Important Safety Information

Symbols used in this manual:

 WARNING	**This symbol identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.**
 CAUTION	**This symbol indicates actions or procedures which if not performed correctly may lead to personal injury or incorrect function of the instrument or connected equipment.**

Terms used in this manual:

Note	**Indicates actions or procedures which may affect instrument operation or may lead to an instrument response which is not planned.**

Technical Support Contact Information:

Sensia LLC
200 Westlake Park Blvd
Houston, TX 77079
+1-866-773-6742
sensiaglobal.com

Document Revision History:

3	Change schematic Ports A – Lower, B - Upper	N.McGee	J. Baker	30/07/2015
2	Revised to reflect change to HESL version	P.Whittle	N.McGee	27/07/2010
1	Sampler connection details clarified	P.Whittle	I.Hunter	24/05/2005
0	First issued	P.Whittle	G.S.Piddington	16/12/2004
Issue	**Description of Change**	**Issued**	**Approved**	**Date**

Table of Contents

1 Introduction

Figure 1-1 Hydraulic Power Pack

The Jiskoot™ Hydraulic Power Pack provides the fluid reservoir and motive power source to operate the Jiskoot™ Series 210-EH Sampler and a sample receiver selection valve actuator.

The Jiskoot™ Hydraulic Power Pack consists of a fixed displacement gear pump, directly driven by a flameproof electric motor, a cartridge-type oil filter, filler/breather cap, oil level/temperature indicator, pressure control/relief valve, pressure gauge, solenoid diverter valve, drain plug and connection manifold.

The Jiskoot™ Series 210-EH Sampler is operated by energising the solenoid valve which directs the hydraulic oil alternately to the upper and lower ports of the sampler actuator, while, at the same time, returning the fluid displaced from the actuator to the supply tank. When the sampler probe is not being operated, the control valve directs the pump delivery to the tank.

Note:	**When requesting assistance or spare parts, please provide the Power Pack Serial Number to ensure that the correct options are quoted.**

2 Operating Instructions

2.1 Preliminary Checks

Before starting the power unit check the following:

The fluid level in the reservoir should be between the lower (red) and higher (blue) lines in the sight glass.

All fittings are connected and tight.

Pressure control valves are set at their lowest setting.

Pump cases (where applicable) have been filled with clean system fluid.

Ensure that it is safe to start the Sampler and that all personnel are clear of any moving parts.

Alignment of pumps, hydraulic motors, and cylinders should be checked.

2.2 Start Up/Commissioning

Remove the cowl from the top of the motor in order to view the fan.

Momentarily start the electric motor to check that the direction of rotation is correct (Clockwise at the fan). Isolate the supply and reverse two phases to correct if necessary.

Replace the motor cowl.

Start the power unit keeping a watchful eye for leaks and listen for unusual noises.

With the system still set for low pressure operate the sampler by energising the solenoid valve, and bleed any air from the system by cracking open the fitting joints at the highest points of the system and continuing to operate the system.

Allow the unit to run for a period and gradually increase the pressure until the designed pressure setting is reached. With the unit running the flow controls can now be set to control the speed of the sampler actuator. To eliminate erratic operation, trapped air should be removed from the system by bleeding air from the fittings at the highest points of the system.

Check for leaks, high temperatures, excessive noise and that the electric motor current is within the limits specified on the manufacturer's data plate (typically 1.68A).

Monitor the fluid level and condition in the reservoir, topping up as required.

Check that pressure, flow and electric motor current are consistent with the test certificate supplied with the power unit, if these are not consistent, contact Jiskoot immediately, as warranty may be invalidated.

3 Glossary of Special Terms

Grab - The action of taking an individual sample (normally 1 or 2 ml) from the pipeline.

4 Utilities Reference

Reservoir Capacity	48 litres
Grade of Oil	High grade, clean hydraulic oil selected according to duty to have a viscosity of approximately 15 - 20cSt at the operating temperature. The unit should normally operate with an oil temperature below 55ºC (130ºF).
Design Pressure	Max 10 Bar, Normal 5 - 7 Bar
Pump Capacity	20 litres/m at maximum design pressure
Electrical Power Requirements	To suit actual motor and solenoid valve supplied (Motor size 0.75KW, single or three phase)
Nett weight (Approximate)	55kg

5 Full Functional Description

The Jiskoot™ Hydraulic Power Pack consists of a fixed displacement gear pump, directly driven by a flameproof electric motor, a cartridge-type oil filter, filler/breather cap, oil level/temperature indicator, pressure control/relief valve, pressure gauge, solenoid diverter valve, drain plug and connection manifold.

The Jiskoot™ Series 210-EH Sampler is operated by energising the solenoid valve which directs the hydraulic oil alternately to the upper and lower ports of the sampler actuator, while, at the same time, returning the fluid displaced from the actuator to the supply tank. When the sampler probe is not being operated, the control valve directs the pump delivery to the tank.

An auxiliary connection on the Power Pack provides a pressurised feed to operate the can change valve (where required).

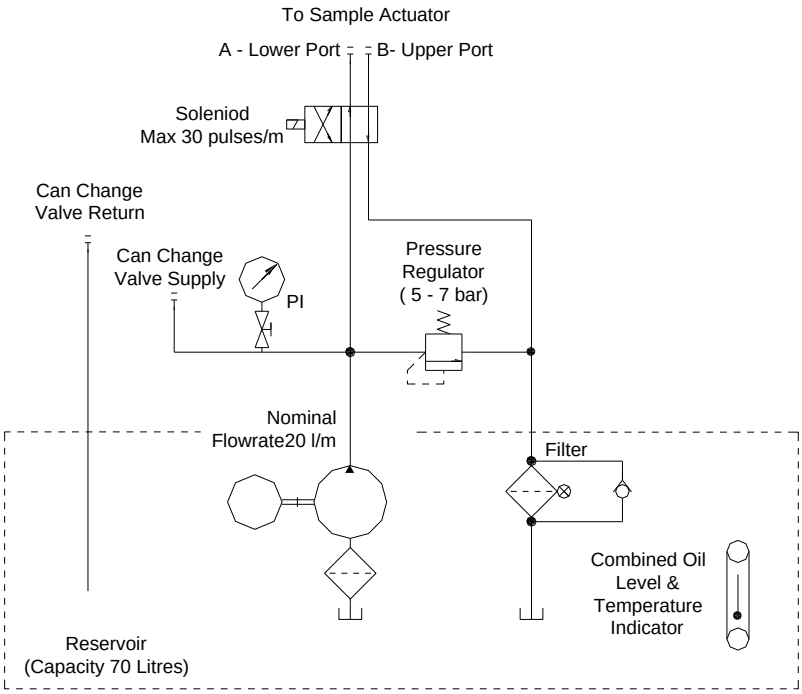


Figure 5-1 Jiskoot™ Hydraulic Power Pack Schematic

6 Installation Details

6.1 Location

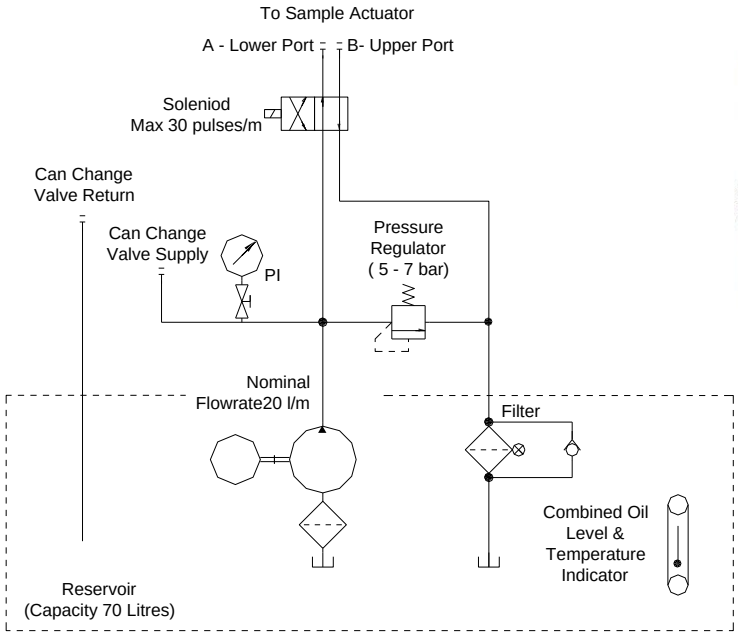
When positioning a hydraulic power unit ensure that there is sufficient space around the unit for maintenance, incoming services (electrical supply, water etc) and pipework to and from the Sampler actuators. Position the unit in a clean and well ventilated area and shield from heat sources. Do not lift the unit by any of the components on the reservoir, always use the lifting points if provided or a fork-lift truck underneath the reservoir.

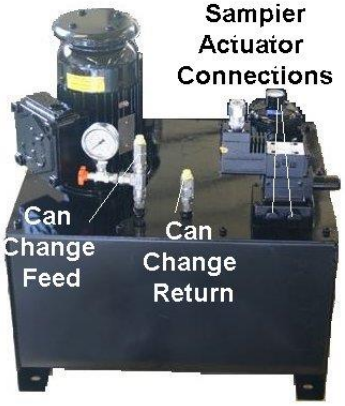
When the power unit is located in position check that it is on a firm, level foundation, if shimming is required ensure that these cannot work loose.

Where possible ensure that the port connections are facing upwards.

All electrical connections, including grounding, must be made in compliance with the local regulatory requirements, taking into account the hazardous area classification of the environment in which it is to be installed.

6.2 Interconnecting Pipework





The interconnecting pipework between the power unit and sampler should always be installed by qualified hydraulic pipe fitters.

Leave the outlet and return blanking plugs on the power unit in place as long as possible to help prevent the ingress of dirt.

It is recommended that flexible hoses of 3/8" (10mm) minimum bore are used to connect the power pack to the sampler as these will assist in damping out any hydraulic shock that may occur during the operation of the sampler. Avoid elbows and keep bends to a minimum, also use as few fittings as possible, each fitting is a potential leak point.

Line lengths in excess of 3 metres (10 feet) should be avoided where possible as they will tend to make operation of the sampler sluggish. If solid piping is used, closing lengths should be in flexible tube to buffer shock loading or a small accumulator may be used.

Steel pipe-work should be supported at regular intervals and should not be stressed or sprung into position. Flexible hoses should be assembled to the manufacturers recommendations, taking care not to have too short a hose resulting in stress at the hose ends. (Hoses contract when pressurised). The use of short flexible hoses to the sampler actuator is recommended, as this will reduce transmitted vibration and noise and will eliminate the need for accurate pipework.

Steel pipe ends must be square, free of burrs and clean. If compression fittings are used parallel threads with bonded washers or captive seals are recommended. The use of tapered threads with tape or liquid sealant is not recommended.

All carbon steel pipework should be degreased and given at least one coat of rust inhibitor primer paint.

Ensure pipework can be easily dismantled later if required and that steel tube cross sections are not reduced when bent.

NOTE Keep pipe work clean

6.3 Flushing

The system should be clean when supplied but the following should be observed after installation. The best flushing method is to use a separate motor/pump/filter unit as the power unit should have been delivered clean from the manufacturer. The flushing pump should be able to generate greater velocity in the pipework than the system pump. Actuators and sensitive valves should be by-passed by temporary bridging loops or bridging plates. The flushing fluid should be preferably be the same as the fluid used in the system.

If the system pump has to be used for flushing before starting the pump see the section on Start Up Procedure before continuing and follow the following instructions.

- Always flush at low pressure.
- Ensure that the fluid is clean and is compatible with the system fluid.
- Check filter indicators regularly, if by-pass is indicating change elements immediately.
- Fit new filter elements when flushing is complete.

After flushing it is good practice to have the fluid examined by a specialist filtration company.

6.4 Filling the System

The system reservoir and filter should be checked and inspected for debris and cleaned as required prior to adding hydraulic fluid. The cleaner the systems, the more efficient it will be with less failures and longer life.

To avoid contamination always fill with a separate pump unit incorporating a filter or through a filter in the system. Even new oil must be filtered into the reservoir.

Always check that the correct fluid is being used (Refer to Section 8 of this manual), typically the oil should have a viscosity of approximately 15 - 20cSt at the operating temperature. Do not mix fluid types or grades.

Make sure that the reservoir is filled to the correct level, remember that the fluid level will fall when the system is first run as the fluid fills the pipework and actuators, check this regularly.

6.5 Electric Connections

Check that mains supply and motor nameplate coincide and that the supply to control equipment is correct. Cable glands must be suitable for the area classification and type of cable used.

7 Maintenance and Troubleshooting

7.1 Health and Safety Precautions

It is the user's responsibility to ensure compliance with the statutory health and safety regulation including risk assessment. All routine servicing and maintenance work should be undertaken by qualified personnel.

7.2 Routine Service

The following items should be checked at regular intervals (typically weekly).

7.2.1 Fluid Level

The fluid level in the reservoir should be checked at regular intervals. It should be visible in the sight glass above the red line. Initially this should be quite frequent until experience indicates an optimum inspection period. The cause of excessive fluid losses must be corrected as soon as possible. Contaminated fluid must be changed immediately. All top-up fluid should be filtered into the reservoir at the correct cleanliness level.

7.2.2 Filters

Filter indications should be inspected at regular intervals and if these indicate "clogging" new elements to the same manufacture and specification must be fitted as replacements, as failure to do so could well invalidate warranty.

7.2.3 Pipework

Inspect all pipework for signs of leakage and repair or replace defective items, tighten joints to their correct torque figure and adjust supports where necessary.

7.2.4 Performance

The performance and running conditions of the equipment should be checked against suppliers and established values. Inspect strainers (if fitted), filter indicators, breathers, pressure and flow controls are set and locked at the correct values, tank gaskets and solenoid covers etc. Check fluid temperature.

7.3 Periodic Maintenance

After some time in service the hydraulic unit should be subjected to a through overhaul. Depending on the type of unit and local operating conditions the interval between such overhauls will vary between 1 and 5 years, but both shorter and longer periods may be found should be checked for deterioration and contamination and renewed or purified as necessary. Clean the air, oil and magnetic filters and when necessary clean the reservoir, pipes, pumps and valves. Make sure that no dirt enters the system during the overhaul. Seals, packing and damaged or worn parts should be renewed as necessary. Inspect pipe anchoring and connections, renew and tighten where necessary.

Overhauls can be best carried out by the use of replacement units while the original unit is returned to the manufacturer for reconditioning. The use of a log book and planned maintenance at fixed intervals is strongly recommended.

7.4 Troubleshooting

Hydraulic systems that have been correctly designed to meet the required operating conditions and properly installed, give many years of trouble-free service. However, then trouble does occur it is essential to find the cause and rectify it as quickly as possible. The following notes have been compiled as a general guide for the tracing of faults. Troubleshooting is simplified if a hydraulic circuit diagram of the system is available. Access to observe the flow of return fluid to the reservoir will further assist in troubleshooting.

7.4.1 Fault 1 – Excessive Noise in the System

Cause	Reason	Remedy
Pump Cavitation	Suction strainer clogged or too small	Clean or renew
	Bore of suction line too small	Fit larger bore pipes
	Too many bends in suction line, or line too long larger bore pipes	Modify pipe layout
	Local restriction in suction line, such as partly-closed valve, heavy non-return valve spring, damaged pipe, hose collapse	Open or modify valves, repair or renew pipe or hose
	Fluid too cold	Heat fluid to recommended temperature
	Unsuitable fluid	Replace with correct fluid
	Formation of vapour	Reduce working temperature to correct level. Replenish fluid or replace with correct fluid
	Failure to boost pump	Repair or renew boost pump
	Pump running too fast	Reduce speed
	Sealed reservoir, air breather too small or blocked	Fit new breather with suitable air filter element
Aeration of Fluid	Reservoir fluid level too low	Fill to correct level
	Poor reservoir design	Improve design
	Return line in reservoir above fluid level	Carry return pipe below fluid level
	Unsuitable fluid	Replace with correct fluid
	Shaft seal allowing entry of air	Renew seals
	Suction line joints allowing entry of air	Renew or tighten joints
	Porous suction hose	Renew hose
	Improper bleeding	Re-bleed system
Mechanical Vibration	Faulty alignment or loose coupling	Re-align or refit
	Vibration pipework	Improve anchorage
Pump	Worn or damaged	Repair or renew
	Unsuitable type	Replace with more suitable type
Prime Mover	Worn or damaged	Repair or renew
	Unsuitable type	Replace with more suitable type
Relief of Pressure Limiting Valve	Unstable	Replace with suitable designed valve

Cause	Reason	Remedy
	High oil velocity	Increase sizes of pipes and valves

7.4.2 Fault 2 – Inadequate pressure or no pressure

Cause	Reason	Remedy
Pump not properly primed	Air leaking into suction line	See Fault 1
High pump Temperature	Worn or damaged pump	Repair or replace
	Low fluid viscosity	See Fault 1
	Inadequate or incorrectly adjusted cooling system	Increase cooling Capacity or adjust correctly. Ensure flow of cooling water
	Prime mover	Check speed at full load Check direction of rotation
Leakage from Pressure Return	Incorrect pressure setting	Adjust setting
	Relief valve will not close due to dirt or defective component	Clean, locate defect and repair or renew
	Selector or other valve open, due to dirt defective component or electrical failure	Clean, locate defective unit adjust, repair or renew
	Low fluid level in reservoir	Top up reservoir
	Damaged cylinder bore, rod or piston packing	Repair or replace Defective items
	Breakdown of piston seal material which is not compatible with the fluid in use	Fit seals of correct material

7.4.3 Fault 3 – Abnormal pressure or flow fluctuations and vibration

Cause	Reason	Remedy
Pump Cavitation	See Fault 1	See Fault 1
Aeration of Fluid	See Fault 1	See Fault 1
Mechanical vibration	See Fault 1	See Fault 1
Unstable Pressure Limiting or Relief Valve	See Fault 1	See Fault 1
	Damaged Valve Seat	Repair or renew
	Valve has inadequate or no	Fit more suitable

Cause	Reason	Remedy
	damping arrangements	unit
Valve Components Tending to stick	Dirt contaminated fluid	Drain fluid, clean system and components. Fill with dirt-free fluid
Pump Ripple	Unsuitable type of pump or pump design for the required duty	Replace with more suitable pump after discussion with manufacturer of system or original pump
Air Pockets in System Causing Erratic and Spongy Movement	System not completely vented of air	Vent system. See section starting and venting

7.4.4 Fault 4 – Low or no fluid flow

Cause	Reason	Remedy
Pump Cavitation	See Fault 1	See Fault 1
Aeration of Fluid	See Fault 1	See Fault 1
Worn Pump	See Fault 1	See Fault 1
Leakage from Pressure to Return	See Fault 2	See Fault 2
Pump Running Reversed	Incorrect electrical connections	Correct wiring

7.4.5 Fault 5 – Excessive fluid temperature

Cause	Reason	Remedy
Leakage from Pressure to Return	Relief setting too high	Adjust setting
	Poor relief valve characteristics	Replace with improved design
	Malfunctioning of valves and failure of seals	See fault 2
	Fluid viscosity too low	Drain fluid and fill system with correct viscosity fluid advised by manufacturer
Excessive Flow From Relief	Pump held on load unnecessarily	Change duty cycle

Cause	Reason	Remedy
or Pressure Regulating Valves		
	Pressure compensator on pump set above relief	Adjust setting
	Malfunction of unloading system due to contamination component failure	Clean or repair as necessary
	Relief setting too low	Adjust setting
	Inadequate unloading arrangements	Select correct type of unloader in consultation with manufacturer
Inadequate Cooling	Failure of cooling water supply or failure of fan	Rectify
	Deposits in cooling water pipes	Clean out
Inadequate Heat Dissipation	System has insufficient area to dissipate heat input	Fit cooling system and/or increase reservoir capacity and area
	Inadequate air circulation around power pack	Relocate
	Sampler performance uprated without corresponding increase of cooling facilities	Improve cooling system and/or increase reservoir capacity and area
Pump Overheating	Loss of efficiency due to wear	Repair or replace
	Working on fluid too low in viscosity	See 4 above
Excessive circulation of Fluid	Fluid level allowed to fall too low for system	Top up system to recommended level
Excessive fluid friction	Inadequate pipe sizes used for required flow rate or due to uprating of performance without increasing pipe and valve sizes	Fit Pipe and valves of correct size or down-rate performance

NOTE ***Whenever there is evidence of wear or damage to components it is essential that all traces of the damaged components are removed from the system. If in doubt or when serious failure has occurred, the system must be completely stripped, cleaned and filled with fresh, clean fluid.***

8 Recommendations & Regulations

8.1 Hydraulic Fluids

8.1.1 Selection of Fluid

The life-blood of any hydraulic system is the fluid, and a carefully thought-out initial choice, coupled with proper maintenance, can give rise to long-life, efficient and safe operation.

Refined mineral oil is still the basis for the majority of applications. It is low in cost, has good lubricating properties and can be boosted with a variety of built-in additives to enhance its resistance to ageing, and its protection against corrosion and wear.

Correct oil for the operating duty is paramount, high quality anti-wear oil is best. The hydraulic oil should be selected according to the ambient temperature conditions and whether the power pack will be operated continuously or intermittently. Typically the oil should have a viscosity of approximately 15 - 20cSt at the operating temperature. The unit should normally operate with an oil temperature below 55ºC (130ºF). Special oils may be needed if low oil temperatures are expected, starting the unit with depressed oil temperature giving excess oil viscosity may impair the priming of the pump. Picking the wrong grade could increase wear or energy consumption, or decrease efficiency.

In some applications, synthetic chemicals are used to replace mineral oil, maybe for reasons of biodegradability, extend life or usually operating temperature conditions. The most commonly found are esters and polyglycols. Both have specific characteristics and are more expensive than oils. It is advisable to consult manufacturers for information.

Still another important group of fluids is those with improved fire-resistance, crucial for added security in areas where fluids may lead into flames or on to hot surfaces and like the synthetic chemicals could need special seals and materials. There is always a trade-off with these fluids in terms of equipment manufacturer should be consulted.

Regardless of fluid choice, once the fluid is in the system it must be cared for if best results are to be maintained. Cleanliness has probably the most influence in the life o system components. Ensure that filers are of the correct type and properly maintained. Ensure that they have a low workload by minimising the introduction of dirt into the hydraulic system.

Keep the fluid level topped up and, if the fluid is one of the water-containing type, ensure that the advice of the fluid supplier is followed concerning acid-balance and how much and what type of water to add. Try to keep operating temperatures close to recommended temperature, where most fluid perform at their best. And, finally, if in doubt, ask questions of the people with the experience, be they power pack or fluid manufacturers.

The International Standards Organisation (ISO) has a specification (ISO 6743) in which the different grades of oil are listed. This is summarised in the following table

The other aspect of ISO 6743 describes grades of viscosity, or ease of flow, e.g. VG 32, 46, 68 all describe kinematic viscosity at 40°C, as standardisation measurement.

General Applications	More Specific Applications	Composition and Properties	Symbol ISO-L	Typical Applications	Remarks
Hydraulic Systems/ Hydrostatic Applications		Non-inhibited refined mineral oils	HH		
		Refined materials oils with improved anti-rust and anti-oxidation properties	HL		
		Oils of HL type with improved anti-wear properties	HM	General hydraulic systems which include highly loaded components	
		Oils of HL type with improved viscosity/temperature properties	HR		
		Oils of HM type with improved viscosity/temperature properties	HV	Construction and marine equipment	
		Synthetic fluids with no specific fire resistant properties	HS		Special properties
	Applications where environmentally acceptable fluid are requested	Triglycerides	HETG	General hydraulic systems (mobile)	
		Polyglycois	HEPG	General hydraulic systems (mobile)	
		Synthetic Esters	HEES		
		Oils of HM type with anti-stick/slip properties	HG	Machines with combined hydraulic and plain bearing way lubrication or intermittent sliding (stick/slip at low speed is to be minimised	

General Applications	More Specific Applications	Composition and Properties	Symbol ISO-L	Typical Applications	Remarks
Hydraulic systems/ Hydrostatic Applications	Applications where fire resistant fluids are required	Oils in water emulsion	HFAE		Typically more than 80% water content
		Chemical solutions in water	HFAS		Typically more than 80% water content
		Water-in-oil emulsions	HFB		
		Water polymer solutions	HFC		Typically less than 80% water content
		Synthetic fluids containing no water and consisting of phosphate esters	HFDR		Fluids in these categories should be selected carefully, taking into account possible environmental or health hazards
		Synthetic fluids containing no water and consisting of chlorinated hydro-carbons	HFDS		
		Synthetic fluids containing no water and consisting of mixtures of HFDR and HFDS fluids	HFDT		
		Synthetic fluids containing no water and of other compositions	HFDU		

NOTE: if systems with different hydraulic fluids are used on the same site, it is recommended that a label stating the fluid to be used should be fitted to each unit adjacent to the filling point.

8.2 Storage

The fluid should be stored in a covered area at workshop temperature to reduce the effects of condensation. Barrels should be stored horizontally to avoid contamination on the barrel end. Fluid should be dispensed from the barrel into the system via a pump and filter to ensure that the system is not contaminated during the filling process.

In addition extra precautions are required for fire resistant fluids, since some of these categories contain water, checks should be made on the percentage content and be corrected using the correct procedure as stated in the manufacturers data. Protection against frost is particularly important. Many of these fluids require special seal materials and require special consideration under the UK Control of Substances Hazardous to Health Regulation SI 2002 No. 2667 (COSHH).

Note: If systems with different hydraulic fluids are used on the same site, it is recommended a label stating the fluid to be used should be fitted to each unit adjacent to the filling point.

8.3 Control of Substances Hazardous to Health Regulation (COSHH)

The equipment shall be operated taking account of the UK COSHH or other relevant regulations. In the case of hydraulic equipment these normally relate to the system fluid, which in the majority of cases, will be a mineral oil. *In the case of synthetic or fire resistant fluids the manufacturer of the particular fluid should be consulted for COSHH information since fluid types and hazards vary widely.* All manufacturers of hydraulic fluids now produce information leaflets on each type of their product, with full COSHH requirements.

For mineral oils, the hazards can be summarised as follows although we recommend that the manufacturer's data is obtained wherever possible.

Although hydraulic mineral oils contain various additives, mineral oils can be considered to be the most hazardous component – there is no significant health hazard when properly used.

Ingestion Only slight oral toxicity – do not induce vomiting due to risk of ingestion – administer half a pint of milk and seek medical attention.

Inhalation Due to low volatility, there is no risk of vapour except in open systems at elevated temperatures – avoid build up of oil mists. In the event of overexposure move to fresh air, loosen clothing, keep patient warm and resting

Skin & Eye Contact Frequent or prolonged skin contact can cause dermatitis. Splashes to the eyes may cause irritation. Good standards of industrial hygiene are recommended and use of gloves, barrier creams, goggles and regular changes of contaminated clothing. Wash well with soap and water in event of direct skin contact. Splashes to the eyes should be flushed clean with copious amounts of clean water.

Aspiration This is dependant on viscosity. Above 40°C and below 7°C ST is highly hazardous and can cause pneumonitis. At higher viscosities and low temperature the risk is only slight. If aspiration occurs, admit to hospital immediately requesting an ambulance with oxygen facilities.

Storage & Housing In a clear dry place, protected from extremes of temperature. Store barrels horizontally to prevent ingress of water. Avoid prolonged or repeated skin contact.

Fire Extinguishing Carbon Dioxide, dry chemical foams.

Spillage Soak with absorbent material, do not allow to contaminate water supplies.

Waste Disposal In accordance with the Hazardous Waste Directive 91/689/EC and other relevant regulatory requirements.

9 Frequently Asked Questions

Hydraulic systems that have been correctly designed to meet the required operating conditions and properly installed, give many years of trouble-free service. However, then trouble does occur it is essential to find the cause and rectify it as quickly as possible. The following notes have been compiled as a general guide for the tracing of faults. Troubleshooting is simplified if a hydraulic circuit diagram of the system is available. Access to observe the flow of return fluid to the reservoir will further assist in troubleshooting.

9.1 Fault 1 – Excessive Noise in the System

Cause	Reason	Remedy
Pump Cavitation	Suction strainer clogged or too small	Clean or renew
	Bore of suction line too small	Fit larger bore pipes
	Too many bends in suction line, or line too long larger bore pipes	Modify pipe layout
	Local restriction in suction line, such as partly-closed valve, heavy non-return valve spring, damaged pipe, hose collapse	Open or modify valves, repair or renew pipe or hose
	Fluid too cold	Heat fluid to recommended temperature
	Unsuitable fluid	Replace with correct fluid
	Formation of vapour	Reduce working temperature to correct level. Replenish fluid or replace with correct fluid
	Failure to boost pump	Repair or renew boost pump
	Pump running too fast	Reduce speed
	Sealed reservoir, air breather too small or blocked	Fit new breather with suitable air filter element

Cause	Reason	Remedy
Aeration of Fluid	Reservoir fluid level too low	Fill to correct level
	Poor reservoir design	Improve design
	Return line in reservoir above fluid level	Carry return pipe below fluid level
	Unsuitable fluid	Replace with correct fluid
	Shaft seal allowing entry of air	Renew seals
	Suction line joints allowing entry of air	Renew or tighten joints
	Porous suction hose	Renew hose
	Improper bleeding	Re-bleed system
Mechanical Vibration	Faulty alignment or loose coupling	Re-align or refit
	Vibration pipework	Improve anchorage
Pump	Worn or damaged	Repair or renew
	Unsuitable type	Replace with more suitable type
Prime Mover	Worn or damaged	Repair or renew
	Unsuitable type	Replace with more suitable type
Relief of Pressure Limiting Valve	Unstable	Replace with suitable designed valve
	High oil velocity	Increase sizes of pipes and valves

9.2 Fault 2 – Inadequate pressure or no pressure

Cause	Reason	Remedy
Pump not properly primed	Air leaking into suction line	See Fault 1
High pump Temperature	Worn or damaged pump	Repair or replace
	Low fluid viscosity	See Fault 1
	Inadequate or incorrectly adjusted cooling system	Increase cooling Capacity or adjust correctly. Ensure flow of cooling water
	Prime mover	Check speed at full load Check direction of rotation
Leakage from Pressure Return	Incorrect pressure setting	Adjust setting
	Relief valve will not close due to dirt or defective component	Clean, locate defect and repair or renew
	Selector or other valve open, due to dirt defective component or electrical failure	Clean, locate defective unit adjust, repair or renew
	Low fluid level in reservoir	Top up reservoir
	Damaged cylinder bore, rod or piston packing	Repair or replace Defective items
	Breakdown of piston seal material which is not compatible with the fluid in use	Fit seals of correct material

9.3 Fault 3 – Abnormal pressure or flow fluctuations and vibration

Cause	Reason	Remedy
Pump Cavitation	See Fault 1	See Fault 1
Aeration of Fluid	See Fault 1	See Fault 1
Mechanical vibration	See Fault 1	See Fault 1
Unstable Pressure Limiting or Relief Valve	See Fault 1	See Fault 1
	Damaged Valve Seat	Repair or renew
	Valve has inadequate or no damping arrangements	Fit more suitable unit
Valve Components Tending to stick	Dirt contaminated fluid	Drain fluid, clean system and components. Fill with dirt-free fluid
Pump Ripple	Unsuitable type of pump or pump design for the required duty	Replace with more suitable pump after discussion with manufacturer of system or original pump
Air Pockets in System Causing Erratic and Spongy Movement	System not completely vented of air	Vent system. See section starting and venting

9.4 Fault 4 – Low or no fluid flow

Cause	Reason	Remedy
Pump Cavitation	See Fault 1	See Fault 1
Aeration of Fluid	See Fault 1	See Fault 1
Worn Pump	See Fault 1	See Fault 1
Leakage from Pressure to Return	See Fault 2	See Fault 2
Pump Running Reversed	Incorrect electrical connections	Correct wiring

9.5 Fault 5 – Excessive fluid temperature

Cause	Reason	Remedy
Leakage from Pressure to Return	Relief setting too high	Adjust setting
	Poor relief valve characteristics	Replace with improved design
	Malfunctioning of valves and failure of seals	See fault 2
	Fluid viscosity too low	Drain fluid and fill system with correct viscosity fluid advised by manufacturer
Excessive Flow From Relief or	Pump held on load unnecessarily	Change duty cycle

Cause	Reason	Remedy
Pressure Regulating Valves		
	Pressure compensator on pump set above relief	Adjust setting
	Malfunction of unloading system due to contamination component failure	Clean or repair as necessary
	Relief setting too low	Adjust setting
	Inadequate unloading arrangements	Select correct type of unloader in consultation with manufacturer
Inadequate Cooling	Failure of cooling water supply or failure of fan	Rectify
	Deposits in cooling water pipes	Clean out
Inadequate Heat Dissipation	System has insufficient area to dissipate heat input	Fit cooling system and/or increase reservoir capacity and area
	Inadequate air circulation around power pack	Relocate
	Sampler performance uprated without corresponding increase of cooling facilities	Improve cooling system and/or increase reservoir capacity and area
Pump Overheating	Loss of efficiency due to wear	Repair or replace
	Working on fluid too low in viscosity	See 4 above
Excessive circulation of Fluid	Fluid level allowed to fall too low for system	Top up system to recommended level
Excessive fluid friction	Inadequate pipe sizes used for required flow rate or due to uprating of performance without increasing pipe and valve sizes	Fit Pipe and valves of correct size or down-rate performance

NOTE ***Whenever there is evidence of wear or damage to components it is essential that all traces of the damaged components are removed from the system. If in doubt or when serious failure has occurred, the system must be completely stripped, cleaned and filled with fresh, clean fluid.***

10 Sub Supplier Information

11 Recommended Spares List

Filter

When requesting assistance or spare parts, please advise the Product Model and Serial Numbers to ensure that the correct options are supplied.

WARRANTY - LIMITATION OF LIABILITY: Seller warrants only title to the products, software, supplies and materials and that, except as to software, the same are free from defects in workmanship and materials for a period of one (1) year from the date of delivery. Seller does not warranty that software is free from error or that software will run in an uninterrupted fashion. Seller provides all software "as is". THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE WHICH EXTEND BEYOND THOSE STATED IN THE IMMEDIATELY PRECEDING SENTENCE. Seller's liability and Buyer's exclusive remedy in any case of action (whether in contract, tort, breach of warranty or otherwise) arising out of the sale or use of any products, software, supplies, or materials is expressly limited to the replacement of such products, software, supplies, or materials on their return to Seller or, at Seller's option, to the allowance to the customer of credit for the cost of such items. In no event shall Seller be liable for special, incidental, indirect, punitive or consequential damages. Seller does not warrant in any way products, software, supplies and materials not manufactured by Seller, and such will be sold only with the warranties that are given by the manufacturer thereof. Seller will pass only through to its purchaser of such items the warranty granted to it by the manufacturer.