

# Hydrauvision

HYDRAULICS & PNEUMATICS

## SYSTEM DESCRIPTION

### Hydraulic System Flexible Fall Pipe Vessel FFPV H215



Client : Yantai Raffles Offshore Ltd. / Van Oord  
Project no: : Yantai contract no. YROL2007-215-4C-E007-JEBSENS2# / ERP PO no. 67850  
Project no. : Hydrauvision 1-42695  
Version : 2.1 December 10, 2008  
Initiator : A.W. Overbeeke

## Table of contents

1	General description:.....	3
2	Safety:.....	4
3	Description hydraulic components:.....	5
4	Description Control cabinet panel lay-out.....	15
5	Direction for piping and flushing:.....	16
5.1	Pipe connections on valveblocks.....	16
5.2	Piping and pipe connections in covered spaces.....	16
5.3	Guide lines for flushing of hydraulic piping.....	17
5.3.1	Flushing procedure.....	17
5.3.2	Minium oil speed for flushing requirements.....	18
5.4	Pressure testing.....	19
5.4.1	Basic requirements for pressure tests.....	19
6	Commissioning instructions:.....	20
6.1	Visual inspection before taking in operation.....	20
6.2	Hydraulic precautions:.....	20
6.2.1	Piping works.....	20
6.2.2	HPU container.....	20
6.2.3	Precautions for electric system.....	21
6.2.4	Stackwinch.....	21
6.3	Hydraulic cylinders.....	21
6.3.1	Assembly of Main Cylinder Bucket Storage Container.....	22
6.4	Valve boxes.....	23
7	Storage and handling instructions:.....	24
7.1	HPU container.....	24
7.2	Hydraulic Cylinders.....	24
7.3	Stack Winches.....	25
8	Maintenance:.....	26
8.1	Safety during maintenance.....	26
8.2	Scheduled maintenance.....	26
8.2.1	Oil quality.....	26
8.2.2	Every 100 running hours or 1 month of operation:.....	26
8.2.3	Every 1000 running hours or 1 year of operation:.....	27
8.3	Removing the main pumps.....	27
9	Disposal of the equipment:.....	28
10	Preservation remarks and specifications:.....	28
11	Preferred spare parts:.....	29

## **1 General description:**

The installation was designed for use in a hydraulic system on board of a Freefall Pipe Vessel. Its purpose is to drive a number of hydraulic cylinders, winches and drives in order to move the Bucket Storage Container and Tower System.

Hydrauvisions total scope of supply comprises:

- 1 pc. Hydraulic Power Unit (HPU)
- 2 pc. Stack winch
- 23 pc. Hydraulic cylinders
- 4 pc. Moonpool door drives
- 2 pc. Valve boxes
- Single parts to be assembled on board

## **2 Safety:**

**Do not use the installation for any other purpose than it was designed for.**

**Operation by trained and experienced operators only.**

**Maintenance by trained and experienced mechanics only.**

**Convince yourself that electric power is shut off before applying maintenance on the hydraulic or electric equipment.**

**Convince yourself that the installation is depressurized before applying any maintenance to the hydraulic equipment.**

### **3 Description hydraulic components:**

Description of the hydraulic system is made by highlighting the specific function of each installed component.

Reference drawing: - Hydraulic Circuit Drawing 042695-5-00000.

#### **Item 1: Hydraulic pump**

This variable displacement axial piston pump has a capacity of 140 cc / revolution. The pump flow is hydraulically pressure controlled. By means of a remote valve the pressure setting can be switched between 150 and 260 bar. The displacement of the pump is limited at 200 l/min. at 1800 rpm.

#### **Item 2: Electric motor**

The main electric motor drives the hydraulic pumps. The maximum continuously power output is 104 kW S1 duty (100%) at 60 Hz.

#### **Item 3: Drive coupling**

This flexible drive coupling is mounted between the electric motor and the hydraulic pump.

#### **Item 4: Bell housing**

The bell housing is mounted in a sub plate to support both the electric motor and the hydraulic pump. To reduce the noise and vibration level from the pump the bell housing comprises a rubber-dampening element.

#### **Item 5: Circulation pump**

The circulation pump provides a fixed flow of approximately 200 l/min through the oil cooler and return oil filter. The pump is equipped with an external safety valve set to 10 bar. The circulation pump is operated in 2 modes: 1: automatically started when the oil temperature of the hydraulic oil tank exceeds 45 degrees Celsius, or 2: manually start from the control box in case of heating function.

#### **Item 6/7: Suction valve**

Butterfly valve to isolate the pumps from the oil tank for maintenance purposes only. Under normal operating conditions the suction valves are fully open at all times.

#### **Item 10: Air breather**

To prevent pressure build up inside the tank due to temperature and oil contents variations an air breather is installed on the tank cover, mesh 10 microns.

#### **Item 11: Oil tank**

The oil tank is an atmospheric carbon steel vessel, gross content approx. 2500 liter.

### **Item 12: Drain valve**

This gate valve is mounted at the lowest point of the tank and is used as a drain valve. The outlet of the valve is plugged for safety reasons. Remove the plug before opening the valve in order to drain the oil tank.

### **Item 13: Pressure relief valve**

The pressure relief valve is provided to limit the pressure of the main pumps in case of malfunctioning displacement control or peak pressures.

As the pressure rises above the setting of the valve (300 bar), the pressure relief valve opens to discharge to tank.

### **Item 14: Oil/air cooler**

Under normal operating conditions the oil in the hydraulic system shall not easily overheat. An operating temperature of 30-50°C is considered normal.

In case the temperature rises above 45°C the electric motor of the cooler pump is switched on automatically.

### **Item 15: Check valve**

Check valve 15 is provided as pre tension valve in order to keep the higher piping system filled with oil.

### **Item 16: Pressure relief valve**

The pressure relief valve 16 is provided to limit the pressure of the oil circulation pump 5 at 10 bar.

### **Item 18: Return oil filter**

The return filter is mounted on the tank cover to filter the oil flow coming from the return line to the oil tank.

The filter comprises a removable filter cartridge (Item 19), a spring-loaded bypass valve that opens in case of contamination of the filter cartridge and a dirt indicator (Item 64).

### **Item 19: Filter cartridge**

The filter cartridge can be replaced by removing the cover of the filter housing.

Unscrew the nuts at the cover of the filter housing and take out the filter cartridge.

The glass fiber cartridge filters up to 10 microns abs. Do not attempt to clean the cartridge; always replace by a new and clean cartridge.

### **Item 20: Drain oil filter**

The drain filter is mounted on the tank cover to filter the oil flow coming from the drain line to the oil tank.

The filter comprises a removable filter cartridge (Item 21), a spring-loaded bypass valve that opens in case of contamination of the filter cartridge and a dirt indicator (Item 64).

### **Item 21: Filter cartridge**

The filter cartridge can be replaced by removing the cover of the filter housing. Unscrew the nuts at the cover of the filter housing and take out the filter cartridge. The glass fiber cartridge filters up to 10 microns abs. Do not attempt to clean the cartridge; always replace by a new and clean cartridge.

### **Item 22: Temperature sensor:**

The temperature sensors are mounted at the lower front of the oil tank. This analogue measuring device is each provided with 2 digital outputs:

- < 10 °C: Advise to heat up the oil
- > 45 °C: Circulation pump and Oil cooler is started
- > 65 °C: Alarm level "Oil temperature high"

### **Item 23: Ball valve**

Ball valves to isolate the level indicator for testing and maintenance purposes.

### **Item 24: Level gauge**

The level gauge is mounted at the front of the oil tank. The red flaps indicate the oil contents in the tank.

In case of all cylinders retracted the level should be at the indication "max. filling level - all cylinders retracted".

The contacts of the reed switches (item 49) are monitored by the PLC.

- LSH "Oil level high": Emergency shut down, all pumps stopped.
- LSL "Oil level low": Warning only, check oil level, pumps remain running.
- LSLL "Oil level low/low": Emergency shut down, all pumps stopped.

The oil level is correct when the sight glass indicates that the tank is filled in accordance with the instructions on level gauge.

### **Item 25: Check valve**

Check valves to prevent back flow from one main pump pilot line to the other.

### **Item 26: Base plate**

Base plate for mounting 4/3 way valve 29 and pressure pilot valve 27/28.

### **Item 27/28: Pressure relief valve**

The pressure relief valve is actually a pilot valve to control the pump pressure remotely.

### **Item 29: 4/3 way pilot valve**

Electrical operated directional control valve acting as a pilot for the pump pressure. Energizing solenoid y1a pilots the pump at 260 bar, energizing solenoid y1b pilots the pump at 150 bar, de-energizing will unload the pump.

### **Item 30: Check valve**

Check valves to prevent back flow from one main pump to the other.

**Item 31: Ball valve**

Ball valve to block the pump pressure line for testing and maintenance purposes.

**Item 32/33: 2/2 way valve**

Solenoid operated valve to shut off the flow coming from circulation pump 5 going to oil cooler 14 in order to force the oil circulation flow through pressure relief valve 16 as heating function.

**Item 34: Ball valve**

Low pressure ball valve with pipe connection 42L for filling purposes.

**Item 35: Manifold pressure line**

Hydraulic manifold assembled for connecting main pumps to each other and with pressure relief valve.

**Item 36: 10-fold base plate NG10**

10-fold base plate for assembling of 10 pcs. Cetop 5 valves (NG10).

**Item 37: Compensator valve NG10**

Pressure compensator valve with the function to keep the flow through 4/3 way valves 41 constantly and insensible to load and pressure changes by providing a constant pressure difference of 7 bar.

**Item 38/39: Pressure relief valve**

Pressure relief valve from working lines A and B to return line T with the purpose to limit working pressure.

**Item 40: Double flow control valve**

Double flow control valve to independently regulate the running speed of the actuators in both directions. Flow control valve is assembled as meter in control.

**Item 41: 4/3 way directional control valves**

Directional control valve to operate actuators in two directions.

**Item 42: Double pilot operated check valves**

When not pressure operated both valves shut off the oil lines to the actuators to prevent unwanted movement.

**Item 43: Blinding plate**

Blinding plate to shut off spare position on 10-fold base plate 36.

**Item 44: Pressure gauge**

Mounted to the 10-fold base plate manifold 36 to indicate the actual main pressure.

**Item 45: Pressure transmitter**

Mounted to the 10-fold base plate manifold 36 to digitally indicate the actual pressure in the main pressure ports with an analogue output of 0..10V.

**Item 46: Flow divider**

Mounted in HPU container behind 10-fold base plate 36, to divide flow to cylinders for adjustable bucket frame in two equal parts with an accuracy of approximately 3%. The purpose is to create an equal movement of these cylinders. The flow divider is provided with integrated pressure relief and make up check valves in order to compensate inequality at the end of both extended and retracted stroke.

**Item 47: Flow divider**

Mounted in HPU container behind 10-fold base plate 36, to divide flow to moonpool door drives in two equal parts with an accuracy of approximately 3%. The purpose is to create an equal movement of these drives. The flow divider is provided with integrated pressure relief and make up check valves in order to compensate inequality at the end of both extended and retracted stroke.

**Item 48: Check valve**

Check valve is provided as pre tension valve in order to keep the higher piping system filled with oil.

**Item 49: Reed switch**

See item 24

**Item 50/51: Ball valve**

Ball valves for blocking actuators for maintenance purposes.

**Item 52: Cylinder (Right) for attachment frame**

Hydraulic cylinder with bore diameter 125 mm, rod diameter 90 mm, stroke 2090 mm for movement of adjustable bucket frame. Cylinder is provided with PNP type limit switches at end of stroke in both extended and retracted position.

Item 52 is different from 72 as limit switches are provided on right or left side of cylinder housing. To be mounted by buyer.

**Item 53/54: Load control valve**

Function of valve is to hold and control load in negative load conditions. To be mounted during assembly of piping works as short as possible to cylinder

**Item 55/56: Load control valve**

See item 53/54

**Item 57:**

See item 50/51

System Description

Project : Flexible Fall Pipe Vessel FFPV H215

Project nr. : 42695 / Yantai contract no. ROL2007-215-4C-E007-JEBSENS2# / ERP no. 67850

---

**Item 58: Hydraulic cylinder conveyor belt**

Hydraulic cylinder with bore diameter 125 mm, rod diameter 90 mm, stroke 3700 mm for movement of conveyor belt. To be mounted by buyer.

**Item 59: Hydraulic motor**

Low speed, high torque, gerotor type motor, mounted on top of planetary gear box 60. Max. continuous pressure of motor is 210 bar.

**Item 60: Planetary gear box**

Planetary gearbox, 3 stages, with incorporated multi disc brake. The gearbox is provided with cylindrical keyed shaft and assembled with pinion wheel for the drive of moonpool doors. To be mounted in vertical position (with hydraulic motor on top) by buyer.

**Item 61: Hydraulic cylinder splitter doors**

Hydraulic cylinder with bore diameter 80 mm, rod diameter 55 mm, stroke 1630 mm for movement of splitter doors. To be mounted by buyer.

**Item 62: Hydraulic cylinder retractable guidance frame**

Hydraulic cylinder with bore diameter 100 mm, rod diameter 60 mm, stroke 1350 mm for movement of retractable guidance frame. To be mounted by buyer.

**Item 63: Hydraulic cylinder locking pins**

Hydraulic cylinder with bore diameter 40 mm, rod diameter 22 mm, stroke 100 mm for movement of locking pins for retractable guidance frame (2 pcs.) and umbilical moonpool frame (4 pcs.). To be mounted by buyer.

**Item 64: Clogging indicator return filter**

Mounted on return oil filter to indicate the contamination level of the filter cartridge. Under normal operating conditions with clean oil filter the pressure build up in the filter housing is too low to activate the switch. If the filter is clogged the switch is activated. The filter cartridge must be replaced.

**Item 65: Compensator**

Rubber compensator bellow to isolate pump born vibrations from other parts of the system and HPU.

**Item 66/67: Temperature sensor and mounting sleeve.**

See item 22

**Item 68: Compensator**

See item 65

**Item 69/70: Load control valve**

See item 53/54

System Description

Project : Flexible Fall Pipe Vessel FFPV H215

Project nr. : 42695 / Yantai contract no. ROL2007-215-4C-E007-JEBSENS2# / ERP no. 67850

---

**Item 71: Clogging indicator drain filter**

Mounted on drain oil filter to indicate the contamination level of the filter cartridge. Under normal operating conditions with clean oil filter the pressure build up in the filter housing is too low to activate the switch.

If the filter is clogged the switch is activated. The filter cartridge must be replaced.

**Item 72: Cylinder (Left) for attachment frame**

See item 52

**Item 73: Compensator valve NG10**

Pressure compensator valve with the function to keep the flow through 4/3 way valves 41 constantly and insensible to load and pressure changes by providing a constant pressure difference of 14 bar.

**Item 91: Base plate NG16**

Base plate for mounting 4/3 way valves NG16.

**Item 92/93: Pressure relief valve**

Pressure relief valve from working lines A and B to return line T with the purpose to limit working pressure.

**Item 94/95: Load control valve**

See item 53/54

**Item 96: Compensator valve NG16**

Pressure compensator valve with the function to keep the flow through 4/3 way valves 41 constantly and insensible to load and pressure changes by providing a constant pressure difference of 7 bar.

**Item 97: Proportion 4/3 way valve NG16**

Proportional electrically operated 4/3 way valve for operation of BSC Main Cylinder (item 100). Valve is provided with on board electronics with standard input signal -20..0..+20mA. Supply voltage is 24 Vdc.

**Item 98: Mini mess connection**

This standardized connector is used to monitor the oil pressure in various locations in the hydraulic system. Do not over tighten the cap.

**Item 99: Ball valve**

Ball valve with SAE connection for blocking Main cylinder for maintenance purposes.

**Item 100: Hydraulic Main cylinder**

Hydraulic cylinder with bore diameter 400 mm, rod diameter 220 mm, stroke 5500 mm for movement of Bucket Storage Container. To be mounted by buyer.

System Description

Project : Flexible Fall Pipe Vessel FFPV H215

Project nr. : 42695 / Yantai contract no. ROL2007-215-4C-E007-JEBSENS2# / ERP no. 67850

---

**Item 101: Hydraulic Aux. cylinder**

Hydraulic cylinder with bore diameter 200 mm, rod diameter 140 mm, stroke 5500 mm for movement of Bucket Storage Container. To be mounted by buyer.

**Item 102: Ball valve**

Ball valves for blocking Aux. cylinder for maintenance purposes.

**Item 103: Ball valve**

Ball valve, manifold type, mounted on top of hydraulic motor (item 103) for stack winch drive. Ball valve can be used as freewheel valve for emergency running applications. In case of failure of one of the hydraulic motor control a special coupling can be mounted between Stack winches in order to drive both stack winches with one hydraulic motor. The driven hydraulic motor has to be in freewheel running mode by switching over the ball valve item 103.

**Item 104: Hydraulic motor**

Hydraulic motor for Stack winch drive. Type of hydraulic motor is radial plunger motor with camring principle, with a displacement of 7543 cc/rev.

CAUTION: be sure that drain lines are connected before taking in operation.

**Item 105: Base plate NG6**

Base plate 2-fold for mounting control valves NG6.

**Item 106: Base plate NG10**

Base plate for mounting control valves NG10.

**Item 107: Base plate NG6**

Base plate 3-fold for mounting control valves NG6.

**Item 108/109: Pressure reducing valve**

Mounted in control box on stack winch as pressure reducing function for stack winch spanner cylinders.

**Item 110/111: Pressure relief valve**

Pressure relief valve from working line A to return line T with the purpose to limit working pressure.

**Item 112: Double flow control valve**

Double flow control valve to independently regulate the speed of the stack winch spanner cylinders in both directions.

**Item 113: Compensator valve NG10**

Pressure compensator valve with the function to keep the flow through 4/3 way valves 127 constantly and insensible to load and pressure changes by providing a constant pressure difference of 7 bar.

**Item 114: Pilot operated check valves**

When not pressure operated both valves shut off the oil lines from bottom side of stack winch spanner cylinders.

**Item 115: 4/3 way directional control valve**

Directional control valve to operate actuators in two directions.

**Item 116: Blinding plate**

Blinding plate to shut off spare position on 10-fold base plate 107.

**Item 117: Accumulator**

Serve as a hydraulic energy storage in order to keep constant pressure at bottom side of stack winch spanner cylinders in order to compensate leakage through piston seals.

**Item 118: Ball valve**

Ball valves for blocking cylinders for maintenance purposes.

**Item 119: Pressure switch**

Mounted in valve box on stack winches. The purpose of the pressure switches is to indicate that pressure at bottom side of stack winch spanner cylinders is too low and has to be increased.

**Item 120: Ball valve**

Bleed valve for unloading accumulators (item 117).

**Item 121: Hydraulic Stack winch spanner cylinder**

Hydraulic cylinder assembled on stack winch, with bore diameter 100 mm, rod diameter 60 mm, stroke 300 mm with the purpose of spanning function to span the stack chains.

**Item 122/125: Pressure relief valve**

Pressure relief valve from working lines A and B to return line T with the purpose to limit working pressure.

**Item 123/124: Pressure relief valve**

Pressure relief valve from working lines A and B to return line T with the purpose to limit working pressure.

**Item 126: Double pilot operated check valves**

When not pressure operated both valves shut off the oil lines to the actuators to prevent unwanted movement.

**Item 127: Proportion 4/3 way valve NG10**

Proportional electrically operated 4/3 way valve for operation of BSC Auxiliary Cylinder (item 101). Valve is provided with on board electronics with standard input signal -20..0..+20mA. Supply voltage is 24 Vdc.

System Description

Project : Flexible Fall Pipe Vessel FFPV H215

Project nr. : 42695 / Yantai contract no. ROL2007-215-4C-E007-JEBSENS2# / ERP no. 67850

---

**Item 128: Hydraulic cylinder locking pins BSC**

Hydraulic cylinder with bore diameter 65 mm, rod diameter 35 mm, stroke 240 mm for movement of locking pins for Bucket Storage Container. To be mounted by buyer.

**Item 129/130: Load control valve**

Function of valve is to hold Aux. cylinder and control load in negative load conditions. To be mounted during assembly of piping works as short as possible to cylinder

**Item 131: Proportion 4/3 way valve NG16**

Proportional electrically operated 4/3 way valve for operation Stack winch drive. Valve is provided with on board electronics with standard input signal - 20..0..+20mA. Supply voltage is 24 Vdc.

**Item 132: Mini mess connection**

This standardized connector is used to monitor the oil pressure in various locations in the hydraulic system. Do not over tighten the cap.

**Item 133: Freewheel manifold**

Mounted on top of Hydraulic motor for stack winch drive with the purpose to mount ball valve 103.

**Item 134: Ball valve**

Ball valves for blocking actuators for maintenance purposes.

System Description

Project : Flexible Fall Pipe Vessel FFPV H215

Project nr. : 42695 / Yantai contract no. ROL2007-215-4C-E007-JEBSENS2# / ERP no. 67850

---

## **4 Description Control cabinet panel lay-out**

For further description of the Control Cabinet reference is made to the manual of "Bakker Sliedrecht".

## 5 Direction for piping and flushing:

Assembly of hydraulic components as described in the prior chapter and supply, assembly and flushing of hydraulic piping work has to be carried out by buyer. In the following chapters a direction for piping and flushing is given.

Dimensions of piping work has to be carried out according to hydraulic circuit 042695-5-00000.

**CAUTION:** be sure that drain lines are connected before taking in operation, otherwise severe damage may occur.

### 5.1 Pipe connections on valveblocks

- Low pressure piping with a diameter up to and including 25x2,5 joined by means of pipe couplings with captive seals (WD).
- Low pressure piping with a diameter of 30x3 up to and including 114,3x3,6 with SAE flanges- 3000 psi with O-rings.
- High pressure piping with a diameter up to and including 25x3 joined by means of pipe couplings with captive seals (WD).
- High pressure piping with a diameter of 30x4 up to and including 101,6x10 with SAE flanges-6000 psi with O-rings.
- High pressure piping with a diameter of 168,3x12,5 with DIN 2638 flanges DN150- PN160 with O-rings.

### 5.2 Piping and pipe connections in covered spaces

- Pipes made out of seamless carbon steel precision piping acc. DIN 2445/2 - St.37.4 -NBK phosphated or DIN 2448/17.121 - St.52.3N.
- High pressure piping with a diameter up to and including 30x4 and return and drain piping with a diameter up to and including 38x3 joined by means of steel pipe couplings with captive seals (WD) and connected with WALFORM with sealing rings.
- Low pressure piping up to 16 bar (return and suction pipes) with a diameter of 48,3x2,6 up to and including 139,7x4 with SAE flanges-3000 psi with welding nipples with O-rings.
- Low pressure piping up to 16 bar (return and suction pipes) with a diameter of 168,3x4,5 and 219,1x5,6 with DIN 2633 butt welded flanges-PN16 with O-rings.
- High pressure piping of 280 bar with a diameter of 30x4 with SAE flanges-6000 psi with welding nipples with O-rings.
- High pressure piping with a diameter of 38x4 up to and including 76,1x8 with SAE flanges-6000 psi with welding nipples with O-rings.
- Material of bolts and nuts are hot dip galvanized steel; socket head cap screws acc. DIN 912-8.8 GV.
- Pipeclamps, make "Stauff" or equal, heavy duty, poly propylene clampjaws, mounted on carbon steel rails or welding plates (not fully welded).

- Coverplates made of galvanized carbon steel.
- Mounting bolts made of hot dip galvanized steel.
- Flexible hoses, make "Aeroquip" or equal with type approval B.V. and type certificate, burstpressure at least 4x working pressure.
- Hose connection nipples and couplings made of yellow passivated carbon steel.

### **5.3 Guide lines for flushing of hydraulic piping**

Flushing has to be carried out by authorised personnel under supervision of a representative from Hydrauvison or Van Oord Marine Contractors.

For all tests an unique certificate should be delivered. Testing results has to be verified by calibrated testing equipment.

Each hydraulic function has to be connected separately to the flushing equipment. Connect the hoses at the cylinder (hydraulic motor) to each other in order to obtain a closed circuit. Carry out flushing until the required cleanliness is reached.

It is allowed to flush more than one function in a time, in that case connect functions to each other in order to obtain one loop. Be sure to flush the biggest pipe with the required flow.

After flushing connect pipes and hoses to their function straight away. Be sure that the environment is clean and that no contamination can enter the lines.

#### **5.3.1 Flushing procedure**

- It is strongly advised to flush each individual piping piece in a workshop prior to installation in the vessel.
- Flushing speed shall be at least 10 m/sec. There is no actual limit to the maximum limit to the maximum flushing speed. A higher speed leads to a better result.
- During flushing the flushing medium temperature must be between 50°C and 60°C.
- The same type and make of mineral oil shall be used for flushing and operating the system.
- Flush until the cleanness level is 18/16/13 in accordance with ISO 4406.
- It is strongly advised to flush each line in 2 directions in order to flush dirt particles in confined spaces.
- Several piping pieces may be connected for flushing but do not exceed a total length of approximately 50 meters.
- After flushing use clean and dry compressed air to remove the flushing oil from each individual piping piece.
- Install steel blind flanges with proper O-rings on both sides of each piping piece.
- Do not remove the blind flange prior to the actual installation and connection of the piping piece.
- It is advised to flush the complete piping system after installation in the vessel.

System Description

Project : Flexible Fall Pipe Vessel FFPV H215

Project nr. : 42695 / Yantai contract no. ROL2007-215-4C-E007-JEBSENS2# / ERP no. 67850

---

- Provisions have to be made interconnect the main piping sections in order to create a closed flushing loop (e.g. interconnection of the split cylinders close to the split cylinders).
- A flushing pump connection flange must be provided in one of the lines for the split cylinder to connect an external flushing pump.
- Only after consultation with Supplier the HPU may be used for flushing after installation of the piping system.

### 5.3.2 Minimum oil speed for flushing requirements

Minimum speed of oil through hydraulic lines during flushing : 10 m/s (for required flow see fig. 1)

Minimum cleanliness acc. to NAS 1638 : Class 7

Oil quality : Esso Nuto H32 or equal quality

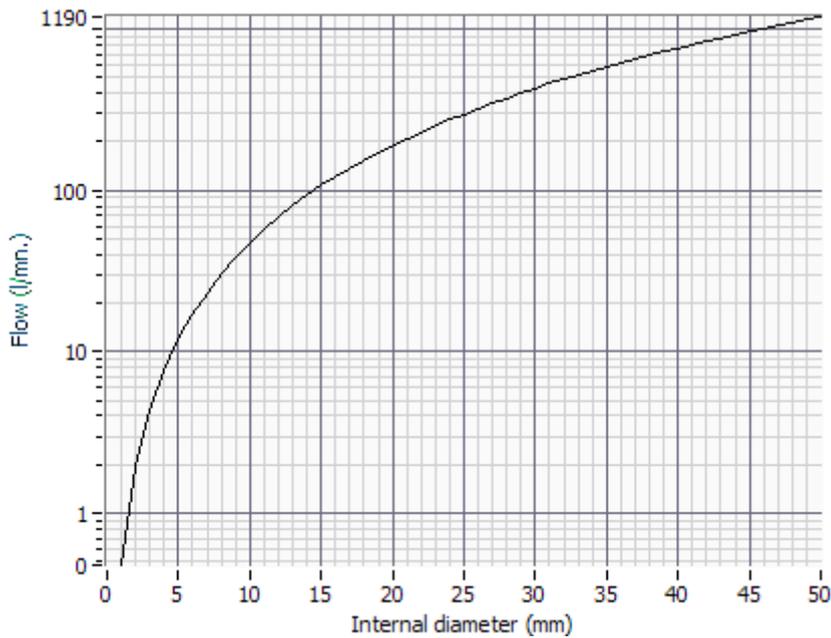


Fig. 1 Required flow at oil speed of 10 m/s

## 5.4 Pressure testing

Pressure testing has to be carried out by authorised personnel under supervision of a representative from Hydrauvision or Van Oord Marine Contractors.

For all tests an unique certificate should be delivered. Testing results has to be verified by calibrated testing equipment.

### 5.4.1 Basic requirements for pressure tests

All hydraulic pipe- and hose-assemblies has to be tested at a minimum pressure of 1,5x maximum working pressure, according to Table 1.

Every loop has to be tested on required test pressure during a minimum time of five minutes.

	Working pressure (bar)	Test pressure (bar)
<b>Bucket Storage Container</b>		
Central P line HPU to Valve Manifolds	260	400
Central T line HPU to Valve Manifolds	5	50
Working line Skidding Cylinders roside	330	500
Working line Skidding Cylinders bottomside	260	400
<b>Tower</b>		
Central P line HPU to cranes	260	400
Central T line cranes to HPU	5	50
Drainlines	1	50
Attachment frame	140	400
Adjustable bucket guidance frame	60	400
Conveyor belt	120	400
Moonpool doors	170	400
Locking pins	60	400

Table 1 Required testing pressures

## **6 Commissioning instructions:**

Note: This chapter describes the items to be checked before taking the HPU into operation.

Before taking the installation into operation the hydraulic piping work has to be installed as described in chapter 5, accordingly flushed and pressure tested.

Commissioning should be carried out in co-operation with Bakker Sliedrecht, which is responsible for complete electric system

### **6.1 Visual inspection before taking in operation**

It is advised to make a visual routine inspection to keep track of any deviations in the condition of the complete installation.

1. Check the general condition of lines and hoses
2. Check of any lose connections, leakages, damages cables, etc.
3. Check the general condition of the electric installation

### **6.2 Hydraulic precautions:**

#### **6.2.1 Piping works**

The complete hydraulic piping work for Tower and Bucket Storage Container is for the responsibility of buyer. It is strictly recommended to follow up piping and flushing direction as described in chapter 5.

#### **6.2.2 HPU container**

Before taking the installation into operation the following items must be checked.

1. Check the oil level in the tank using the level indicator at the front of the tank.
2. The tank must be filled in accordance with the instructions on the level gauge. Fill the oil tank up to the indication "max. filling level - all cylinders retracted".
3. If necessary fill the some oil into the tank by using the filling connection. Use the prescribed oil type.
4. Do not fill the tank through filter housings. Always use the prescribed filling connection.
5. Check whether suction valves of the main pumps(item 6) and circulation pump (item 7) are fully opened.
6. The hydraulic installation is ready for operation.

### 6.2.3 Precautions for electric system

1. Carry out hydraulic precautions as described in chapter 6.2.
2. Check direction of rotation of the installed electric motors by starting the oil/air cooler (item 14).for 1 second.
3. If direction of rotation is wrong change incoming power supply of main cabinet in HPU and check again the direction of rotation of oil/air cooler (item 14). Do not change connection in box on electric motors.
4. If direction of rotation of oil/air cooler is ok, check direction of rotation of the other electric motors by starting for 1 second.

Note: Running with hydraulic pumps in wrong direction of rotation can cause severe damage.

For further description on starting the electric motors reference is made to the manual of "Bakker Sliedrecht".

### 6.2.4 Stackwinch

It is very important that drain lines from hydraulic motors are connected to the correct connection before taking the stackwinch in operation, because otherwise serious damage can occur.

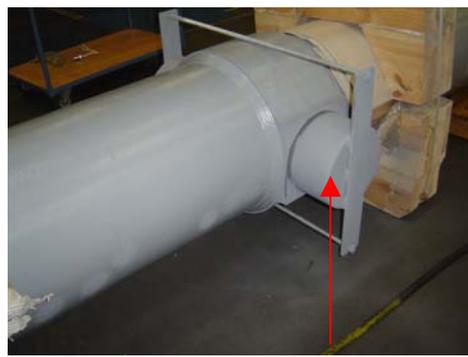
## 6.3 Hydraulic cylinders

Hydraulic cylinders are supplied without mounting pins or shafts.

Protection covers on trunnions, ball bearings or electric connections should be removed before assembly and/or installation.



Protection cover on ball bearing



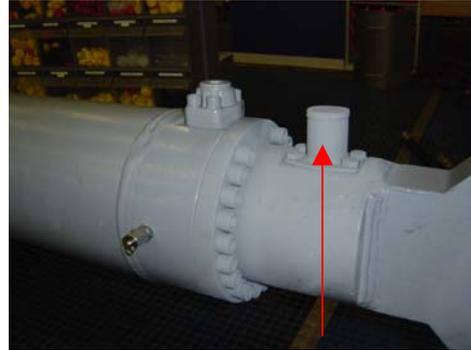
Protection covers on trunnions

System Description

Project : Flexible Fall Pipe Vessel FFPV H215

Project nr. : 42695 / Yantai contract no. ROL2007-215-4C-E007-JEBSENS2# / ERP no. 67850

---



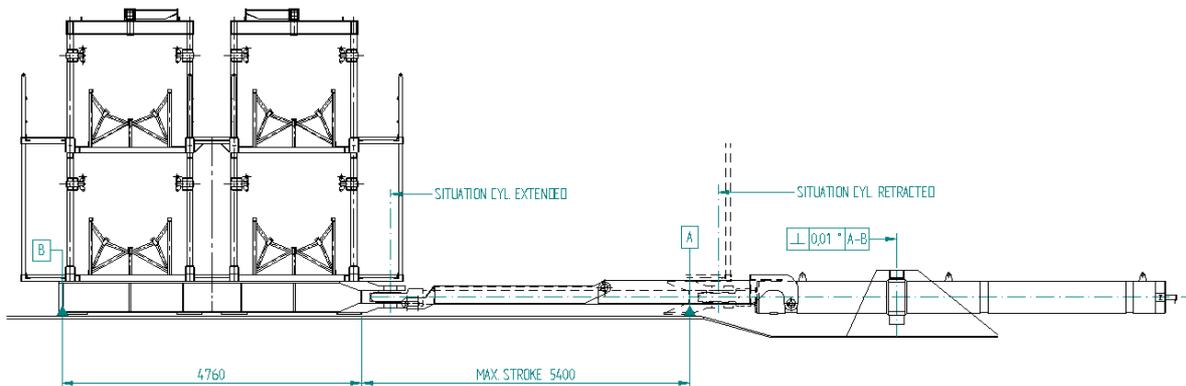
Protection cover on electric connections

### 6.3.1 Assembly of Main Cylinder Bucket Storage Container

Especially the Main Cylinder for skidding of the Bucket Storage Container needs extra attention for assembly in the construction.

Main requirements:

1. It is very important that vertical axes of Main Cylinder is perpendicular to skidding bed of Bucket Storage Container, see also figure below.



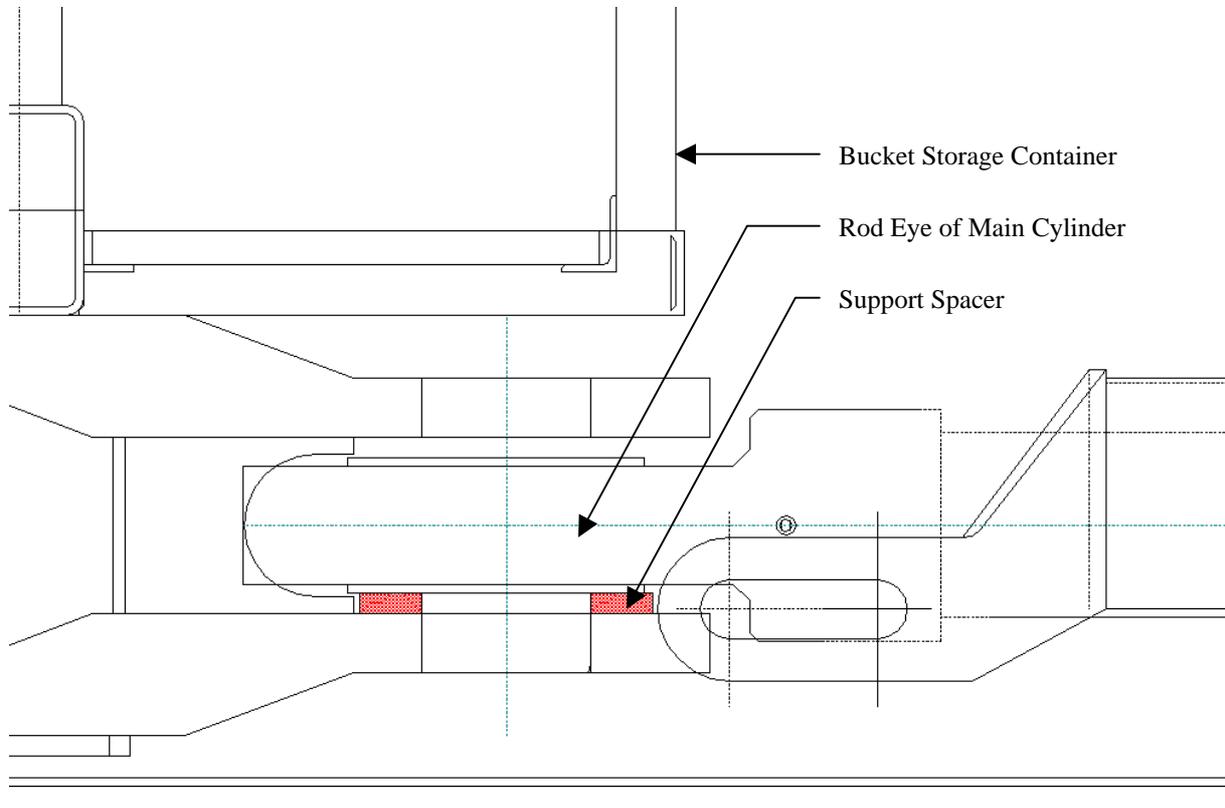
System Description

Project : Flexible Fall Pipe Vessel FFPV H215

Project nr. : 42695 / Yantai contract no. ROL2007-215-4C-E007-JEBSENS2# / ERP no. 67850

---

2. It is very important that Rod Eye of Main Cylinder is supported by a spacer (made of PTFE or similar) in order prevent rod for bending, causing damage or leakage through rod seals, see also figure below.



#### 6.4 Valve boxes.

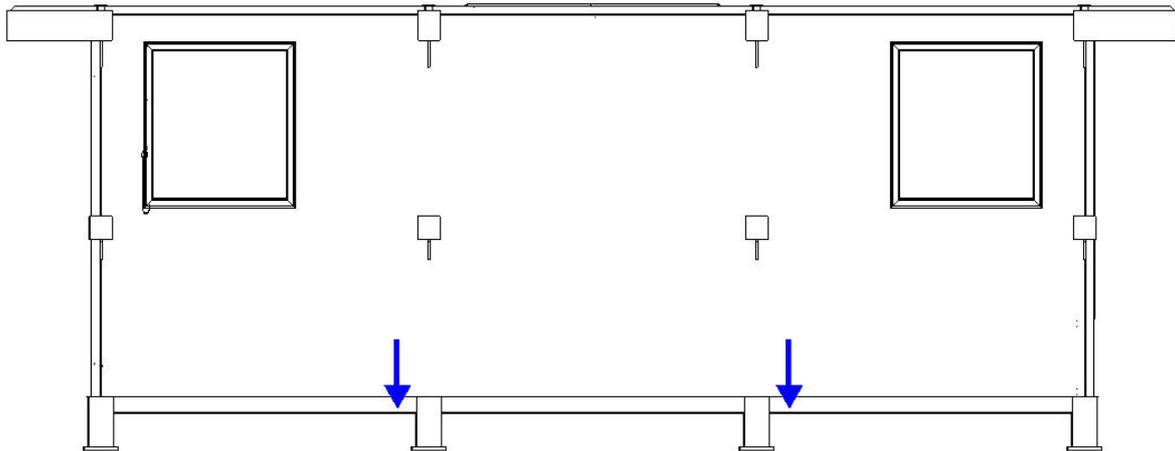
It is strictly recommended to locate valve boxes for Main Cylinder and Auxiliary Cylinder of Bucket Storage Container as near as possible to hydraulic connections of cylinders in order to provide the required control behavior.

## 7 Storage and handling instructions:

### 7.1 HPU container

Only lift the HPU container with 2 hoisting slings as indicated with blue arrows in figure below.

Total weight of HPU container without fluids: 11.050 kgs.



The HPU container is assembled with several parts that are sensible for moisture. It is strongly recommended to store the HPU container in an environment that is protected from moisture and temperature extremes.

If not possible to store the HPU container in an environment that is protected from moisture and temperature extremes it is strongly recommended to connect control box to electric supply and switch on electric room heating and stand still heating of electric motors. For connection diagrams please contact Bakker Sliedrecht.

### 7.2 Hydraulic Cylinders

Never lift a cylinder at the plunger or with chains.

Main cylinder is provided with welded on lifting lugs. Only use the lifting lugs to lift and handle the main cylinder.

Cylinders are plugged with steel plugs or flanges and partly filled with hydraulic oil. Do never fill a cylinder for 100%, otherwise serious damage can occur due to the increase of pressure by warming up. Maximum filling level is 95%.

Some of the cylinders are provided with incorporated measurement system or limit switches with fixed electric cable. Take special care to prevent damage to cables.

Some of the cylinders are provided with protection covers. Do not remove protection covers before assembly in ship.

System Description

Project : Flexible Fall Pipe Vessel FFPV H215

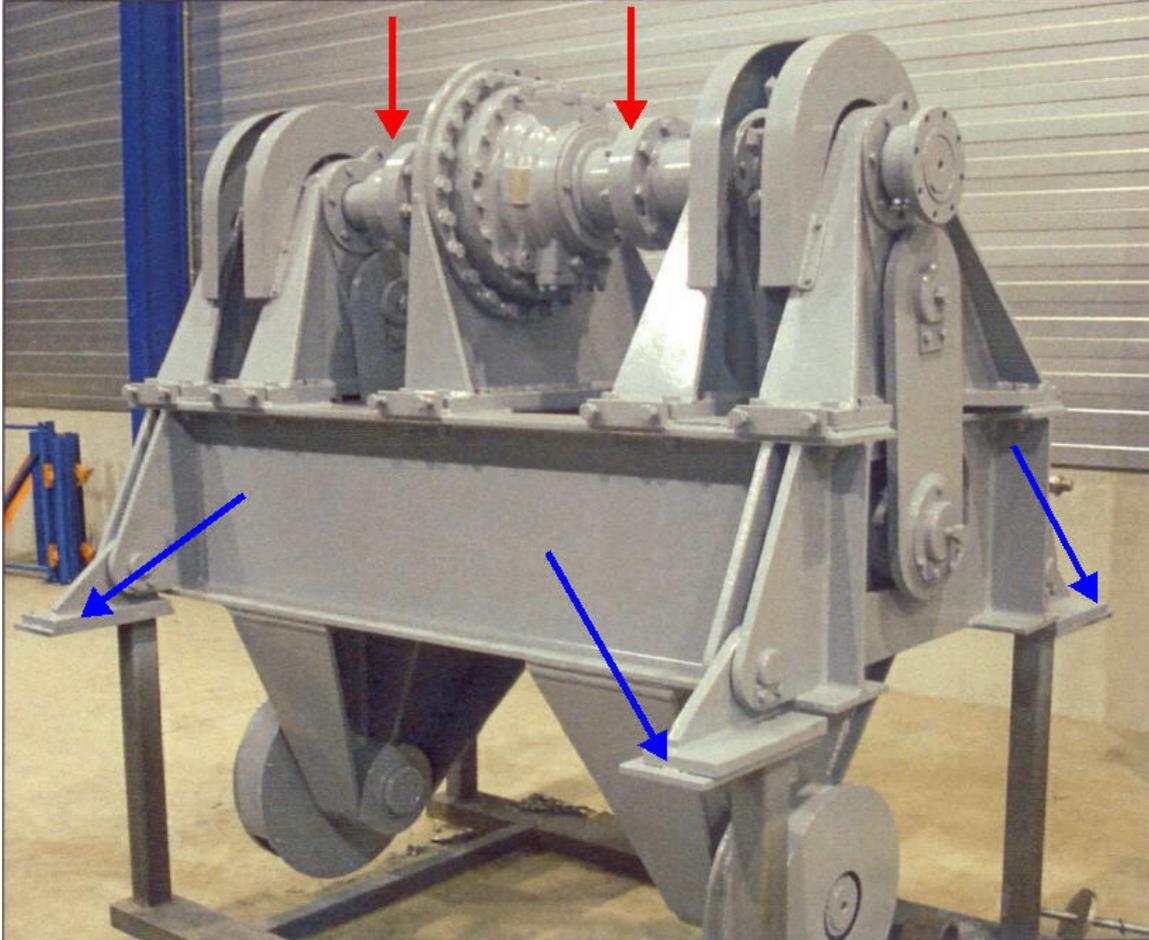
Project nr. : 42695 / Yantai contract no. ROL2007-215-4C-E007-JEBSENS2# / ERP no. 67850

---

### 7.3 Stack Winches

It is allowed to lift the Stackwinches with hoisting slings on shafts as indicated with red arrows.

Stack winches are assembled with welding feet. For shipping purposes the Stack winches are strip welded with these welding feet to a transport frame. Before assembly to Bucket Storage Container, welding feet have to be seperated from transport frame by grinding of the strip welds, as indicated with bleu arrows.



## **8 Maintenance:**

### **8.1 Safety during maintenance**

**Think before you act !!**

**Release the hydraulic pressure from the system before applying any maintenance activity !!**

**Shut off the electric motor before applying any maintenance !!**

**Apply no maintenance by others than qualified persons !!**

**In case of questions concerning safe operation or maintenance of the system do not hesitate to contact Vendor !!**

### **8.2 Scheduled maintenance**

It is strongly advised to have the hydraulic installation serviced by trained mechanics only.

Dirt particles entering the hydraulic system can cause severe damage!  
Only make only use of genuine parts.

#### **8.2.1 Oil quality**

Only make use of Esso Nuto H32 or equal quality

#### **8.2.2 Every 100 running hours or 1 month of operation:**

1. Check the oil level in the tank.
2. Check whether the suction valves are fully opened.
3. Check the hydraulic cylinders for leakage.
4. Check the general condition of lines and hoses
5. Check of any lose connections, leakages, etc.
6. Check for any unfamiliar mechanical noises
7. Check the general condition of the electric installation
8. Grease ball bearings of all cylinder
9. Grease shafts of Stack winches

### 8.2.3 Every 1000 running hours or 1 year of operation:

Make sure that the new cartridge is completely kept clean. Clean your hands before changing the cartridge.

#### **Do not try to clean the cartridge; always replace by a new and clean cartridge!**

1. Unscrew the for nuts of the filter cover
  2. Take out the complete insert
  3. Place the cover back onto the filter head
  4. Unscrew the nut at the bottom of the filter cartridge
  5. Slide the filter cartridge of the rod
  6. Open the package containing the new filter cartridge and place it onto the rod
  7. Screw the nut back onto the rod
  8. Place the insert back into the housing and mount the filter cover back
- 
1. Replace filter cartridge Item 19 in the return oil filters Item 18  
Hydrauision part no.: 081006-0142
  2. Replace filter cartridge Item 21 in the pressure filter Item 20  
Hydrauision part no.: 081006-0119

### **8.3 Removing the main pumps**

Before removing the main pumps or a single part of the main pumps the following must be taken in account:

1. Close the suction valve on the oil tank
2. Carefully remove pilot hoses, plug it directly after removal and bend it away in a protective manner to prevent damage.
3. Remove cover of drain filter (item 20) in order to bleed air.
4. Both main pumps can be removed without dismantling the electric motor.

## **9 Disposal of the equipment:**

After the economical or technical lifetime, the equipment must be disposed in accordance the Laws and Regulation of the country of disposal.  
Extra care must be taken with components containing hydraulic oil or grease.

## **10 Preservation remarks and specifications:**

The HPU. has been coated in accordance with the paint specification. Repairs on damages coating shall be executed only in accordance.

System Description

Project : Flexible Fall Pipe Vessel FFPV H215

Project nr. : 42695 / Yantai contract no. ROL2007-215-4C-E007-JEBSENS2# / ERP no. 67850

## 11 Preferred spare parts:

Position no. refer to hydraulic circuit drawing 042695-5-00000

Itemno.	Description	Quantity	Remark
01	PV140-R1-K1-T1-N-FRC	1	
03	ROTEX 65	2	Flexible part
05	28VPBM-3/1,0/P/132/130/7.5/690	1	
14	OK-EL10L/3.1/M/A/1	1	
19	0850 R 010 BN4HC	8	
21	0500 R 010 BN4HC	4	
22	ETS 386-2-150-000	1	
28	VPN1-06/S-32S	1	
29	RPE3-06 3 H11	2	Complete valve
29	RPE3-06 3 H11	4	Solenoid only
33	VEI-8A-2B-16-NA-NSS 2/2 N.O.	1	
37	YFEJ-XFN-BA/S	1	
39	VPN2-10/S-21S	2	
40	AM5.QFABC NG10	2	
41	RPE4-10-3-Y11/T2	1	Complete valve
41	RPE4-10-3-Y11/T2	2	Solenoid only
42	VJR2-10 MC	1	
44	0-400 BAR 63 OA 1/4"BSP GG	1	
45	HDA 4745-B-400	1	
46	MTC-2-2-20-DA050	1	
47	MTC-2-2-20-DA160	1	
49	TBV FIG.7190	1	
52	DN-125.090.2090-GF60	1	Seal kit
54,56, 69	CBCA-LHN	3	
58	125/90-3700	1	Seal kit
59	OMS 125	1	
60	309-L3-PC i=80,6 D0AH ø100m6	1	
61	DN-80.055.1630-GF	2	Seal kit
62	DN-100.060.1350-M	1	Seal kit
63	DN-040.022.0100-FKPS	6	Seal kit
64	VR 2 C.0	1	
66	TFP 100 PT 100	1	
70	CBCH-LJN	1	
71	VR 0.8 C.0	1	
72	DN-125.090.2090-GF60	1	Seal kit
73	LPFC-XHN	1	
93	RDFA-LCN	1	
95	CBGA-LHN	1	
97	D41FHE02F1NE00	1	
100	DNP-400.220.5400-MSP+FSSP200	1	Seal kit
101	DNP-200.140.3100-GF100+FSSP100	1	Seal kit
104	CA 140 120 SA0NH0 S33	1	
109	VRN2-06/S-21S	1	
112	2VS3-06 C	2	
113	YFEK-XFN-BB/S	1	
114	2RJV1-06 MA	1	
115	RPE3-06 3 Y11	2	
117	SBO 210-1,4E1/112U-210AK	1	

System Description

Project : Flexible Fall Pipe Vessel FFPV H215

Project nr. : 42695 / Yantai contract no. ROL2007-215-4C-E007-JEBSENS2# / ERP no. 67850

---

119	DS302-350	2	
121	DN-100.060.0300-GF	4	Seal kit
123	MD06-VP NG6 A-B-T	1	
124	VPN1-06/S-21S	2	
125	RPGC-LCN	1	
126	2RJV1-06 MC	1	
127	D31FHE02C1NE00	1	
128	DN-065.035.0240-GF35	6	Seal kit
130	CBEA-LHN	1	
131	D41FTE02FC1NG00	1	
	Accumulator filling kit	1	Special tool