

THULE RIGTECH

VSM 300

SHALE SHAKER

OPERATING MANUAL

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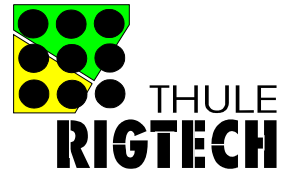
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CE DECLARATION OF CONFORMITY

VSM 300 : SHALE SHAKERS

Description of Equipment

Machine Type : **VSM 300 SHALE SHAKER**
Serial Number :

Thule Rigtech hereby declare that the machinery supplied by the Company complies with the relevant essential Health and Safety requirements of the Machinery Directive 89/392/EEC, 91/368/EEC and associated amendments 93/44/EEC and 93/68/EEC enacted in the United Kingdom by The Supply of Machinery (Safety) Regulations 1992 (SI1992/3073)

Company Details

Name: : **Thule Rigtech**
Address : **South College Street
Aberdeen
Grampian
SCOTLAND AB11 6LB**
Responsible Person : **Gordon Harrison**

The equipment has been manufactured in accordance with Thule Rigtech requirements by the following approved Sub-Contractor:

Company Details

Name : **Reekie Manufacturing**
Address : **Orchardbank
Forfar
Tayside
SCOTLAND DD8 1UQ**

The machinery has been designed to meet the requirements of the following transposed harmonised European Standards:

- EN 292 Part 1 Safety of Machinery - Basic Concepts, General Principles for Design -
Basic Terminology, Methodology**
- EN 292 Part 2 Safety of Machinery - Basic Concepts, General Principles for Design -
Technical Principles and Specifications**
- EN 414 Safety of Machinery - Rules for Drafting and Presentation of Safety Standards**
- EN 418 Safety of Machinery - Emergency Stop Equipment, Functional Aspects -
Principles of Design**
- EN 60204 - 1 Electrical Equipment**

In addition to the above harmonised standards, the equipment has been designed to meet the safety requirements of Health and Safety Executive - Provisions and Use of Work Equipment Regulations 1992

A complete Technical File is available for review at the Thule Rigtech offices.

Signed: Date:
Name: **Gordon Harrison** Position: **Service Manager**



CE DECLARATION OF CONFORMITY

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SECTION 1.3 - GENERAL EQUIPMENT DETAILS

1.3.1 EQUIPMENT DESCRIPTION

The VSM 300 Shale Shaker is designed to meet the demands of the oilfield drilling industry and is purpose built to provide a more efficient primary solids removal system.

The VSM 300 Shale Shaker is designed on a modular basis thus enabling multi unit installations and flexible configurations to be achieved using standard equipment. The modular design construction is also advantageous on existing rig locations where the equipment can be easily installed into the shaker room through a standard shaker house door.

Description of Main Components:

◆ Basket/Drive Assembly

The basket/drive assembly is supplied in accordance with Thule Rigtech standard equipment design and manufacturing process. The vibratory head is fitted with two (2) electric motors which have been manufactured by Brook Hansen in accordance with Thule Rigtech's standard electric motor specification. The electric motors drive counter rotating shafts which induce vibration into the basket/drive assembly. The basket is supported onto the skid base by four (4) springs.

◆ Skid Base

The skid base is manufactured to form a fluid sump and is located under the basket/drive assembly. It is used to collect the processed mud before it is returned to the mud tanks.

Each skid base is manufactured with two (2) exit gates, one at each side, which enables the mud to flow into either an adjacent link section or a site built ditch.

◆ Link Sections

The link sections between the shale shakers are used for the following functions:

- * Distribution of mud between skid bases
- * Header tank dump/bypass facility
- * Access walkway between shale shakers

The various options are achieved by opening/closing the appropriate sluice gates on the link section to divert the mud flow as required.

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1.3.1 EQUIPMENT DESCRIPTION (Continued)

◆ Header Tank Assembly

The header tank units supplied with standard equipment are of a shallow modular design with the following options available:

- * Header tank only
- * Header tank with splitter box
- * Header tank link section
- * Header tank link section complete with dump valve
- * Header tank link section complete with splitter box and dump valve
- * Feed chutes

The configuration of the header tank assembly will be dependent on the number of shale shakers installed.

◆ HVAC Enclosures (where applicable)

The HVAC enclosures mounted onto the shale shakers are in accordance with Thule Rigtech standard design and manufacture. However, the interface connection on the duct outlet may be modified to suit project requirements.

◆ Screens

The screens used on the VSM 300 Shale Shaker can be easily changed out to suit operational conditions.

The following screen types are used:

* Top Deck Screens (Scalping Screen)

The top deck of the VSM 300 utilises multi panel pretensioned screens which are used to scalp off large volumes of solids thus protecting the finer mesh of the lower deck screens. The top deck screens are retained in position by pneumoseal clamping systems which enable rapid screen changeout.

* Lower Deck Screens (Primary)

The lower deck screen configuration of the VSM 300 comprise four (4) multi panel pretensioned screens. All the screens are mounted on a constant 7° ramp. This screen configuration ensures consistent conveyance of solids thus minimising solids build-up. This results in a higher throughput capacity. The lower screens are retained in position by pneumoseal clamping systems which enable rapid screen changeout.

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1.3.1 EQUIPMENT DESCRIPTION (Continued)

◆ Screens (Continued)

* Secondary Screens (Drying Screens)

Optional screen carriers are provided to enable secondary screens to be fitted to the front of the lower deck screens. This facility should be used to reduce fluid levels on cuttings when drilling with low toxicity or synthetic oil based muds.

The secondary screens and carriers are fitted into 'C' channels and held in place by pneumoseal clamping systems which enable rapid screen changeout.

1.3.2 PRINCIPLE OF OPERATION

The configuration on each installation will vary depending on final equipment layout but the basic principle of operation is simple.

The mud return flowline is diverted into the splitter box on the header tank and the mud is evenly distributed into the main header box section by manually operating the sliding gate valves located between the splitter box and the header tank.

The flow over each shaker is regulated by operating the three (3) sliding gate valves which are located at the feed chute/header tank interface. The processed mud flows through the shale shaker and is discharged back to the mud distribution gutter via the skid base outlet gates.

The cuttings from the shale shaker are transported over the screens to the front of the unit and discharged into the cuttings ditch. The shale shaker package has the facility to divert mud returning through the flowline directly into the cuttings ditch by closing the isolation gate valves within the main header tank and opening the dump valve in the bypass link section.

The VSM 300 has the optional facility of being fitted with a specifically designed HVAC enclosure should this be required. The design of the enclosure is such that any fumes are contained within the enclosure whilst still allowing adequate access to the equipment for operational and maintenance activities.

1.3.3 STRENGTH OF COMPONENTS

The VSM 300 shale shaker has been subjected to extensive field testing in its 3 year development, to prove suitability of components and design. All materials used in the manufacture are new and of suitable strength to meet the applied working conditions.

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SECTION 1.4 - TECHNICAL SPECIFICATIONS

1.4.1 EQUIPMENT SPECIFICATION

IMPORTANT NOTE:

The Specification below relates to Thule Rigtech's standard VSM 300 Shale Shaker. All components listed are manufactured as standard items.

Different electrical and dimensional/weight configurations are available and the customer should contact Thule Rigtech directly for information on these.

The specifications were correct at time of printing. However, Thule Rigtech's policy is one of continuous development and therefore Thule Rigtech reserve the right to amend the equipment specification at their discretion. Thule Rigtech accept no liability for loss or damage incurred through the use of the data attached. It is recommended that the customer contact Thule Rigtech for a current status if in doubt.

General

Equipment Type	- Elliptical Motion Shale Shaker	
Vibratory Motion Type	- Elliptical	
Angle of Motion	- Fixed	
Speed of Vibration	- Variable	
 <u>Screening Arrangement</u>		
Screen Configuration	- Dual Deck	
Screen Type	- Scalping	- Pretensioned Multi-Panel
	- Primary	- Pretensioned Multi-Panel Site Repairable
	- Secondary	- Pretensioned Panel Site Repairable
Solids Drying Deck	- Optional Secondary Screen Module (Supplied)	
All Screen Clamping	- Pneumatic	
Screen Angles	- Scalping	- 0°
	- Primary	- 7°
	- Secondary	- 7°
Screen Angle Adjustment	- No	- Fixed
Screen Areas	- Scalping Screen Deck	- 1.91m²
	- Primary Screen Deck	- 2.44m²
	- Secondary Screen Deck	- 0.28m²
Mesh Sizes	- Refer to Section 3.4.1 of this manual	

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1.4.1 EQUIPMENT SPECIFICATION (Continued)

Drive System

Drive System - **Electrically Operated** - **Direct Drive**

Air System

Air Supply Requirements - **Pressure** - **80 - 90 psi**
(for Pneumoseal Clamping System)- Capacity - **0.5 ft³m/in(intermittent)**

Dimensions

<u>Type of Unit:</u>	<u>Length:</u>	<u>Width:</u>	<u>Height:</u>
Single	2754 mm	1870 mm	1504 mm
Dual	2754 mm	4070 mm	1504 mm
Triple	3004 mm	6270 mm	1504 mm
Quadruple	3004 mm	8470 mm	1504 mm
Quintuple	3004 mm	10670 mm	1504 mm

N.B. The above dimensions for triple, quadruple and quintuple units are based upon the header box being fitted with a 420 mm wide splitter box.

Please contact Thule Rigtech for details of this feature.

Dry Operating Weights

Single Unit	-	2338 kg
Dual Unit	-	4936 kg
Triple Unit	-	7619 kg
Quadruple Unit	-	10132 kg
Quintuple Unit	-	12650 kg

N.B. The above weights for triple, quadruple and quintuple units are based upon the header box being fitted with a 420 mm wide splitter box.

Please contact Thule Rigtech for details of this feature.

Screens - Boxed for Shipping

Scalping (Top) Screen	-	16.0 kg
Primary (Lower) Screen	-	15.5 kg
Secondary Screen	-	3.5 kg

All weights inclusive of packaging.

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1.4.2 ELECTRICAL SPECIFICATIONS (Continued)

Drive Motor Specification

Make	-	Brook Hansen : Argus 55 IP56 (Specification modified to meet Thule Rigtech requirements)
Certification	-	BASEEFA to BS5501 Parts 1 & 5 EExd, Gas Group IIA & IIB, Temperature Class. T4
Rating	-	3kW
Voltage	-	460V
Frequency	-	60Hz (Inverter Rated - 50-70 Hz)
Phase	-	3
Thermistors	-	140° C cut out
Frame Size	-	AENV 132 MH
Maximum Speed	-	2000 RPM

Speed Control Station Specification

Type	-	CS3
Part No.	-	CS3XA1YA1ZA1
Manufacturer	-	MEDC
Certification	-	BASEEFA No. 96D3435X EExed, Gas Group IIC, Temperature Classification T6
Ingress Protection	-	In accordance with IP66
Description	-	Glass Reinforced Polyester, anti-static enclosure with stainless steel cover screws and fitted with the following: 1 Push-button (Momentary-white-inscribed “Boost”) 1 Push-button (Momentary-green-inscribed “Norm”) 1 Push-button (Momentary-white-inscribed “Low”) Contact ratings AC15 500 V 3 amp. Unit to have 1 x M20 cable entry - bottom. Unit engraved with “Speed Control”
Dimensions	-	(W) 90mm x (H) 200mm x (D) 90mm
Fixing Centres	-	(W) 73mm x (H) 160 mm (4 @ 6 mm dia)
Approx Weight	-	1.3 kg

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1.4.2 ELECTRICAL SPECIFICATIONS (Continued)

Starter Enclosure Specification

Type	-	GP3
Manufacturer	-	MEDC
Certification	-	BASEEFA No. 95D1442 EExd, Gas Group IIB, Temperature Classification T4
Ingress Protection	-	In accordance with IP65
Description	-	Cast Iron enclosure with hinged lid (hinges on LHS) The following components to be mounted on a steel backplate : a) 1 x 7.5 Kw Frequency Inverter b) 1 x EMC Filter c) 2 x Thermistor Relays d) 1 x 7.5Kw contactor e) 2 x 6 - 9 Amp Thermal Overloads f) 2 x Fault Relays g) 1 x Run Relay h) 3 x Speed Control Relays i) 1 x Stepdown Transformer j) 2 x Primary Control Fuses k) 1 x Secondary Control Fuse l) 1 x Neutral Link m) 17 x DK4Q Double Bank Terminals n) 6 x SAK6 Terminals o) 2 x Ammeters p) 1 x Hours Run Meter q) 2 x Fault Lights r) 1 x Reset Switch 4 x 70mm Indicator windows on hinged lid (inverter, 2 x ammeters, hours run meter) 3 x 25mm Indicator windows on hinged lid (inverter status, 2 x fault lights)
Wiring / Layout	-	All in accordance with drawings 254-884 and 254-883
Supply	-	Suitable for 380 - 460 V (480 safe maximum)
Entries	-	Bottom 3 x M25 10 x M20
Dimensions	-	(W) 582mm x (H) 482mm x (D) 410mm
Fixing Centres	-	(W) 550mm x (H) 420mm (4 @ 12mm dia)
Approx Weight	-	225 Kg

1.4.2 ELECTRICAL SPECIFICATIONS (Continued)

Start/Stop Station Specification

Type	-	CS2
Part No.	-	CS2XA1YCS1NN1B2BN
Manufacturer	-	MEDC
Certification	-	BASEEFA No. 96D3435X EExed, Gas Groups IIC, Temperature Classification T6
Ingress Protection	-	In accordance with IP66
Description	-	This unit will be manufactured from glass reinforced polyester anti-static enclosure with stainless steel cover screws and be fitted with the following : a) 1 Start Push-button - (Momentary - green - inscribed "Start") b) 1 Stop Latched Mushroom Button - (Stayput - red, yellow base, inscribed "Stop") Contact ratings AC15 500V 3 amp Unit to have 2 x M20 cable entries - one top (EExe plugged), one bottom
Dimensions	-	(W) 90 mm x (H) 150 mm x (D) 135 mm
Fixing Centres	-	(W) 73 mm x (H) 110 mm (4 @ 6 mm dia)
Approx Weight	-	1.0 Kg

Safety Isolator Specification

Manufacturer	-	ABB
Part No.	-	GHG262 2301R0007
Certification	-	PTB No Ex96.D.3134 EExed, Gas Group IIC, Temperature Classification T6
Ingress Protection	-	In accordance with IP66 to EN60529
Material	-	Glass-fibre reinforced polyester
Approx Weight	-	1.5 Kg
Dimensions	-	(W) 110mm x (H) 200mm x (D) 140mm
Fixing Centres	-	(W) 96mm x (H) 150mm (4 @ 7 mm dia)
Type	-	4 Pole + Auxiliary Safety switch with lock off facility and cover interlock in the OFF position
Rated Current	-	20 amps
Rated Voltage	-	690V a.c.
Ambient Temperature	-	(-20) to (+40) °C
Area of Use	-	Zones 1 and 2

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1.4.2 ELECTRICAL SPECIFICATIONS (Continued)

Emergency Stop Station Specification

Type	-	CS1
Part No.	-	CS1C1NN1B2BN
Manufacturer	-	MEDC
Certification	-	BASEEFA No. 96D3435X EExed, Gas Group IIC, Temperature Classification T6
Ingress Protection	-	In accordance with IP66
Description	-	Glass Reinforced Polyester, anti-static enclosure with stainless steel cover screws and fitted with: 1 Latched Mushroom Button - (Stayput-red, yellow base inscribed “Emergency Stop”) Contact rating AC15 500 V 3 amp. Unit to have 2 x M20 cable entries one top (EExe plugged), one bottom.
Dimensions	-	(W) 90mm x (H) 100mm x (D) 135mm
Fixing Centres	-	(W) 73mm x (H) 60 mm (4 @ 6 mm dia)
Approx Weight	-	0.5 kg

1.4.3 PAINT SPECIFICATION

Manufacturer	-	W & J Leigh’s & Co.
Surface Preparation	-	Shotblasted to SA 2½
Coating Systems	-	Two Pack Epoxy
Colours	-	Thule Green (R4754) Golden Yellow (BS4800 : 08.6.51)
Description	-	Primer: Epigrip J984 -Two pack Epoxy zinc rich anti-corrosive primer High Build: Epigrip L653 - Two Pack Epoxy/Resin hi-build containing anti-corrosive pigments Top Coat: Epigrip M262 - Two Pack Epoxy/Resin pigmented with high quality light fast pigments
DFT	-	Primer - 50 microns High Build - 150 microns Top Coat - 50 microns

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1.4.4 RECOMMENDED CABLE SPECIFICATIONS

Cable to Start/Stop, Emergency Stop and Potentiometer Stations

Type	:	GEXOL - 125 IEC 600V / 1000V
Size	:	2.3 mm ² (14 AWG)
No. of Conductors	:	4
Part Ref	:	U37 - 102 - 509 BS
Nominal O/D	:	15.7 mm
Approvals	:	UL E111461 Lloyds 89/0075 DNV E - 1675 through E - 1678 CSA LL80350 ABS 93 - BT52174 - X CCG 9400 - 20 USCG 1987 / 9304
Construction	:	i) Conductor Soft annealed tinned copper per ASTM B-33. Flexible stranding to Class 5 (IEC 228) ii) Insulation Chemically cross linked/non chlorinated thermosetting flame retardant polyolefin (XLPO) iii) Armour Basket weave wire armour per IEEE 45 and IEC 92-3, Bronze iv) Base Jacket Heavy duty Arctic grade neoprene v) Outer Jacket Same as base jacket
Properties	:	Flame retardant tested in accordance with IEEE 45 UL temperature rating 100°C Flame test meets requirements of IEEE 45, IEC 92-3 and IEC 332-3
Application	:	Tested for compatibility with PETROFREE, ENVIROMUL and XP-07 muds and base fluids For machine installations with presence of vibrations on mobile drilling units, aboard ships and offshore fixed and floating production facilities.

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1.4.4 **RECOMMENDED CABLE SPECIFICATIONS** (Continued)

Cable from Starter Enclosure to Electric Motors

Type	:	GEXOL - 125 IEC 600V / 1000V
Size	:	2.3 mm ² (14 AWG)
No. of Conductors	:	7
Part Ref	:	U37 - 102 - 521 BS
Nominal O/D	:	17.7 mm
Approvals	:	UL E111461 Lloyds 89/0075 DNV E - 1675 through E - 1678 CSA LL80350 ABS 93 - BT52174 - X CCG 9400 - 20 USCG 1987 / 9304
Construction	:	i) Conductor Soft annealed tinned copper per ASTM B-33. Flexible stranding to Class 5 (IEC 228) ii) Insulation Chemically cross linked, non chlorinated thermosetting flame retardant polyolefin (XLPO) iii) Armour Basket weave wire armour per IEEE 45 and IEC 92-3, Bronze iv) Base Jacket Heavy duty Arctic grade neoprene v) Outer Jacket Same as base jacket
Properties	:	Flame retardant tested in accordance with IEEE 45 UL temperature rating 100°C Flame test meets requirements of IEEE 45, IEC 92-3 and IEC 332-3 Tested for compatibility with PETROFREE, ENVIROMUL and XP-07 muds and base fluids
Application	:	For machine installations with presence of vibrations on mobile drilling units, aboard ships and offshore fixed and floating production facilities.

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1.4.4 **RECOMMENDED CABLE SPECIFICATIONS** (Continued)

Cable from Mains Supply to Isolator and Isolator to Starter Enclosure

Type	:	EO2 600V/1000V TO BS6883
Size	:	4.0 mm ²
No. of Conductors	:	4
Part Ref	:	EO204C004
Nominal O/D	:	19.3 mm
Construction	:	i) Conductor - Tinned stranded copper ii) Insulation - EPR iii) Inner Sheath - CSP iv) Armour - Galvanised steel wire braid v) Outer Sheath - CSP
Properties	:	Flame retardant tested in accordance with IEC 332-3 Cat. A Oxygen index of bedding and sheathing: Greater than 32%. H.C.L. Emission less than 5% at 800°c. Melinex tapes below and above braid for ease of stripping.
Application	:	Power control and distribution cables for fixed installations.

1.4.5 **NOISE DATA**

Noise Data was obtained from a noise test carried out on a single VSM 300 Shale Shaker unit which was operating under test conditions.

db Total	OCTAVE BAND CENTRE FREQUENCY								
	31.5	63	125	250	500	1k	2k	4k	8k
78.7	55.3	51.2	59.1	63.7	75.5	73.3	69.7	65.7	59.9

Note: The sound pressure levels are measured at 1m from the VSM 300 and are the logarithmic mean of measured results from various locations around the machine. A full Noise Test Report is available upon request from Thule Rigtech.

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SECTION 2.1 - UTILITY REQUIREMENTS

2.1.1 ELECTRICAL

The shale shaker is fitted with two (2) x 3kW, 3 phase electric motors which will operate on 380V - 460V, 50 or 60 Hz supply.

The no load current is 3.3 Amps and the maximum load current is 7.5 Amps.

2.1.2 AIR SUPPLY

An air supply is required to inflate the pneumoseal clamping system.

Pressure range : 80 - 90 psi

Flowrate : 0.5 ft³/min (intermittent)

2.1.3 WATER SUPPLY

Washdown

A high pressure wash gun is required for cleaning and washing down the shakers and screens. The cleaning medium must be suitable for the drilling fluid being used.

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SECTION 2.2 - INSTALLATION INSTRUCTIONS

2.2.1 INTRODUCTION

This section details the installation for Thule Rigtech standard VSM 300 shale shaker equipment. Each installation will vary depending on the circumstances of the rig and any special requirements for the shale shakers.

2.2.2 HEALTH AND SAFETY

Health and Safety are of principle importance to Thule Rigtech for the design, manufacture and operation of equipment.

To achieve these objectives, Thule Rigtech have carried out the following assessments on the VSM 300 Shale Shaker:

- i) Risk Assessments in accordance with the Supply of Machinery (Safety) Regulations 1992 (SI 1992/3073) and Associated Harmonised European Standards.**

A comprehensive Technical File is available for review at Thule Rigtech's premises.

- ii) COSHH Assessments have been carried out in accordance with Control of Substances Hazardous to Health 1988 (COSHH).**

A COSHH Assessment File is available for review at Thule Rigtech's premises.

2.2.3 EQUIPMENT LOCATION

The VSM 300 is supplied with an integral skid base and can be positioned directly onto the deck or above the sand traps as required.

Note: Structural checks must be carried out on the deck beams to ensure capability of supporting the applied loads from the shale shaker assembly.

To ensure the package is installed correctly the tolerances on deck levels should be + 25mm.

Link sections can be installed between single shaker units to allow multiple underflow options.

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2.2.3 EQUIPMENT LOCATION (Cont'd)

The final location of the equipment will depend on a number of factors and since each installation will differ, each case should be carefully considered. Prior to installing equipment a full installation survey should be carried out by a Thule Rigtech service engineer. Please contact Thule Rigtech for details if applicable.

As a guide, the following areas should be addressed when considering equipment location.

i) Relationship to Flowline

The shaker distribution chute must be located below the bell nipple to ensure sufficient fall from and to thus avoid back up and/or spillage from the flowline.

ii) Flowline Pipework

Flowline pipework should not include sharp bends or traps for the accumulation of solids. Open ditches/troughs should be used where possible.

Where possible a flowline direct dump capability should be provided.

iii) Flowline Connections

The flowline can enter the header box either from the rear or vertically from the top. On triple, quadruple, quintuple (or larger) configurations, a splitter box is supplied as standard to ensure that the optimum flow distribution is achieved.

To assist even flow distribution, the flowline should enter the header tank/splitter box arrangement as centrally as possible.

Valves are fitted in specific link sections of multiple units for dumping/bypassing and cleaning purposes.

iv) Underflow Discharge

Shaker skid bases are provided with discharge gates on either side and should be connected to channel the underflow discharge to an appropriate location.

2.2.4 UNPACKING, LIFTING and HANDLING INSTRUCTIONS

i) Introduction

This section details the unpacking, lifting and handling instructions for Thule Rigtech Standard VSM 300 Shale Shaker equipment

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2.2.4 UNPACKING, LIFTING and HANDLING INSTRUCTIONS (Cont'd)

ii) Unpacking

The equipment will be delivered to site as palletised units and will consist of the following packages:

- ◆ Shale Shaker Assemblies comprising - Drive System/Basket with or without the skid base and header tank
- ◆ Link Section(s)

The total number of packages delivered will depend on the quantity and configuration of the system required. Final packing details will be available on dispatch.

The equipment shall be unpacked by removing the polythene protective outer cover and by cutting the fixing bands which are used to retain the equipment onto the pallets.

Note: Basket securing devices are used to retain the basket onto the skid base and these should remain secured in position until the equipment is sited in its final location.

iii) Lifting and Handling

The VSM 300 shaker is designed on a modular basis and can be dis-assembled into the following discrete components for installation (if required):

<u>Description:</u>	<u>Lifting Method:</u>	<u>Notes:</u>
Basket/Drive System	Soft slings around the basket or alternatively four (4) x Lifting Eyebolts can be fixed to the basket spring mounts	Spring mounting may be removed to further reduce the basket size

Note: If eyebolts are used please ensure full certification is available

Warning: Basket assembly must not be lifted by the drive motors or any other part of the drive system

Header Tank Soft slings around the box section cross members at the top of the tank

Skid Base Four (4) x padeyes - One (1) at each corner

Feed Chute Soft slings/man-handle

Note: For details of lifting configurations refer to Drawing No: 314-008 in Section 7.0

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2.2.4 UNPACKING, LIFTING and HANDLING INSTRUCTIONS (Cont'd)

iv) Safe Working Load

The safe working load for the skid base is as follows:

Padeyes for skid base (four (4) per skid) S.W.L. = 5.5kN (0.560T) per padeye.

2.2.5 INSTALLATION PROCEDURE

Mechanical Installation

The overall installation of the shaker will depend upon a number of factors including:

- ◆ **Number of shakers to be installed**
- ◆ **Retrofitting to existing skid bases**
- ◆ **Supply of header tanks**

The following steps should be used as a guideline for the installation of a complete shaker package which includes skid bases, link sections and header tanks. In certain locations the full workscope detailed below may not be required. However, this workscope would apply to the most common offshore scenario.

The installation to be carried out as follows:

- i) **Remove the distribution chute from the header tank.**
- ii) **Release the transportation brackets (four (4) per Shaker) and lift the basket/drive assembly off the skid base.**
- iii) **Lift the header tank from the skid base.**
- iv) **If necessary to fit through confined space, remove the drive system from the basket.**
- v) **Position the skid base(s) and link section(s) as required. These are installed in sequence of skid-link section-skid-link section, etc.**
- vi) **Assemble the header tank sections to the skid bases.**
- vii) **Align the skid/header tank assembly and carry out a dimensional check.**
- viii) **Fully weld the skid bases to the deck at the padeye locations with a 6mm fillet weld**
- ix) **Fully seal weld the link sections to the skid bases and header tanks.**
- x) **Seal weld joints between the header tank sections.**
- xi) **Lower the basket assemblies on to skid bases - install the mounting springs and rubber pads.**

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2.2.5 INSTALLATION PROCEDURE (Cont'd)

Mechanical Installation (Cont'd)

- xii) If required, reinstall the drive system onto the basket and torque the securing bolts to the specified settings. Refer to Torque Chart in Section 4.6.4.
- xiii) Re-install the distribution chutes.
- xiv) Position the pneumatic clamping panels as required.
- xv) Install a suitable air line from the control panels to shaker pneumatic clamping systems. The air line should be terminated using flexible polythene hose.
- xvi) Paint damaged areas/weld areas with recommended paint system.

Electrical Installation

For wiring details please refer to the Electrical Schematic Drawing: 314-009 in Section 7 of this Manual.

For termination details refer to Drawing: 314-016.

For cable schedule refer to Drawing: 314-017.

For Cable Specifications please refer to Section 1.4.4 of this Manual.

i) Starter Enclosure

The unit is certified Zone 1 and has an ingress rating of IP65.

If the starter enclosure is sited within the shaker room, ensure that it is positioned away from areas subject to mud or water ingress.

The enclosure should be easily accessible and located at between 0.6m and 2.0m above the servicing level. A maximum height of 1.7m is preferred.

In order to maintain certification of this enclosure all glands must be Exd barrier type.

Warning: Hot spots on components can occur within the starter enclosure. A stainless steel notice on the outside of the enclosure warns against this hazard. The enclosure should not be opened whenever explosive gases are present and should be left for at least 30 minutes after the power has been isolated for the components to cool down.

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2.2.5 INSTALLATION PROCEDURE (Cont'd)

Electrical Installation (Cont'd)

ii) Safety Isolator

The unit is certified Zone 1 and has an ingress rating of IP65.

It should be sited alongside the starter enclosure in an area free from mud or water ingress. The recommended height of the operating handle is 1.7m above the servicing level.

Use either Exd Barrier Glands or dual certified Exd/Exe Double Seal Glands.

Warning: The safety isolator must be locked OFF whilst any maintenance is being carried out on any part of the electrical system.

iii) Remote Start/Stop Station

The unit is certified Zone 1 and has an ingress rating of IP65.

The remote Start/Stop Station must be sited within the shaker area such that the operator can ensure that no exposed persons are in the danger zone around the machine before operating.

It should be readily accessible for service and maintenance and mounted in such a manner as to minimise the possibility of damage from other handling or mobile equipment.

Care should be taken to ensure that it is not placed in a hazardous location when being operated and that the possibility of inadvertent operation is minimised.

**The unit should be mounted not less than 0.6m above the servicing level.
A height of 1.7m is recommended.**

Use either Exd Barrier Glands or dual certified Exd/Exe Double Seal Glands.

2.2.5 INSTALLATION PROCEDURE (Cont'd)

Electrical Installation (Cont'd)

iv) Emergency Stop Station

The unit is certified Zone 1 and has an ingress rating of IP65.

The unit must be positioned for easy access and for non-hazardous operation by the operator or others who may need to use it. Measures against inadvertent operation should not impair accessibility.

The unit should be mounted not less than 0.6m above the servicing level and within easy reach of the normal working position of the operator. The ideal position is central on the shaker, above and slightly forward of the drive head, supported from above the shaker.

The emergency stop should NOT be used as a functional stop for the machine but should be tested on a regular basis to ensure reliable switching. Weekly testing is recommended.

Use either Exd Barrier Glands or dual certified Exd/Exe Double Seal Glands.

v) Speed Control Station

The unit is certified Zone 1 and has an ingress rating of IP65.

The speed control station must be sited within the shaker area such that the operator can ensure that no exposed persons are in the danger zone around the machine.

It should be readily accessible for service and maintenance and mounted in such a manner as to minimise the possibility of damage from other handling or mobile equipment.

Care should be taken to ensure that it is not placed in a hazardous situation when being operated and that the possibility of inadvertent operation is minimised.

**The unit should be mounted not less than 0.6m above the servicing level.
A height of 1.7m is recommended.**

Use either Exd Barrier Glands or dual certified Exd/Exe Double Seal Glands.

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2.2.5 INSTALLATION PROCEDURE (Cont'd)

Electrical Installation (Cont'd)

vi) Bonding Arrangement

For details of earth bonding for the equipment, please refer to drawing 314-007 in Section 7 of this Manual.

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SECTION 2.3 - COMMISSIONING PROCEDURE

2.3.1 COMMISSIONING CHECKLIST

Note: A Checklist to be completed for each Shale Shaker

Shale Shaker - Serial No: _____

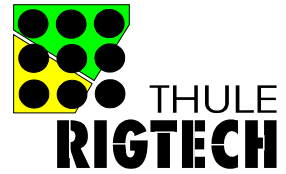
(Please tick on Completion)

- | | |
|--|---|
| i) Isolate rig power supply | <input type="checkbox"/> |
| ii) Ensure pneumatic clamping systems are correctly fitted | <input type="checkbox"/> |
| iii) Install screens and inflate pneumoseals to 80 - 90 psi.
Monitor for a period of thirty (30) minutes to ensure pneumoseals remain inflated (Refer to Section 4.6.1) | <input type="checkbox"/> |
| iv) Remove the drive shaft guards | <input type="checkbox"/> |
| v) Check motor starter overload setting is correct and ensure auto/hand reset lever on overload is set to 'A' (auto setting) | <input type="checkbox"/> |
| vi) Check motor winding insulation resistance: phase to phase and phase to earth | <input type="checkbox"/> |
| vii) Reconnect rig power supply | <input type="checkbox"/> |
| viii) Start the shaker | <input type="checkbox"/> |
| ix) Check the direction of the drive shafts. Motors should be wired in order that the drive shafts rotate down through the centre. | <input type="checkbox"/> |
| x) Re-Inspect pneumoseal clamping system for leaks. | <input type="checkbox"/> |
| | OK |
| | Problem |
| xi) Check current drawn by the motors using the ammeters in the starter enclosure. Readings will be approximately 4 - 5 amps after the bearings have reached normal running temperature. | <input type="checkbox"/> <input type="checkbox"/> |
| xii) Check the operating temperature of the main shaft bearings.
The normal operating temperature should lie between 65° - 90°C | <input type="checkbox"/> |

Signature:

Date:

(Commissioning Engineer)



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2.3.2 TEST RUNNING - CHECKLIST

Note: A Checklist to be completed for each Shale Shaker

Shale Shaker - Serial No: _____

(Please Tick)

		OK	Fail/Problem
i)	Connect motors for recommended rotation so that drive shafts rotate down through the centre.	<input type="checkbox"/>	<input type="checkbox"/>
ii)	Ensure pneumoseal clamping systems are fitted correctly.	<input type="checkbox"/>	<input type="checkbox"/>
iii)	Install screens.	<input type="checkbox"/>	<input type="checkbox"/>
iv)	Check air pressure is 80 - 90 psi.	<input type="checkbox"/>	<input type="checkbox"/>
v)	Check air hose for any visible defects.	<input type="checkbox"/>	<input type="checkbox"/>
vi)	Run unit for twelve (12) hours, record bearing housing temperatures and motor current.		

		4 Hours	8 Hours	12 Hours
Front Left Housing	Outer Bearing	<input type="text"/> °C	<input type="text"/> °C	<input type="text"/> °C
	Inner Bearing	<input type="text"/> °C	<input type="text"/> °C	<input type="text"/> °C
Front Right Housing	Outer Bearing	<input type="text"/> °C	<input type="text"/> °C	<input type="text"/> °C
	Inner Bearing	<input type="text"/> °C	<input type="text"/> °C	<input type="text"/> °C
Rear Left Housing	Outer Bearing	<input type="text"/> °C	<input type="text"/> °C	<input type="text"/> °C
	Inner Bearing	<input type="text"/> °C	<input type="text"/> °C	<input type="text"/> °C
Rear Right Housing	Outer Bearing	<input type="text"/> °C	<input type="text"/> °C	<input type="text"/> °C
	Inner Bearing	<input type="text"/> °C	<input type="text"/> °C	<input type="text"/> °C
Front Motor	Amps	<input type="text"/>	<input type="text"/>	<input type="text"/>
Rear Motor	Amps	<input type="text"/>	<input type="text"/>	<input type="text"/>

Signature:

Date:

(Commissioning Engineer)

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SECTION 3.0 - OPERATION

3.1 FUNCTIONAL DESCRIPTION OF EQUIPMENT

The basic function of the VSM 300 Shale Shaker is to provide primary solids removal from both oil based mud (OBM) and water based mud (WBM) during drilling operations.

With the VSM 300, this is achieved by inducing elliptical motion within the shaker basket assembly.

The design of the VSM 300 also minimises the operator input required during drilling operations.

3.2 HEALTH AND SAFETY/COSHH STATEMENT

Please refer to Section 2.2.2 of this Manual for Health and Safety information.

3.3 OPERATING INSTRUCTIONS

3.3.1 Start Up

- i) Ensure rig air supply is available and pressure regulator is set at 80 - 90 PSI.
- ii) Ensure screens are fitted , then set the 3 way ball valve to 'FEED' and check pneumoseals are fully inflated.
- iii) Ensure isolator is set to 'ON' and the reset button has been depressed.
Inverter display will show:

DRIVE FREQUENCY 0.0 HZ

- iv) Ensure all stop and emergency stop push buttons have been reset.

- v) Push start button on remote start/stop station.
Inverter display will now show:

DRIVE FREQUENCY 60.0 HZ

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3.3 OPERATING INSTRUCTIONS (Cont'd)

3.3.1 Start Up (Cont'd)

- vi) **Open sluice gate on header box/feed chute.**
- vii) **Adjust flow until the level of fluid is approximately 10"-15 from the discharge end of the front primary screen. The fluid level can be adjusted by controlling the volume of fluid entering the feed chute or by careful selection of mesh size.**

NOTE: Do not operate the unit with a higher fluid level than recommended. To do so could result in screen overload and premature screen failure.

3.3.2 Normal Running

When the VSM 300 is running under normal conditions, there are several parameters which can be adjusted to optimise performance - screen size, flow rate and shaker speed.

Screen Size

The selection of screen mesh will depend on a number of factors - namely flowrate, fluid condition, formation, ROP, fluid type and number of shakers.

To ensure optimum performance, the finest screen possible should be operated - with due consideration taken of the relative screen life.

Flowrate

Flow should be adjusted to maintain the required beach length. Other preferences such as screen mesh and vibratory speed may also be adjusted to deliver optimised performance.

Shaker Speed

The VSM 300 is designed to operate at 60Hz - both in water and oil based muds. However, a facility is provided to boost the frequency to 67Hz where conditions require i.e. bottoms-up, cold mud etc.

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3.3 OPERATING INSTRUCTIONS (Cont'd)

3.3.3 Controlled Shutdown

- i) **Close sluice gate on header box/feed chute.**
- ii) **Continue to run unit until mud already on screens has been processed.**
- ii) **Thoroughly clean basket/drive assembly and screens using appropriate medium. For water based muds use steam or high pressure water. For oil based muds use base oil gun.**
- iv) **Push 'STOP' push button on the start/stop station.**
- v) **Set the 3 way ball valve to 'VENT'.**

NOTES:

- i) ***DO NOT* turn air supply to vent prior to switching off machine. This can cause structural damage to the basket assembly and excessive wear to the clamping systems.**
- ii) **If the unit is out of use for long periods, all screens should be removed, cleaned thoroughly, dried and either re-boxed or stored in a safe dry area.**
- iii) **The electrical power supply to the inverter starter should always be left on unless maintenance is being carried out, even when the shaker is not in use. The temperature will thus be maintained at a level whereby condensation build-up can be avoided.**

3.3.4 Emergency Shutdown

In the event of an emergency shutdown being required for whatever reason, the following procedure must be actioned:

- i) **Press emergency button for applicable shaker.**
- ii) **Close feed chute gates.**

Note: At this point there may still be unprocessed drilling fluid within the basket assembly

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3.3 OPERATING INSTRUCTIONS (Cont'd)

3.3.4 Emergency Shutdown

- iii) **Assess the nature of emergency and take appropriate action to rectify/resolve problem.**
- iv) **After completion of rectification work and the area is safe, re-start the shaker by activating the start button on the remote start/stop station. The remaining drilling fluid can now be processed.**

NOTE:

Should the problem arise due to power failure, the inverter must be reset as follows:

- ◆ Set isolator to 'ON'
- ◆ Press reset button

The equipment can now be re-started

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3.4 SCREEN DATA

3.4.1 Screen Details

VSM 300 Scalping Screens

<u>Mesh Size</u>	<u>Aperture Micron</u>	<u>Open Area %</u>
8 x 8	2465	60
10 x 10	1976	61
20 x 20	895	49
30 x 30	567	45
40 x 40	399	39
60 x 60	253	36
<u>Special Order Only</u>		
80 x 80	186	34
100 x 100	142	31

VSM 300 Pretensioned Screens - Primary

52 x 52	340	48
84 x 84	215	49
105 x 105	165	45
120 x 120	150	49
145 x 145	120	46
165 x 165	105	45
180 x 180	91	42
200 x 200	87	47
230 x 230	75	46
<u>Special Order Only</u>		
300 x 300	49	33
325 x 325	42	29

VSM 300 Secondary Screens - Oil Recovery Mode

100H	557 x 184	40
84 x 84	215	49
40 x 80	465 x 148	34
105 x 105	165	45
145 x 145	125	51
165 x 165	104	45
180 x 180	91	42
200 x 200	87	47
230 x 230	75	46

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3.4 SCREEN DATA (Cont'd)

3.4.2 Screen Selection

Scalping Screens - Upper Deck

The function of the upper deck screen is to remove the large and heavy cuttings only.

In general the screen should be selected such that the majority of fluid passes through the first screen.

Pre-tensioned Primary Screen - Lower Deck

Pre-tensioned primary screens range in size from 52 - 325 mesh. The mesh should be selected such that during normal operation a beach length of 10 - 15" is maintained. By selecting a mesh which will allow the unit to operate with the correct beach length, a 50% overload capacity is reserved to compensate for changes in mud properties, rig motion and drilled solids.

Secondary Screens (Drying Module)

Secondary screens are designed to reduce the fluid content on solids discharged from the primary screens. These screens are normally used with oil based muds, but are equally suitable with water based muds if required.

Additional fluid is recovered from the solids by the secondary screens in conjunction with the drying bar, allowing the solids to rotate on the mesh before being discharged.

3.4.3 Screen Repair Procedure

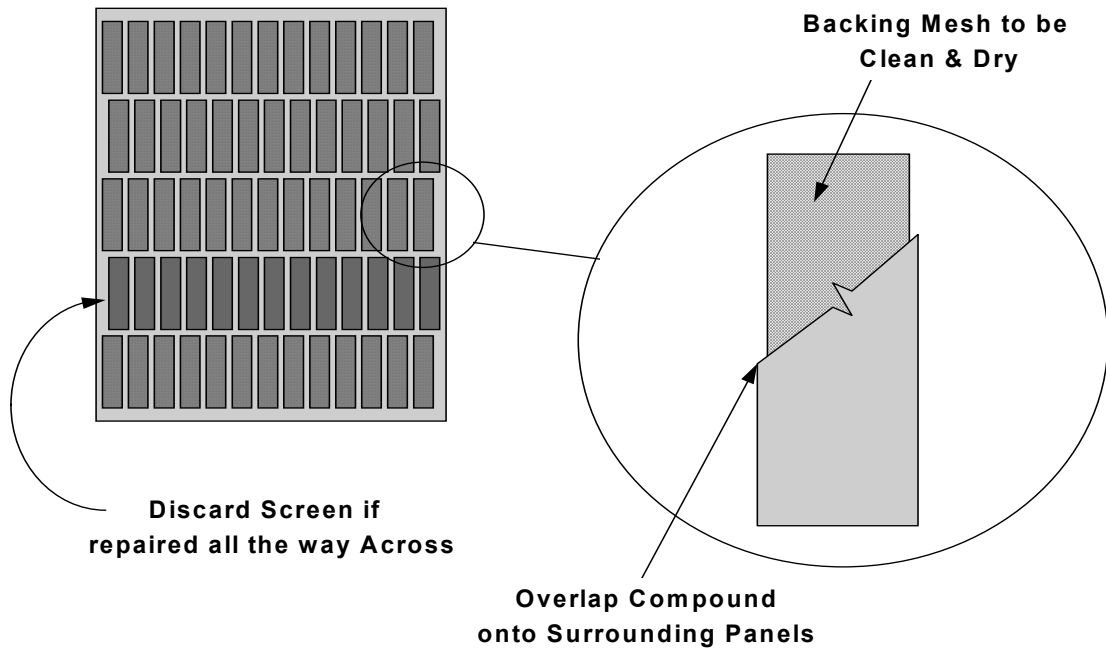
- i) Carefully clean screen from front and rear.
- ii) Using sharp knife (i.e. Stanley Knife), cut torn fine mesh screen from the panel. Cut carefully around the rectangle, ensuring there is no damage to the backing mesh.
- iii) Carefully dry the backing mesh with a cloth. This will ensure the repair compound bonds properly.
- iv) Lay the screen flat if possible. Using the supplied applicator gun, apply a small amount of the repair compound to the damaged panel.

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3.4 SCREEN DATA (Cont'd)

3.4.3 Screen Repair Procedure (Cont'd)

- v) Using the plastic spreader, spread the compound, ensuring the backing mesh is fully blanked off. This will ensure that no mud or solids pass through this part of the screen.
- vi) Do not apply compound too thickly as this would cause the solids to be stopped on this panel. Ensure also that the compound is applied over the original grey plastic around the damaged panel to give more strength to the repair.
- vii) Stand the screen aside and allow the repair to dry for 4-5 hours.
- viii) Only use screens which have less than 25% damage.
- ix) Do not use screens which have buckled edges as these will be sharp and may cut the air clamping system. Such screens should be discarded.



3.4.4 Screen Storage

Screens should be stored in the cardboard containers supplied in a dry environment and out of direct sunlight. Horizontal or vertical stacking is permissible. Care should be taken to avoid mechanical damage.

When transporting the screens from rig store to VSM 300 unit, the screens should be kept in their containers to minimise the risk of damage.

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3.4 SCREEN DATA (Cont'd)

3.4.5 Screen Washing

Before the VSM 300 is shut down, the screens should be washed with the appropriate medium to avoid plugging or blinding of the meshes by dried mud.

3.4.6 Screen Fitting Procedure

All screens on the VSM 300 are held in place by the pneumoseal clamping systems which allow rapid screen changeout. All pneumoseals are connected to a common air supply so that the 3 way ball valve supplied will inflate/deflate all pneumoseals simultaneously.

The top deck and primary deck screens are both of pre-tensioned design but have a different orientation therefore are not interchangeable.

The primary screens can be distinguished by the male/female joint arrangement.

CAUTION: Gloves should be worn when fitting screens

NOTE: The shaker should not be run without screens otherwise the clamping system will 'blow' out of its housing when the air is turned on.

i) Top Deck - Pretensioned Screens

Set the 3 way ball valve to 'VENT'.

Insert the first screen along the top deck 'C' channel towards the rear of the shaker (there is no front/back orientation to the top deck screen).

Repeat with the second screen.

Insert the third (front) screen until all screens are firmly located.

Set the 3 way ball valve to 'FEED'.

ii) Lower Deck Screens (Primary)

Set the 3 way ball valve to 'VENT'

With the female joint facing the operator, insert the rear screen into the primary channel.

With the female joint facing the operator, insert the front screen into the primary channel.

Set the 3 way ball valve to 'FEED'.

3.4 SCREEN DATA (Cont'd)

3.4.6 Screen Fitting Procedure (Cont'd)

iii) Secondary Screens (Drying Screens)

To be fitted when drilling with low toxicity or synthetic oil based mud.

Set the 3 way ball valve to 'VENT'.

Insert the secondary screen into secondary screen carrier

With the drying bars facing the operator, insert the secondary carrier assembly into the secondary channel and ensure it is firmly located.

Set the 3 way ball valve to 'FEED'.

NOTE: On occasions where the facilities of the secondary screens are not required, the carrier frames can be removed and replaced with the Solids Deflector Plate. (Supplied)

3.4.7 Screen Removal Procedure

Screen removal is the reverse of the Screen Fitting Procedure above.

Note: A screen removal bar is supplied to enable access to the rear screens.

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 - 4.3 Routine Maintenance**
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 - 4.6 Parts Replacement Procedure**
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 - 4) Torque Setting Chart**
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SECTION 4.0 - MAINTENANCE

4.1 INTRODUCTION

Before detailing the recommended maintenance procedures, the following statements on machine maintenance and safety are given and should prove useful to the maintenance engineer.

- ◆ Ensure that power supplies are isolated before commencing work on the unit.
- ◆ Clean down all parts and the work area prior to commencement of work.
- ◆ Block up heavy parts before commencing work beneath the unit or parts.
- ◆ Where heavy lifting is involved always seek assistance.
- ◆ Remove the primary screens before commencing work on the shaker.
- ◆ Before restarting the VSM 300 after maintenance, ensure that all tools, old parts, nuts, bolts, washers etc. are removed.
- ◆ The bearings are designed to run warm and can be used safely up to an operating temperature of 100°C. Normal operating temperature between 65°- 90°C.
- ◆ DO NOT weld on any part of the basket or head assembly.
- ◆ All maintenance to be carried out by suitably qualified personnel.

4.2 HEALTH AND SAFETY

Please refer to Section 2.2.2 of this Manual for Health and Safety information.

4.3 ROUTINE MAINTENANCE

The VSM 300 has been designed to minimise downtime by reducing routine maintenance. To prolong equipment life maintenance instructions given in this section must be strictly adhered to at the prescribed intervals.

Daily

- i) Visually examine the unit for signs of wear and or damage. Repair/replace as necessary.
- ii) Clean the VSM 300, removing solids build-up.
- iii) Perform audible check, investigating as necessary.
- v) Check air regulator is set at correct pressure (80-90 psi). Adjust if necessary.
- vi) Inspect pneumoseal clamping systems and associated fittings for leaks or wear. Replace as necessary.



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4.4 6000 HOUR MAINTENANCE SCHEDULE (Reference Run Hour Meter)

This Checklist should be completed every 6000 hours of shaker run time and kept in maintenance records.

Shaker No:

Date:

Hours Run:

Rig/Location:

Visually examine unit for signs of wear/damage. Repair/replace as necessary.

Remove any build-up of solids from electrical motors

Run machine and perform audible check. Investigate as necessary

Check air regulator is set at the correct pressure (80-90 psi). Adjust if necessary.

Initiate Shutdown Procedure - Refer to Section 3.3.3 of this manual.

Partially disassemble housings to enable access to bearings. Remove used grease, clean bearings and inspect for wear. If visual inspection satisfactory, replenish grease and replace seals in clump weight housings.

Note: **To attain good bearing life it is essential that the specified grease is used.
(Shell Retinax LX2)**

Inspect the pneumoseal clamping systems and associated fittings for leaks or wear. Replace as necessary.

Using touch-up paint, prepare and paint any part of the shaker basket as required.

Mechanics Name:

Signed:

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4.5 MOUNTING SPRINGS

Thule Rigtech recommends that the four (4) main mounting springs are replaced on a bi-annual basis.

4.6 PARTS REPLACEMENT PROCEDURE

WARNING : Before commencing any part replacement procedures initiate a controlled shutdown (Refer to Section 3.3.3). Thereafter the isolator should be switched to 'OFF' and locked to isolate the power supply.

4.6.1 PNEUMOSEAL CLAMPING SYSTEM

Top Deck - Removal

- i) **Initiate shutdown procedure (Refer to Section 3.3.3)**
- ii) **Set the 3 way ball valve to 'VENT'.**
- iii) **Remove the top deck screens.**
- iv) **Pull down the pneumoseal at the air connector.**
- v) **From above press the pneumoseal poppets down through the screen clamping channel and remove from the shaker.**
- vi) **Ensure the poppet holes in the channels are clear of debris, solids, cement etc.**

Top Deck -Replacement

- i) **Spray poppets on the new pneumoseal with a light oil: e.g. WD40.**
- ii) **Slide the pneumoseal into the channel, lining up the poppets with the holes in the clamping channels.**
- iii) **Starting at the rear, engage poppets into the holes in the clamping channel. Check that each poppet is properly located.**
- iv) **Push the air connector up into its locator on the clamping channel.**
- v) **Replace screens.**
- vi) **Set 3 way ball valve to 'FEED'.**

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4.6.1 PNEUMOSEAL CLAMPING SYSTEM (Cont'd)

Primary Deck - Removal

- i) **Initiate shutdown procedure (Refer to Section 3.3.3)**
- ii) **Set the 3 way ball valve to 'VENT'.**
- iii) **Remove the primary screens.**
- iv) **Pull down the pneumoseal at the air connector.**
- v) **Push each poppet on the side rail down through the screen clamping channel and pull forward the rear poppets to release them. Carefully withdraw the pneumoseal from the screen clamping rails.**
- vi) **Ensure the poppet slot/holes in the channels are clear of debris, solids, cement etc.**

Note: **Rear poppet locators are slotted.**

Primary Deck Replacement

- i) **Spray poppets on the new pneumoseal with a light oil: e.g. WD40.**
- ii) **Slide the pneumoseal into the basket - lining up the poppets with slots in the rear channel.**
- iii) **Starting at the rear, engage poppets into the holes in the clamping channel. Check that each poppet is properly located.**
- iv) **Push the air connector up into its locator on the clamping channel.**
- v) **Replace the primary screens.**
- vi) **Set the 3 way ball valve to 'FEED'.**

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4.6.1 PNEUMOSEAL CLAMPING SYSTEM (Cont'd)

Secondary Screen Carrier Removal

- i) **Initiate shutdown procedure (Refer to Section 3.3.3)**
- ii) **Set the 3 way ball valve to 'VENT'.**
- iii) **Remove the secondary screen and secondary screen carrier arrangement.**
- iv) **Pull down the pneumoseal at the air connector.**
- v) **From above, press the poppet down through the screen clamping channel and remove from the shaker.**

Secondary Screen Carrier Replacement

- i) **Spray poppets on the new pneumoseal with a light oil: e.g. WD40.**
- ii) **Slide the pneumoseal into channel and push the air connector up into its locator.**
- iii) **Press poppet into the hole in the channel.**
- iv) **Replace secondary screen carrier arrangement.**
- v) **Set the 3 way ball valve to 'FEED'.**

Pneumoseal Air Connectors

- i) **The pneumoseal air connectors fitted in the shaker basket can be replaced if necessary.**
- ii) **The air connectors are removed with a 10mm alley key.**

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4.6.2 DRIVE SYSTEM - REMOVAL

Drive Shaft Guards

- i) **Remove the top stainless cover four (4) M12 socket cap screws.**
- ii) **Slacken off the tyre coupling taper lock bushings (4 x 5mm grub screws).**
- iii) **To remove the lower guard section use a 10mm hex bar (65mm long) and 10mm ring or ratchet spanner, remove the four (4) M12 socket cap screws.**
- iv) **Repeat this process for all four drive guards.**

Clump Weight Housing Removal

- i) **Remove the drive guards as detailed above.**
- ii) **Remove four (4) M20 bolts.**
- iii) **Lift the housing from the shaker by means of a fabric strop through lifting eyes which can be inserted into the bearing end plate jacking points.**
- iv) **Repeat this with all the clump weight housings.**

Clump Weight Housing Disassembly

- i) **Remove six (6) M12 socket cap screws from the baseplate/access cover and remove.**
- ii) **Remove V ring seal from shaft.**
- iii) **Remove six (6) M12 socket cap screws from the end caps (both ends).**
- iv) **Use three (3) M12 socket cap screws to jack off end caps (both ends).**
- v) **Remove the circlips from both ends of the shaft.**
- vi) **Turn the housing upside down to allow access to the clump weight and slacken the two (2) M12 hex head screws clamping the weight to the shaft.**
- vii) **Using a screwdriver prise the clamping sections of the weight open to allow the weight to slide along the shaft.**

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4.6.2 DRIVE SYSTEM - REMOVAL (Cont'd)

Clump Weight Housing Disassembly (Cont'd)

- viii) **Attach disassembly flange to the housing in place of the non-drive end cap with four (4) M12 screws and screw in the centre bolt to displace the shaft.**

Note: As the shaft is being displaced it is necessary to have the housing sitting upside down so that the weight key way can locate the slide through the notch cut in the housing. It is also necessary to slide the weight along the shaft as the shaft is being displaced.

- ix) **Once the shaft has been removed from the housing the inner bearing race can be taken off the shaft using three legged pullers.**
- x) **The outer bearing races can be jacked out of the housing from the inside using two (2) M8 70mm bolts.**

Clump Weight Housing Assembly

- i) **For ease of fitment of the non-drive bearing inner race, use a hot plate or similar to warm prior to fitting shaft. Fit circlip.**
- ii) **Refit both bearing outer rings (Use end caps if required to locate).**
- iii) **With end caps removed, offer shaft assembly through the clump weight and housing.**
- iv) **Fit opposite bearing inner ring. (Inner ring locating tool supplied) Fit circlip.**
- v) **To ensure the electric motor will not overload, the bearings should not be overcharged with grease.**

To grease each bearing, use a spatula to manually pack the race from the outer face. After ensuring the bearing is fully packed, half fill the void in the end cap prior to refitting.

Note: Both end caps should be oriented: one tapped hole top to ensure correct alignment with drive guards.

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4.6.2 DRIVE SYSTEM - REMOVAL (Cont'd)

Electric Motor

- i) **Remove the drive guards as detailed above.**
- ii) **Remove four (4) M16 bolts.**
- iii) **Lift the motor by means of a fabric strop through the motor lifting bolt.**
- iv) **To remove the electric motor support plates, remove the two (2) M12 socket cap screws per plate.**
- v) **Repeat for both motors.**

4.6.3 DRIVE SYSTEM - REFIT

Refit of the drive system is the reverse of removal with the following important checks:

- i) Note: Clump weight alignment is essential to enable the VSM 300 to function correctly
- ii) **To ensure correct clump weight alignment, slacken the tyre couplings to allow both weights to self align by gravity.**
- iii) **This is an essential requirement as the keyways in the motor shafts may not be in direct alignment**
- iv) **Once weight alignment has been achieved, secure tyre couplings.**
- v) **Check drive rotation and replace the guards before operating.
(Re: Start-up 3.3.1).**

4.6.4 TORQUE SETTING CHART

All bolts and threads on the equipment are of metric sizes and constructed from high tensile stainless steel (U.O.N.)

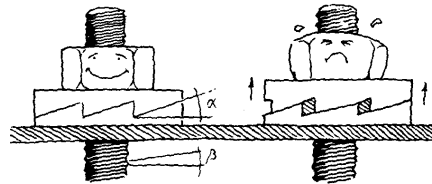
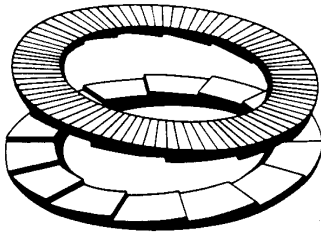
M8	-	34 Nm (25 lbf.ft)
M10	-	68 Nm (50 lbf.ft)
M12	-	118 Nm (87 lbf.ft)
M16	-	293 Nm (216 lbf.ft)
M20	-	570 Nm (420 lbf.ft)
³ / ₁₆ " BSW (Taperlock Grub Screw)	-	20 Nm (15 lbf.ft)
⁷ / ₁₆ " BSW (Taperlock Grub Screw)	-	30 Nm (22 lbf.ft)

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4.6.5 NORD LOCK INFORMATION

All bolts on the VSM 300 are held in place using 'NORD LOCK' vibration proof washers. It is very important that the washers are used in the correct orientation for the system to work. The large cams locate together with the fine teeth cutting into the workpiece and bolt / nut. The pair of washers expand more than the corresponding pitch of the thread locking the nut in place.



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5.0 PARTS DATA

5.1 Parts List

5.2 Cross Sectional Drawings

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SECTION 5.1 - PARTS LIST

CLUMP WEIGHT HOUSING ASSEMBLY

<u>Parts List</u> <u>Drwg No:</u>	<u>Item</u> <u>No:</u>	<u>Description:</u>	<u>Qty per</u> <u>Shaker:</u>	<u>Part</u> <u>Number:</u>
314-010	1a	Clump Weight Housing Assy (Primary)	2	300/01/001a
314-010	1b	Clump Weight Housing Assy (Secondary)	2	300/01/001b
314-010	2	Housing Fabrication	4	300/01/002
314-010	3	End Cap	4	300/01/003
314-010	4	Seal Housing	4	300/01/004
314-010	5	Shaft	4	300/01/005
314-010	6	Clump Weight Key	4	300/01/006
314-010	7	Motor Coupling Key	4	300/01/007
314-010	8	Access Cover	4	300/01/008
314-010	9	Primary Clump Weight	4	300/01/009
314-010	10	Secondary Clump Weight	4	300/01/010
314-010	11	Roller Bearing	8	300/01/011
314-010	12	Shaft Seal	4	300/01/012
314-010	13	O-Ring	8	300/01/013
314-010	14	External Circlip	8	300/01/014
314-010	15	V-Ring Seal	4	300/01/015
314-010	16	Plug	8	300/01/016
314-010	24	Clump Weight Housing Spacer	8	300//01/032
314-010	25	Csk Set Screw M8 x 45	16	SSCSK M8x45
314-010	17	Socket Head Cap Screw -M12 x 25 lg	48	SSSKT M12x25
314-010	18	Socket Head Cap Screw - M12 x 20 lg	24	SSSKT M12x20
314-010	19	Hex Head Screw - M12 x 40 lg	8	SSHHS M12x40
314-010	20	Nord-lock Washer - M12	80 pairs	SSNLW M12
314-010	21	Hex Head Bolt - M20 x 110 lg	16	SSHIBM20x110
314-010	22	Hex Nut - M20	16	SSPLN M20
314-010	23	Nord-lock Washer - M20	32 pairs	SSNLW M20

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SECTION 5.1 - PARTS LIST (Cont'd)

MOTOR / ASSEMBLIES

<u>Parts List Drwg No:</u>	<u>Item No:</u>	<u>Description:</u>	<u>Qty per Shaker:</u>	<u>Part Number:</u>
314-011	16	Electric Motor	2	300/01/017
314-011	17	Electric Motor Shaft Key	4	300/01/031
314-011	7	Motor Shaft Coupling Assembly	4	300/01/018
314-014	1	Coupling Flange	8	300/01/019
314-014	2	Coupling Tyre	4	300/01/020
314-014	3	Taperlock Bush	8	300/01/021
314-014	4	3-Bolt Tab Washer	8	300/01/026
314-014	5	2-Bolt Tab Washer	8	300/01/027
314-014	6	Insert	40	300/01/028
314-014	7	Hex Head Bolt - M6 x 40 lg	40	SSH HB M6x40
314-011	2	Motor Coupling Guard Assembly	4	300/01/022
314-011	3	Coupling Guard	4	300/01/023
314-011	4	Socket Head Cap Screws - M12x20 lg	48	SSSKT M12x20
314-011	5	Nord-lock Washer - M12	48 pairs	SSNLW M12
		Motor Mounting Plate Assy.	4	300/01/024
314-011	8	Motor Mounting Plate	4	300/01/025
314-011	13	Hex Head Screw - M16 x 50 lg	8	SSHHS M16x50
314-011	15	Hex Nut - M16	8	SSPLN M16
314-011	14	Nord-lock Washer - M16	16 pairs	SSNLW M16
314-011	4	Socket Head Screw - M12 x 20 lg	48	SSSKT M12x20
314-011	5	Nord-lock Washer - M12	48 pairs	SSNLW M12
314-011	9	Motor Packing Plate	4	300/01/030
314-011	6	Csk Screws - M8 x 16 lg	16	SSCSK M8x16

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SECTION 5.1 - PARTS LIST (Cont'd)

BASKET FABRICATION

<u>Parts List</u> <u>Drwg No:</u>	<u>Item</u> <u>No:</u>	<u>Description:</u>	<u>Qty per</u> <u>Shaker:</u>	<u>Part</u> <u>Number:</u>
314-018		Basket Assembly	1	300/02/001
314-018	17	Primary Screen Rear Seal Bar	2	
	300/02/014			
314-018	18	Seal Bar Viton Strip	2	300/02/015
314-018	20	Socket Head Screw - M8 x 30 lg.	10	SSSKT M8x30
314-018	21	Nord-lock Washer - M16	10 pairs	SSNLW M8
314-018	19	Csk Screws - M6 x 15 lg	12	SSCSK M6x15
314-018	8	Front Spring Mounting Bracket Assembly	2	300/02/002
314-018	9	Front Spring Mounting Bracket	2	300/02/003
314-018	10	Hex Head Screw - M16 x 40 lg.	8	SSHHS M16x40
314-018	11	Nord-lock Washer - M16	8 pairs	SSNLW M16
314-018	12	Rear Spring Mounting Bracket Assembly	2	300/02/004
314-018	13	Rear Spring Mounting Bracket	2	300/02/005
314-018	14	Hex Head Screw - M16 x 40 lg.	8	SSHHS M16x40
314-018	15	Nord-lock Washer - M16	16 pairs	SSNLW M16
314-018	16	Hex Nut	8	SSPLM M16
314-018	7	Front Deflector Plate	2	300/02/006
314-018	1	Secondary Screen Carrier Assembly	2	300/02/007
314-018	2	Weir Bar	2	300/02/016
314-018	3	Socket Head Screw - M12 x 25 lg.	10	SSSKT M12x25
314-018	4	Nord-lock Washer - M12	10 pairs	SSNLW M12
314-018	5	Plain Washer - M12	10	SSPLW M12
314-018	6	Hex Nut - M12	10	SSPLN M12
314-004	1	Top Screen Pneumoseal	2	300/02/008
314-004	2	Primary Screen Pneumoseal	2	300/02/009
314-004	3	Secondary Screen Pneumoseal	4	300/02/010
314-004	4	Air Connector 'O' Ring	8	300/02/011
314-004	5	Air Connection Receptacle	8	300/02/012
314-004	6	Air Receptacle 'O' Ring	8	300/02/013

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SECTION 5.1 - PARTS LIST (Cont'd)

INVERTER

<u>Parts List</u> <u>Drwg No:</u>	<u>Item</u> <u>No:</u>	<u>Description:</u>	<u>Qty per</u> <u>Shaker:</u>	<u>Part</u> <u>Number:</u>
300-013		Inverter Assembly	1	
300-013	1	Inverter Enclosure	1	300/03/001
300-013	2	Inverter 7.5 kW	1	300/03/002
300-013	3	Filter	1	300/03/003
300-013	4	Thermistor Relay	2	300/03/004
300-013	5	Contactoer 7.5 kW	5	300/03/005
300-013	6	Overload Relay 6 - 9A	2	300/03/006
300-013	7	Transformer	1	300/03/036
300-013	8	Relay	2	300/03/037
300-013	9	Primary Fuse Holder	2	300/03/009
300-013	10	Primary Fuse	2	300/03/010
300-013	11	Secondary Fuse Holder	1	300/03/011
300-013	12	Secondary Fuse	1	300/03/012
300-013	11	Neutral Link Holder	1	300/03/011
300-013	13	Neutral Link	1	300/03/013
300-013	14	Ammeter	2	300/03/014
300-013	15	Hours Run Meter	1	300/03/015
300-013	16	Reset Pushbutton	1	300/03/016
300-013	17	Terminal	17	300/03/017
300-013	18	Fault Indicator Light (Red)	2	300/03/018
300-013	19	Terminal	3	300/03/034
300-013	20	Terminal	3	300/03/035

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SECTION 5.1 - PARTS LIST (Cont'd)

ASSOCIATED ELECTRICAL EQUIPMENT

<u>Description:</u>	<u>Qty per Shaker</u>	<u>Part No:</u>
Isolator	1	300/03/019
Stop/Start Station	1	300/03/020
Emergency Stop Station	1	300/03/021
Gland - M20 Barrier Exd	2	300/03/024
Gland - M25 Barrier Exd	4	300/03/038
Gland - M20 Double Compression Exd/Exe	10	300/03/039
Shroud - M20	2	300/03/025
Shroud - M25	4	300/03/040
Exd Plug - M20	7	300/03/026
Exd Plug - M25	4	300/03/027
Exd Adaptor - M20 Male x M25 Female	3	300/03/041
Locknut - M20	2	300/03/042
Lockwasher - M20	2	300/03/043
Earth Strap	3	300/03/023
Earth Tag - M20	12	300/03/028
Earth Tag - M25	4	300/03/044
Fibre Washer - M20	12	300/03/029
Fibre Washer - M25	4	300/03/045
Pan Head Set Screw Assy - M6 x 25 lg.	4	SSPHS M6x25
Pan Head Set Screw Assy - M4 x 25 lg.	6	SSPHS M4x25
A.C. Supply Choke	1	300/03/030
A.C. Supply Choke Enclosure *	1	300/03/031
3 Button Speed Control Station	1	300/03/032

* Note: Enclosure sized to suit number of Shakers per installation

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SECTION 5.1 - PARTS LIST (Cont'd)

PNEUMATIC ASSEMBLY

<u>Parts List</u> <u>Drwg No:</u>	<u>Item</u> <u>No:</u>	<u>Description:</u>	<u>Qty per</u> <u>Shaker:</u>	<u>Part</u> <u>Number:</u>
314-015	1	Pneumatic Control Panel Assembly	1	300/04/001
314-015	2	Mounting Plate c/w Bolts	1	300/04/002
314-015	3	Air Regulator	1	300/04/003
314-015	4	Pressure Gauge : 0 - 100 PSI	1	300/04/004
314-015	5	3 Way Valve	1	300/04/005
314-015	6	Non-Return Valve	1	300/04/006
314-015	7	Adaptor - N°. 6 JIC x ¼" NPT	3	300/04/007
314-015	8	90° Swivel Elbow N°. 6 JIC	3	300/04/008
314-105	9	Swivel Hosetail N°. 6 JIC	3	300/04/009
314-015	10	Hose Clips	6	300/04/010
314-015	11	Air Hose	30m	300/04/011

VSM 300 RETROFIT KIT

Sump Adaptor Bracket Assembly	2	300/05/002
VSM 300 Feedchute	1	300/05/003
Mounting Spring	4	300/05/004
Mounting Spring Pad	8	300/05/005

MAINTENANCE EQUIPMENT

Screen Repair Applicator	1	300/06/001
Screen Repair Compound (380ml)	1	300/06/002
Main Bearing Grease (400g)	1	300/06/003

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314-010	Clump Weight Housing Assembly
314-011	Vibratory Drive Assembly
314-013	Inverter Enclosure General Arrangement
314-014	Motor Shaft Coupling Assembly
314-015	Pneumatic Control Panel
314-018	Basket Assembly

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- 6.0 **FAULT FINDING**
- 6.1 Fault Finding/Correction Checklist

SECTION 6.1 - FAULT FINDING/CORRECTION CHECKLIST

Symptom:	Probable Cause:	Remedial Action:
<u>Electrical:</u>		
i) Both motors fail to rotate	Main supply down	Check supply to inverter enclosure Inverter should read Drive Frequency 0.0Hz Check isolator is in 'ON' position Check fuses Check reset button is depressed
ii) One motor fails to rotate	Broken wires to motor(s)	Check wiring
iii) One motor fails after start-up (Fault light showing)	Electric motor faulty Excessive grease in main shaft bearings Thermal overload setting Thermister relay tripped	Check/change motor Remove excess grease Reset overload to correct setting Check wiring inside terminal box to thermister terminals
iv) Shaker stops (No fault light showing)	Inverter trips	Check fault finding section of Inverter Manual (See Section 9.0)
<u>Mechanical:</u>		
i) Both drive shafts fail to rotate	Bearing failure	Replace bearings
ii) One drive shaft fails to rotate	Bearing failure	Replace bearings
iii) Bearing failure	Wrong grease Grease system/ seal failure	Use recommended grease - Section 6.0 Check grease passage
iv) Motor running with no vibration/unusual vibration	Tyre coupling failure	Replace tyre coupling Check weights set in line.
v) Pneumatic clamping failure	Incorrect pressure Incorrectly fitted screens Incorrectly fitted air connector	Check air supply and pressure is correct (80-90 psi) Check screens are properly located Check air connection

SECTION 6.1 - FAULT FINDING/CORRECTION CHECKLIST

Symptom:	Probable Cause:	Remedial Action:
vi) Solids transportation limited	Shaft rotation Damaged screen Angle of basket Spray bars off (WBM)	Check shaft rotation Replace screen Operate unit in horizontal position only Use spray bars
vii) Short screen life	Screen too fine Premature damage Angle of basket Inadequate washdown facilities Incorrect fluid level	Change to coarser screen Check storage and handling Check basket is operated in horizontal position High pressure clean with appropriate fluid Adjust to 10-15" beach (OBM)
viii) Excessive noise	Loose bolts Pneumatic clamping system Bearing failure	Check torque on all bolted assys. Check pressure Replace bearings
ix) Unusual vibrations	Weakened mounting spring	Change mounting spring
	Incorrect shaft rotation	Check directions

Additional Recommendations for Water Based Drilling Fluids

<u>Symptom:</u>	<u>Remedial Action:</u>
i) Lack of bottom screen transportation	Fit finer primary screens and ensure beach length is 6-8" Rotate screens, allowing one set to be used as back-up Clean back-up screens from rear with high pressure wash gun Ensure adequate washdown facilities are available (ie high pressure wash gun) Install spray bar system (Contact Thule Rigtech)
ii) Lack of top transportation	Remove front gate in distribution chute and allow fluid to wash over onto screen.

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7.0 DRAWINGS

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314-002	Vibratory Drive General Arrangement
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8.0 SUB VENDOR MANUALS

- 1) Inverter Manual
- 2) Thermistor Protection Units

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9.0 SERVICE BULLETINS