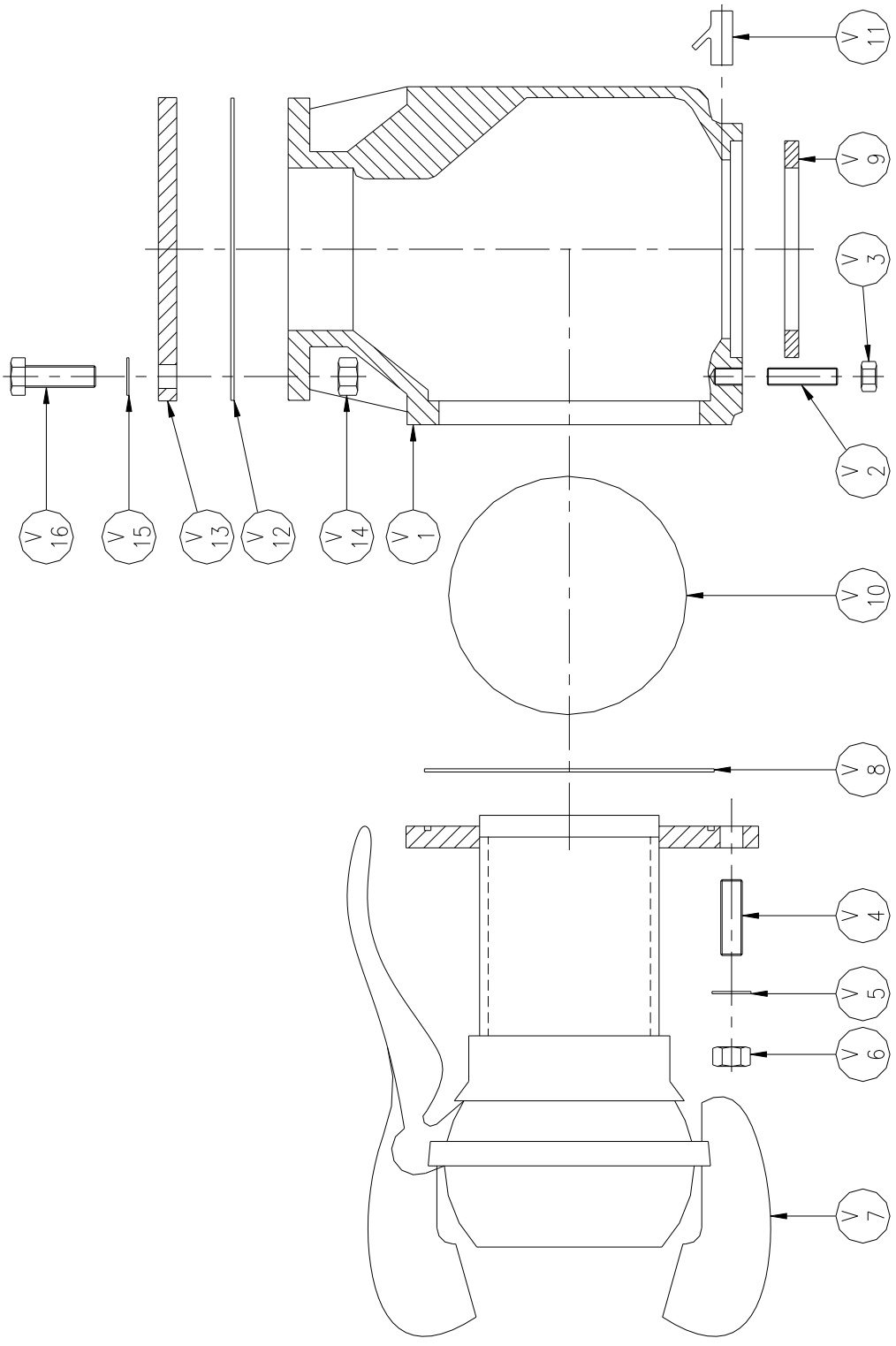


Figure 8 – Reflux Box Non Return Valve Exploded Assembly Drawing

REFLUX BOX NON RETURN VALVE PARTS LIST			
Illustration Number	**Description**	**Part Number**	**Quantity**
	REFLUX BOX COMPLETE	356-6000	
V1	Reflux Box	356-4061	1
V2	Stud M16 x 65		8
V3	Nut M16		8
V4	Stud M20 x 70		4
V5	Flat Washer M20		4
V6	Nut M20		4
V7	Reflux Box Discharge (Optional)	356-4064	1
V8	O-Ring	356-4153	1
V9	Reflux Box Seat	356-4063	1
V10	Reflux Box Ball	313-4169	1
V11	Drain Cock	920-9242	1
V12	Joint	500-4051	1
V13	6" T.E Blank Flange	FB150TE	1
V14	Nut M16		8
V15	Washer M16		8
V16	Bolt M20 X 70		8

14.7 Engine Coupling Parts List

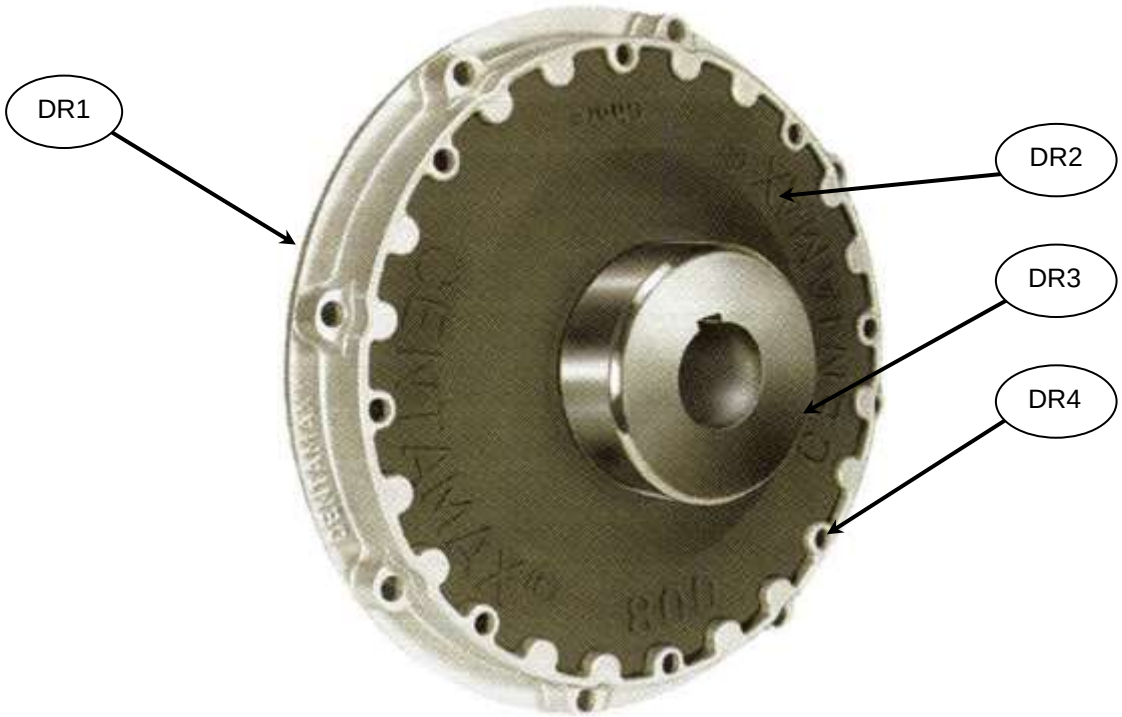


Figure 9– Engine / Pump Coupling Drawing

ENGINE / PUMP COUPLING PARTS LIST			
Illustration Number	**Description**	**Part Number**	**Quantity**
	Complete Coupling Assembly	CM-240-50-10-42	1
DR1	Flywheel Flange	CM-0240-FL1-10	1
DR2	Coupling Rubber Element	CM-0240-EL-50	1
DR3	Hub (to suit 42mm shaft)	CM-0240-H-SB1-42	1
DR4	Bolt Set to suit Hub	CM-0240-BS	1

14.8 Chassis & Accessories

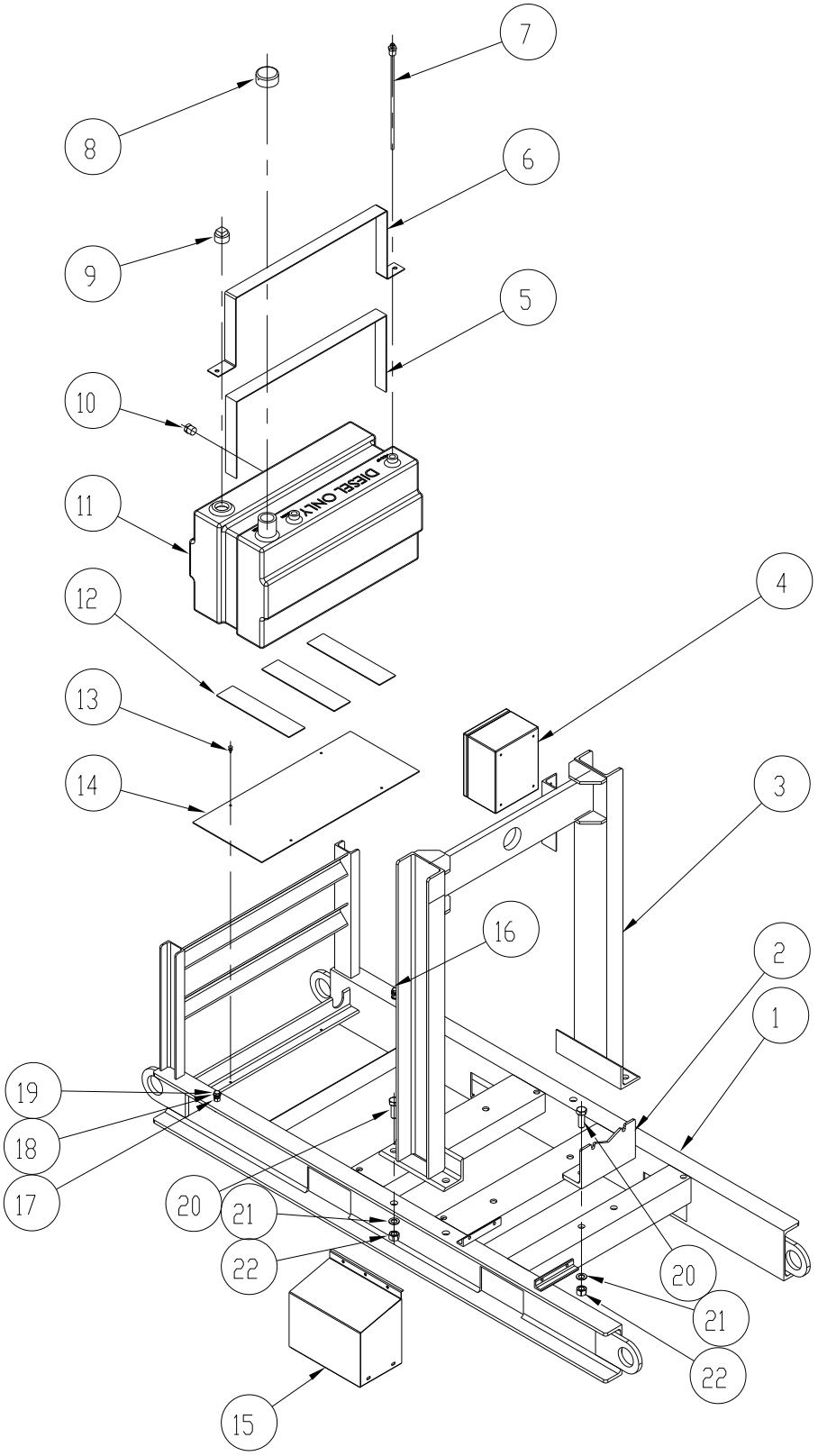


Figure 10 – Chassis Exploded Assembly Drawing

CHASSIS & ACCESSORIES PARTS LIST			
Illustration Number	**Description**	**Part Number**	**Quantity**
1	MV Chassis	MV-1000	1
2	Pump-End Support	MV-1020	1
3	MV - Lifting Frame	MV-1200	1
4	Control Box		1
5	MV - Sticky Back Rubber	MV-2005	1
6	GALVABOND SHEET 50 x 3	MV-2006	1
7	MV -Fuel Line Pickup	MV-2004	1
8	2" BSP Pipe Cap - Gal Mal c/w Breather	C50NB	1
9	Plug BSP GAL/MAL 1 1/2"	P24	1
10	Plug BSPT Black 3/4"	P12	1
11	80L Fuel Tank	MV-2001	1
12	MV - Rubber Insert for Fuel Tank	MV-2003	3
13	Magna Bulbs 6.5mmx1/4"	MV-2007	4
14	GALVABOND Sheet 320 x 3	MV-2002	1
15	Battery Box	340-8002	1
16	Bolt (M12x55)		1
17	Nut (M12)		5
18	Washer (M12)		6
19	Bolt (M12x65)		1
20	Bolt (M20x55)		6
21	Washer (M20)		6
22	Nut (M20)		6

15 PUMP UNIT ACCESSORIES

Your MV150iC Olympic pumpset has been mounted on a robust custom built skid chassis and comes complete with extras include.

Description		Part /Drawing Number
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		

For further information please refer to the manufacturer's Operation and Maintenance Manuals.

16 DIESEL ENGINE MANUAL

Your MV150iC Olympic pumpend is driven by a Deutz F3L912 Diesel Engine and comes complete with the following.

Description		Part/Drawing Number
1		
2		
3		
4		
5		

For further information please refer to the manufacturer's Operation and Maintenance Manuals.

17 ELECTRIC MOTOR MANUAL

N/A

Description		Part Number
1		
2		
3		
4		
5		

For further information please refer to the manufacturer's Operation and Maintenance Manuals.

18 WARRANTY CLAIM PROCEDURE

SYKES WARRANTY POLICY

Sykes Group warrants all manufactured product against faulty workmanship or material for a period of 12 months from the invoice date. Lip seals, “O” rings and other “rubber” components which age/degrade naturally over time may not be covered by Sykes warranty if the failure is a result of this natural aging/degrading

Subject to material inspection and completion of correct warranty claim forms, Sykes Group will re-supply faulty parts for claims arising from faulty workmanship or materials.
Sykes warranty does not cover any consequential losses due to product failure.

Sykes Warranty Notification Procedure;

1. Upon determining a failure, the end user will advise the Sykes Group representative of the failure and the cause.
2. A decision will be made as to if a serviceman is sent to site or the unit is returned to Sykes.
3. Freight is to be covered by the customer and a nil value order number raised to cover any non-warranty issues.
4. The end user will then be required to complete a Sykes Group warranty claim form, with all relevant information completed. (See attachment A and B).
5. Digital photos, if applicable, will be taken and attached to the warranty claim form, to document failure and allow for a clearer interpretation of the failure.
6. Upon receiving the warranty claim form and relevant documentation Sykes will review the cause of failure, and advise the end user of the status within a reasonable time period.

Warranty claim processing procedure:

1. The After Sales Service Manager will be the Primary Contact between the end user and Sykes Group for all matters, relating to warranty.
2. All correspondence will be done by or backed up with e-mail, so as to create easy tracking, Sykes claim form part A) and B) where applicable are to be completed and forwarded as an attachment to the relevant person.
3. The local Sykes Representative will be copied in on any warranty correspondence in there region.

Warranty Claim Form Part A

Customer		Date		Report No.	
Name		Date Purchased		Date of Failure	
Pump Description		Serial Number		Time Operated Hrs	
Description of Failure					

Failed Parts.

Part No.	Description	Qty

Please use Sykes partnumbers

Witnessed by Sykes Representative

This section to be completed by Sykes

Y/N	
	Ship to Sykes Group 42 Munibung Rd, Cardiff NSW 2285
	Retain for inspection by area representative or agent
	To be scrapped
	To be repaired on site by Sykes

Decision

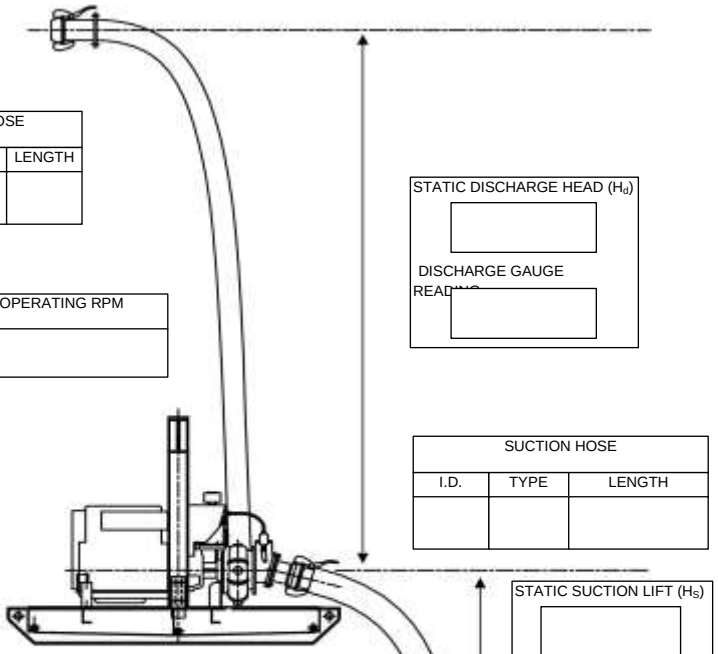
Decision pending upon inspection of defective parts

Claim Approved ____ Y/N Name ____ Date ____

Total Costs	Amount A$	Comments
Type of Cost		
Parts Used		
Other		
TOTAL		

Warranty Claim Form Part B

Warranty/Failure Report No. _____



DISCHARGE HOSE		
I.D.	TYPE	LENGTH

PUMP	OPERATING RPM

STATIC DISCHARGE HEAD (H_d)

DISCHARGE GAUGE READING

SUCTION HOSE		
I.D.	TYPE	LENGTH

STATIC SUCTION LIFT (H_S)

SUCTION GAUGE READING

STRAINER Y/N?

SUCTION RESTRICTIONS		DISCHARGE RESTRICTIONS	
TYPE	QTY	TYPE	QTY

Eg.

ELBOW	2	BUTT/W	1

LIQUID PUMPED		
S.G.	Ph	TEMP

19 MISCELLANEOUS ENGINEERING INFORMATION

19.1 Main Factors Affecting Pump Suction Lift

Pump's Suction Lift / NPSHR curve capabilities can be influenced by various factors in particular altitude (refer to *Table 1 – Effect of Altitude on Available Suction Lift*) and temperature of fluid being pumped (refer to *Table 2 – Effect of Temperature on Available Suction Lift*).

Sykes manufacture automatic self priming pumps where the available suction lift plays a critical part in the pump dynamic system.
Therefore, any increase in fluid temperature or altitude will adversely affect the available suction lift. The higher the temperature or altitude the greater the adverse affect on the available suction lift.

In addition, higher temperature will introduce thermal expansion of pump parts and reduce internal pump clearances.

Pump o-rings, gaskets and associated parts are rated as listed;

Viton	*Min -40 ^{o}C*	*Max 176 ^{o}C*
Buna N	*Min -4.4 ^{o}C*	*Max 121 ^{o}C*
Polyurethane	*Min -4.4 ^{o}C*	*Max 93.3 ^{o}C*
Teadit NA-1002 (Gasket Material)	*Min -29 ^{o}C*	*Max 260 ^{o}C*

Sykes recommend contacting Sykes Engineering Department with high fluid temperature (> 60 ^{o}C), altitude or any different applications to ensure the pump is correctly rated / set up.

Please note that Sykes Pump's Suction Lift / Net Positive Suction Lift Required (NPSHR) curves as published are based on standard clean water at 15^{o} C.

The below table show the effect of altitude on the Pump's Suction Lift / NPSHR curve capabilities;

Altitude (m)	**Reduction in Suction Lift (m)**
0	0
250	0.30
500	0.60
750	0.89
1000	1.16
1250	1.44
1500	1.71
1750	1.97
2000	2.22
2250	2.47
2500	2.71
2750	2.95
3000	3.18
3250	3.40
3500	3.62
(International Standard Atmosphere)	

Table 1 – Effect of Altitude on Available Suction Lift

Altitude

In basic terms, the higher the altitude the less atmospheric pressure resulting in a reduction of pressure differential between atmosphere and vacuum created in Sykes self priming system resulting in a reduction of available suction lift.

The below table show the effect of temperature on the Pump's Suction Lift / NPSHR curve capabilities;

Temperature (^oC)	**Reduction in Suction Lift (m)**
15	0
20	0.06
30	0.22
40	0.52
50	0.98
55	1.32
60	1.73
65	2.23
70	2.85
75	3.60
80	4.51
85	5.59
90	6.88
95	8.39
100	10.18
(For Water Relative to 15^oC)	

Table 2 - Effect of Temperature on Available Suction Lift

Temperature

In basic terms, the higher the water temperature the greater the reduction in suction lift due to changing water vapour pressure and density.

19.2 Pump Suction Pipe Velocity

Achieving correct suction pipe velocity is a significant part in obtaining satisfactory suction lift.
Any increase of velocity (i.e. increase in flow) will result in greater friction losses and adversely affect the available suction lift.
Sykes manufacture automatic self priming pumps where the available suction lift plays a critical part in the pump dynamic system and therefore it is essential to take suction pipe velocity into consideration.

Sykes recommend the maximum suction pipe velocity is 4 m/s.

This velocity is on the high side when comparing to other published recommended figures but Sykes supply, in most instances, mobile dewatering equipment. To achieve lower velocities would result in large hoses that would be difficult and impractical to transport or install.

For Example
A standard CP150i pump 108 l/sec – BEP at 1800 rpm:
150mm ID Pipe = 6.34 m/s
200mm ID Pipe = 3.57 m/s
250mm ID Pipe = 2.28 m/s

In this example it is recommended to use 200mm ID pipe to ensure satisfactory suction lift performance.

Please note that the suction pipe velocity is an important part of the suction lift set up but other factors also affect suction lift such as static suction lift, elbows, valves, pipe internal roughness etc. All these factors combined determine the available suction lift of the pump.

Please refer to enclosed tables for recommended pipe ID by pump type (refer to Table 1) and a generic flow versus pipe diameter chart (refer to Table 2).

	Suction Hose or Pipe Internal Dimension (ID) (mm)							
Pump Type	**80**	**100**	**150**	**200**	**250**	**300**	**350**	**400**
CP80i	18	32	40*					
CP100i		32	67*					
CP150i			70	125	173*			
CP220i				125	195	218*		
CP300i						280	380	444*
MH300						280	340*	
HH80	18	30*						
HH125			57*					
HH150				125	163*			
HH160i				125	185*			
HH220i				125	195	280*		
XH80	18	28*						
XH100			70	82*				
XH150				125	150*			

Table 1 – Recommended Pipe ID vs Flow Rates by Pump Type

- Matrix Unit of Measure of Flow = litres / second
- * = Maximum flow for pump type
- Recommendation based on maximum velocity = 4 m/s
- Suction pipe is based on Inside Diameter (ID)
- For high static suction lifts oversized suction pipe / hose may be required even at lower flow rates

This information this should be read in conjuction with the pump curve for reference to the pump's recommended operating flow rates

	PIPE INTERNAL DIMENSION (mm)											
FLOW	2"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"
(L/sec)	50	75	100	125	150	200	250	300	350	400	450	500
2	1.02	0.45	0.25	0.16	0.11	0.06	0.04	0.03	0.02	0.02	0.01	0.01
4	2.04	0.91	0.51	0.33	0.23	0.13	0.08	0.06	0.04	0.03	0.03	0.02
6	3.06	1.36	0.76	0.49	0.34	0.19	0.12	0.08	0.06	0.05	0.04	0.03
8	4.07	1.81	1.02	0.65	0.45	0.25	0.16	0.11	0.08	0.06	0.05	0.04
10	5.09	2.26	1.27	0.81	0.57	0.32	0.20	0.14	0.10	0.08	0.06	0.05
12	6.11	2.72	1.53	0.98	0.68	0.38	0.24	0.17	0.12	0.10	0.08	0.06
14	7.13	3.17	1.78	1.14	0.79	0.45	0.29	0.20	0.15	0.11	0.09	0.07
16	8.15	3.62	2.04	1.30	0.91	0.51	0.33	0.23	0.17	0.13	0.10	0.08
18	9.17	4.07	2.29	1.47	1.02	0.57	0.37	0.25	0.19	0.14	0.11	0.09
20	10.19	4.53	2.55	1.63	1.13	0.64	0.41	0.28	0.21	0.16	0.13	0.10
25	12.73	5.66	3.18	2.04	1.41	0.80	0.51	0.35	0.26	0.20	0.16	0.13
30	15.28	6.79	3.82	2.44	1.70	0.95	0.61	0.42	0.31	0.24	0.19	0.15
40	20.37	9.05	5.09	3.26	2.26	1.27	0.81	0.57	0.42	0.32	0.25	0.20
50	25.46	11.32	6.37	4.07	2.83	1.59	1.02	0.71	0.52	0.40	0.31	0.25
60	30.56	13.58	7.64	4.89	3.40	1.91	1.22	0.85	0.62	0.48	0.38	0.31
70	35.65	15.84	8.91	5.70	3.96	2.23	1.43	0.99	0.73	0.56	0.44	0.36
80	40.74	18.11	10.19	6.52	4.53	2.55	1.63	1.13	0.83	0.64	0.50	0.41
90	45.84	20.37	11.46	7.33	5.09	2.86	1.83	1.27	0.94	0.72	0.57	0.46
100	50.93	22.64	12.73	8.15	5.66	3.18	2.04	1.41	1.04	0.80	0.63	0.51
112	57.04	25.35	14.26	9.13	6.34	3.57	2.28	1.58	1.16	0.89	0.70	0.57
120	61.12	27.16	15.28	9.78	6.79	3.82	2.44	1.70	1.25	0.95	0.75	0.61
130	66.21	29.43	16.55	10.59	7.36	4.14	2.65	1.84	1.35	1.03	0.82	0.66
140	71.30	31.69	17.83	11.41	7.92	4.46	2.85	1.98	1.46	1.11	0.88	0.71
150	76.39	33.95	19.10	12.22	8.49	4.77	3.06	2.12	1.56	1.19	0.94	0.76
160	81.49	36.22	20.37	13.04	9.05	5.09	3.26	2.26	1.66	1.27	1.01	0.81
170	86.58	38.48	21.65	13.85	9.62	5.41	3.46	2.41	1.77	1.35	1.07	0.87
180	91.67	40.74	22.92	14.67	10.19	5.73	3.67	2.55	1.87	1.43	1.13	0.92
190	96.77	43.01	24.19	15.48	10.75	6.05	3.87	2.69	1.97	1.51	1.19	0.97
200	101.86	45.27	25.46	16.30	11.32	6.37	4.07	2.83	2.08	1.59	1.26	1.02
210	106.95	47.53	26.74	17.11	11.88	6.68	4.28	2.97	2.18	1.67	1.32	1.07
220	112.05	49.80	28.01	17.93	12.45	7.00	4.48	3.11	2.29	1.75	1.38	1.12
230	117.14	52.06	29.28	18.74	13.02	7.32	4.69	3.25	2.39	1.83	1.45	1.17
240	122.23	54.32	30.56	19.56	13.58	7.64	4.89	3.40	2.49	1.91	1.51	1.22
250	127.32	56.59	31.83	20.37	14.15	7.96	5.09	3.54	2.60	1.99	1.57	1.27
260	132.42	58.85	33.10	21.19	14.71	8.28	5.30	3.68	2.70	2.07	1.63	1.32
270	137.51	61.12	34.38	22.00	15.28	8.59	5.50	3.82	2.81	2.15	1.70	1.38
280	142.60	63.38	35.65	22.82	15.84	8.91	5.70	3.96	2.91	2.23	1.76	1.43
290	147.70	65.64	36.92	23.63	16.41	9.23	5.91	4.10	3.01	2.31	1.82	1.48
300	152.79	67.91	38.20	24.45	16.98	9.55	6.11	4.24	3.12	2.39	1.89	1.53
310	157.88	70.17	39.47	25.26	17.54	9.87	6.32	4.39	3.22	2.47	1.95	1.58
320	162.97	72.43	40.74	26.08	18.11	10.19	6.52	4.53	3.33	2.55	2.01	1.63
330	168.07	74.70	42.02	26.89	18.67	10.50	6.72	4.67	3.43	2.63	2.07	1.68
340	173.16	76.96	43.29	27.71	19.24	10.82	6.93	4.81	3.53	2.71	2.14	1.73
350	178.25	79.22	44.56	28.52	19.81	11.14	7.13	4.95	3.64	2.79	2.20	1.78
360	183.35	81.49	45.84	29.34	20.37	11.46	7.33	5.09	3.74	2.86	2.26	1.83
370	188.44	83.75	47.11	30.15	20.94	11.78	7.54	5.23	3.85	2.94	2.33	1.88
380	193.53	86.01	48.38	30.97	21.50	12.10	7.74	5.38	3.95	3.02	2.39	1.94
390	198.63	88.28	49.66	31.78	22.07	12.41	7.95	5.52	4.05	3.10	2.45	1.99
400	203.72	90.54	50.93	32.59	22.64	12.73	8.15	5.66	4.16	3.18	2.52	2.04
410	208.81	92.81	52.20	33.41	23.20	13.05	8.35	5.80	4.26	3.26	2.58	2.09
420	213.90	95.07	53.48	34.22	23.77	13.37	8.56	5.94	4.37	3.34	2.64	2.14
430	219.00	97.33	54.75	35.04	24.33	13.69	8.76	6.08	4.47	3.42	2.70	2.19
440	224.09	99.60	56.02	35.85	24.90	14.01	8.96	6.22	4.57	3.50	2.77	2.24
450	229.18	101.86	57.30	36.67	25.46	14.32	9.17	6.37	4.68	3.58	2.83	2.29

Matrix Unit of Measure is Velocity = metres / second

= Cells that can be changed - Password = pipe

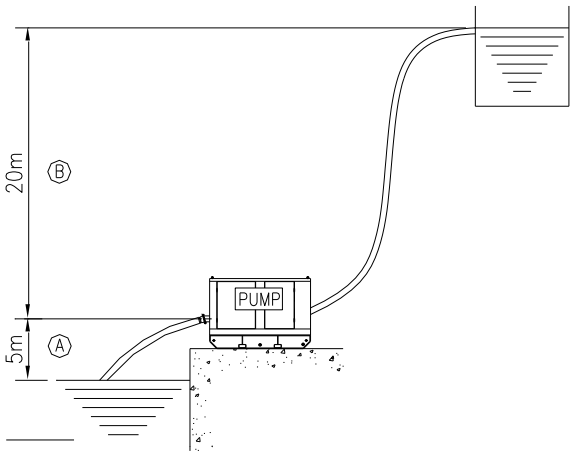
= Cells that can be changed - Password = flow

= Velocity > 4 m/s (in unmodified setting)

= Velocity < 4 m/s (in unmodified setting)

Table 2 – Flow vs Pipe ID Generic

19.3 Total Dynamic head Explanation Diagram



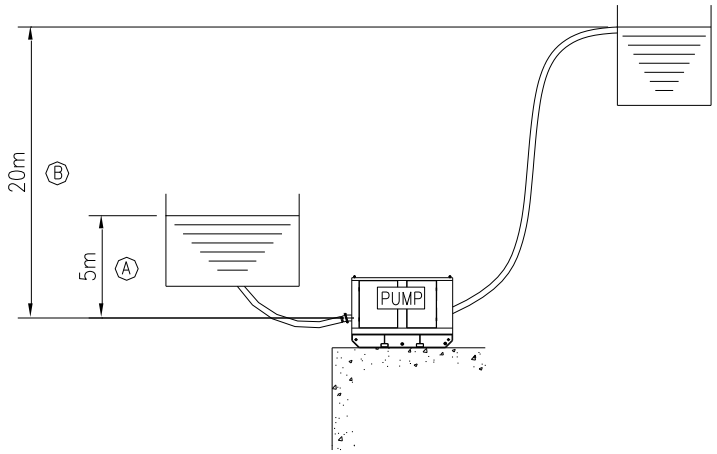
SUCTION LIFT

A = STATIC (5m) + LOSSES (1m) = 6m

B = STATIC (20m) + LOSSES (3m) = 23m

TOTAL DYNAMIC HEAD (TDH) = 23 + 6 = 29m

Suction Lift Set Up



SUCTION HEAD

A = STATIC (−5m) + LOSSES (1m) = −4m

B = STATIC (20m) + LOSSES (3m) = 23m

TOTAL DYNAMIC HEAD (TDH) = 23 + (−4) = 19m

Suction Head Set Up

19.4 pH Compatibility Chart

The abbreviation pH means 'hydrogen potential' – or the ability of the liquid to take up acidic hydrogen ions and become more acid.
The numbers used are the logarithms or the actual numbers, which would otherwise be in millions.

pH 7.0 is neutral.

An already acid solution cannot take up as much additional acid. Therefore pH less than 7.0 is acidic.

pH greater than 7.0 is alkaline.

As each change of 1 on the log scale is equivalent to 10 times on the linear scale, a linear scale, a solution of pH5 is ten times more acidic than a solution of pH6.

Similarly, pH4 is 100 times more acidic than pH6, and so on.

Wetted Material Compatibility Guideline for Metals

Fluid	**pH Level**	**Metals**
Alkaline	14 13 12 11	Stainless Steels
Caustic Basic	10 9	Cast Iron
Neutral	8 7 6	Aluminium
Acid	5 4	Cast Iron
	3 2 1 0	Stainless Steels

19.5 Jet and Nozzle Information

The results are for a standard compressor prime pump build with a Bendix Compressor.

PUMP TYPE	JET	NOZZLE	JET	NOZZLE
	23-0568-2016	23-0571-2016	23-0415-2016	23-0414-2036
CP80	✓	✓		
CP100	✓	✓		
CP150	✓	✓		
CP200	✓	✓		
CP300			✓	✓
CP300i			✓	✓
HH80	✓	✓		
HH100			✓	✓
HH125			✓	✓
HH150			✓	✓
HH160i			✓	✓
HH200			✓	✓
HH250			✓	✓
MH300			✓	✓
XH100			✓	✓
XH150			✓	✓

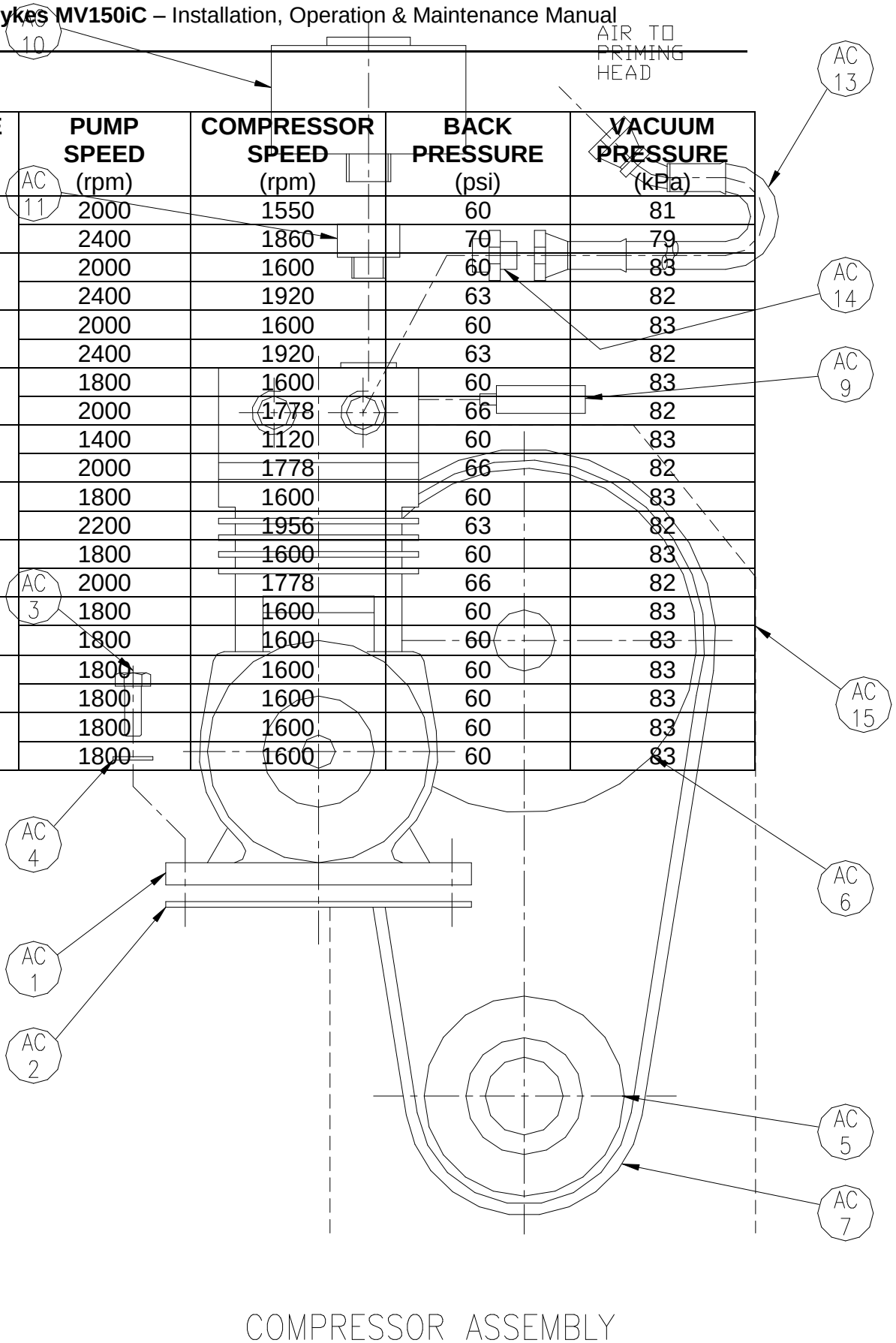
The following tables show the performance data for the complete compressor pump range at nominated speed (normal pump speed) and at maximum pump speed.
These results are for a standard compressor prime pump built (Bendix Compressor).

PUMP TYPE	COMPRESSOR / PUMP PULLEY RATIO
CP80	- 1.60
CP100	- 1.60
CP150	- 1.29
CP200	- 1.29
CP300	+ 1.56
CP300i	+ 1.56
HH80	- 1.29
HH100	- 1.25
HH125	- 1.25
HH150	- 1.125
HH160i	-1.125
HH200	- 1.125
HH250	- 1.125
MH300	- 1.125
XH100	- 1.125
XH150	- 1.125
- = Reducing Drive Ratio + = Increasing Drive Ratio	

PUMP TYPE	PUMP SPEED (rpm)	COMPRESSOR SPEED (rpm)	BACK PRESSURE (psi)	VACUUM PRESSURE (kPa)
CP80	2000	1250	50	83.5
	2400	1500	58	81.0
CP100	2000	1250	50	83.5
	2200	1375	54	82.0
CP150	1800	1395	54	82.0
	2200	1705	65	80.0
CP200	1800	1395	54	82.0
	2000	1550	60	81.0
CP300	1000	1560	59	82.5
	1200	1872	66	82.0
CP300i	1000	1560	59	82.5
	1200	1872	66	82.0

Figure 9– Engine Coupling Exploded Assembly

PUMP TYPE	PUMP SPEED (rpm)	COMPRESSOR SPEED (rpm)	BACK PRESSURE (psi)	VACUUM PRESSURE (kPa)
HH80	2000	1550	60	81
	2400	1860	70	79
HH100	2000	1600	60	83
	2400	1920	63	82
HH125	2000	1600	60	83
	2400	1920	63	82
HH150	1800	1600	60	83
	2000	1778	66	82
HH160i	1400	1120	60	83
	2000	1778	66	82
HH200	1800	1600	60	83
	2200	1956	63	82
HH250	1800	1600	60	83
	2000	1778	66	82
MH300	1800	1600	60	83
	1800	1600	60	83
XH100	1800	1600	60	83
	1800	1600	60	83
XH150	1800	1600	60	83
	1800	1600	60	83



COMPRESSOR ASSEMBLY