SAFETY INSTRUCTIONS

Read This First

It is the responsibility of the contractor, the installer, and the owner to maintain and operate the equipment supplied by ANDRITZ in such a manner as to comply with the laws concerning occupational safety and health, as well as with all national, state, and local laws and ordinances. Consult the local safety standard authorities or plant supervisors for a complete listing of these regulations.

Safety must be considered a primary factor in all aspects of equipment installation, operation, and maintenance, at all times. Safety training and equipment maintenance will be covered by authorized ANDRITZ personnel prior to startup of the equipment. All operating personnel will be advised of the location and operation of all emergency control devices.

The following safety instructions are basic guidelines and should be considered minimum provisions:

- Unobstructed access to controls and emergency stop devices must be maintained at all times. Sufficient lighting and good housekeeping practices must be maintained around the equipment at all times.

- All rotating equipment — such as drives, gears, fans, pumps, shafts, couplings, chains, belts, and ropes — must be guarded as required by the applicable laws and standards. The equipment must not be operated until all covers and guards are in place.

- If equipment is to be opened for inspection, maintenance, or servicing, the drive motor must be locked out and secured against being switched on again (lockable repair switch, shorting bar, and the like). Equipment operation must not resume until all covers and safety guards are in place.

- High-voltage and rotating electrical machinery can cause serious or fatal injury. Installation, operation, and maintenance of rotating electrical machinery must be performed only by qualified personnel.

- Inlet and discharge openings must remain connected to other equipment so that dangerous parts of the machinery are not exposed.

- Warning signs must not be removed. If warning signs become dirty or damaged, they must be cleaned or replaced immediately.

LIMITED WARRANTY

MATERIAL AND WORKMANSHIP

a. Seller warrants to Buyer that the Products will be delivered free from defects in material and workmanship. This warranty shall commence upon delivery of the Products and shall expire on the earlier to occur of 12 months from initial operation of the Products and 18 months from delivery thereof (the "Warranty Period"). If during the Warranty Period, Buyer discovers a defect in material or workmanship and gives Seller written notice thereof within 10 days of such discovery, Seller will, at its option, either deliver to Buyer a replacement part or repair the defect in place. Seller will have no warranty obligations under this paragraph (a) if

   i. Buyer fails to ensure that the Products are operated and maintained in accordance with generally approved industry practice and with Seller's specific written instructions;

   ii. If the Products are used in connection with any mixture or substance or operating condition other than that from which they were designed;

   iii. If Buyer fails to give Seller such written 14-day notice;

   iv. If the Products are repaired by someone other than Seller or have been intentionally or accidentally damaged; or

   v. Corrosion, erosion, ordinary wear and tear or in respect to any parts which by their nature are exposed to severe wear and tear or are considered expendable.

b. Seller further warrants to Buyer that at delivery, the Products will be free of any liens or encumbrances. If there are any such liens or encumbrances, Seller will cause them to be discharged promptly after notification from Buyer of their existence.

c. The express warranties Seller makes in these paragraphs are the only warranties it will make. There are no other warranties, whether statutory, oral, express, or implied. In particular, there are no implied warranties of merchantability or fitness for a particular purpose.

d. The Seller warrants the bowl for 10 years against bowl distortion that would require the bowl to be serviced or rebalanced. In the event the bowl becomes distorted during this 10-year time period, the Seller will replace the bowl.

e. The remedies provided in paragraphs (a) and (b) are Buyer's exclusive remedy for breach of warranty.

Remedy:

To report any problems or request parts, contact our Spare Parts and Service Department at (817) 465-5611 or write to:

Andritz Separation, Inc.
1010 Commercial Blvd S
Arlington, TX 76001

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CHAPTER 1

SAFETY REQUIREMENTS

CAUTION: The centrifuge with full bowl is a high-speed precision turning machine. It was designed using the latest technological advances and safety measures. ANDRITZ makes centrifuges that have precision-balanced parts. Our long experience in this area has allowed us to establish specific safety measures for operating the centrifuge and for protecting maintenance personnel. Various running conditions or environments make it impossible to document every risk. The operator must keep safety in mind at all times and take appropriate steps to protect plant personnel and the centrifuge.

1.1 GENERAL SAFETY REMARKS

1.1.1 Safety Instructions

This chapter covers general safety measures.

Along with these general security instructions, additional safety measures are listed for specific operations in other chapters of the O&M Manual.

Safety instructions relative to equipment not belonging to ANDRITZ are located in the relative O&M Manuals. These manuals are in addition to the ANDRITZ O&M Manual.

All safety instructions must be followed to the letter. Deviating from these instructions can bring about injury or death to personnel as well as pollution and/or damage to equipment.

Personnel responsible for transportation, assembly, start up, operation and maintenance must understand the user manual completely and particularly the chapter referring to safety for all operations as well as 3rd party safety measures concerning 3rd party parts.

1.1.2 Running Condition

Installation should be performed only if in perfect running order, with the operator fully aware of all safety measures and risks. All safety measures and emergency stop apparatus must be in place and fully operational.

Any unforeseen modifications or abnormalities must be eliminated immediately.

ANDRITZ will not be responsible if the following points are not adhered to:

- The centrifuge shall be installed as per local laws concerning health and work place protection and in accordance with installation schematics carried out by qualified technicians for construction, mechanical, electrical, etc. purposes.

- The operating owner will assemble all appropriate security stop measures (emergency stop buttons and markings), as stipulated in applicable regulations. Appropriate emergency stop measures will be established by the employer.

- Owner/Operator will establish a complete general security plan. All personnel working within the machine area will be trained for this type of installation.

1.1.3 Danger and Warning Symbols

All indications contained in the safety chapter are important and essential. For this reason, indications are enhanced by specific warning symbols. The following warning instructions signs are used:

This symbol warns of danger to health / life. 

Ignoring these instructions can cause bodily harm, death as well as serious equipment damage.

This symbol warns of health risk and / or pollution or equipment damage. 

Ignoring these instructions can cause health risks and/or pollution and equipment damage.

1.1.4 Usage Standards

The centrifuge can only be used for reasons mentioned in the purchasing contract. All other usage can be considered non standard and could be the cause of harmful death for its operator.

All modifications to supplied equipment not validated by ANDRITZ, are considered non-standard.

Adhering to usage standards includes the O&M Manual, running conditions, maintenance as well as cleaning.

Note: Usage is restricted to indications spelled out on the serial number plate located on the frame:

- Maximum bowl speed

- Maximum solids suspension density

- Temperature range

For higher speeds or density, contact ANDRITZ.

1.1.5 Dangerous Situation Usage

The machine was designed specifically for usage as per the sales contract. Any deviation from the specified process must be inspected and confirmed for the chemical, biological matter possibly involved. At sales time, this machine was not designed for use with dangerous materials.

Treatment of flammable products, explosives, or toxic chemicals (or other products which could contain the preceding after chemical reaction) can cause harmful death.

Before treatment, end user must carry out an analysis of dangers and risks involved. This includes a plan of action in case of error in process and malfunctions.

If flammable materials or potential explosive materials are treated, all motors and electrical equipment, cables and command equipment **MUST** be explosion proof. The mechanical components **MUST NOT** be sources of hot surface, sparks, static electricity, etc.

If product treated is toxic, adequate measures **MUST** be taken.

1.2 CENTRIFUGE OPERATION

Machine usage is not authorized if security devices are not in place and operational.

Safety devices must not be bypassed, dismantled or shut down. Safety devices are put in place to protect the operator.

Access to safety equipment must be kept free.

1.2.1 Protection Hood

The centrifuge rotor turns at high speed and presents a risk of burning, cutting, bodily harm, in case of human contact.

Foreign objects can be ejected if casings are absent, causing bodily harm.

Centrifuge usage is authorized only if casings and hoods are in place, locked down with all appropriate screws and fasteners, and functional.

Rep.	Component
1	Rotor protection
2	Transmission protection
3	Under frame protection
4	Trap door

1.2.2 Emergency Stop Button

The machine must be equipped with emergency stop buttons.

End user must foresee the following emergency stop buttons:

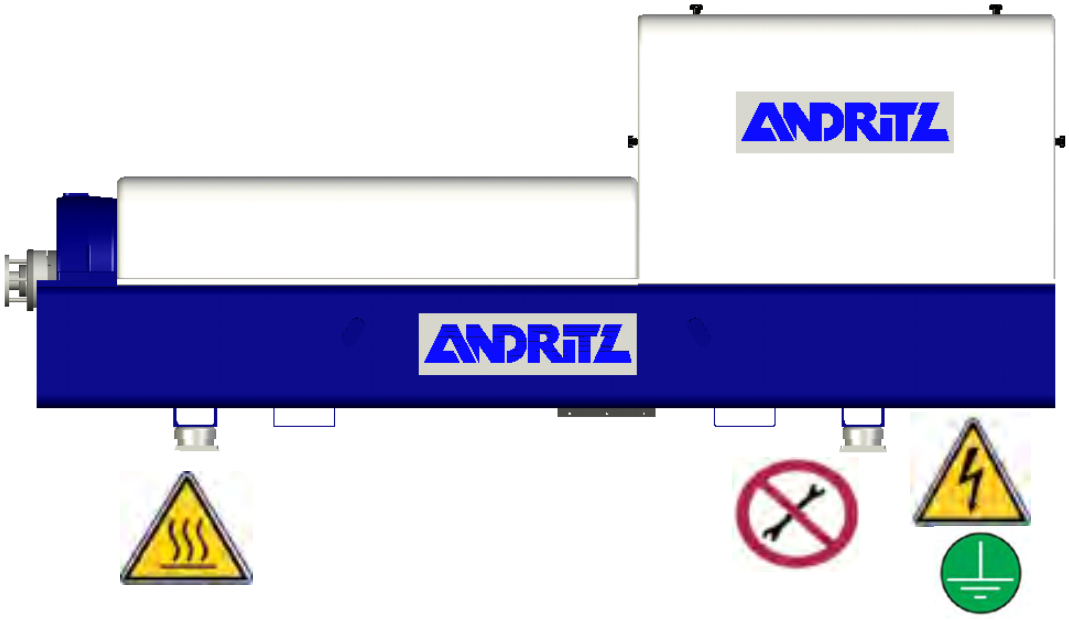
- Emergency stop button near centrifuge
- Emergency stop button on power switch box

Emergency stop button must be designed in accordance with appropriate technical manual.

1.2.3 Indicator Panel, Warnings and Indicators

Indicator panel warnings must be adhered to. Check to make sure the warnings are readable and complete. They must not be removed or hidden.

The centrifuge is furnished with the following warning indicators:



1.2.4 Vibrations

The centrifuge is made up of a rotor turning at high speed. Initial balancing enables acceptable vibration levels.

With wear and other phenomena, high vibration levels during a long period of time can bring about mechanical degradation.

Stop the machine if vibrations are abnormal, and look for the cause. See Chapter 5 on troubleshooting for assistance.

As a rule: the machines are accepted at the bench test stage when block vibrations (block mounted on frame) do not exceed **0.18 in/s effective** (0.28 in/s peak to peak), measured vertically on each block. This value corresponds to slightly detectable vibrations when using your fingertips as detectors.

Up to **0.60 in/s effective** (0.83 in/s peak to peak) the machine can run momentarily without major risk. If run continuously under these conditions there is major risk to rotor fixations, hood, bearings, etc.

CAUTION: Over 0.60 in/s effective (0.83 in/s peak), the operator must immediately stop the centrifuge. Failure to stop the centrifuge immediately will result in equipment damage.

The bowls are assembled balanced. For this reason, both the conical and cylindrical bowls must be returned to ANDRITZ for repairs and/or balancing.

For scheduling reasons one element could be replaced and balanced on site by an ANDRITZ technician.

Partial scroll flight repair can be done on site, by replacing tiles, if the flight support has not been damaged. In this situation, balancing is not needed.

1.2.5 Hot Surfaces

Contact with surfaces with a temperature of more than 149 °F can cause bodily harm.

When the machine is treating very hot or very cold product, extreme caution must be given to avoid accidental burn. Access to these surfaces should be restricted. Surfaces should be insulated.

When working on machines, wear gloves. Be especially aware when manipulating the centripetal pump, during dismantling procedures when machine is fed with product with temperatures over 140 °F, during assembly of bearings, and during assembly of heated parts.

Do not unscrew or disconnect circuits under pressure. Make sure that circuits have been switched off.

1.2.6 Noise

Noise pollution from machines on site can cause hearing problems.

WARNING**: When prolonged visits near a running machine are involved (e.g. maintenance, adjustments) wear protective earphones/plugs.**

1.3 LIFTING AND TRANSPORTATION

An unattended or falling load can cause bodily harm or death as well as consequential equipment damage.

Qualifications

Maintenance on the machine or its parts should be carried out by qualified personnel.

Personnel in charge of machine operation/lifting and transportation, must have the necessary qualifications.

Method

Use only recommended tools and methods.

Do not stand under loaded hoist.

See Chapter 3 for detailed instructions on transportation, storage and maintenance.

During repairs, if equipment is likely to be physically or electrically unstable, observe security barriers.

Do not place fingers, hands, feet, or head in areas where there may be risk of pinching. Beware of sharp edges from worn parts.

1.4 ELECTROMAGNETIC AND ELECTRICAL RISKS

Contact with electrical equipment, under power, can bring about bodily harm or death.

Exposure of certain personnel to magnetic fields can bring about death.

Qualification

Work carried out on electrical equipment should be done by qualified personnel only.

Power Down

Before any intervention or repair work, the centrifuge must be switched off and powered down. The user must also power down all peripheral equipment following local power down procedures.

Powering down avoids electric shock but also avoids accidental start up without protections in place.

Check circuit breaker or fuses between power source and equipment. Use locking system to avoid accidental power on. Inspect and test security systems to insure they are in good working order.

The work zone must be properly indicated.

Ground

Ground the machine to avoid electrostatic events. Motors and switch boxes must be grounded and connected as per local law.

Humidity

Never wash electronic equipment with liquid unless specifically designed for this purpose. Never wash electronic equipment which is switched on. Never touch electronic equipment with wet hands or while standing in water.

Magnetic Fields

Personnel wearing medical electronic equipment (pacemakers) will be restricted from entering the danger zone and from dismantling motors with permanent magnets.

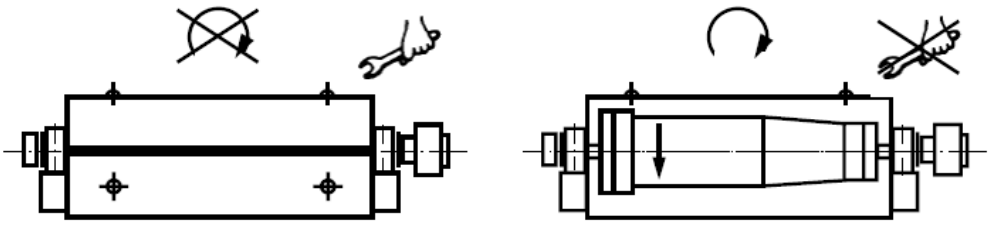
1.5 MAINTENANCE

Total Machine Shut Down

The centrifuge runs under high inertia. Total stoppage can take more than 10 minutes, depending on the size of the machine.

Contact with rotating rotor can cause bodily harm.

Never try to dismantle or repair machine that is not at a complete stop with power switched off, locked and indicated as such.



Complete stop is verified by:

- No more noise
- No fan motor rotation
- No belt rotation (via sight hole located in belt guard)

Modifications

Machine modification can cause mechanical damage and risk of parts ejection.

This can cause bodily harm.

Heavy repair to centrifuge should not be undertaken before prior consultation with an ANDRITZ technician. Machine modification should not be done without prior written consent from ANDRITZ. Parts breakage can bring about bodily harm and/or machine damage if these instructions are not followed. Use only parts approved for use by ANDRITZ.

Do not place fingers, hands, feet or head in areas where there may be risk of pinching. Beware of sharp edges from worn parts.

Wear and Corrosion

Abrasion and parts corrosion can bring about machine degradation/damage and risk of parts ejection.

This can cause bodily harm.

Upkeep

Product accumulation in the casings or frame can cause friction and overheating.

Regularly inspect machine cleanliness and check for product and lubricant leaks.

Lubricate machine as per the maintenance recommendations in Chapter 6 using only recommended frequency and lubricant type.

Regularly check that nuts and bolts are tight on blocks, hood, transmission, connecting pipes.

Follow assembly and dismantle/maintenance procedures correctly.

Provide a sufficiently wide area around the machine for maintenance purposes, handling means and if possible, cleaning.

Assembly and Disassembly

Handling used parts can cause bodily harm.

Individual protection devices must be worn. Moreover, we recommend the following protection for certain activities:

Maintenance			
Assembly and maintenance procedures involving dismantling of parts or machine			

Belt Tension

Poor belt tension can bring about slippage, thus causing overheating and fire.

Refer to Chapter 6 in the manual concerning belt tension for appropriate operations.

Welding

Normal machine usage requires no welding. Written consent from ANDRITZ must be obtained before welding.

During welding, adhere to applicable security measures, especially if in restricted space.

Switch off and unplug all motors before electrical welding.

During electrical welding, ground must not be connected to bearing block. Connect a ground near the area to be welded.

Hydraulics and Pneumatics

Hydraulic and pneumatic systems run under high pressure levels.

A hydraulic system failure can bring about serious personnel risk, equipment risk, and a risk of pollution.

Hydraulics and pneumatics must be checked and operated under recommended frequencies only.

Maintenance procedures must be done only when systems are void of pressure.

Work carried out on hydraulic and pneumatic equipment must be carried out by qualified personnel only, with experience in this domain.

1.6 FLUIDS (LIQUIDS, GAS, VAPOR OR SMOKE)

Work carried out in the presence of corrosive (acids or other) and/or toxic or product or cleaning solvents can cause bodily harm.

Workplace Environment

Centrifuge location areas can be filled with H2S or other toxic gases. Use detectors before entering.

During maintenance operations, do not switch off air extraction devices. Block off openings that could be sources of toxic gas.

Product Data

Check product data for product characteristics, precautions, handling. Follow all recommendations.

- If product is flammable take all necessary precautions to avoid fire and/or explosion.
- Avoid contact with skin and eyes. Wear protective glasses, gloves, helmet, etc. as required per product type.

If in doubt as to product nature, consider it as dangerous by default and take all necessary precautions to avoid bodily harm.

Sample Taking

During product sample taking, wear protective devices (gloves, overalls, glasses).

CHAPTER 2

EQUIPMENT INFORMATION

2.1 EQUIPMENT DESCRIPTION

The ANDRITZ decanting centrifuge accelerates removal of solid particles from water in feed. Decanted solids are evacuated from one end of the centrifuge and clarified liquid (centrate) is removed from the opposite end. The centrifuge operates automatically. A centrifuge basically consists of a cylindrical bowl joined to a cone-shaped bowl and a scroll that extracts solids driven to the side of the bowl by centrifugal force. The centrifuge bowls and scroll are powered so that the scroll turns faster than the bowls to evacuate solids at the end of the cone-shaped bowl. See figure 2-1.

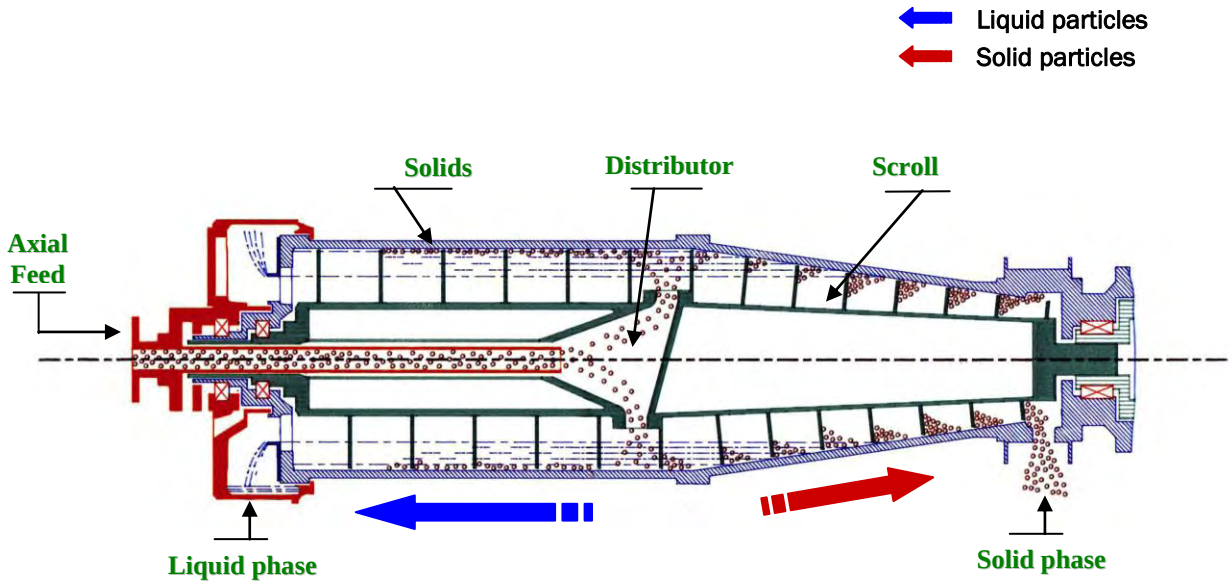


Figure 2-1. How the Centrifuge Works

The centrifuge has two motors and two gear reducers. The main motor turns the bowls, and a secondary motor, or back drive, turns the scroll inside the bowls. Primary and secondary reducers are used to drive the bowl and scroll at different speeds. The primary reducer is called the "Cyclo reducer," and the secondary reducer is called the "Redex." The Redex is mounted between the scroll and the bowl and develops a significant torque on the outlet shaft attached to the scroll. The Redex reducer creates a precise and variable differential speed between the scroll and the bowl by simple action on the inlet shaft. The main motor torque is applied to the exterior collar of the Cyclo reducer through the centrifuge pulley. This torque directly drives the bowl at high speed (also called "absolute speed") and indirectly drives the scroll at a higher speed in relation to the bowl (called "relative speed").

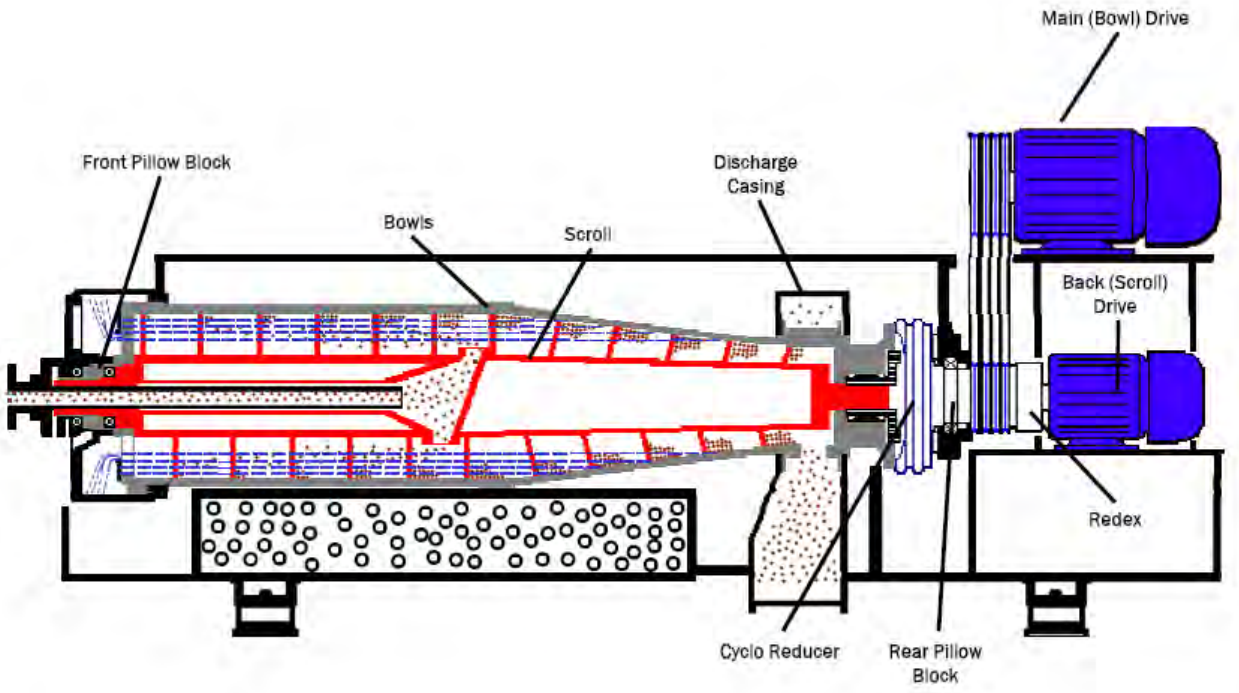


Figure 2-2. Major Components of the Centrifuge

2.2 TECHNICAL SPECIFICATIONS

The centrifuge has been designed to the following process specifications:

CONDITIONS OF SERVICE	
Type of feed product	Chocolate from raw cocoa bean
Solids concentration (% TSS)	15 % to 20 %
Feed rate	5-10 gpm
Operating cycle (hr/day)	6 hr/d, 6 days a week
pH	4 to 7

2.3 MAJOR SCOPE OF SUPPLY

MAJOR EQUIPMENT SUPPLIED			
Item	**Quantity**	**Model #**	**Description**
1	1	D2LC30CNV3-PH-SA	Centrifuge
2	1		Control panel
3	1 lot		Tools
4	5 days/1 trip		Field services

LOOSE PARTS SUPPLIED			
Item		**Quantity**	**Description**
1	LUBRICANTS FOR ONE YEAR		
		1 lot	BP Energrease LS-EP-0 (Cyclo Gearbox unit)
		1 lot	AGRO EP2 (Main & Scroll bearing grease)
2	TOOLS/ MISC		
		1	Scroll Maintenance bar
		2	Bearing roller extractors
		1	Scroll thrust bearing extractor
		1	Cyclo maintenance tool
		1	Greasing kit
		1 set	Wenches
		1 set	Threaded rods
		1	Grease pump
		1	Tool box

2.4 DESIGN SPECIFICATIONS

SPEED	Nominal absolute speed Maximum safety absolute speed For maximum density of feed product Variable relative speed	4,000 rpm 5,000 rpm 1.2 5 to 10 rpm
MATERIALS	Bowls Scroll Scroll thread coating Casing in contact with product Covers (bowl, transmission) Seals in contact with product	Stainless steel 316L Stainless steel 316L RV 99 Stainless steel 304L Stainless steel 304L Viton
CYCLO REDUCER	Make — size/ratio Lubrication	ZS 614/87 BP Energrease LS EP 0
LEVEL ADJUSTMENT	Level adjustment plates Conical bowl overflow	6.46 to 8.03 inches diameter 6.9 inches
DRIVE MOTOR	BOWL	SCROLL
Make Type Power	Baldor Premium Efficiency Custom 20 HP	Baldor Premium Efficiency Custom 7.5 HP
VFD		
Make Type Power	480V PowerFlex 755VC 20G11ND027AAONNNNN 20 HP	480V PowerFlex 755VC 20G11ND011AAONNNNN 7.5 HP
Voltage/Frequency	480 v/60 Hz	480 v/60 Hz
BELTS	SPB 1500	Set of3 matched belts
PULLEY RATIO	1.429	
WEIGHT: ENTIRE UNIT	2,072.34 lbs (940 kgs)	

2.5 CENTRIFUGE CHARACTERISTICS

Length	84 inches
Width	30 inches with shock absorber plate, no de-aerator
Height	41 inches
Weight with drive	2072.34 lbs (940 kgs)
Product feed	1.5-inch ANSI flange
Discharge outlet	8.27 x 12.99 inches OD
Centrate inlet	Flexible connection supplied
Centrate outlet	4-Inch ANSI flange
Air outlet	5-Inch ANSI flange
Support	Height adjustable; 50.7-inch maximum

2.6 MATERIALS OF CONSTRUCTION

MATERIALS: PARTS	
WETTED PARTS:	
Cast parts (bowl)	Stainless steel AISI 316L
Welded parts (Scroll)	Stainless steel AISI 316L
NON-WETTED PARTS:	
Frame	Stainless steel 304L
Cover and de-aerator	Fiberglass

MATERIALS: BOWL	
Discharge nozzles	Field replaceable
Inner diameter	10.2 inches
L/D ratio	3.7
Total length	37.87 inches
Nominal speed	4,000 rpm
Maximum speed	5,000 rpm
G-Value at maximum speed	3,633
Conical bowl angle	11 degrees

2.7 EQUPMENT DATA

SCROLL	
Scroll design	High performance
Discharge nozzles	Field replaceable
For dismantling purposes: Total length of scroll with handling hoist and bowl plate Corresponding weight to lift	 55.5 Inches 265 lb

GEARBOX	
Type	Cyclo reducer
Nominal torque value	921.96 ft-lb (1250n.m.)

MAIN CENTRIFUGE BEARINGS	
Type	FAG / SKF
Lubrication	Grease (AGRO EP2)
AFBMA L-10	100,000 hours minimum

POND DEPTH ADJUSTMENT	
Type	Sliding weir plates
Range	6.46 to 8.03 inches diameter

WEAR PROTECTION	
Inner bowl surface	Integral cylinder and cone grooving
Scroll	Replaceable sintered tungsten carbide tiles
Vickers hardness of the carbide grains	2,500 to 4,000
Scroll feed chamber (distributor)	Polished tungsten carbide nozzles
Bowl discharge (diffuser)	Tungsten carbide nozzles
Average life span	16,000 hr / 2 years

ANTICORROSION PROTECTION	
Frame and parts in cast iron or steel	
Standard epoxy paint (RAL 9010) Primer Second coat Finish coat	 2.5–3.0 mils 4.0 / 6.0 mils 4.0 / 6.0 mils
Minimum dry film thickness	12.0 mils

SEALS	
Type	Viton
Maximum temperature admissible	175 ° F

NOISE LEVEL	
Measured at nominal speed from 4 feet while empty	80 dB (A)

MISCELLANEOUS	
Minimum feed product pressure	8 psi
Wash water flow rate	13 to 26 gpm for 15 minutes at each stop @ 45 to 60 psi
Air flow	30 cfm

2.8 CENTRIFUGE MOTOR DRIVE LIST

BOWL DRIVE:

Manufacturer:	Baldor
Model:	Premium Efficiency Custom similar to ECP4106T
Motor Data:	20 Hp, 460 v, 60Hz, 3600 rpm 256T frame, F3 mount, 40 ºC ambient, cast iron frame with severe duty construction. NC thermostats Similar to ECP4106T-4 except in F3 mount (Ref 09LYK229), inverter duty NP marks, 3 NC thermostats.
Paint:	RAL 9010

SCROLL DRIVE:

Manufacturer:	Baldor
Model:	Premium Efficiency Custom similar to EM3616T
Motor Data:	7.5 Hp, 460 v, 60Hz, 3600 rpm 184T frame, F3 mount, 40 ºC ambient, rolled steel frame with dirty duty construction, NC thermostats. Similar to EM3616T except in F3 mount (Ref 36LYJ047), 460 volt only connection, dirty duty construction (Ref S/P 32-2), Inverter duty NP marks & 3 NC thermostats.
Paint:	RAL 9010

2.9 CONTROL SYSTEM DESCRIPTION

The Centrifuge will be supplied with a Centrifuge Control Panel (CCP). The CCP will be a free standing NEMA 4X 304 Stainless Steel enclosure 60" x 37" x 14" on 12" legs.

2.9.1 Major Control Panel Components

The following major components are mounted within the CCP:

- Main power circuit breaker disconnect, lockable in the OFF position, accepts 460 VAC, 3-phase, 100-amp power
- Control power transformer
- Primary control power fuses
- Variable frequency drives for:
  - Bowl drive (20 Hp)
  - Scroll (back) drive (7.5 Hp)
- Ethernet IP VFD communication module (1 for each VFD)
- DC bus fuses for VFD bus connection
- VFD branch fuses
- Terminal strip for all external connections with other equipment
- GFCI Receptacle
- PLC processor, power supply, and all I/O cards – AB 1769-L32E (CompactLogix)
- Surge Protector
- Industrial Ethernet Switch
- 24VDC Power supply
- Miniature Circuit Breakers
- Fuses
- Control relays

The following major components are mounted on the CSP:

- Air conditioner
- System control power on-off illuminated selector switch (white)
- Emergency stop pushbutton (red mushroom head non-illuminated)
- Convenience port
- VFD HIM modules
- Alarm Horn
- Alarm Beacon
- Operator interface terminal (OIT): Color touch screen (AB PanelView +1000)

All pushbuttons, selector switches, indicator lights, and OIT will be NEMA 4X rated.

2.9.2 Major Components of the Operator Interface Terminal (OIT)

- The following controls are provided for the centrifuge control system via the COP-mounted OIT:
- Auto mode selected indication
- Auto START – in progress
- Auto STOP – in progress with countdown timer
- Torque/Relative Speed mode selection
- Manual mode selected indication
- CIP mode selected indication
- Stopped in auto indication
- Starting in auto indication
- Running in auto indication
- Stopped in manual indication
- Running in manual indication
- CIP start in progress with countdown timer
- Running in CIP indication

- Stopped in CIP indication
- Centrifuge wash water valve – open/closed
- Centrifuge – runtime
- E-Stop – alarm
- Bowl drive VFD fault – alarm
- Bowl motor high temperature – alarm
- Back drive VFD fault – alarm
- Back motor high temperature – alarm
- Centrifuge high torque – alarm
- Centrifuge high torque 3-strikes – alarm
- Centrifuge high-high torque – alarm
- Centrifuge high vibration – alarm
- Centrifuge high vibration 3-strikes – alarm
- Centrifuge high-high vibration – alarm
- Centrifuge drive end bearing high-high temperature – alarm
- Centrifuge feed end bearing high-high temperature – alarm
- Centrifuge drive end bearing high temperature – alarm
- Centrifuge feed end bearing high temperature – alarm
- Low relative speed – alarm

The following digital displays area provided on the CCP via the panel-mounted OIT:

- Centrifuge bowl drive speed – rpm
- Centrifuge bowl drive load – % full load
- Centrifuge back drive speed – rpm
- Centrifuge back drive relative speed – rpm
- Centrifuge back drive torque – % full load
- Centrifuge vibration – in./sec

- Drive end bearing temperature - °F
- Feed end bearing temperature - °F
- Total KW per hour meter - KWH
- Feed pump speed setpoint – % maximum speed

2.9.3 Machine Wiring

The centrifuge machine will be supplied with the following NEMA 4X rated components: 316 stainless steel terminal box for machine mounted components, vibration sensor, bearing temperature RTDs, and centrifuge wash water solenoid valves. All machine components will be wired complete to the machine mounted terminal box. The centrifuge wash water flush vales and the centrifuge motors will be field wired. Wire runs will be rigidly mounted along the centrifuge frame.

2.9.4 Centrifuge Control Panel Interface Requirements

- Power input from customer supply:
  - 460 VAC, 3-phase, 60 Hz, 100 amps
- Power output from CCP to motors (460 VAC 3-phase, 60 Hz):
  - Bowl drive motor, 20 Hp
  - Back drive motor, 7.5 Hp
- Inputs to CCP from centrifuge motors (dry contact):
  - Bowl drive motor thermostat
  - Back drive motor thermostat
- Inputs from customer supplied equipment to CCP (120 VAC):
  - Feed pump running
  - Solids pump running
- Inputs to CCP from machine junction box (4–20 MADC signal):
  - Centrifuge vibration
  - Drive end bearing temperature
  - Feed end bearing temperature

- Outputs from CCP to Andritz-supplied equipment (120 VAC):
  - Inner bowl flush valve
  - Solids discharge housing flush valve
  - Liquid discharge flush valve
  - Outer bowl flush valve
- Outputs from CCP to customer equipment (dry contact):
  - Feed pump start
  - Solids pump start
- Outputs from CCP to customer equipment (4-20 MADC signal):
  - Feed pump speed command
- Outputs from CCP for customer use-(dry contacts):
  - Cake available
  - No cake available
  - Feed alarm
  - Shutdown alarm

• 2.10 CONTROL PANEL MAJOR COMPONENT LISTING

COMPONENT	MANUFACTURER
Enclosure(s)	Hoffman or equivalent (per drawing size and configuration)
Main circuit breaker	AB 140U-H6C3-C60 or equivalent
Terminal lug kit	AB 140U-H-MTL6A (6 wires per terminal)
Flange mount hardware	AB 140U-H-FCS03 Flex cable SS 3 ft
VFD branch fuse block	AB: 1491-N266 or equivalent
VFD branch fuses	Bussmann: LPJ-40SP
Surge protector	AB 4983-PF120-15
Control transformer	AB 1497A-A11-M6-0-N or equivalent
Variable frequency drives	480V PowerFlex 755VC VFD's BOWL VFD – 20HP 20G11ND027AAONNNNN SCROLL VFD – 7.5HP 20G11ND011AAONNNNN Remote mounted HIM Module – 20-HIM-C6S
DC bus fuses	DC Fuses: Bussmann 170M1410 Fuse Block: Bussmann 170H1007 Micro switch: Bussmann 170H0238
PLC	A-B COMPACTLOGIX 1769-PA4 – CompactLogix power supply 1769-L32E – ENET CPU 1769-IA16 – 16 Channel Input 1769-OA16 – 16 Channel Output 1769-IF4I – 4 Channel Isolated Analog Input 1769-OF4CI - 4 Channel Analog Current Isolated Output Module 1769-ECR – End cap resistor 1784-CF64 – Compact Flash memory storage
Operator interface	A-B PanelView Plus 1000 2711P-T10C4A9
24 VDC power supply	A-B 1606-XL120DR Power Supply
Industrial Ethernet switch	N-Tron 108-TX or equivalent
Convenience port	GEP Graceport P-R2-M6R0
Master control relay	AB 700-P400A1 or equivalent
Control relays (AC)	AB 700-HF33A1-4 w/led (120VAC coil) or equivalent
Fuse blocks	AB 1492-FBxC30-L w/led or equivalent
E-Stop pushbutton	AB 800H-FRXT6A1 (red) or equivalent
2-position lighted selector switch	AB 800H-16HRWH2KB6AX (white) or equivalent
Terminal blocks	AB 1492-J4 or equivalent
Mini circuit breakers	AB 1492-SP1Bxxx or equivalent
Beacon	AB 855BL-S10RH4 Red 120 volt
Elapsed time meter	ENM T32F72D
Wire duct	Panduit

COMPONENT	MANUFACTURER
Wire/cable	UL Listed
Air Conditioner	Pfannenberg DTS3185 5-7000 BTU
MACHINE COMPONENTS	
Vibration sensor	Metrix 5701vte 0-1ps/4-20 MADC Sensor: Weed # 110-01B-A-3-B-24-FB1 (2-total) Head: WEED # 2A00D1 (2-total) Transmitter: WEED # 4HQT3U+000+0400F (2-total)
Terminal box	Hoffman or equivalent 8”X6”X4” stainless steel (2)
Centrifuge wash water solenoid	ASCO 8210

CHAPTER 3

CENTRIFUGE DELIVERY AND INSTALLATION

3.1 RECEIVING

The centrifuge, with its drive system, is fixed on a pallet for transport from the manufacturer to the customer. When the centrifuge is delivered, the two shock absorbers used in shipping are removed and replaced with two beams across the frame. The frame itself rests on four shock absorbers (vibration isolators), one under each leg.

The motors and the feed tube are on opposite ends of the centrifuge. The dimensions of the pallet must exceed the dimensions of the motors and the feed tube to protect these two ends, which are sensitive to shock. The whole centrifuge must be securely fixed to its foundation to prevent any possible displacement and must be protected against the weather.

The rotating assembly is locked on both ends by one radial screw attached to the base plate to avoid roller bearing and ball-bearing damage. A plate with the corresponding instructions is attached to the casing. The centrifuge is wrapped in bubble wrap. All unpainted ferrous surfaces — hoods, threaded parts, and rotating parts — are protected with grease.

3.2 STORAGE

The following are the ***ANDRITZ*** recommendations for storage. However, if the centrifuge is to be stored during the winter, we recommend indoor storage for the centrifuge with its motors and the tools and spares.

3.2.1 Centrifuge

The centrifuge must be stored in a dry, dust-free, ventilated area on a wooden pallet. As discussed above, the pallet must exceed the footprint of the centrifuge including the dimensions of its motors and feed tube. The centrifuge must be covered and completely enclosed with at least two layers of tarp if stored outside and one layer of tarp if stored inside. The centrifuge must be stored in an area where the ambient temperature is greater than 0 °F.

If the centrifuge has been in use before storage, then it must be washed internally thoroughly, and all electrical switch gear must be locked out, before placing it in storage. New equipment may be stored as it arrives from the manufacturer.

Each centrifuge is lubricated before shipping. However, if the centrifuge has been in use, protect the bearing block bearings from moisture by injecting a third to a half an ounce of grease through the lubricators. Turn the rotating assembly by hand so that rolling elements are properly coated. Repeat this procedure every 6 months during storage.

CAUTION: A total filling of the bearing housing will result in abnormal heating during startup, which might then require partial disassembly to remove excess grease.

Note: The other bearings and the Cyclo reducer are enclosed in a tight housing filled with lubricant, and no maintenance is required.

Loosen the belts and coat the pulley with a light lubricant such as WD-40. This procedure is required to keep the belts from becoming deformed and to protect the pulley from corrosion during storage.

3.2.2 Tools and Parts

Tools and spares must be crated and stored on blocks or a wooden pallet.

3.2.3 Control Panels

The control panels should be stored in an indoor ventilated environment.

3.3 HANDLING

Handling is shown in figure 3-1. Four 4" slings are required to move the centrifuge.

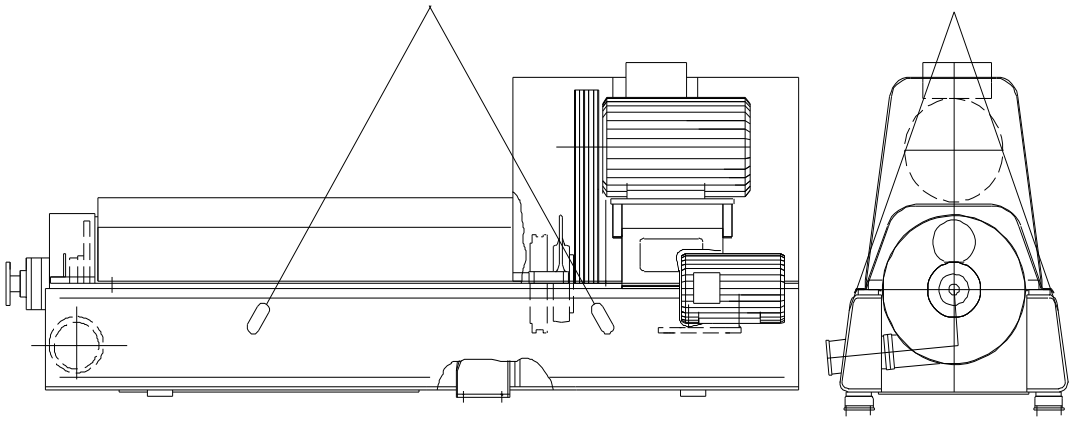


Figure 3-1. Centrifuge Handling Diagram

3.4 CENTRIFUGE SETUP

Typically, when centrifuges arrive at a customer site, the customer's general contractor will need to set up the centrifuge on a stable foundation and attach chute and/or gate connections. Also, the feed inlet, centrate discharge, solids discharge, wash water connection, front frame drain connection to centrate tank, rear frame drain connection to solids discharge conveyor, and lubrication system will need to be attached to the centrifuge.

3.5 GENERAL STARTUP PROCEDURES

During centrifuge startup, the operator must supervise acceleration and be ready to stop the centrifuge quickly in case of noise, oil leaks, or abnormal vibration. Before feeding product, the centrifuge must reach its nominal working speed, which takes 1 to 3 minutes, depending on the startup method. Product must be fed through the centrifuge progressively. Startup must always be performed at low speed. These are the basic startup steps:

1. Start the solids discharge conveyor.

2. Open the manual valve to start the flow of feed, if supply is not motor-driven.

3. Start the feed pump (minimum output).

4. Progressively increase the feed input by varying the feed pump adjustment.

3.6 GENERAL SHUTDOWN PROCEDURES

These are the basic shutdown steps:

1. Reduce the supply input to a minimum to avoid product loss during the wash and to provide for a low-flow restart.

2. Rinse at full speed for 10 minutes. Adjust the rinsing liquid valve to 13 to 26 gal/min.

   Note: The liquid inlet is located on the intake pipes between the feed pump and the feed inlet valve so that the entire feed pump, pipes, and centrifuge can be washed.

3. Close the feed supply valve. This delay valve is designed to prevent the pump from running empty.

CAUTION: If the solids are to remain dry, an independent evacuation for the rinse liquid has to be created at the solids discharge casing output.

4. Stop the centrifuge when the liquid output of the centrifuge is clear.

3.6.1 Shutdown Procedures

Low-speed wash must be used for thorough bowl and scroll cleaning. A variable frequency inverter (VFD) must be controlling the bowl speed for low-speed washing. The VFD must be set between 70 and 200 rpm, and the wash and/or bowl speed flow must be adjusted so that there are no leaks on the face of the pillow block. Relative speed must be slightly positive and can be increased in the case of a transmission having two VFDs per reverse rotation of the Cyclo reducer input shaft. The relative speed may not exceed 500 rpm maximum.

During slowdown, the bowl speed will, at some point, correspond to the frequency resonance of the shock absorber (at about 400 rpm). When this occurs, there will be a strong, but slow, vibration of the centrifuge for several seconds.

Below 100 rpm, the liquid ring collapses. This liquid is extracted with the solids in the solids discharge casing.

These are the basic steps for shutdown:

1. Stop the motor.

2. During deceleration, keep the rinse liquid at the same flow rate to avoid hydraulic unbalance until the centrifuge reaches approximately 500 rpm.

3. Close the liquid feed valve at the end of the rinse cycle. For a sanitary wash, refer to the cleaning in place procedure in § 4.7.2.

3.6.2 Emergency Stop

The "Emergency Stop" is an emergency procedure only. Do not use this procedure for routine centrifuge operation.

In an emergency, the whole installation can be stopped by pushing the emergency stop button on the control panel (E-Stop button).

CAUTION: DO NOT restart the centrifuge in production mode until you have completed the following procedures:

1. Rinse the bowl at low speed (200 to 500 rpm) with the VFD to drive the centrifuge.

2. Repeat step 1 once or twice, at most, to prevent motor damage, [1] until the clarity of the liquid is satisfactory.

3. Close the liquid supply valve.

[1] Running the motor at low speed for an extended period may cause the motor to overheat.

CHAPTER 4

BASIC OPERATION

4.1 SAFETY

Bowl speed and scroll speed are adjusted from the control panel and present no risk to plant personnel. For more information on safety, see chapter 1, Safety Requirements.

Weir plate adjustment requires a centrifuge stop and power cut-off (lock out/tag out). Access to elements of the rotating assembly is through an access hatch or by dismantling the centrate casing. Accidental contact with rotating assembly elements can cause serious injury to plant personnel.

4.2 GENERAL OPERATING PRINCIPLES

The overall objective is to separate solids from a liquid stream (the product) with solids exiting the drive end of the centrifuge and centrate exiting the centrate end without impairing design life of the centrifuge.

The objectives regarding the product are as follows:

- Steady flow of product into and through the centrifuge
- Clarified centrate and air exiting the centrifuge at the centrate end
- Dry solid product exiting the centrifuge at the drive end

The operating objective regarding the centrifuge is as follows:

- Run the centrifuge as fast as possible (up to design limits) without overheating its components or plugging its exit or internal parts

Optimal operation of the centrifuge is a balancing act. The speed of the bowl, the scroll, the differential speed between the bowl and the scroll can all be adjusted to achieve optimal product separation. The *amount* of product in the centrifuge also affects separation rate. Correct operation is a matter of balancing these speeds and adjusting the amount of liquid in the centrifuge for optimal separation of the specific product running through the centrifuge at any given time.

To sum up, the amount of product and its solids characteristics affect optimal dewatering. The speed of various components of the centrifuge affects optimal product separation.

In this chapter, we examine cause and effect relationships for each parameter that an operator can change and give specific examples to help determine how best to balance a centrifuge.

Centrifuge operation consists of regulating several key parameters affecting product clarification, dryness, flow, as follows:

- Bowl speed, called “absolute speed” or “AS”
- Liquid ring radial depth (adjusted by adjusting the weir plates)
- Relative speed between scroll and bowl (differential speed), called “relative speed” or “RS”
- Scroll torque setting

4.3 BOWL SPEED ADJUSTMENT

Rotating assembly overspeed may cause bowl deformation or breakage, so bowl speed (absolute speed) must be carefully monitored and adjusted to the manufacturer’s specification.

Never increase bowl speed over maximum speed indicated on manufacturer’s name plate. Bowl breakage resistance calculations take into account maximum admissible solid densities.

An increase in absolute speed is favorable for the following:

- Particles settle faster (which translates to increased throughput)
- More feed can be pumped into the centrifuge
- The cake is dryer

Refer to figures 4-1 and 4-2. Figure 4-1 shows a point of diminishing return between bowl speed and dryness. The faster the bowl speed, the dryer the product, but there is a point where increased bowl speed no longer increases dryness. That point is the design limit. Figure 4-2 shows that the rate of solids trapping increases with increasing bowl speed, although the curve changes when the solids reach the cone shaped portion of the bowl. It is advisable, however, to optimize the bowl speed considering these risks:

- Torque increase
- Vibration (unbalance is proportional to the square of the speed)
- High noise level

- Phenomena of solids thrown towards the cone (large side) when the particles are colloidal (very fine particles suspended in the product that do not settle and are not easy to filter).

The centrifuge limits for torque and vibration are preset in the control system. The operator uses the screens on the operator interface terminal (OIT) to monitor the centrifuge.

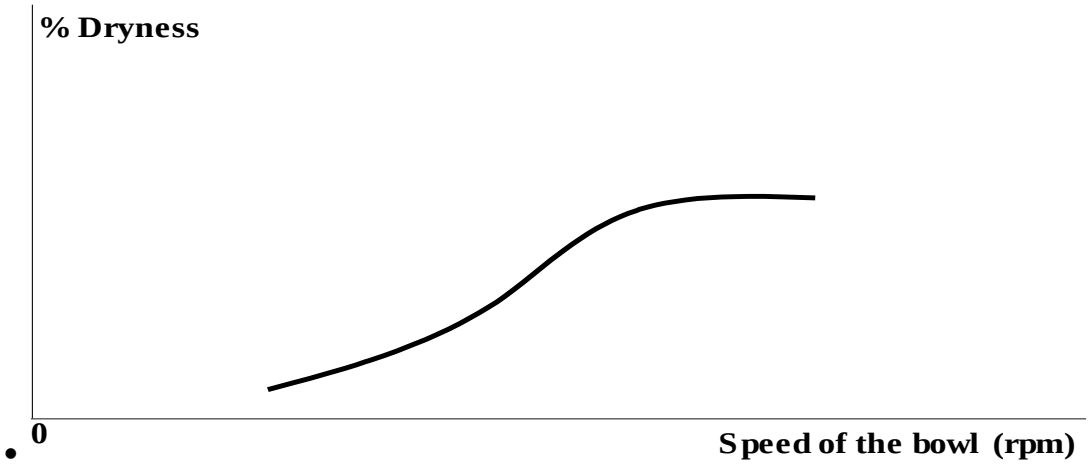


Figure 4-1. Dryness of the Product

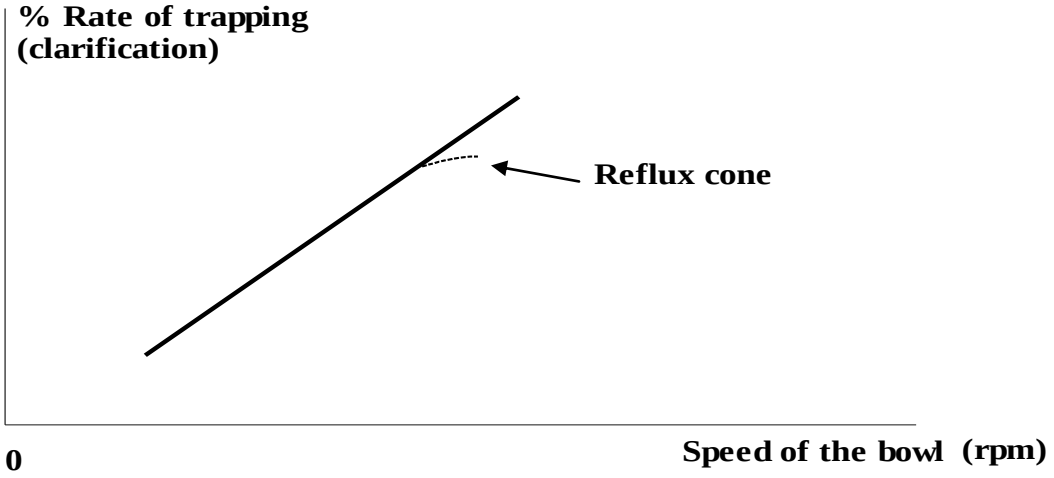


Figure 4-2. Rate of Trapping (Separation of Solids from Water)

4.4 LIQUID RING (POND DEPTH) ADJUSTMENT

4.4.1 Standard Operating Mode

The objective of standard operating mode is to balance dry product against high clarification and high levels of solid matter extraction The liquid level, which can be thought of in terms of a radial depth inside the centrifuge, is controlled by weir plates at the water exit. Four weir plates are used as dams against the four water exit openings in the centrate end of the centrifuge. The weirs can be adjusted to obtain good operating conditions by changing the amount of water exiting the centrifuge.

In the standard mode, the weir plates at low level (large opening) produce drier product, but increase scroll torque and decrease clarification. See figure 4-3.

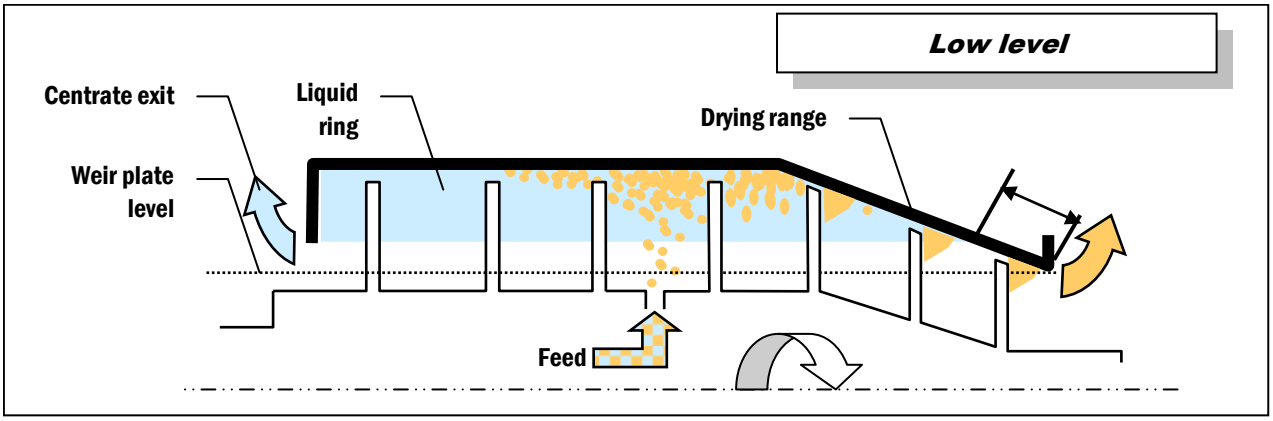


Figure 4-3. Weir Plates at Low Level in Standard Operating Mode

With the weir plates a high level (smaller opening), the product will be clearer, and more solid matter will be extracted, but the output will not be as dry as desired. See figure 4-4.

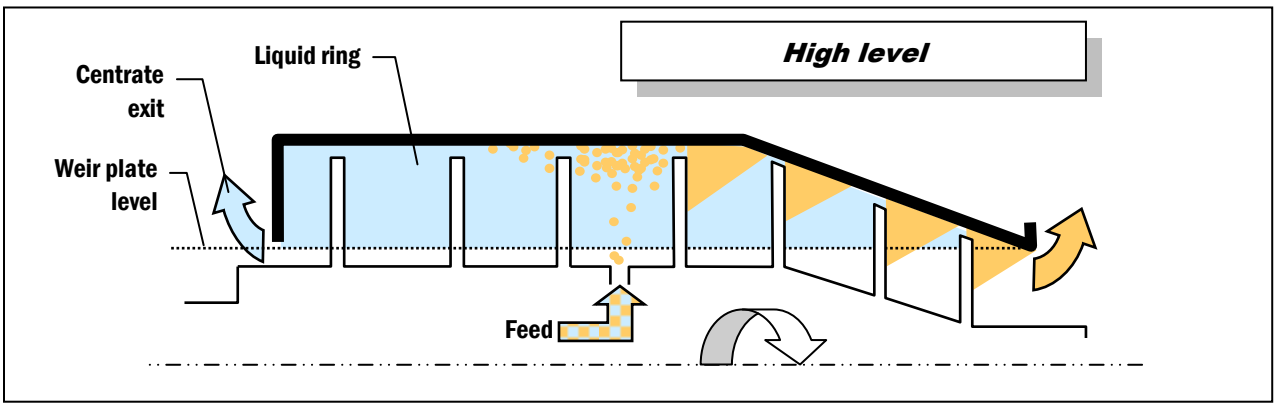


Figure 4-4. Weir Plates at High Level

For feed products with a high concentration of solid matter, it is possible to get very close to overflow conditions without increasing the water content of the solids, which, at an optimal relative speed, dam up the liquid inside the centrifuge. Basically, solids load the centrifuge to the point where very little liquid is needed. The weir plates need to be opened more in response to this situation.

4.4.2 High Performance Mode

In high performance operation mode, a negative level is induced by setting the weir plates so that the diameter of the liquid ring is less than the diameter of the overflow level. That is, the weir plate adjustment diameter must be less than the overflow point at the discharge end of the bowl. See figure 4-5. In this example, water is actually running out the solids discharge.

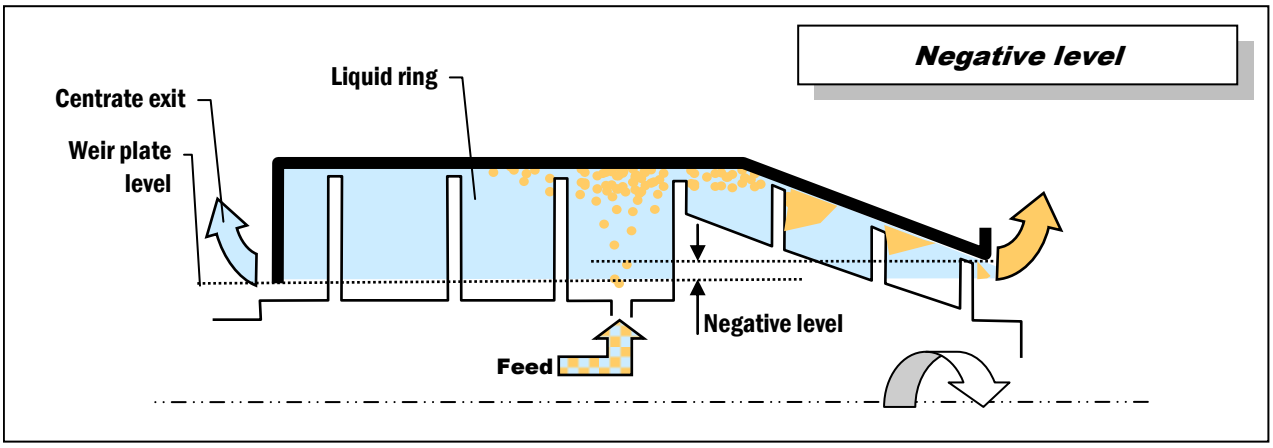


Figure 4-5. Diameter of the Liquid Ring Is Less Than the Diameter of the Overflow

4.4.3 Level Adjustment Procedure

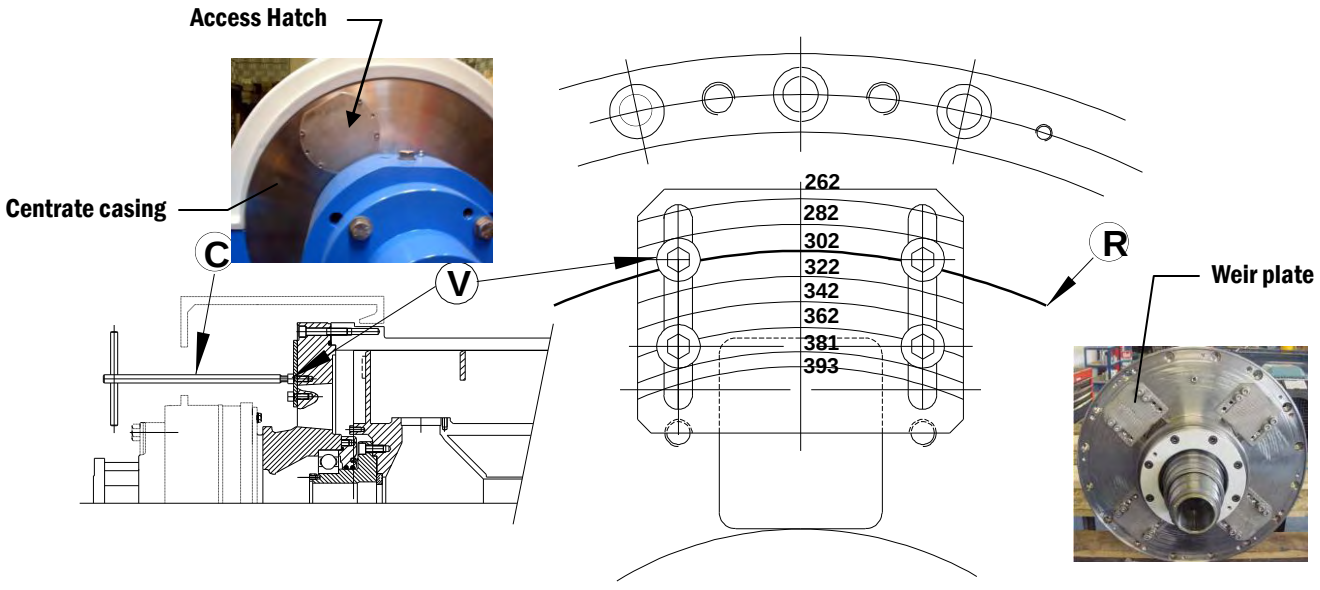


Figure 4-6. Weir Plate Adjustment, Where Level Is Adjusted to Diameter 302 mm

Use the following procedure to adjust the weir plate level for optimal operation, depending on the type of product being processed in the centrifuge.

Stop the centrifuge and turn off the power.

Remove the access hatch and centrate casing, as appropriate, as shown in figure 4-6. The R-values shown in figure 4-6 are the diameters across the plate in millimeters.

Loosen the four bolts ("V" in figure 4-3) with a hexagonal spanner wrench, "C".

Slide the weir plates toward the center or toward the outer rim until the scribed tool mark below the desired depth aligns with the tool mark "R" shown on the front hub.

CAUTION: Given the centrifugal force on the weir plates, incorrect tightening of screws can cause ejection of the weir plates which will damage the centrate casing and weir plates.

CAUTION: Adhere to torque tightening limits indicated in this O&M manual. Be sure to unscrew the bolts and apply Loctite 262. Allow the Loctite to cure before restarting equipment.

Tighten the bolts "V".

For balance, make sure that the four weir plates are all aligned to the same depth, as shown in figure 4-7.

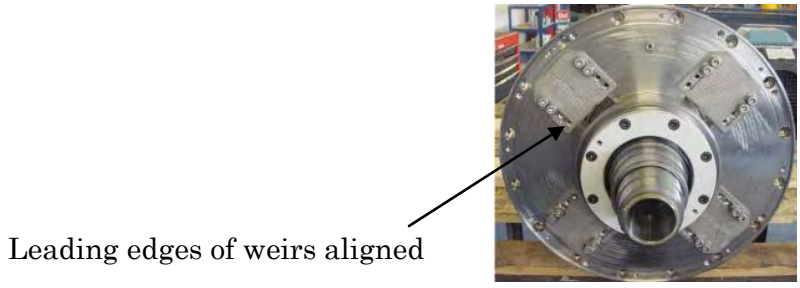


Figure 4-7. Aligning the Weir Plates Evenly

Adjustments to the weir plates vary depending on feed types. Use the following table to select the parameters for adjustment.

Concentration of Feed	Difference in the Radius of the Liquid Ring (or Pond Depth)
< 0.5% (feed without texture)	Near overflow (zero or +2 to 3 mm)
0.5% to 1.0%	-5 mm
1.0% to 2.0%	-10 mm
2.0% to 3.0%	-15 mm
> 3.0%	-20 mm

4.5 RELATIVE SPEED ADJUSTMENT

Relative speed (RS) is the differential speed between the scroll and the bowl. In RS mode, the relative speed is adjusted from the HIM torque/RS screen.

Set point	Torque	RS	Dryness	Suspended Matter
	↗+	↘-	↗+	↗+
	↘-	↗+	↘-	↘-

For example, as the above chart shows, if torque increases, relative speed decreases and dryness and suspended matter in the centrate increases.

If torque decreases, relative speed increases and dryness and suspended matter in the centrate decrease.

4.5.1 Relative Speed Influence

The adjustment of the relative speed is important from a mechanical point of view (Cyclo reducer fatigue, centrifuge plugging) as well as from the performance point of view (dryness, even clarification). A relative speed that is too high can cause turbulence, which will affect clarification.

Relative speed adjustment is automated by a regulator on the control panel.

Generally, relative speed must be low for products lightly loaded with solids and high for products highly loaded with solids.

Low speed favors dryness and increases torque. High speed increases humidity and diminishes torque.

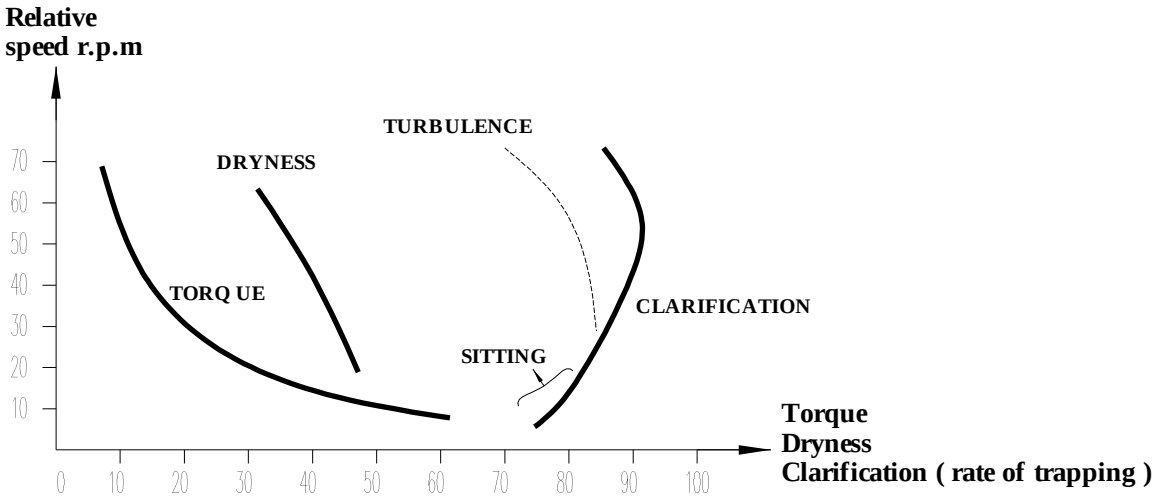
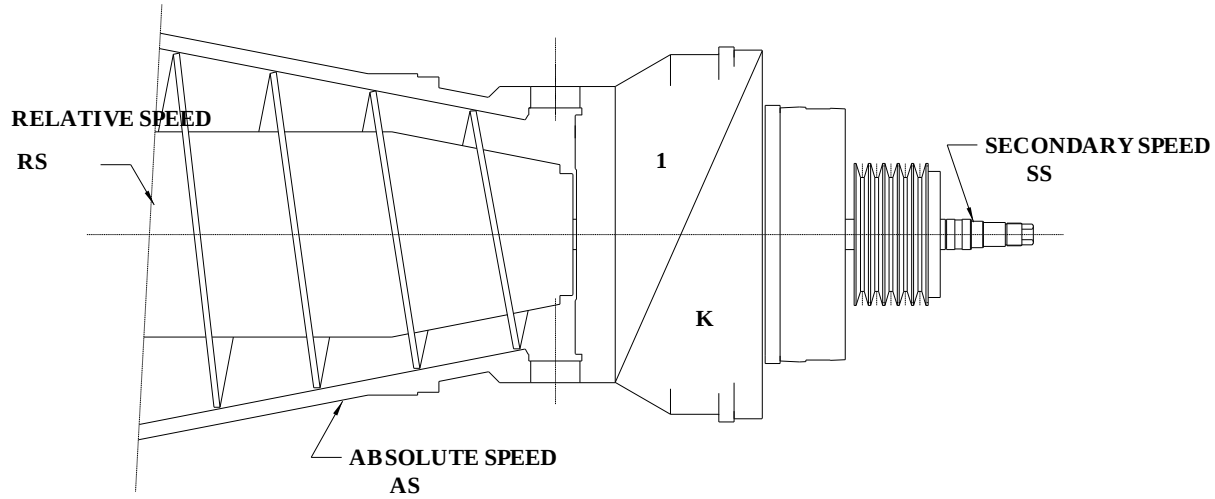


Figure 4-8. Diagram of the Effects of Relative Speed on Centrifuge Performance

4.5.2 Relative Speed Calculation

The relative speed is calculated as follows. More information about calculating relative speed is given in chapter 8. The illustration shows the relationship between relative and absolute speeds.



$$RS = \frac{AS - SS}{k}$$

Where:

RS = Differential speed between screw conveyor and bowl (relative speed)

AS = Bowl Speed (absolute speed)

SS = Scroll shaft Cyclo reducer speed (secondary speed)

k = Reduction of the Cyclo reducer: 12.5 – 29.5 – 43.5 – 88.5, and so on

Example:

If

AS = 3000 rpm

SS = 2130 rpm

k = 43.5

$$RS = \frac{3000 - 2130}{43.5}$$

RS = 20 rpm

4.5.3 Scroll Torque Setpoint Adjustment

For adjustment of the torque setpoint, refer to § 4.8, Control Sequence of Operation.

4.5.4 Summary

This is the basic progression of operator actions:

- With the weir plates adjusted as installed, turn on the centrifuge.
- Adjust bowl speed and scroll speed to obtain optimal product output (dryness without plugging).
- If adjustment of the absolute speed, relative speed, and secondary speed does not produce acceptable output, shut down the centrifuge and adjust the weir plates.

If the product is too dry, decrease the size of the opening with the weir plates.

If the product is too wet, increase the size of the opening with the weir plates.

4.6 RUNNING ADJUSTABLE POND DEPTH

4.6.1 Three phase rotor (solid + light liquid + heavy liquid)

This type of adjustment allows, at the first start up, to rapidly find the optimum adjustment and then to suit the variations of product. These adjustments are carried out during normal running and avoid time loss (stopping the machine and adjustments : 20 minutes).

With this kind of rotor, the level of separation surface between the light liquid and heavy liquid is achieved by the level difference (about from 2 to 8 mm) between the light liquid skimmer and heavy liquid skimmer.

We improve the clarification of liquid having the greatest volume in the bowl, by increasing the passage time, and by modifying the value "e".

Example : see figure 4-9.

To improve the heavy phase, decrease the value "e".

To improve the light phase, increase the value "e".

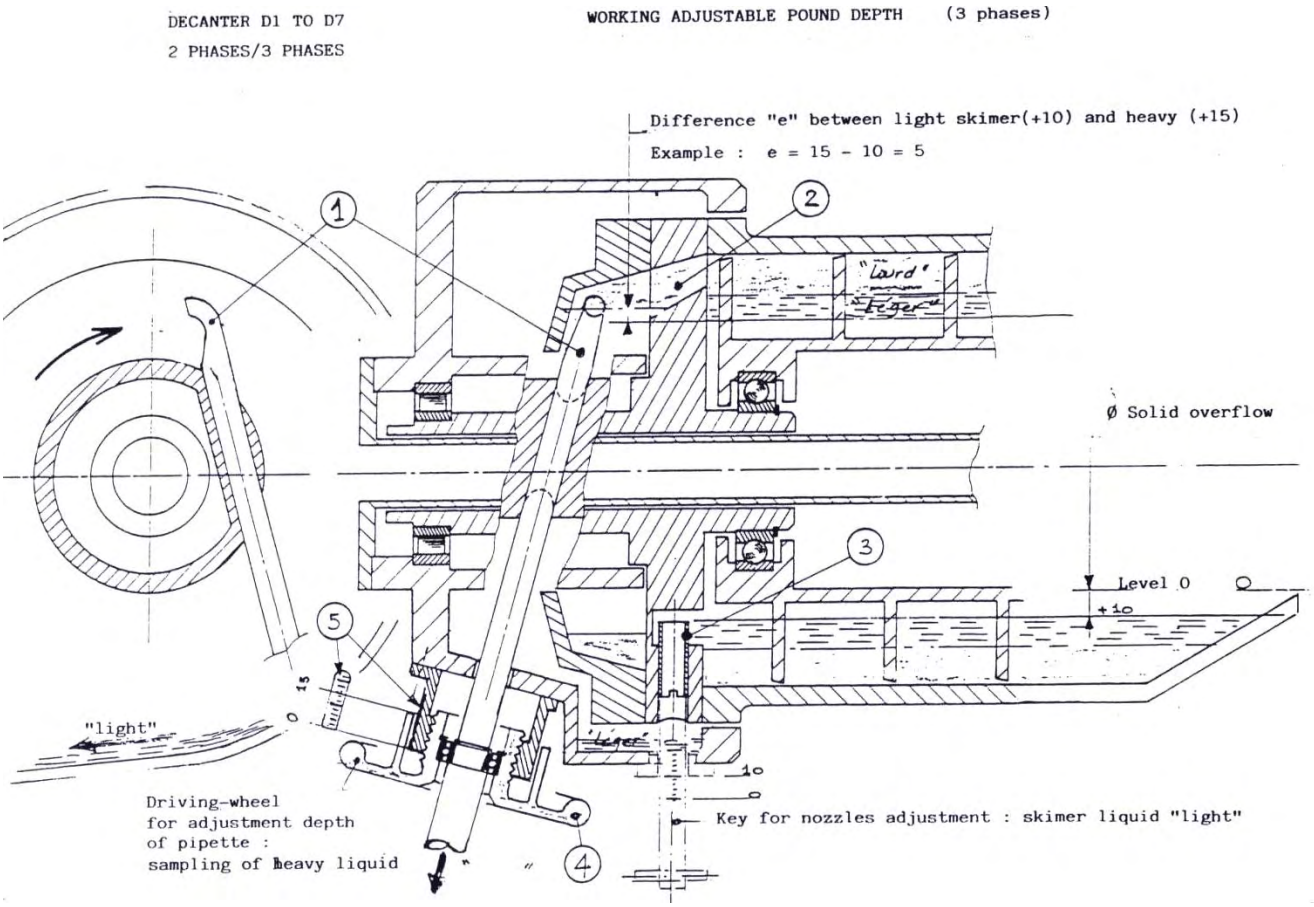


Figure 4-9 Running Adjustable Pond Depth

When the machine runs in 3 phases, before stopping it, there is a possibility to discharge :

- First, the light phase by decreasing the value "e" till the heavy phase appears, and then,
- Partially, the heavy phase, by increasing the value "e" at a maximum value.

4.6.2 Description

Refer to figure 4-9 above. The adjustment device of liquid level is carried out with a pipette (1) dipping into an annular open chamber. This last part is an extension of the cylindrical bowl.

Communication holes of liquid (2) between bowl and this chamber are located at the bottom of bowl plate.

The level of light liquid is adjusted when the machine is stopped by means of radial threaded nozzles (3) fit on the bowl plate.

A wheel (4) moves the pipette according to its axis, so, modifying the heavy liquid level.

A graduated ruler (5) located on the stationary hub indicates the position of the pipette.

In "3 phases" in relation with the radial nozzles : the graduation 0 of the ruler corresponds to 0 of the adjusting key of nozzles (level 0).

NOTE : 0 on the graduated ruler has been determined for an average flow rate with water and for loss of pressure in the flex - pipes (about 1 m) supplied with the machine. For other flow rates and loss of pressure, the operator will have to correct the position of the pipette (approximately 1 mm/m^3/h).

4.6.3 Functioning in 3-Phases

- When the machine is stopped, pre-adjust the level of light phase by means of the radial nozzles (3). This adjustment will be done with an appropriate key. See note 535 (3 phases rotor) to know how to use this key. Pre-adjust these nozzles at an average value (for example at about 10 mm under level 0 (see figure 4-9 above).

- Pre-adjust the pipette when the machine is stopped. This operation will be done by estimating the difference between the skimmer "light" and "heavy" (about 5 mm). Screw or unscrew the wheel until it reaches the depth mark 15.

- Run the machine till the nominal speed.

- Feed the machine till the nominal speed.

- As soon as the machine runs normally, draw samples and check the proportions of light and heavy liquid and if necessary correct them, according to the following operations :

4.6.4. Clarification of Light Liquid

The volume of light liquid will be increased at a value maximum by increasing the difference "e" between the two skimmers. Turn the driving wheel slowly in clockwise, till the light liquid appears into the heavy liquid. Then, return the wheel back a little.

4.6.7. Clarification of Heavy Liquid

The volume of heavy liquid will be increased at a maximum value by decreasing the value "e" between the two skimmers. For that, turn the driving wheel in a counter clockwise until the heavy liquid appears into the light liquid. Then, turn the wheel back a little.

4.6.8. Clarification of Heavy and Light Liquid

Proceed as before to determine the maximum and minimum differences then, adjust the pipette at an average value between these two values.

4.7 CLEARING CENTRIFUGE CLOGGING

Centrifuge choking or clogging may cause partial or complete filling of the scroll flights. This filling of the scroll flights with decanted solids results in undesirable compaction of the solids. Clogging may be caused by a variety of operating conditions:

- Unexpected full stop of the centrifuge (such as a power outage)
- Low relative speed (insufficient flow from scroll or setpoint too high)
- Strong variations in the concentration
- Worn scroll
- Loss of adhesion in the bowl (the solid turns with the scroll instead of the bowl)
- Packing of the solid on the scroll flights

Before disassembling the scroll, perform a maintenance cleanout.

4.7.1 Maintenance Cleanout by Reversing Scroll

These are the instructions for performing a maintenance cleanout with a reversing scroll.

At the centrifuge operator panel, from the main screen of the A-B PanelView Plus, touch the ANDRITZ logo and enter your password to go to the CENTRIFUGE SETUP 1 screen.

Touch numeric display BOWL SPEED (SETPOINT) and enter 1000. Press the enter key to return to the main screen.

At the main screen, touch the centrifuge on the screen to navigate to the TORQUE/RS CONTROL screen.

Touch the RELATIVE SPEED numeric display and set the relative speed to 2.

Select RELATIVE SPEED CONTROL, then return to the main screen.

Change the centrifuge to manual control.

Navigate to the manual control screen.

Start the centrifuge.

Open the centrifuge wash water solenoid.

Start the discharge scroll in the forward direction for 20 to 30 minutes ("forward" means towards the solids discharge end).

Monitor the output of the centrifuge. When the output becomes liquid, reverse the scroll.

Continue running the centrifuge until clean water is discharging.

Stop the centrifuge and return all settings to the original parameters.

Return to automatic operation.

4.8 CLEANING IN PLACE

Cleaning in place (C.I.P.) consists of washing the rotor, without disassembly, by successive circulation of chemical agents in order to eliminate all traces of residue which could cause contamination, and most germs. The rotor, is driven at low speed by the main motor, controlled via the frequency inverter. Casings are cleaned by spray nozzles (optional).

The most commonly used liquid is a combination of nitric acid and 2% diluted soda at a temperature of 122°F to 158°C. Hot water is used at the beginning and at the end of cycle as well as after each cycle of acid or soda for neutralization.

The cleaning cycle begins with a high-speed pre-wash cycle. It is followed by low speed washing sequence. This low speed (70 to 200 rpm) is controlled by the main motor frequency inverter.

Note: In case of equipment such as an exchanger situated down stream of the centripetal pump, a high-speed full wash cycle must be provided.

The relative speed is usually adjusted via stepped cone pulleys. In this case the relative speed (chosen at nominal speed) will be proportional to bowl speed.

For example, if RS = 25rpm with a bowl speed of 3000rpm, at 200 rpm, the relative speed will be :

RS = 25x(200/3000) = 1.6 rpm

A bowl speed of about 70 rpm is ideal for rinsing. The hydraulic ring is at the limit of its formation and effectively stirs up between the scroll and bowl. However, under these conditions, the liquid level rises well above the axis and leaks may appear on the front face of the bearing between the feed tube and the bowl hub.

It is preferable to increase speed rather than decrease flow in order to avoid these leaks. Relative speed does not need to be very high. It just needs to be positive. 1 to 3 rpm suffice to evacuate the solid particles towards the solids discharge casing. In fact it is the hydraulic flux which drives these particles.

Note: In case of machines equipped with 2 motors and 2 frequency inverters, the relative speed is easily adjustable. The secondary motor is not loaded and can be driven at 1 – 5 Hz. It may, if necessary, be driven in reverse at –5 to –10 Hz in order to increase the relative speed.

4.8.1 Cleaning Points

Bowl and Screw Conveyor (L1)

Rinse feed is done via the main feed pipe. At slow speed about 80% of this flow is evacuated towards the sediment casing and 20% to the centrate casing. At full speed almost all of the flow passes through the centripetal pump with a small amount passing through to the centrate casing (depending on internal level settings).

Centrate Casing and Bowl Plate (L2)

The centrate discharge casing and the bowl are cleaned via spray nozzles.

Screw Conveyor (L3)

The centrate discharge casing and the bowl are cleaned via spray nozzles.

Screw Conveyor (L3)

The feed tube is furnished with a rinse ramp to clean the sleeve, which extends from the feed chamber.

Sediment Casing (L4)

The sediment casing is cleaned via a valve nozzle. The valve keeps the solids from entering into the cleaning agent's injection pipes.

Note: Sediment casing cleaning should be done at high speed. At high speed the liquid is projected against the casing at a high enough rate to dislodge the solid particles.

Recovery Zone (L5)

The external surface of parts situated beyond the casing sediments.

The frame is provided with 2 T-branches washing space under the rear pillow block.

For some applications the frame is furnished with a bowl rinse ramp. The liquid is recuperated via a separate collector.

Refer to table 4.1 and figure 4-10.

4.8.2 Cleaning Cycle Duration and Frequency

The cleaning cycle is usually done (depending on the treated product and process) every 36, 48, or 72 hours. The average duration is about 1 hour for 10-minute cycles for each liquid.

TABLE 4-1. D2 WASH FLOW CHART	
WASH POINTS	**Gallons/ Minute**
L1 : Bowl and screw	4.4-8.8
L2 : Centrate casing	2.2
L3 : Conveyor screw	2.2
L4 : Discharge casing	4.4
L5: Under rear pillow block	/

The flow and/or slow speed must be adjusted in order not to have leakage on the front face of the casing.

Liquid flow rates and temperatures are given as an indication only and should be adapted to specific C.I.P. needs.

The order of acid and soda sequences can be inverted.

The admissible counter pressure for the centripetal pump or the adjustable skimmer is about 2 to 3 bars in normal running mode. At slow speed the pumps have no efficiency.

Note: The downstream circuit from the centripetal pump or the adjustable skimmer **MUST** be open with no risk of partial or total obstruction during the CIP phase, in order to avoid any bearing washing out.

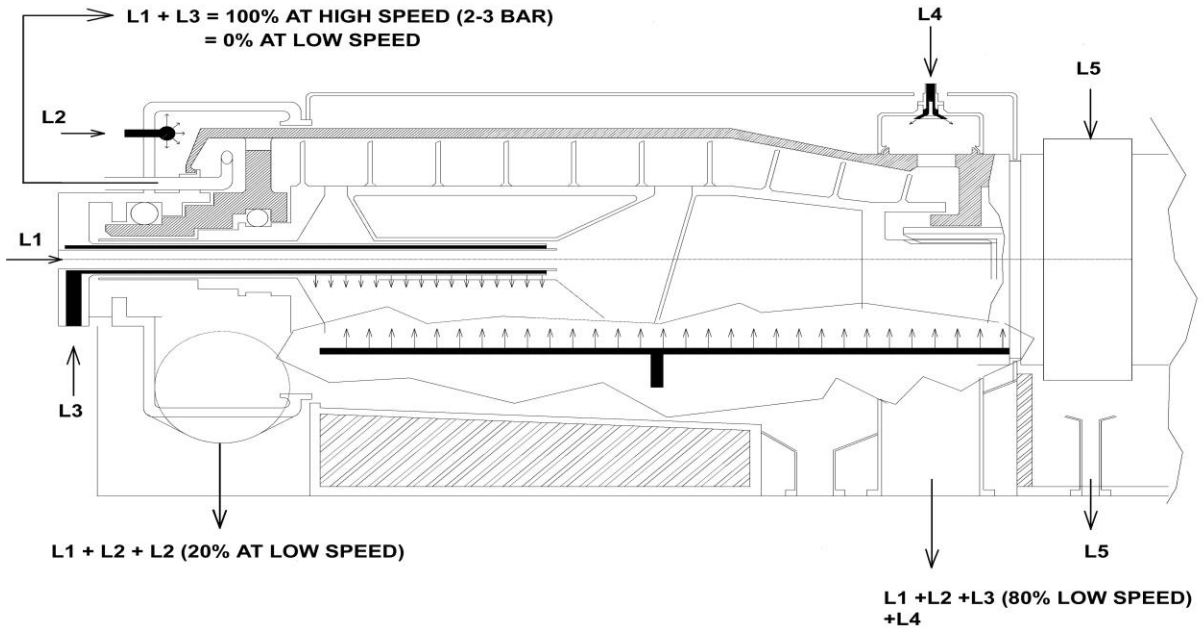


Figure 4- 10 Injection Points

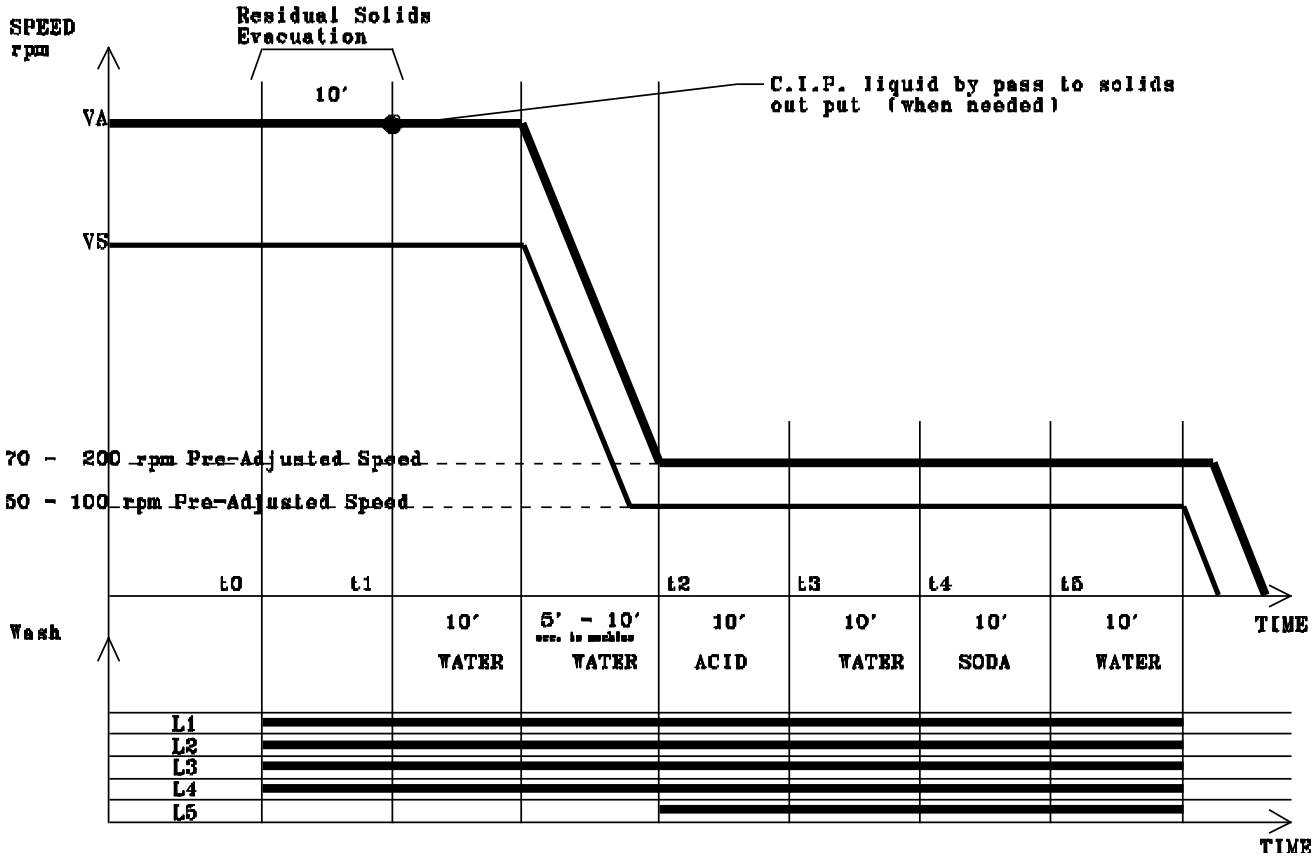


Figure 4-11 Typical Cleaning in Place Cycle – Machine Only

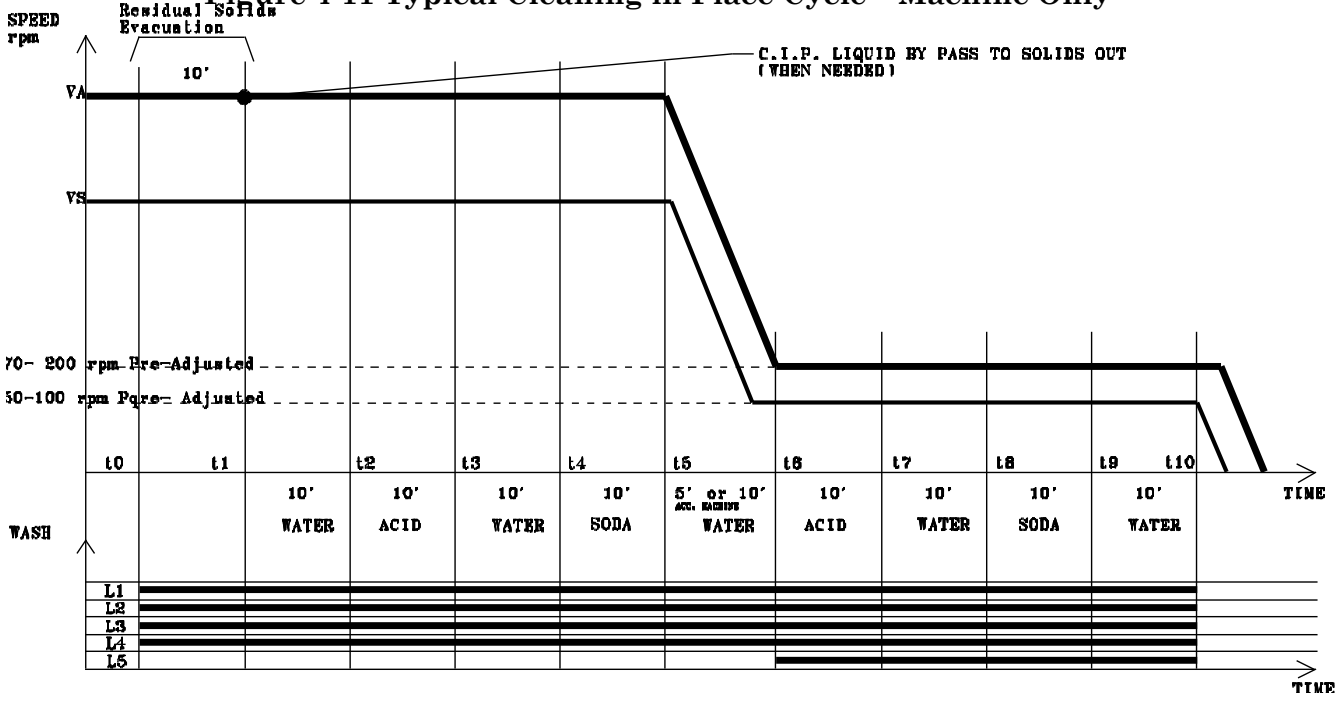


Figure 4-12 Downstream Machine & Circuit C.I.P

Down stream from centripetal pump of adjustable pipette at high and low speed.

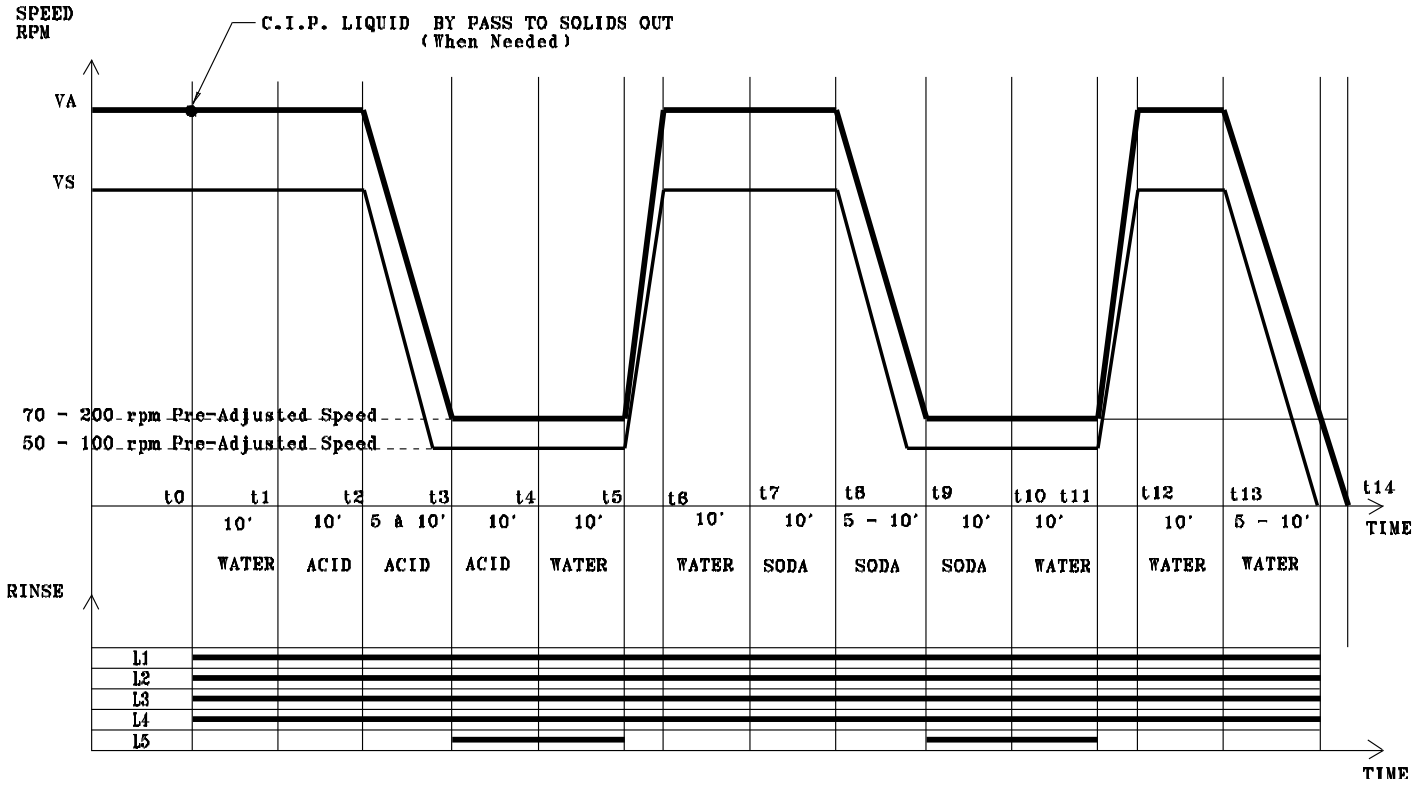


Figure 4-13 Alternating Speed C.I.P.

Machine and circuit down stream from centripetal pump or adjustable pipette via alternating speed.

4.9 CONTROL SEQUENCE OF OPERATION

The centrifuge control system consists of a Centrifuge Control Panel (CCP). The CCP is NEMA 4X 304 SS with an air conditioner unit. The CCP houses the variable frequency drives, the programmable logic controller (PLC), associated I/O, and the operator interface terminal (OIT). It is important to ensure that all control switches are in proper position and equipment is ready to operate from the CCP.

The CCP emergency stop will de-energize the master control relay to interrupt all run commands for immediate shutdown.

To restart the system, the actuated emergency stop must be manually reset.

4.9.1 OIT Screens

- ***Main***: This screen provides a system overview with operational status indicators, mode selection touch zones, sequence start and stop touch zones, and access to other system screens.
- ***Manual Control***: this screen provides start and stop touch zones and status indicators for each piece of equipment under the control of the Centrifuge PLC.
- ***Feed Pump Setup Screen***: This screen provides setpoint entry for feed flows along with numeric and bar graph representations of both setpoints and actual flows. The set-points are changeable by depressing the current set-point and inputting a new number in the pop-up keypad. The new set-point will become effective immediately.
- ***Solids Pump Setup:*** This screen provides numerical and bar-graph representation of solids pump set-point. The set-point is changeable by depressing the current set-point and inputting a new number in the pop-up keypad. The new set-point will become effective immediately.
- ***Centrifuge Torque Control***: This screen allows selection of PID auto or manual mode, entry of relative speed or torque setpoint, and numeric and bar-graph representation of setpoints and actual values.
- ***System Monitor***: This screen provides numeric and bar-graph representation of setpoints and actual values of all system-monitored values along with centrifuge run-time indication.
- ***Alarms:*** This screen provides indication for all system alarms including counters for high vibration and high torque alarms (see alarm description for details).
- ***Centrifuge Torque Control Setup:*** This screen is password protected and provides entry for PID tuning parameters for the torque control loop.
- ***Setup1:*** This screen is password protected and provides entry for centrifuge-specific machine and motor data for PLC program use.

- ***Setup2***: This screen is password protected and provides entry for AUTO START, AUTO STOP, and READY FOR DISCHARGE torque control parameters.

- ***Setup3:*** This screen is password protected and provides CIP settings.

- ***Setup4:*** This screen is password protected and provides entry for critical alarm setpoint parameters.

- ***Setup5***: This screen is password protected and provides entry for automatically analog scaling. Only qualified ***ANDRITZ*** personnel may change these values.

4.9.2 Starting/Stopping Modes

On the ***Main*** screen, select the system operating mode by touching one of the mode select touch zones (auto, CIP, or manual). All equipment must be stopped to change modes; this will be indicated by the mode select enabled indicator.

MANUAL MODE: Selecting the manual mode places all system equipment in manual. In this mode, system components can be started with their respective start pushbuttons, which can be accessed by touching the manual control touch zone, which displays the ***Manual Control*** screen. System components are stopped with their respective stop pushbuttons. Emergency stop always stops all equipment.

CAUTION: This mode of operation is provided for maintenance purposes only and must not be left unattended.

AUTO MODE: In auto mode, startup and shutdown can be controlled from the AUTO START/AUTO STOP pushbuttons. Operating the AUTO START pushbutton initiates the sequence of events described below. At any time while in auto mode, the operator can initiate a startup or shutdown. After an auto stop has completed, an auto CIP cycle will begin.

CLEAN IN PLACE (CIP) MODE: In this mode, startup and shutdown can be controlled from the CIP START/STOP pushbuttons. Operating the CIP START pushbutton or any AUTO STOP sequence will initiate an automatic CIP.

Operating the AUTO START pushbutton will initiate the following sequence of events:

1	Centrifuge bowl drive starts	Instantly
2	Centrifuge back drive starts	3-second delay from bowl starting
3	Feed pump starts	When bowl reaches 95 % speed
4	Centrifuge producing cake relay energizes	When torque setpoint is met[1]
5	Solids pump starts	Once cake is available.

While auto start is in progress, the AUTO START indicator light will flash STARTING IN AUTO. After startup is complete, the indicator light will stay on steady RUNNING IN AUTO.

Operating the AUTO STOP pushbutton initiates the following sequence of events:

1	Feed pump stops	Instantly
2	Centrifuge goes to relative speed control	Instantly
3	Centrifuge NOT producing cake relay de-energizes	Torque setpoint[2]
4	Centrifuge goes to auto stop preset speed #1	Instantly
5	Centrifuge flush valves (all) open	Instantly
6	Centrifuge remains at present speed #1	Duration as set on ***Setup2*** screen
7	Centrifuge goes to auto stop preset speed #2	At normal deceleration ramp
8	Centrifuge remains at this preset speed #2	Duration set on ***Setup2*** screen
9	Centrifuge flush valves (all) close	Once desired speed reached during stop[3]
10	Centrifuge stops	At normal deceleration ramp
11	Automatic CIP	After centrifuge stops

The Auto Stop indicator light will flash STOPPING IN AUTO while in progress and go on steady STOPPED IN AUTO when complete.

In CIP mode, startup and shutdown can be controlled from the CIP START/AUTO STOP pushbuttons. Operating the CIP START pushbutton or any AUTO STOP will initiate the following sequence of events. At any time while in the CIP mode the operator can begin a startup or shutdown.

Operating the CIP START pushbutton will initiate the following sequence of events:

1	Centrifuge bowl drive starts	After pre-determined time delay
2	Centrifuge back drive starts	3-second delay
3	Centrifuge flush valve (all) opens	Once centrifuge reaches speed

The duration and speeds for the CIP cycle are set on ***Setup3*** screen.

[1] Torque setpoint for ready to discharge operation timing is set on ***Setup2*** screen.
[2] Torque setpoint for Centrifuge Cake and No Cake is set on ***Setup2*** screen.
[3] Bowl speed for wash water closing adjustable in ***Setup2*** screen.

Operating the CIP STOP pushbutton will initiate the following sequence of events.

1	Centrifuge wash water valve (all) closes	Instantly
2	Centrifuge stops	At normal deceleration rate

4.9.3 Operating Mode

Torque/Relative Speed Control:

The centrifuge operates in two different control modes — torque control (PID auto) or relative speed control (PID manual). The active control mode is indicated below the centrifuge graphic on the ***Main*** screen. To access control mode selection and setpoint entry, touch the centrifuge graphic to display the ***Torque Control*** screen. The control mode is selected by touching either the auto or manual touch zones. The setpoint is entered by touching the numeric display button, which brings up a numeric entry keypad. The setpoint range is 0–100%[4] for Torque setpoint and 0–15[5] for Relative Speed setpoint.

Feed Control:

Inputs for speed/flow setpoints for the feed pump can be accessed by touching either pump graphic. This will display the ***Feed Setup*** screen. To change the pump settings, touch the pump select cell to display a numeric entry keypad. The setpoint range is based on actual flow range.

Feed Control Pause:

There are PAUSE and RESUME pushbuttons located on the ***Main*** and ***Feed Setup*** screens. The PAUSE pushbutton, when pressed, causes a temporary feed shutdown to allow maintenance or changing of support equipment. To run or re-start the feed pump, press the RESUME pushbutton. When the centrifuge has been paused for 10 minutes, the alarm horn will sound three times to draw attention to a "none processing" centrifuge. This alarm will continue for 60 minutes, at which time an AUTO STOP sequence will be initiated.

[4] Torque setpoint may be limited on the ***Torque Control Setup*** screen during startup for each specific centrifuge.
[5] Relative speed maximum is limited on the ***Torque Control Setup*** screen as part of the centrifuge programming.

4.9.4 Alarms

Alarm conditions are indicated with red indicators on the alarm screen and cause the alarm horn to sound and the beacon to flash. Alarm lights will go on steady as long as the condition is still in fault condition. Operating the ACKNOWLEDGE pushbutton will silence the horn and cause the indicator light to flash only if the condition has been cleared. Operating the RESET button will clear the alarm indicator and allow system startup if the alarm condition has been cleared. The RESET button also resets the alarm horn and beacon.

The following conditions will immediately shut down the complete system in auto, manual, or CIP. No automatic CIP will follow:

- Emergency stop
- Bowl drive VFD fault
- Bowl motor high temperature
- Scroll drive VFD fault
- Scroll motor high temperature
- High-High torque[6]
- High torque 3rd strike alarm (will cause normal shutdown)
- High-High vibration[6]
- High vibration 3rd strike alarm (will cause normal shutdown)
- DC bus blown fuse
- Feed end bearing high-high temperature[6]
- Drive end bearing high-high temperature[6]
- VFD Keypad Stop pressed

[6] These alarm setpoints are set on the ***Setup4*** screen.

The following conditions will enable a feed pause in the auto mode. If the alarm is not cleared within 60 minutes, the centrifuge will auto stop:

- High vibration[6],[7]
- High torque[6],[7]
- Low relative speed[6],[7]
- Feed pump fault
- Solids pump fault

The following conditions enable an alarm only:

- Feed end bearing high temperature[6]
- Drive end bearing high temperature[6]

4.9.5 Oil Lube Timer

On the ***System Monitor*** screen, there is a TIME TILL NEXT LUBE display. This display is in hours and counts down the appropriate amount of time required between lubrications of the centrifuge. When this display reaches zero, it is time to replace the oil. To reset the display after oil lube replacement, you must, with the centrifuge running and the display at zero or below, press the RESET button.

[7] High vibration or high torque initiates a flush sequence, the duration of which is set on the ***Setup3*** screen. If three high vibration or high torque alarms occur within a 10-minute time period, an Auto Stop sequence is initiated. If the alarm clears, the feed pump will restart in Auto mode. In manual mode, the operator will have to restart the feed system.

4.10 THREE-PHASES ROTOR – THEORETICAL OPERATION

4.10.1 Static Theory

Florentine vase

ω h : light phase density (oil)

ω e : heavy phase density (water)

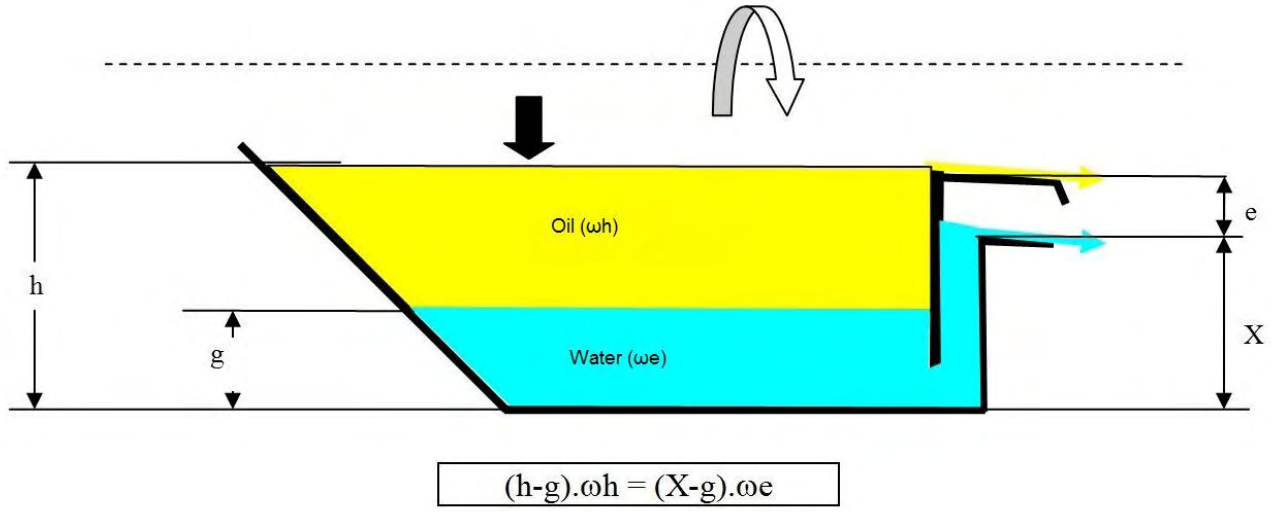


Figure 4-14 3-Phases Rotor – Static Theory

4.10.2 Dynamic Application

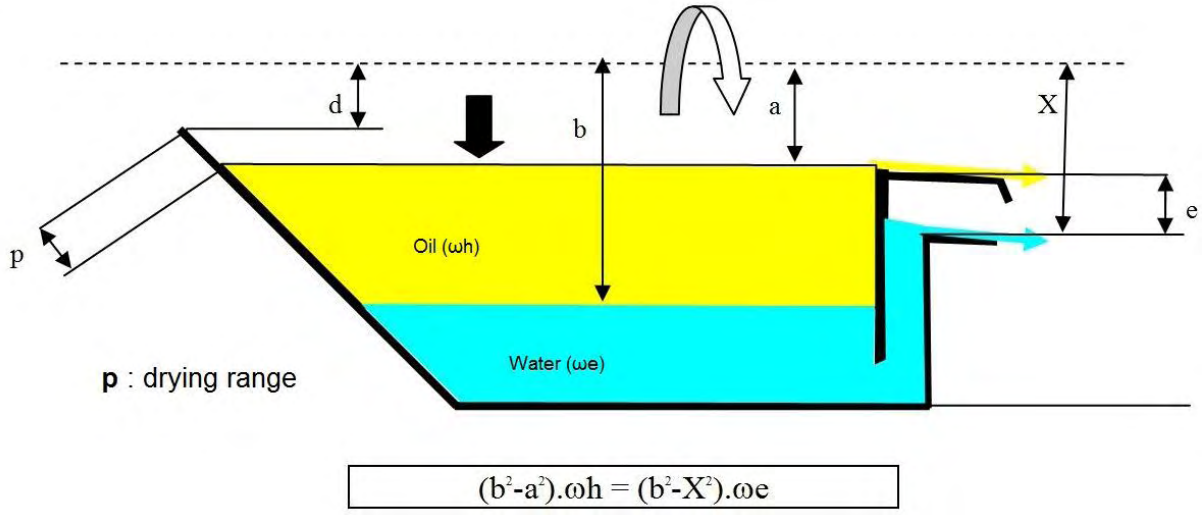


Figure 4-15 3-Phases Rotor – Dynamic Application

Whether $$X = \sqrt{\frac{b^2.\omega_e - (b^2 - a^2).\omega_h}{\omega_e}}$$

Or $$b = \sqrt{\frac{x^2.\omega_e - a^2.\omega_h}{\omega_e - \omega_h}}$$

4.10.3 Use Of This Principle On The Machine

The light threshold (a) is defined as a function of the drying range indicated in the sketch, compatible with the dryness and the extraction of the product.

From this light threshold on, the dimension of the second threshold X is varied in order to choose the dimension (b) of the separation surface. This surface will be kept as far as possible from that of the evacuation of the noble liquid.

Note: The output influences the clarification, but not the calculation of the thresholds. In fact, it is necessary to take into account what is called the cresting effect, linked to the output and to the relative viscosity of the 2 liquids. This threshold effect is grossly evaluated. It is of some 1 to 3 mm.

4.10.4 EXAMPLES OF CALCULATION AND LEVEL ADJUSTMENT

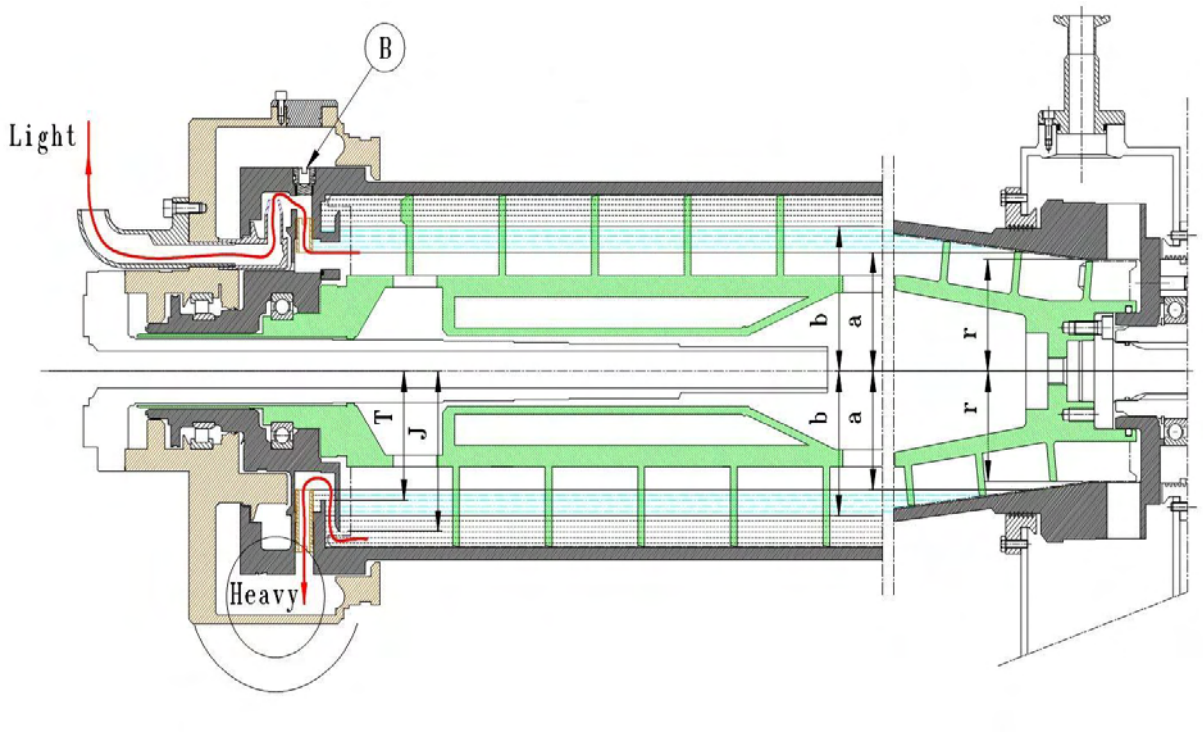


Figure 4-16 Examples Of Heavy And Light Threshold Adjustment Calculation

4.10.5 Calculation of the Heavy Threshold X

- Light phase density (ex. oil) $\omega h = 0.9$
- Heavy phase density (ex. water) $\omega e = 1$
- Light threshold (a) = 130
- Separation surface (b) = 190

Remarks

- The light threshold (a) is chosen as a function of the wanted drying range (P).
- The separation height (b) is chosen considering that the light liquid phase is the important product.

$$X = \sqrt{\frac{b^2.\omega_e - (b^2 - a^2).\omega_h}{\omega_e}}$$

$$= \frac{190^2.1 - (190^2 - 130^2).0{,}9}{1}$$

Which gives a distance of levels of 137,2 -130 = 7,2 mm.

4.10.6 Practical Adjustment of "Light" and "Heavy" Levels.

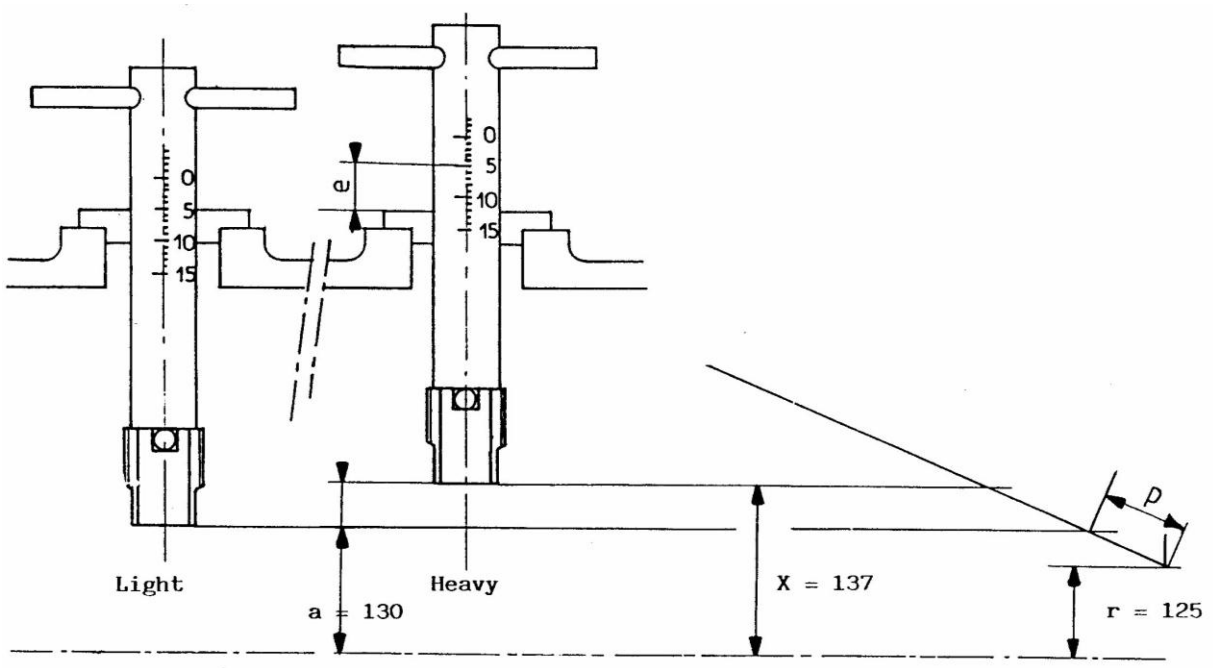


Figure 4-17 Practical Adjustment Of Light And Heavy Levels

Note: The 0 mark on the spanner corresponds to the overflow of the liquid on the conical bowl side, that is to say r = 125.

The "light" nozzles have to be adjusted to 130-125 = 5 mm read on the spanner.

The "heavy" nozzles have to be adjusted to 137-125 = 12 mm read on the spanner

4.10.7 Calculation of the Separation Surface (b)

- Light phase density (oil) ω h = 0.9
- Heavy phase density (water) ω e = 1
- Light threshold (a) = 130
- Heavy threshold (x) = 134

$$b = \frac{X^2.\omega_e - a^2.\omega_h}{\omega_e - \omega_h}$$

$$= \frac{134^2.1 - 130^2.0{,}9}{1 - 0{,}9}$$

$$= 165{,}7mm$$

4.11 PHASE REVERSAL DISK

4.11.1 Heavy Phase Through The Skimmer

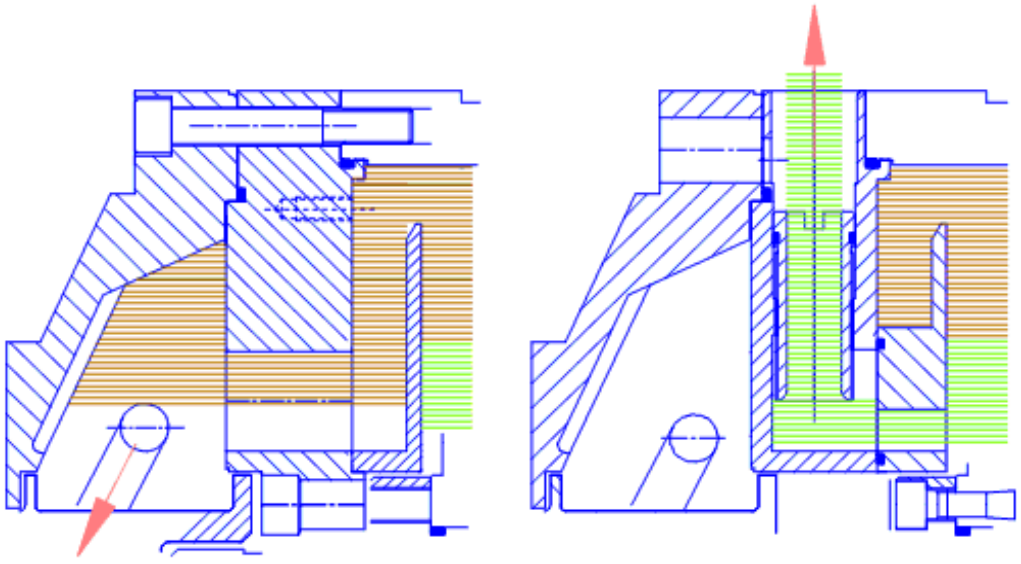


Figure 4-18 Heavy Phase Through The Skimmer

4.11.2 Light Phase Through The Skimmer

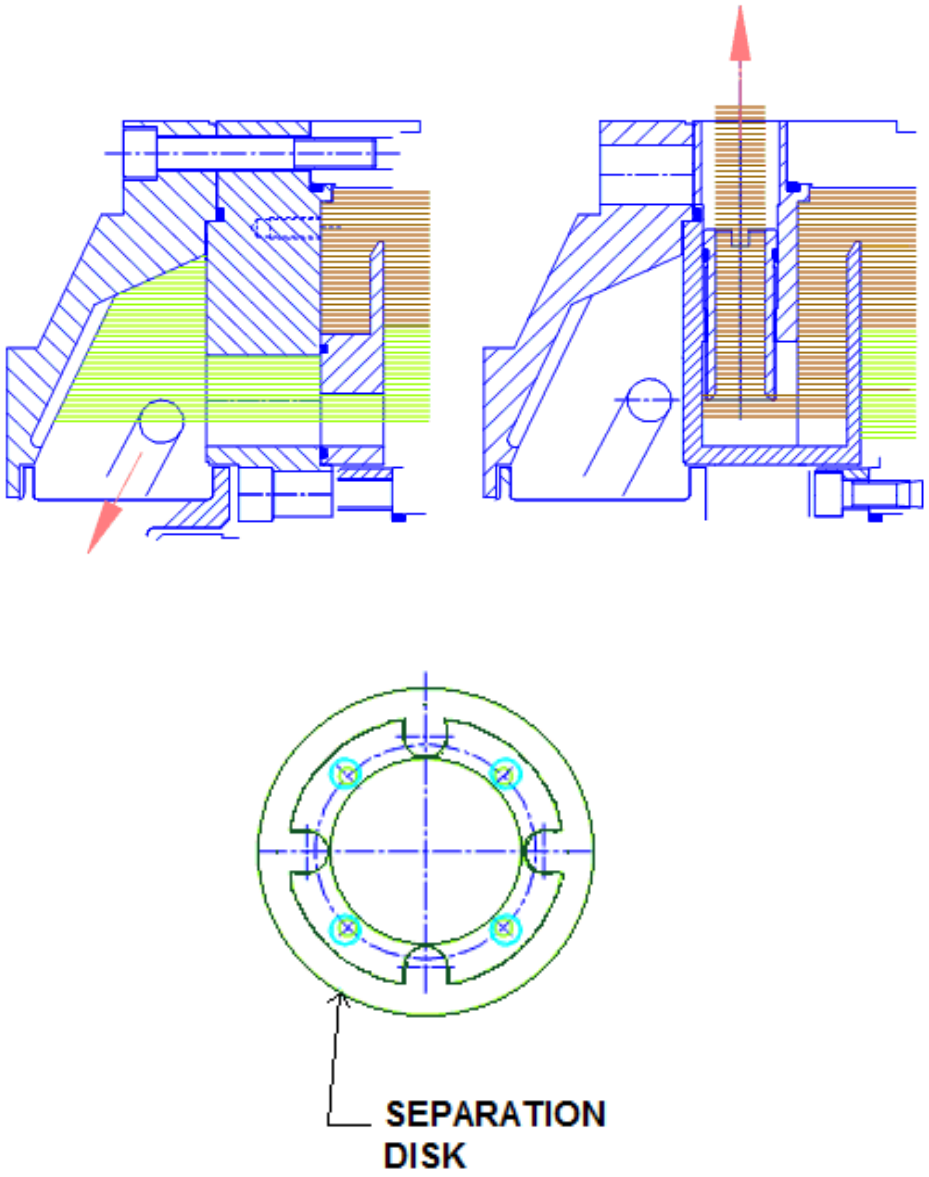


Figure 4-19 – Light Phase Through Skimmer and Separation Disk

CHAPTER 5

TROUBLESHOOTING

5.1 MECHANICAL PROBLEMS — IRREGULARITIES

5.1.1 Vibrations

Vibrations are destructive to the centrifuge and cause the following types of damage when they occur at high speed:

- Rapid deterioration of the bearings on the bearing block
- Breakage of hood fixed parts, transmission, casings, and the like
- Fatigue of rotating parts

The criterion examined to determine centrifuge balance is the vibration intensity or moving speed of the frame in inches/sec.

The centrifuge must be turned off immediately when vibration occurs, and the cause the vibration must be traced.

> **Note: The Andritz service department has a tool for onsite analysis of vibrations and for balancing the centrifuge for emergency repairs.**

To determine the cause of vibration, examine each of the following possible causes shown in table 5-1.

TABLE 5-1. CAUSES OF CENTRIFUGE VIBRATION

Suddenly Occurring Vibration	Progressively Occurring Vibration	Vibration After Maintenance
Product silting up between scroll and bowl	Worn scroll	Mating surfaces damaged or poorly cleaned
Centrifuge not washed properly when stopped	Bearing damaged	Seal nipped between two mating surfaces
Weir plate loose	Shock absorbers damaged	Fastening screws in bearing block or rotary assembly too tight
Scroll tiles damaged or torn off		Weir plate poorly adjusted
		Incorrect tension on the belts

5.1.2 Noise

If the centrifuge is unusually noisy, look for and correct the following conditions:

- Absolute speed has been increased.
- A bearing on a bearing block is worn.
- The shock absorbers are damaged or worn.
- Screws are loose at one of these locations:
  - The main hood
  - The solids discharge casing
  - The transmission
  - The VFD

5.1.3 Overheating

An abnormal temperature (taken while centrifuge is operating at nominal speed) may be caused by any of the following conditions:

- Permanent high torque
- Inadequate grease coverage at the input shaft due to a large speed difference between the outer ring and the input shaft. As a rule, this difference should not exceed 3,000 rpm.
- An incorrect lubricant level (too much or not enough)
- The wrong type of lubricant

Bearing Blocks Overheat

If the front and rear pillow blocks are overheating, check the greased bearings for excessive grease, insufficient amount of grease, or bearing wear. If there is excessive grease, the bearing block will need to cool for several hours to fall back to its normal operating temperature range.

Cyclo Reducer Overheats

The normal operating temperature range is between 100 °F and 140 °F. Measurements taken within 10 minutes of slowing down the centrifuge may not be accurate. Use a laser thermometer for a precise reading.

Abnormal temperatures may be caused by any of the following conditions. Check for and correct these conditions:

- Permanent high torque
- Inadequate grease coverage at the input shaft due to a large speed difference between the outer ring and the input shaft. As a rule, this difference should not exceed 3,000 rpm.
- An incorrect lubricant level (too much or not enough)
- The wrong type of lubricant
- Early deterioration of the Cyclo reducer.

To check the state of the Cyclo reducer without disassembling the equipment, check that the eccentric shaft turns freely by hand without catching.

5.1.4 Abnormal Motor Loads

Several conditions may affect motor load:

- Bowl speed accelerates
- Extraction torque increases
- A bearing is damaged
- The centrate outlet (casing and/or weirs) is blocked up

If the rotating assembly (bowl and scroll assembly) is not turning freely, check for and correct the following conditions:

- The solids discharge casing is packed and the solid grinds against the diffuser.
- Solid material has seeped into the frame cradle and grinds against the bowl or against the Cyclo reducer ring.
- Solid particles carried off by the centrate have dried in the narrow passage between the bowl flange and the centrate casing.
- Product has dried between the feed tube and the outside of the scroll.
- The two screws supporting the bowl on the front pillow block side have not been loosened enough.
- The feed flow rate is too high for the scroll — during the time it takes for a product plug to form at the disc level, the liquid flows through the solids discharge area and uses more power.

5.2 PRODUCT PROBLEMS — IRREGULARITIES

5.2.1 Abnormal Extraction Torque

If the solid extraction torque between the scroll and bowl is abnormal, it will cause the high torque and high-high torque alarms to trigger. Before any major repair or maintenance on the centrifuge, check that the torque is actually abnormal by reading the scroll motor torque directly from the VFD and recalculate the percentage of Cyclo reducer torque so that you can compare it with the display.

> **Note: For centrifuges equipped with an elastic ring and without a torque measure,[1] it is possible to follow the variation of the torque with a stroboscope with the centrifuge running.**

An abnormal torque capable of reaching the alarm trigger can be caused by any of the conditions shown in table 5-2.

TABLE 5-2. CONDITIONS THAT CAN TRIGGER ABNORMAL TORQUE

PROBABLE CAUSES	CHECKS	REMEDIES
The scroll is worn – thread is worn or chamfering has disappeared.	The centrate is more loaded than normal. The centrifuge vibrates slightly.	Replace the scroll. If wear is minimal, rebuild by hand. Balance as needed.
The solid turns with the scroll.	The solid is poorly evacuated in the casing. It comes out in spurts instead of continuous flow.	Raise the level. Lower the absolute speed.
The product has changed.	Check the output, check concentration	If these speeds are adjustable: Increase the relative speed. Decrease the absolute speed.
Scroll thrust bearing is damaged.	Centrifuge vibrates slightly.	Disassemble the front pillow block. Change the bearing.
The Cyclo reducer is damaged. The bearings of the eccentric shaft are damaged.	Check by hand rotation of the eccentric shaft. It must turn in both directions without any catches.	If the shaft catches, disassembly the Cyclo reducer. Change the damaged parts. The pinions or Cyclo discs must be changed in pairs.
Main drive belts slip.	Check state and tension of belts.	Change all belts.
Hydraulic level is too low.	The solid is too dry or the centrate is dirty. The weir plates are loose.	Progressively raise the weir level to balance torque and dryness.
The centrifuge is partly silted up.	The centrate is dirty.	Run the Clean-in-Place cycle.
Silting up behind the seal between the scroll and the bowl.		First try a high-pressure water hose aimed through the holes in the bowl plate to clear the problem. If necessary, dismount the scroll and bowl plate to clean.
Absolute speed has decreased	Solid is too dry, centrate is dirty.	Check and raise level again.

[1] Most centrifuges are equipped with an elastic ring and a torque measurement instrument.

5.2.2 Poor Product Clarification

The probable causes for poor clarification are as follows:

- The scroll is worn, and solids dryness is poor.
- The seal between scroll and bowl is damaged.
- The scroll is partially silted up.
- The product turns inside the bowl.

Maladjustments of the system controls may also produce problems, as shown in table 5-3:

TABLE 5-3. SYSTEM CONDITIONS THAT AFFECT PRODUCT CLARIFICATION

Relative speed	Too high	Turbulence
	Too low	Solid evacuation too slow
Bowl speed	Too high	Solids dryness is poor
	Too low	Not enough centrifugal force to squeeze water out of the solids
Level	Too low	Time in centrifuge is too short
Feed pump output	Too high	Centrifuge overload
Concentration	Too high	

With nonflocculated product, check the following:

- Age of the product (if discharged solids sit too long, it is harder to dewater)
- Output of the pumps
- Concentration - pH and temperature

Other possible causes of poor clarification include these:

- Solids discharge casing silted up: keeps the solids from leaving the bowl.
- The solids turn with the scroll: slips inside the bowl
- The belts slip and lower the relative speed: causes insufficient evacuation of the solids.

5.2.3 Incorrect Product Dryness

With non-flocculated product, check the following items:

- Age of the product

- Concentration: too low
- Relative speed: too high
- Level: too high
- Absolute speed: too low
- Feed input: too high
- The centrate return tubes are blocked up

5.2.4 Poor Solid Product Extraction

The probable causes of poor solid product extraction include blockage of the feed pump and diminished concentration. In addition, relative speed may not be correct. Check these items:

- Elastic ring for shearing
- Loose belts
- Solids turning with the scroll
- Scroll silt
- Blockage at the solids discharge casing

CHAPTER 6

ROUTINE MAINTENANCE AND LUBRICATION

CAUTION: The centrifuge with full bowl is a high-speed precision turning machine with precision-balanced parts. Our long experience in this area has allowed us to establish specific safety measures for operating the centrifuge and for protecting maintenance personnel. Various running conditions or environments make it impossible to list every risk. The operator must keep safety in mind at all times and take steps to protect plant personnel and the centrifuge.

6.1 ROUTINE MAINTENANCE

Maintenance should be carried out regularly by qualified personnel and should be duly recorded. Routine maintenance is extremely important to the design life of the centrifuge because its normal centrifugal force and subjugation to harsh product create wear and tear that needs to be monitored and addressed all the time.

This part of chapter 6 deals with routine procedures for keeping the centrifuge in good working order. These procedures are given in tables with time frames. These maintenance frequencies are only an indicator. Maintenance frequencies must be adapted to each individual environment and treated product.

A sufficient number of spare parts, especially parts subjected to abrasion, should be kept on hand to keep the centrifuge up and running.

6.1.1 Daily Maintenance

- Check for cleanliness around the centrifuge.
- Check for excessive vibration.
- Check for excessive bearing noise.
- Check that the temperature of both pillow blocks does not exceed 175 °F.
- Check torque readings (control panel).
- Check for lubrication leaks from the Cyclo reducer.
- Check for product leakage from the front pillow block.
- Check flexible connectors for deterioration

6.1.2 Maintenance Frequency Tables

Routine maintenance tasks are to be performed at specific times. The following tables give the maintenance tasks at various time intervals. Be sure to perform all maintenance tasks specified when the task is specified. Again, these maintenance frequencies are only an indicator. Maintenance frequencies must be adapted to each individual environment and treated product.

TABLE 6-1A. MAINTENANCE 200 HOURS AFTER CENTRIFUGE STARTUP (BREAK-IN PERIOD)	
Task	**Consumables/Parts**
Check belt tension.	None
Lubricate front & rear pillow block bearings.	See lubrication table 6-10 for correct lubricant.

TABLE 6-1B. MAINTENANCE EVERY 200 HOURS	
Task	**Consumables/Parts**
Lubricate front & rear pillow block bearings.	See lubrication table 6-10 for correct lubricant.

TABLE 6-2. MAINTENANCE EVERY 3,000 HOURS	
Task	**Consumables / Parts**
Make a general Inspection.	None
Change scroll thrust bearing lubricant.	See lubrication table 6-10 for correct lubricant.
Change lubricant in Cyclo reducer. Replace copper seals	See lubrication table 6-10 for correct lubricant. See table 10.2 for part number of seals.
Scraper blade wear control	Replace scraper blades and screws if needed.
Check belt tension.	None
Inspect/replace (if worn) parts subjected to abrasion: Discharge nozzles (option) on bowl Watertight disks (option) Solids discharge casing (projection zone)	 Turn ¼ turn if wear exceeds 2 mm. Disks, two parts (replace before worn out) Protection plate (if wear > 0.25 in. plan for weld repairs)

The following table can be modified if the centrifuge shows exterior signs of wear or change.

TABLE 6-3. MAINTENANCE EVERY 6,000 HOURS	
Task	**Consumables / Parts**
Replace belts	1 set belts; check belt tension after 200 hours
Overhaul front pillow block	1 set bearings, seals, screws
Inspect scroll	Replace tiles at 5 to 7 mm wear.
Visually inspect centrifuge for cracks	Replace cracked parts.
Visually inspect centrifuge for corrosion	Replace corroded parts.
Change scroll thrust bearing lubricant.	See lubrication table 6-10 for correct lubricant.
Change lubricant in Cyclo reducer. Replace copper seals.	See lubrication table 6-10 for correct lubricant. See table 10.2 for part number of seals.
Inspect/replace (if worn) parts subjected to abrasion: Discharge nozzles (option) on bowl Watertight disks (option) Solids discharge casing (projection zone)	 Turn ¼ turn if wear exceeds 2 mm. Disks, two parts (replace before worn out) Protection plate (if wear > 0.25 in. plan for weld repairs)

TABLE 6-4. MAINTENANCE EVERY 9,000 HOURS	
Task	**Consumables / Parts**
Make a general Inspection.	None
Change scroll thrust bearing lubricant.	See lubrication table 6-10 for correct lubricant.
Change lubricant in Cyclo reducer. Replace copper seals.	See lubrication table 6-10 for correct lubricant. See table 10.2 for part number of seals.
Check belt tension.	None
Inspect/replace (if worn) parts subjected to abrasion: Discharge nozzles (option) on bowl Watertight disks (option) Solids discharge casing (projection zone)	 Turn ¼ turn if wear exceeds 2 mm. Disks, two parts (replace before worn out) Protection plate (if wear > 0.25 in. plan for weld repairs)

TABLE 6-5. MAINTENANCE EVERY 12,000 HOURS	
Task	**Consumables / Parts**
Change belts	1 set belts; check belt tension after 200 hours
Overhaul front & rear pillow blocks (mechanical): - Seals and bearing change - Cyclo reducer overhaul - Tension system overhaul	 1 set of bearings, seals, screws 1 set eccentric, bearings, seals Tension rods
Change scroll thrust bearing lubricant.	See lubrication table 6-10 for correct lubricant.
Change lubricant in Cyclo reducer. Replace copper seals.	See lubrication table 6-10 for correct lubricant. See table 10.2 for part number of seals.
Inspect/replace (if worn) parts subjected to abrasion: Discharge nozzles (option) on bowl Watertight disks (option) Solids discharge casing (projection zone)	 Turn ¼ turn if wear exceeds 2 mm. Disks, two parts (replace before worn out) Protection plate (if wear > 0.25 in. plan for weld repairs)

TABLE 6-6. MAINTENANCE EVERY 15,000 HOURS	
Task	**Consumables / Parts**
Make a general Inspection.	None
Change scroll thrust bearing lubricant.	See lubrication table 6-10 for correct lubricant.
Change lubricant in Cyclo reducer. Replace copper seals.	See lubrication table 6-10 for correct lubricant. See table 10.2 for part number of seals.
Check belt tension.	None
Inspect/replace (if worn) parts subjected to abrasion: Discharge nozzles (option) on bowl Watertight disks (option) Solids discharge casing (projection zone)	 Turn ¼ turn if wear exceeds 2 mm. Disks, two parts (replace before worn out) Protection plate (if wear > 0.25 in. plan for weld repairs)

TABLE 6-7. MAINTENANCE EVERY 18,000 HOURS	
Task	**Consumables / Parts**
Inspect shock absorbers, replace if worn	1 set shock absorbers
Replace belts	1 set belts; check belt tension after 200 hours
Overhaul front pillow block	1 set bearings, seals, screws
Inspect scroll	Replace tiles at 5 to 7 mm wear.
Visually inspect centrifuge for cracks	Replace cracked parts.
Visually inspect centrifuge for corrosion	Replace corroded parts.
Change scroll thrust bearing lubricant.	See lubrication table 6-10 for correct lubricant.
Change lubricant in Cyclo reducer. Replace copper seals.	See lubrication table 6-10 for correct lubricant. See table 10.2 for part number of seals.
Inspect/replace (if worn) parts subjected to abrasion: Discharge nozzles (option) on bowl Watertight disks (option) Solids discharge casing (projection zone)	 Turn ¼ turn if wear exceeds 2 mm. Disks, two parts (replace before worn out) Protection plate (if wear > 0.25 in. plan for weld repairs)

TABLE 6-8. MAINTENANCE EVERY 21,000 HOURS	
Task	**Consumables / Parts**
Make a general Inspection.	None
Change scroll thrust bearing lubricant.	See lubrication table 6-10 for correct lubricant.
Change lubricant in Cyclo reducer. Replace copper seals.	See lubrication table 6-10 for correct lubricant. See table 10.2 for part number of seals.
Check belt tension.	None
Inspect/replace (if worn) parts subjected to abrasion: Discharge nozzles (option) on bowl Watertight disks (option) Solids discharge casing (projection zone)	 Turn ¼ turn if wear exceeds 2 mm. Disks, two parts (replace before worn out) Protection plate (if wear > 0.25 in. plan for weld repairs)

TABLE 6-9. MAINTENANCE EVERY 24,000 HOURS	
Control / Intervention	**Consumables / Parts**
Change belts	1 set belts; check belt tension after 200 hours
Overhaul front & rear pillow blocks (mechanical): - Seals and bearing change - Cyclo reducer overhaul - Tension system overhaul	 1 set of bearings, seals, screws 1 set eccentric, bearings, seals Tension rods
Change lubricant in Cyclo reducer Replace copper seals.	See lubrication table 6-10 for correct lubricant. See table 10.2 for part number of seals.
Control parts subjected to abrasion: Solid output nozzle wear control (option) Watertight disks wear control (option) Solids discharge casing (projection zone)	 Turn ¼ turn if wear exceeds 2 mm Disks, two parts (replace before worn out) Protection plate (if wear > 0.25 in. plan for weld repairs)

6.2 DRIVE BELT REPLACMENT AND TENSIONING

The drive belts are a matched set and must be replaced as a set. Make sure the belts match before installation.

6.2.1 Pulley Inspection and Alignment

On a regular basis inspect the pulleys and pulley alignment. Worn grooves, rough spots, oil, rust, and the like, can damage the belts. Proper alignment of the centrifuge pulley and motor pulley is essential to belt life.

Use the following procedure to make sure the drive belts are aligned:

1. Line up the edges of the motor pulley with the centrifuge pulley.

2. If the pulleys are lined up properly, the straight edge will touch the faces of the pulley. See figure 6-1.

3. Rotate each pulley to check that there is no distortion of the pulley or drive shaft.

If the pulleys are out of alignment or there is distortion or wear on the pulley or belt, change the drive belts.

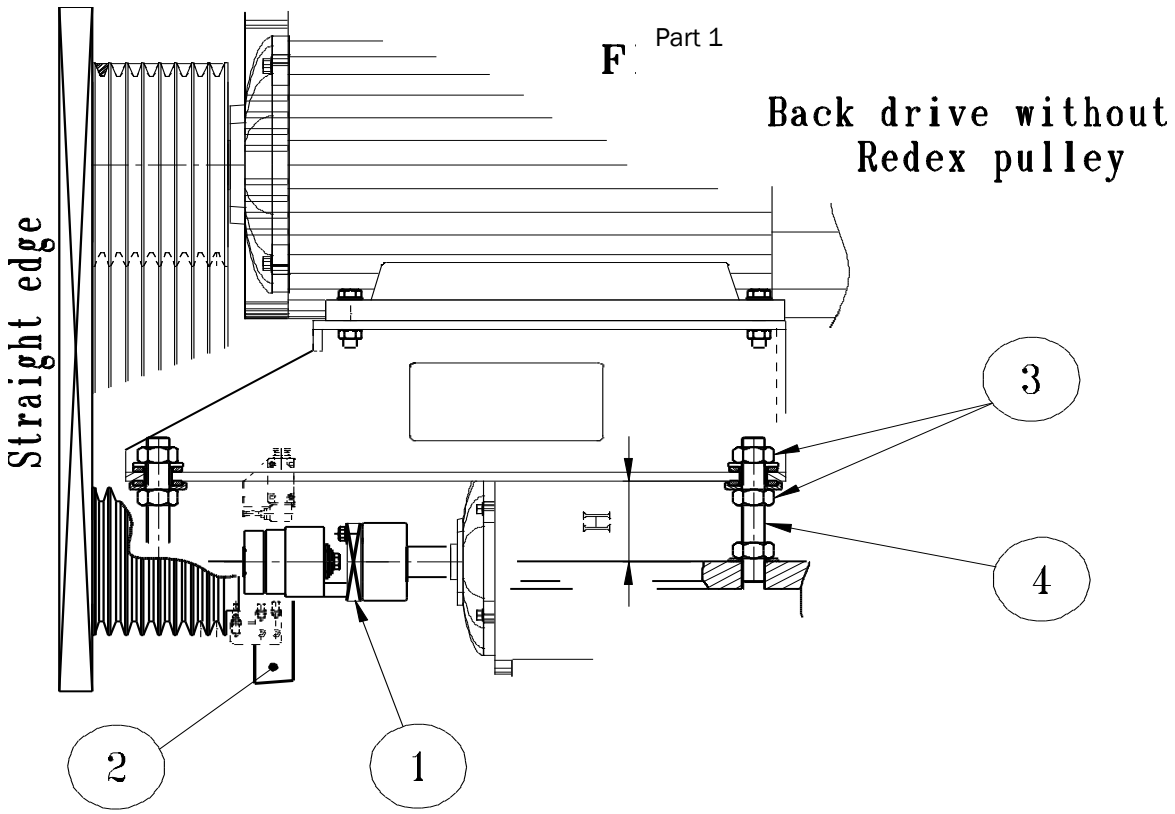


Figure 6-1. Drive Belt Alignment and Installation Diagram

6.2.2 Drive Belt Installation

The drive belts must be mounted by hand. Use this procedure:

1. Remove belt guards.
2. Remove flexible coupling (1) shown in figure 6-1, part 1 (scroll drive without Redex pulley).
3. Remove support speed sensors and torque switch without disconnecting cables.
4. Loose the four nuts (3) to the same height so that you can move the motor support toward the frame until the drive belts can be easily slipped over the motor pulley.
5. Install a new set of belts. Do not force the belts because forcing them may cause premature failure.
6. Tighten the four nuts (3) gradually so that the motor support remains parallel to the top of the motor frame.

CAUTION: Prying belts over flanges by force or with assembly tools may result in damage to the tension member and to the fabric jacket of the belt. This damage may not be visible, but will reduce service life of the belts.

6.2.3 Drive Belt Tensioning

Drive belts must be tensioned with great care. Insufficient tension leads to inadequate power transmission and premature belt wear. Over tensioning causes excessive elongation and unnecessary flexing of the belt along with high heat. These conditions reduce service life. The shaft bearings are also subject to excessive strain.

The tensioning is done using four threaded rods, item (4) in figure 6-1, and nuts, item (3) in figure 6-1. The stretching value is 0.5 to 0.6%.

CAUTION: Insufficient tension results in a risk of belt slippage; excessive tension results in reduced belt service life and the load on the bearing is increased (also leading to reduced service life).

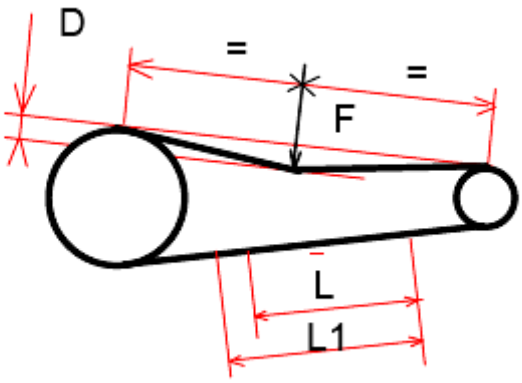


Figure 6-2. Belt Tensioning Gauge

On slightly tightened belts, make two adjustment marks at a distance of L, shown in figure 6-2. Calculate the distance L1 to be obtained through tightening:

$$L1 = L + \left(\frac{0.6 \times L}{100} \right)$$

Tighten the belts until the distance between the marks is equal to L1.

For example:

If

L = 500 mm

$$L1 = 500 + \left(\frac{0.6 \times 500}{100} \right) = 503\,mm$$

After an 8-hour run-in phase, and every 200 hours, the tension must be checked and (if necessary) the belt tightened. Rotate the pulleys by hand to distribute the tension evenly.

Given force F and corresponding deflection D for each centrifuge, you can use the following table and figure 6-2 to determine the specifics of belt tensioning.

D2L Centrifuge	
Belt type	SPB 1500
Number of belts	3
Belt length	59.05 inches
Static force, F	6.0 ft-lb
Deflection, D	0.22 inches

6.3 LUBRICATION OF THE CENTRIFUGE AND CYCLO REDUCER GEARBOX

This section describes procedures for checking and maintaining proper lubrication of the bearing blocks, scroll bearing, and Cyclo reducer. All bearings are lubricated with grease. Refer to the lubrication schedule, table 6-10 and figure 6-3 for lubrication information.

CAUTION: An excess of grease causes an abnormal heating of the bearings. The device for discharging excessive grease does not work instantly, and between 3 and 24 hours may pass before the bearing block has cooled to its normal temperature.

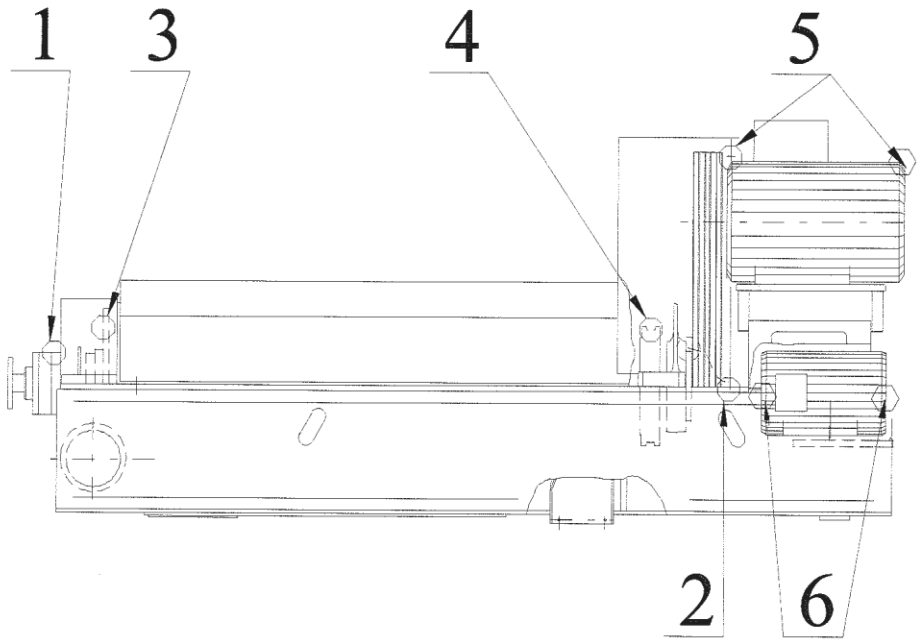


Figure 6-3. Lubrication Points for the Centrifuge and Cyclo Reducer

TABLE 6-10 RECOMMENDED TYPES OF LUBRICATION FOR STANDARD APPLICATION: PRODUCT TEMPERATURE FROM 40 TO 140 °F AND RELATIVE SPEED FROM ZERO TO 20 RPM

Item	Lubrication Point	Type of Grease	Frequency	Quantity
1	Front pillow block	AGRO EP2	Once a day[1]	2 grams (0.071 oz)
2	Rear pillow block	AGRO EP2	Once a day[1]	2 grams (0.071 oz)
3	Scroll thrust bearing	AGRO EP2	1,000 hr	100 grams (3.5 oz)
4	Cyclo reducer	BP ENERGREASE LS EP 0	1,000 hr intermediate 3,000 hr complete	250 grams (8.82 oz) 1,800 grams (64 oz)
5, 6	Motor bearing	See Baldor motor manual		

[1] And systematically after a Cleaning in Place.

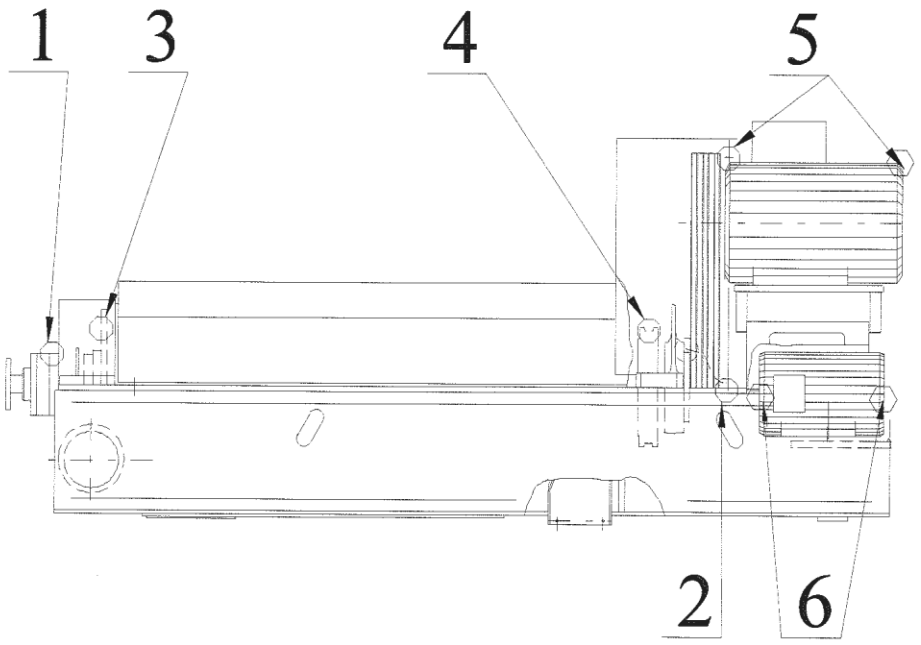


Figure 6-3. Lubrication Points for the Centrifuge and Cyclo Reducer

TABLE 6-10 RECOMMENDED TYPES OF LUBRICATION FOR STANDARD APPLICATION: PRODUCT TEMPERATURE FROM 40 TO 140 °F AND RELATIVE SPEED FROM ZERO TO 20 RPM

Item	Lubrication Point	Type of Grease	Frequency	Quantity
1	Front pillow block	AGRO EP2	Once a day[1]	2 grams (0.071 oz)
2	Rear pillow block	AGRO EP2	Once a day[1]	2 grams (0.071 oz)
3	Scroll thrust bearing	AGRO EP2	1,000 hr	100 grams (3.5 oz)
4	Cyclo reducer	BP ENERGREASE LS EP 0	1,000 hr intermediate 3,000 hr complete	250 grams (8.82 oz) 1,800 grams (64 oz)
5, 6	Motor bearing	See Baldor motor manual		

6.3.1 Pillow Block Bearing Lubrication

Each pillow block bearing is fitted with a grease escape valve that permits lubrication while the centrifuge is running and avoids the accumulation of grease. Grease accumulations may cause the bearing block to overheat.

At each lubrication service, inject grease in the amount shown in table 6-10 through the lubricators, (1) on figure 6-4 for the front pillow block and (2) on figure 6-5 for the rear pillow block. The centrifuge must be rotating when you are injecting grease into the lubricators.

CAUTION: An excess of grease causes the bearings to overheat, which may damage the bearings. The device for discharging excessive grease does not work instantly. If the bearing block is allowed to overheat, it will require 3 to 24 hours to cool to its normal temperature.

If you inject too much grease, most likely the excess grease will not be discharged before damaging the bearing (through overheating). For example, if the fill amount is 15 grams, and 30 grams is injected, bearing overheating may occur. Observe the recommended lubrication amounts.

6.3.2 Scroll Thrust Bearing Lubrication

The scroll thrust bearing is totally filled with grease. Because rotation speed is low, the scroll thrust bearing needs lubrication only every 1,000 hours. Inject grease through the lubricator marked (3) on figure 6-4. This lubricator is accessible when the main cover is open. The used grease is discharged through a lip seal, which must be mounted in the proper direction. The lip ring is labeled (B) on figure 6-. Replace screw (V) and gasket (J) on the oil hole, also shown on figure 6-4. Screw (V) and seal (J1) are a permanent plug in the bearing assembly. The scroll need not be turning during lubrication.

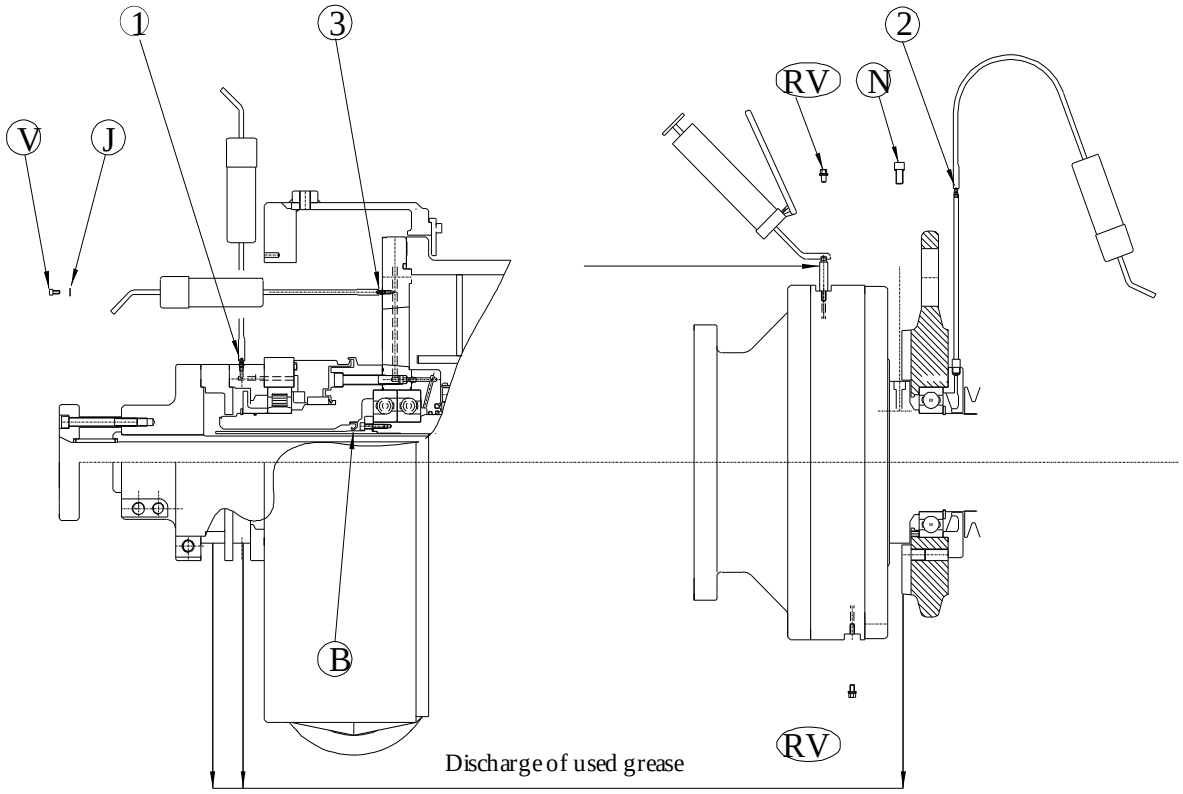


Figure 6-4. Lubrication Point for the Front Pillow Block and Scroll Thrust Bearing

FD = Filling and draining of reducer

L = Establishing the correct level

Note: An excess of grease causes an abnormal heating of the bearings. The device for discharging excessive grease does not work instantly, and between 3 and 24 hours may pass before the bearing block has cooled to its normal temperature.

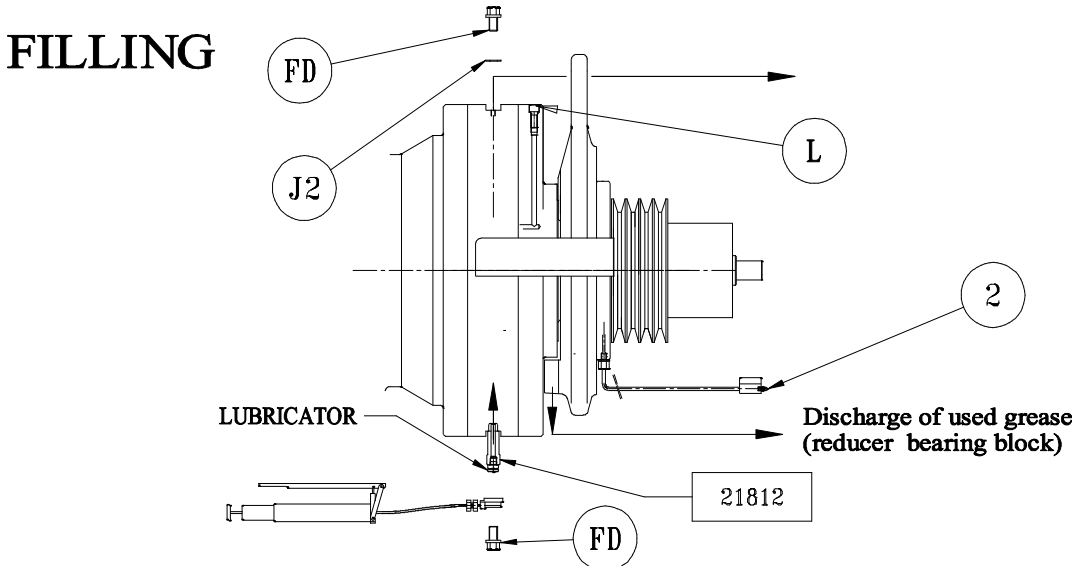


Figure 6-5. Lubrication Points for the Rear Pillow Block

6.3.3 Cyclo Reducer Lubrication

Both bearings on the eccentric shaft are watertight and lubricated for the life. The two bearings on the grooved hub and the Cyclo reducer itself are lubricated with grease. The Cyclo reducer block is completely filled with grease [2] during bench testing. The two bearings on the grooved hub are greased by filling the Cyclo reducer with grease.

The Cyclo reducer is relatively maintenance free and requires no periodic lubrication fill. The lubrication procedure for the Cyclo reducer is to replace all the grease in the Cyclo reducer at 3,000 hours, as shown in table 6-10 and the maintenance tables given earlier in this chapter.

The major steps are as follows:

1. Drain the reducer.
2. Fill the reducer.
3. Establish the correct lubricant level.
4. Close the reducer.
5. Check for grease leakage.

[2] The centrifuge may have been delivered with BP PR EP 00 grease, which is no longer available. There is a placard on the side of the centrifuge that states the type of grease used for the initial fill of the Cyclo reducer. If the Cyclo reducer contains BP PR EP 00, then the grease will have to be replaced with BP LS EP 0 at 3,000 hours. See attached Andritz service bulletin. The two greases are immiscible.

Draining the Cyclo Reducer

The drain the reducer, follow this procedure:

1. Remove the cover from the Cyclo reducer.
2. Take off the two plugs (item FD) on the periphery of the Cyclo reducer ring.
3. Build a cardboard hood and place it over the projections on the frame to reduce grease spatter during the removal.
4. Fit the cover over the Cyclo reducer with its cardboard hood.
5. Run the centrifuge for 1 minute without feeding it any product and without relative speed to discharge the used grease by centrifugal force.
6. Remove cover and cardboard hood.

Filling the Cyclo Reducer

To evacuate air, follow this procedure:

1. Remove the two plugs (FD).
2. Install nipple 21812 with lubricator into hole (FD)
3. Inject grease with a grease gun or pneumatic device until grease appears in the upper hole (FD). See figure 6-5.
4. Install a plug (FD) into the upper hole.
5. Remove plug (L).
6. Continue to inject grease until the grease appears at hole (L).
7. Remove the lubricator nipple and replace the plug (FD) with a new copper seal (J2). See figure 6-6.

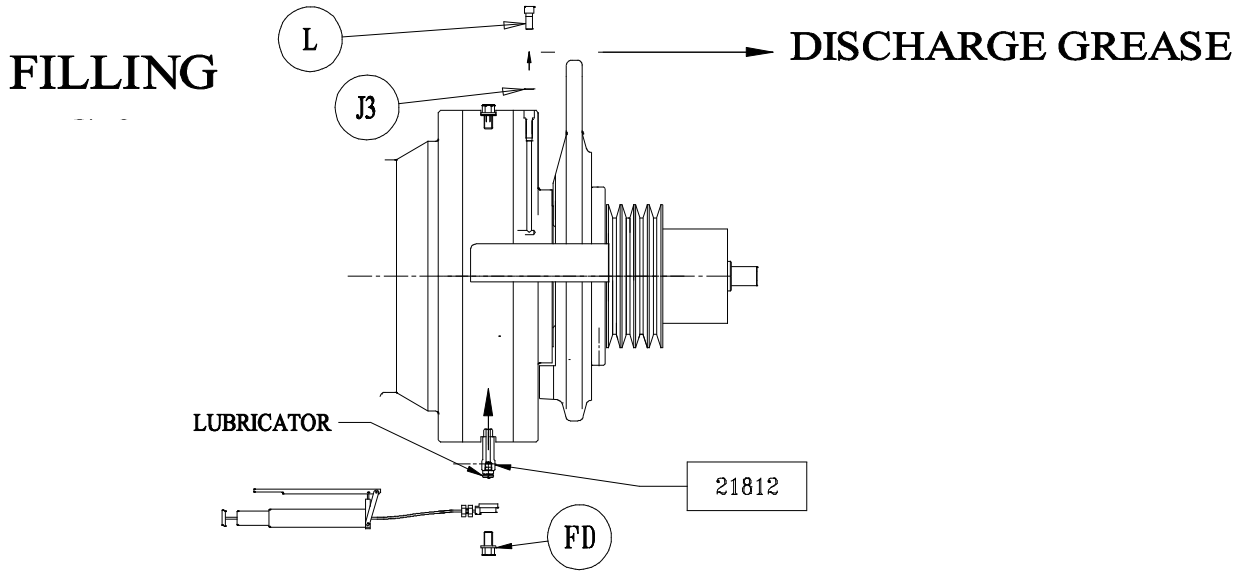


Figure 6-6. Injecting Grease into the Cyclo Reducer

Establishing the Correct Lubricant Level

To establish the correct level, use this procedure and refer to figure 6-7.

1. Run the centrifuge at its normal working speed without the plug screw (L) so that the excess grease can be ejected.

2. After 10 minutes of running, stop the centrifuge and start the operation again twice by injecting a small amount of grease each time to make sure that the level is correct and that all air pockets have been eliminated.

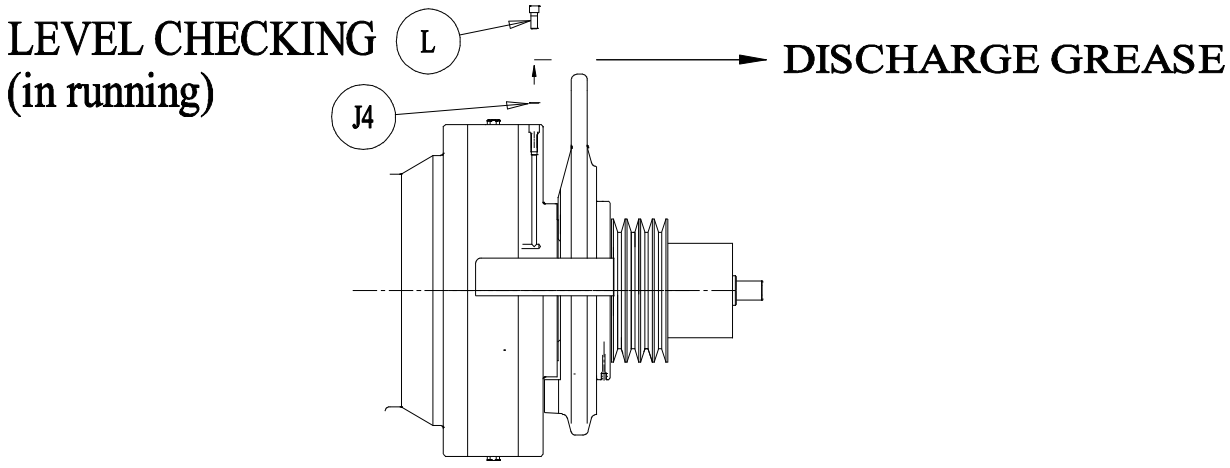


Figure 6-7. Checking the Lubricant Level in the Cyclo Reducer

3. Close the Cyclo reducer.

4. Put plug (L) back with a new seal (J3), and verify, by rotating the centrifuge by hand, that there are no grease leaks.

Check for Leaks

1. Remove all traces of grease on the Cyclo reducer block, the hood, and the frame with solvent.

2. Attach a piece of white paper on the inside of the upper hood opposite the Cyclo reducer.

3. Close the hood.

4. Run the centrifuge for a few minutes, then check the paper for grease marks.

CAUTION: The Cyclo reducer must be absolutely leak-proof before replacing the hood and restarting the centrifuge in production mode.

6.4 MAINTENANCE SUMMARY FORM: THEO CHOCOLATE — JOB NO 814694

1. EQUIPMENT ITEM	D2LC30CNV 3PH-SA Centrifuge
2. MANUFACTURER'S CONTACT INFO	Carl Malkiewicz, Manager, Aftermarket Services, Andritz Separation 1010 Commercial Blvd South; Arlington, TX 76001 817-419-1768; 817-419-1968 (fax)
3. EQUIPMENT SERIAL NO.	132171840
4. WEIGHT OF COMPONENTS	Dry weight of centrifuge = 2,072.34 lbs
5A. BOWL MOTOR NAMEPLATE DATA	Baldor Premium Efficiency Custom 20 hp, 460 V, 60Hz, 3600 rpm, 256T frame
5B. SCROLL MOTOR NAMEPLATE DATA	Baldor Premium Efficiency Custom 7.5 hp, 460 V, 60Hz, 3600 rpm, 184T frame

6A. MAINTENANCE REQUIREMENTS (BEYOND EQUIPMENT RUN-IN)

Maintenance Item	Frequency: Every…	Action
Check for excessive vibration	Day	
Check for excessive bearing noise	Day	
Check that pillow blocks temp < 175 °	Day	
Check torque readings (at the control panel)	Day	
Check for lubricant leaks from the Cyclo reducer	Day	
Check for product leaks from front pillow block	Day	
Check flexible connectors for deterioration	Day	
Lubricate front & rear pillow block bearings	Day	AGRO EP2
Check vibration isolators for deterioration	Month	
Change scroll thrust bearing lubricant	1,000 hours	AGRO EP2
Make a general inspection	3,000 hours	
Change lubricant in Cyclo reducer	3,000 hours	Use BP LS EP 0, replace copper seals
Check belt tension	3,000 hours	Tighten as necessary
Inspect/replace bowl discharge nozzles	3,000 hours	Replace nozzles if worn
Check both discs for water tightness (no leaks)	3,000 hours	Replace discs if worn
Check for wear on solids discharge casing	3,000 hours	
Grease motor bearings	3,000 hours	AGRO EP2
Replace belts	6,000 hours	Replace set of belts; tighten @ 200 hr
Overhaul front pillow block	6,000 hours	Replace bearings, seals, screws
Inspect scroll	6,000 hours	Replace tiles when wear = 5 to 7 mm
Check for cracks and corrosion	6,000 hours	
Mechanical overhaul of front and rear pillow blocks, Cyclo reducer, and tension system	12,000 hours	Replace bearings, seals, scroll shaft, tension rods
Inspect vibration isolators	18,000 hours	Replace vibration isolators

CHAPTER 7

CENTRIFUGE DISASSEMBLY AND REASSEMBLY

7.1 GENERAL INSTRUCTIONS

This chapter gives specific instructions for disassembling and reassembling the centrifuge and its components. Andritz provides skilled field personnel for disassembly and reassembly of the centrifuge. Unless your maintenance staff is extremely proficient in disassembling and reassembling a centrifuge, we recommend that no disassembly/reassembly be performed without the supervision and assistance of Andritz field service personnel. Centrifuges may also be completely reconditioned at Andritz.

CAUTION: Unless your maintenance service staff is extremely proficient in disassembly and reassembling a centrifuge, do not service the centrifuge without the supervision of Andritz field service personnel. Damage to the centrifuge during unsupervised repair may invalidate your warranty. Call Andritz first.

WARNING: Do not let screws or other parts fall into the centrifuge. This will damage the centrifuge.

7.1.1 Disassembly Warnings

- Never hit the parts of the centrifuge with a hammer.
- Never remove bearing surfaces using tools such as a screwdriver or chisel.
- Never use a blow torch to remove the roller bearing inner rings. Use a bearing extractor.
- Always use the tapped holes and specific tools for each procedure.

7.1.2 Reassembly Warnings

- Strict cleanliness is required. Clean all parts carefully before reassembling them. The work area must be free from dust, metallic particles (no grinding in the vicinity of the repair), during low humidity.
- Check bearing faces for smoothness. Polish faces to remove any lifting screw marks and traces of shocks. Check bearing centering.

- Change any less-than-perfect parts — those which are corroded, abraded, deformed, unbalanced, or having abnormal assembly play.
- Change seals and bearings at each disassembly procedure.
- Change stainless steel screws every third disassembly procedure.

7.1.3 Assembly of the Roto Seal in Between the Bowl and Scroll

A roto seal is 2 to 5 percent longer than the groove that houses it. Therefore, the seal has to be compressed when fitted into its groove. Before proceeding, oil the seal and the groove.

1. Refer to figure 7-1. Place the seal in the groove and leave two loops facing one another.
2. Push the loops into the groove simultaneously using steady pressure, as shown by arrows "F" in figure 7-1.
3. Make sure no bulges remain. Touch the seal with your finger to feel for bulges. If bulges remain, then remove them gently with an oiled tool handle.

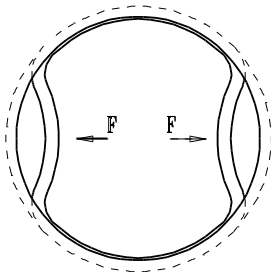


Figure 7-1. Fitting the Roto Seal into the Groove

7.1.4 Assembly of Bearings

Before proceeding, clean and de-burr shafts and bores carefully. Check the shape and dimensions of the parts to make sure they are suitable for reuse. Leave the new bearings in their original packing until you are ready to use them. Never wash a sealed bearing.

1. Refer to figure 7-2 for the correct manner of assembling bearings using a striking socket.
2. Slightly oil all adjustment surfaces for ease of fit.

CAUTION: Do not hit bearings directly. The assembly stress must on no account be transmitted through the roller elements.

3. Fit smaller bearings with slight hammer blows applied using a lightweight steel circle or tube all around the ring to facilitate a good fit and to avoid a slanted entry of the bearing.

4. For simultaneous assembly of both rings, use a fitting as shown in figure 7-3.

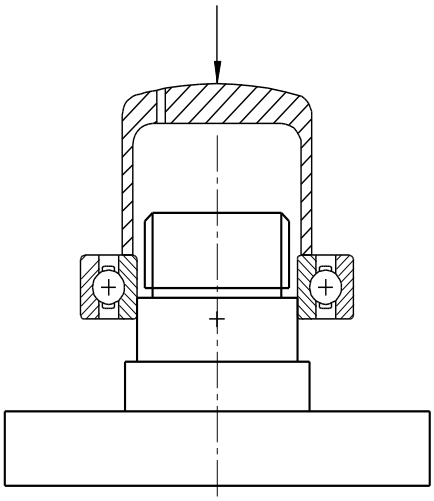


Figure 7-2. Achieving Properly Aligned Stress with a Striking Washer

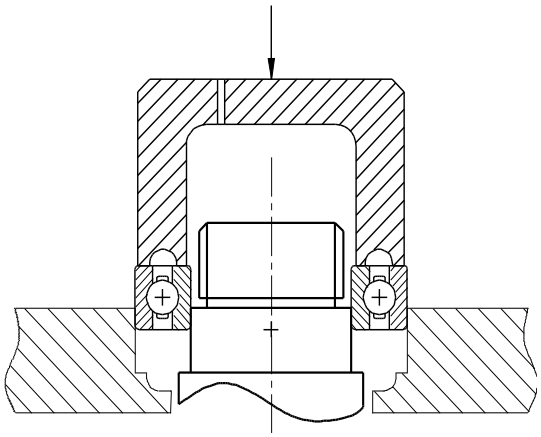


Figure 7-3. Assembly of Both Rings

7.1.5 Stainless Steel Fasteners

Table 7-1 is a chart of tightening torque values for various types and diameters of stainless steel fasteners. The standard fastener is type 70.

CAUTION: To prevent seizing, coat the thread with a lubricant such as LOWAC.

TABLE 7-1. TIGHTENING TORQUE FOR STAINLESS STEEL FASTENERS (ft-lb)						
TYPE/SIZE	**6 MM**	**8 MM**	**10 MM**	**12 MM**	**16 MM**	**20 MM**
80	7	16	32	56	138	268
70	5	13	24	42	103	201
50	2	6	11	20	48	94

7.1.6 Hardened Steel Fasteners

Table 7-2 is a chart of tightening torque values for various types and diameters of hardened steel fasteners. Oil the screw thread and beneath the screw head as well as the flights.

TABLE 7-2. TIGHTENING TORQUE FOR HARDENED STEEL FASTENERS (ft-lb)						
TYPE/SIZE	**6 MM**	**8 MM**	**10 MM**	**12 MM**	**16 MM**	**20 MM**
8-8	6	15	31	52	125	251
10-9	9	21	43	74	177	354

7.2 DISASSEMBLY/REASSEMBLY OF FRONT PILLOW BLOCK

7.2.1 Front Pillow Block Disassembly

Figure 7-4 shows the parts to disassemble during the following procedures.

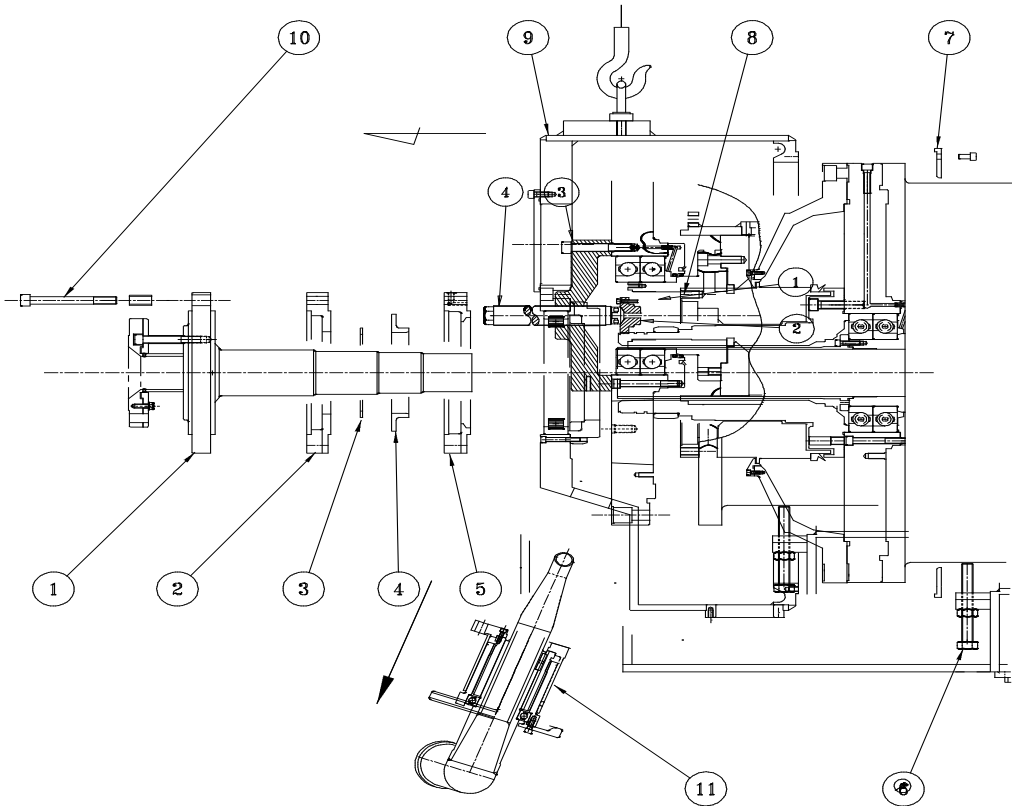


Figure 7-4. Parts of the Front Pillow Block

Use the following procedure to disassemble the pillow block:

1. Disconnect the tube-work, that feeds in the product and drain the liquid.
2. Take down the:
   - Feed pump (11) in according figure 7-8.
   - Feed tube (1) with feed and sight-glass (1)
   - Centering ring (2).
3. Remove the circlips (3), the grease valve (4), the screws (10) and the cover of the front bearing block (5). Loosen the support pump (8) before doing the work as follows.
4. Pull out the positioning pins with the Andritz tool, as shown in figure 7-5.

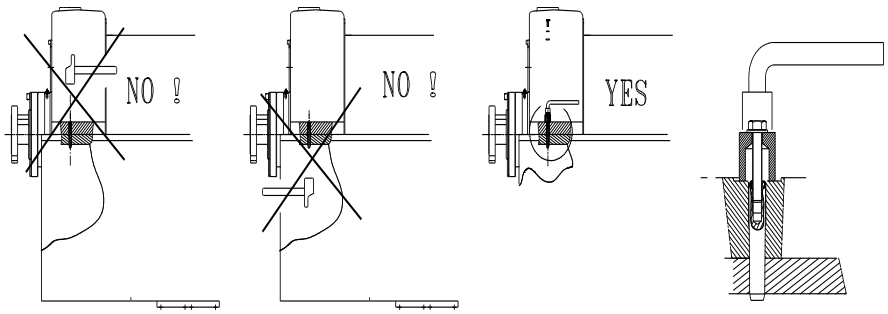


Figure 7-5. Removing the Positioning Pins

5. Remove the bearing block/frame fastening screws.

6. Lift up the rotating assembly slightly, using the screws (6) fixed on the frame.

7. Remove the half rings (7).

8. Take down the pillow block with the outer ring of the bearing and the rear cover by moving it axially. Take care not to damage the roller bearing inner ring.

7.2.2 Reassembly of the Front Pillow Block

Reassembly is carried out in reverse order. Before reassembly, heat the inner ring of the roller bearing in an oil bath of 175 °F to 200 °F. You can also use an induction heating tool.

1. Lightly grease the rolling elements of the bearing and fill the cavity on the grease entry side about half way with grease.

2. Grease the bearing surface of the lipped V-ring.

3. Clean the mating surface of the bearing block and frame and polish if necessary to eliminate any traces of shocks.

4. Unscrew the screws (9) supporting the bowl and block their locknuts.

5. Oil the positioning pins and push them into place without forcing them. Use a plastic or wooden mallet to tap them gently into position.

6. Replace the pin clamps.

7. Screw in the fastening screws of the pillow block and tighten them to the torque value given in table 7-1 or 7-2, as appropriate.

7.3 DISASSEMBLY/REASSEMBLY OF THE REAR PILLOW BLOCK

7.3.1 Disassembly of the Rear Pillow Block

Follow this procedure and refer to figure 7-6:

1. Take down the upper hood, belt guard and belts.

2. Unscrew the nut (1), figure 7-7.

3. Take down in this order:

   - The hub (2) with its aluminum ring,
   - The elastic ring holder with the elastic ring
   - The pulley

4. Extract the hub (5) with the two bearings by means of the threaded rods screwed onto the hub. Use the extractor to remove the second bearing if it remains on the shaft.

5. Take down the pulley machine (7), bearing block cover (8), and circlips (9).

6. Use extractor tool to remove fixing screws on the bearing block/ frame and positioning pins.

7. With a pulley block, slightly lift the rotor and steady it by means of wooden chocks placed between the cradle of the frame and the bowl.

8. At this point, the bearing of the pillow block (R) is accessible. To extract it from the shaft use the jacking screws (V) screwed onto the bearing block (P).

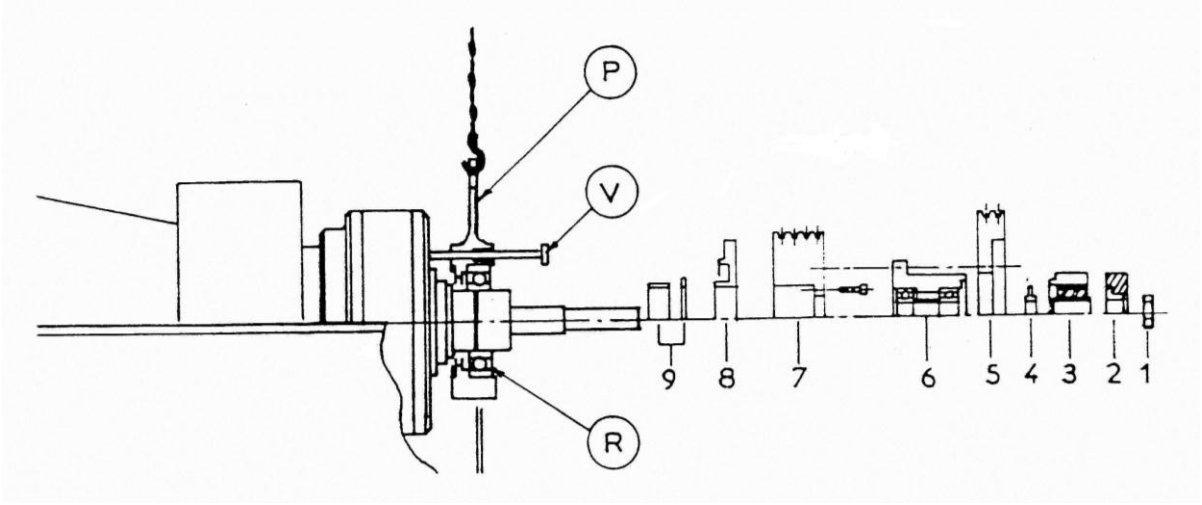


Figure 7-6. Disassembly of the Rear Pillow Block

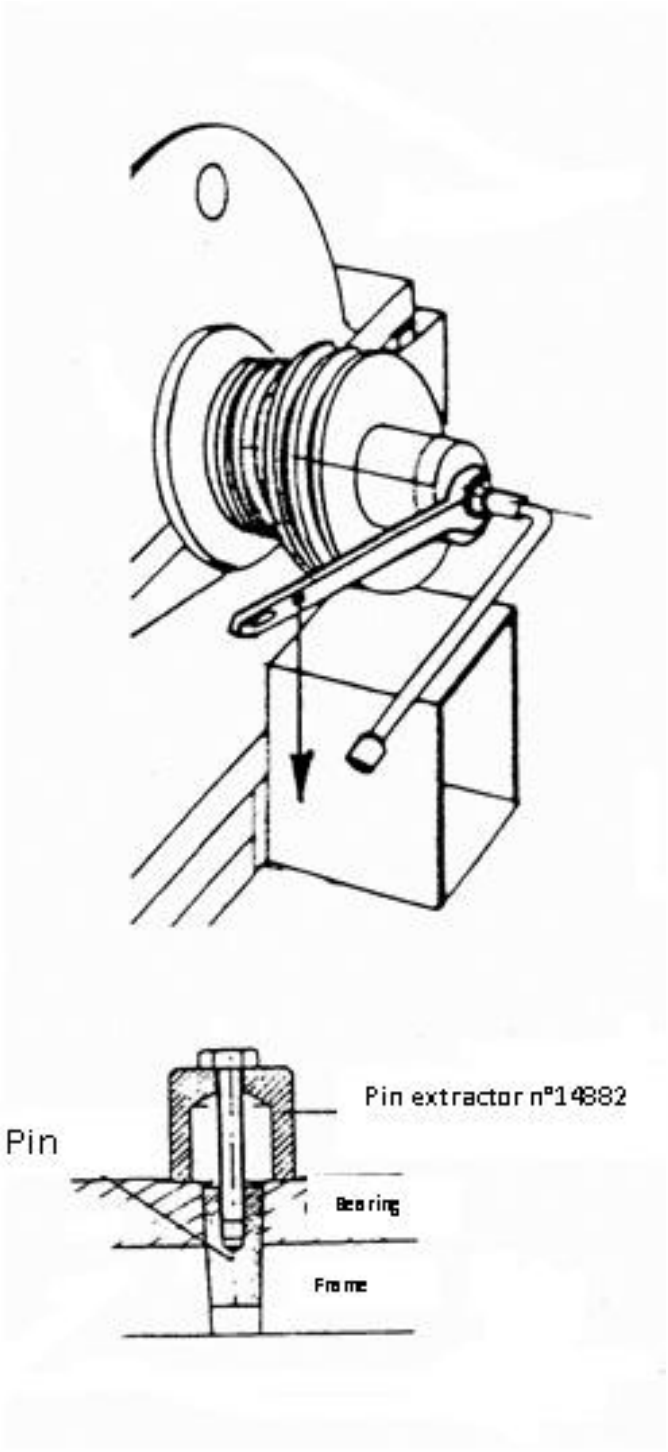


Figure 7-7. Dismantling the Rear Pillow Block - Detail

7.3.2 Reassembly of the Rear Pillow Block

The reassembly is carried out in reverse order. To make it easier to place the bearing on the shaft, warm the inner ring to 175 °F to 200 °F.

1. Lightly grease the rolling elements and fill the cavity on the grease entry side about halfway with grease.
2. Clean and oil mating surfaces, frame to pillow block. Polish if necessary.
3. Oil the positioning pins and push them into place without forcing them. Use a plastic or wooden mallet to tap them gently into position.

7.4 DISASSEMBLY/REASSEMBLY OF THE FRONT HUB AND THRUST BEARING

7.4.1 Dismantling the Front Hub

Refer to figure 7-7 for this procedure.

1. Remove the screws from the front pillow block.
2. Remove the front pillow block.
3. Screw the four threaded rods (2) into the tap holes on the bowl plate.
4. Turn progressively and simultaneously to detach the bowl plate from the bowl until separated by about 6 to 8 inches.

CAUTION: Do not use undue force on the screws, or damage will occur to the front hub.

5. Remove the bowl hub (3) as well as scroll hub sleeve (4).
6. Disassemble the bearing with the tool provided.
7. Screw a lifting eye into one of the tap holes located on the outer radius of the bowl plate.
8. Use a lifting eye and hoist to move the bowl plate.

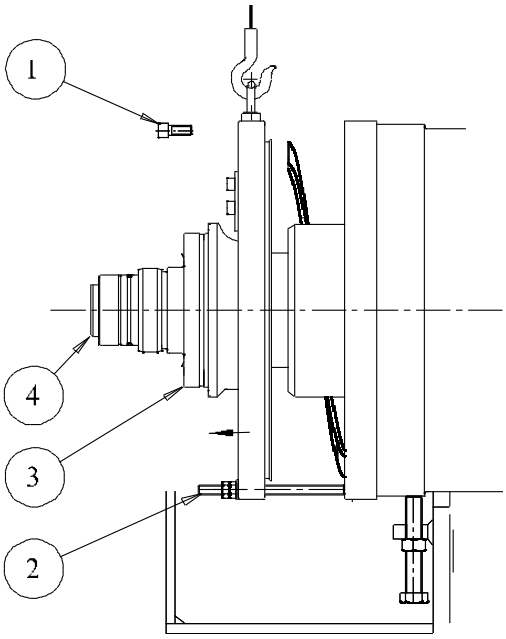


Figure 7-8. Disassembly of the Front Hub

7.4.2 Dismantling the Thrust Bearing

Refer to figure 7-8 for the next procedure.

The bearing is extracted with a bearing extractor. Install the bearing extractor (3) in the place provided on the bowl plate. Before installing this tool, check that the inner thread is clean. If it is not clean, you must first clean it.

1. Screw a lifting eye into one of the holes on the outer radius of the bowl plate.
2. Hold the front plate with the hoist.
3. Screw in (4) until the bowl plate is free of its assembly.

Note: Lubricate the screw (4) and its thrust ball bearing with oil.

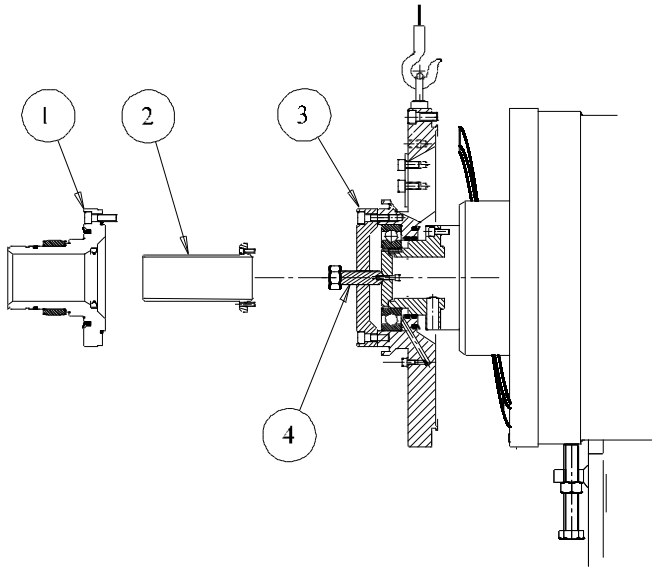


Figure 7-9. Dismantling the Thrust Bearing

7.4.3 Scroll Thrust Bearing Reassembly

Refer to figure 7-9 for this procedure.

1. Replace the seals. Grease new seals before inserting them.

2. Put a new bearing in the bowl plate.

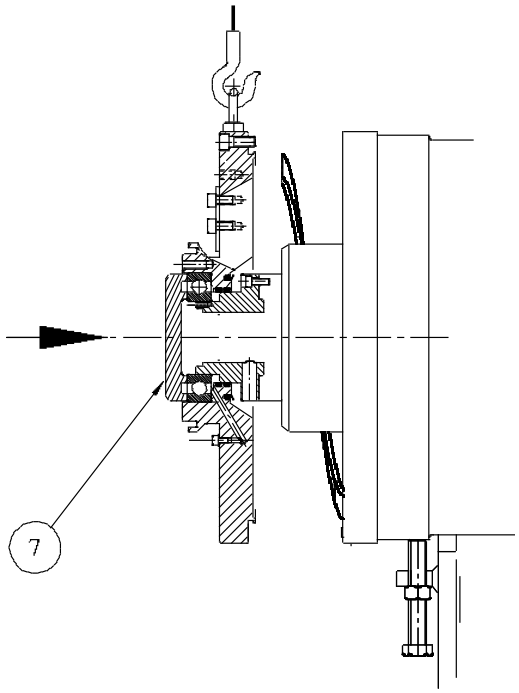


Figure 7-10. Reassembling the Thrust Bearing

3. Disassemble the bearing extractor tool (3).

4. Align the bowl plate within the inner surface of the scroll hub.

5. Fit disk (7), disk or bearing protection plate

6. Fit the interior bearing race onto the scroll hub using a rubber mallet on disk (7).

Note: It is easier to assemble the bearing if you remove the scroll from the bowl.

7.4.4 Reassembly of the Front Hub

Refer to figure 7-10 for this procedure.

CAUTION: Before assembling the sleeve (F) (which extends from the scroll hub), fix the O-ring (J) inside the hub, to tighten the bearing.

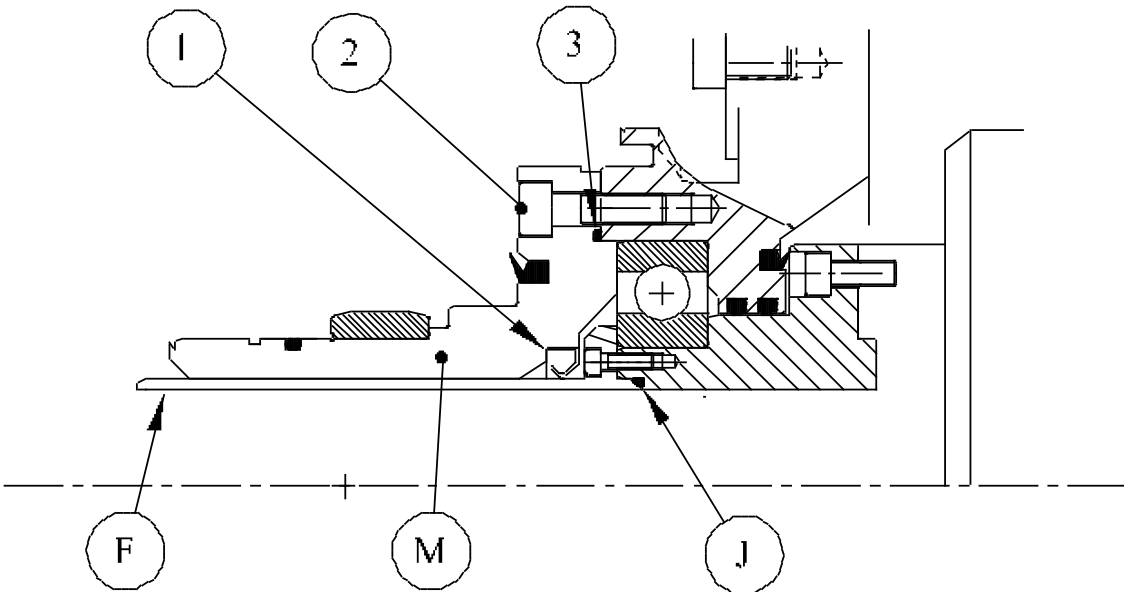


Figure 7-11. Reassembly of the Front Hub

Before reassembling the bowl hub (M), do the following:

1. Change the lip seal (1).

2. Replace O-ring (3).

To reassemble the front hub, use this procedure:

1. Reinstall the front hub and scroll hub sleeve.

2. Turn the screws (2) progressively and block them using tables 7-1 and 7-2 for the correct torque values.

3. Lubricate as instructed in chapter 6.

7.5 DISASSEMBLY/REASSEMBLY OF THE SCROLL

7.5.1 Removing the Scroll

Refer to figure 7-11 for this procedure. The scroll, when removed, must rest on a sturdy wooden support. Therefore, prepare a suitable support structure for the scroll before proceeding.

CAUTION: The thread of the scroll is covered with tiles made of sintered tungsten carbide. These tiles are highly wear-resistant, but are very sensitive to bumps and bangs. Remove the scroll very carefully to avoid damage to the scroll tiles. Do not force the detaching screws.

1. Remove the fixing screws of the bowl plate/ bowl and screw the detaching screws (D), length about 160mm (6 inches) into the 4 threaded holes in the bowl plate, protected by plug screw.

2. Tighten the screws progressively and simultaneously to detach the bowl plate and grooved shaft of the scroll.

3. Fit the handling bar (P) on the scroll.

4. Lift the scroll slightly to center it with the bowl.

5. Adjust the position of the handling bar and lock it so that you can pull the scroll out axially.

6. Pull out the scroll axially while avoiding shocks to its tiles (such as bumping or hitting them).

7. Place the scroll on its support and protect the grooved shaft with an oiled cloth.

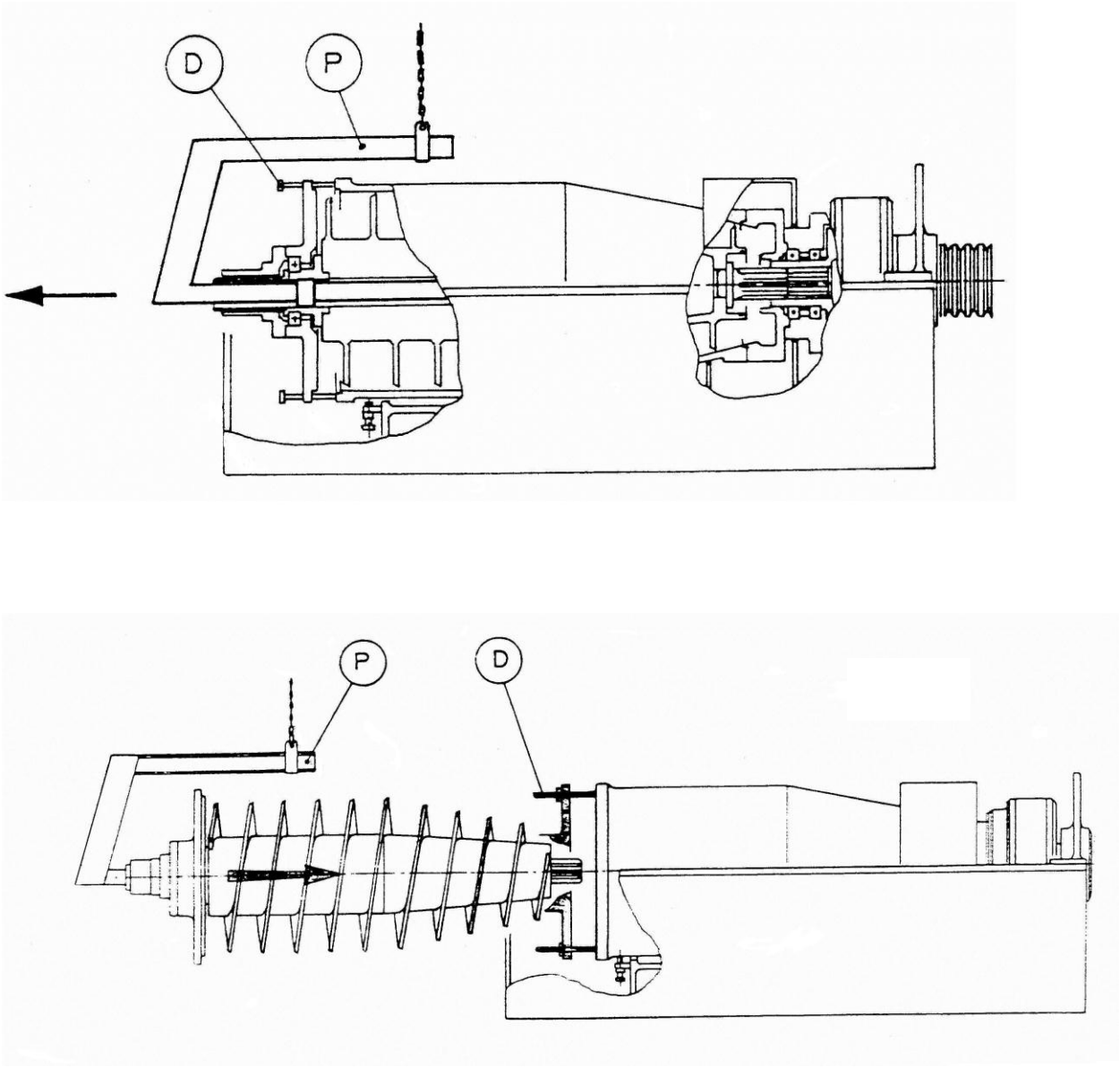


Figure 7-12. Disassembly/Reassembly of the Scroll

7.5.2 Reassembly of the Scroll

Re-assembly is carried out in reverse order. Before reassembling the scroll, check the centering and the joining edges (bowl/bowl plate). Check that grooved hub is clean; remove dirt or dust.

1. Grease the grooved hub.

2. Change the O-ring on the scroll (figure 7-12).

3. Clean the grooved shaft and, if necessary, remove any rust or scratches.

4. Lubricate the shaft and O-ring.

5. Check the centering and mating surfaces of the bowl and bowl plate bearing faces. Polish if necessary.

6. Place the scroll inside the bowl using care to avoid damaging the tiles.

Use the following procedure to fit the grooved shaft into the hub.

1. Bring the grooved shaft in contact with the grooved hub.

2. Screw the threaded rods on the bowl and moderately tighten the corresponding nuts to create a light pressure on the front hub.

3. Turn the inlet shaft of the Cyclo reducer slowly in either direction until the grooves fit together.

4. Finish the assembly by putting the bowl plate assembling screws in place of the threaded rods.

5. Progressively tighten one screw after another in a circle until all are torqued. Refer to tables 7-1 and 7-2 for the correct torque values.

6. Check that the mating surfaces are in full and complete contact.

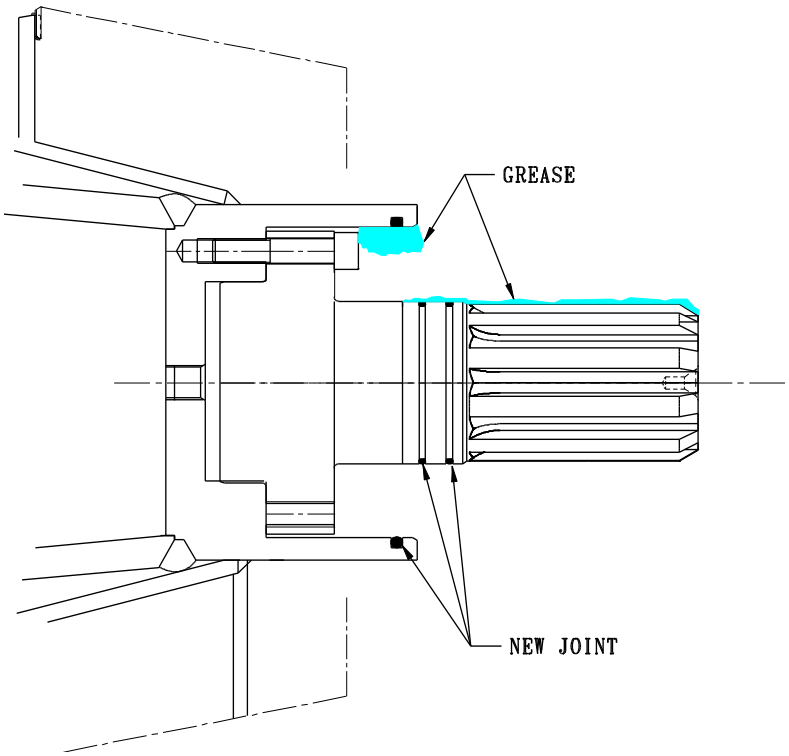


Figure 7-13. Fitting the Grooved Shaft into the Front Hub

7.6 BOWL PLATE

7.6.1 Dismantling the Bowl Plate

Refer to figures 7-13 and 7-14. First disassemble the cover (2) and frame supporting the pump (3).

Remove the scroll (5), by adjusting the holes in the bowl plate.

Disengage by hanging from a hoist.

Remove the circlips (6) and screw two threaded rods into the tapped holes (7) to extract the bearing.

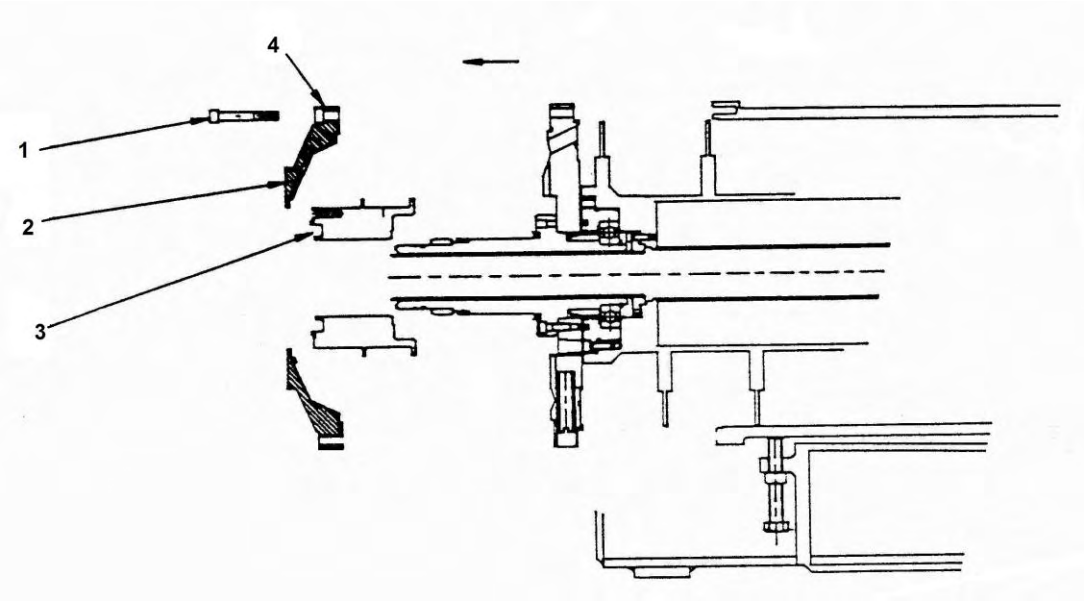


Figure 7-14 Dismantling Bowl Plate

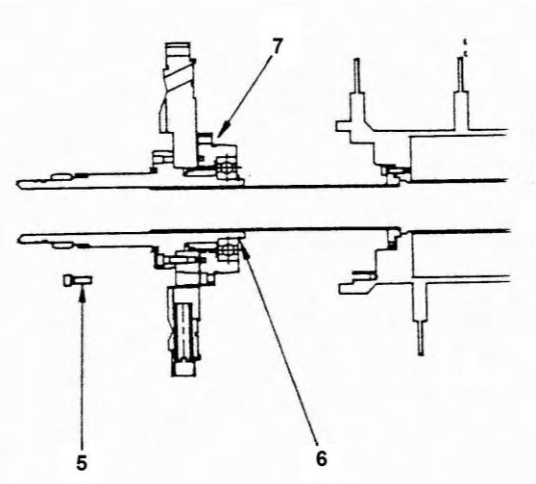


Figure 7-15 Dismantling Bowl Plate – Detail

7.7 REMOVING THE CYCLO REDUCER FROM THE CENTRIFUGE

There are two possibilities here: you can completely dismantle the Cyclo reducer or partially dismantle it. The complete disassembly of the Cyclo reducer is discussed first.

7.6.1 Complete Dismantling of the Cyclo Reducer

The Cyclo reducer is uncoupled from the centrifuge at the junction of the conical bowl and hub. The grooved shaft must be removed from the hub first by retracting the scroll. During this operation, use the pulley block to slightly suspend the Cyclo reducer.

To dismantle the Cyclo reducer, refer to figure 7-15 and use this procedure:

1. Remove all the guards and the upper solids discharge casing.
2. Remove the belts.
3. Remove the pins and fastening screws of the rear pillow block.
4. Lift the rotating assembly slightly. Steady it in this position with chocks between it and the frame cradle.
5. Remove the small lateral plates from the diffuse that prevent disengaging the centering.
6. Uncouple the Cyclo reducer block from the conical bowl by removing screws (1) that fix the hub against the conical bowl.
7. Take the Cyclo reducer block out axially, using the jack screws attached to the hub flange.
8. Remove the Cyclo reducer and the pulley.

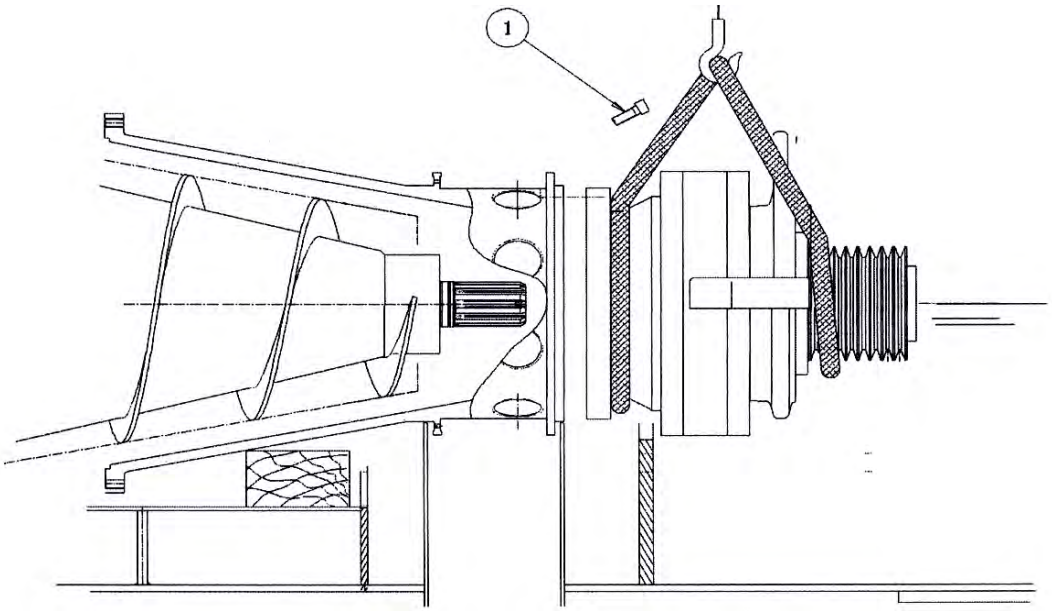


Figure 7-16. Removing the Cyclo Reducer

7.6.2 Reconnection of the Cyclo Reducer

The Cyclo reducer is reassembled in the reverse order. Clean the mating surfaces and make sure there are no damage marks before reassembly.

7.6.3. Partial Disconnection of the Cyclo Reducer

This procedure permits rapid access to the Cyclo reducer. The frame allows axial movement of the Cyclo reducer block/rear pillow block without having to dismantle the bowl or the scroll. The disconnection is made at the ring of the Cyclo reducer.

Refer to figure 7-16 for this procedure.

1. Remove all the guards and the upper solids discharge casing.
2. Remove the belts.
3. Remove the pins and fastening screws of the rear pillow block.
4. Lift the rotating assembly slightly. Steady it in this position with chocks between it and the frame cradle.
5. Remove all blocking screws (V2).
6. Detach the mating surfaces using the jack screws (V3)
7. Move the Cyclo reducer block axially until the pins come free.
8. Place a piece of cardboard under the Cyclo reducer to collect any grease that may drip.

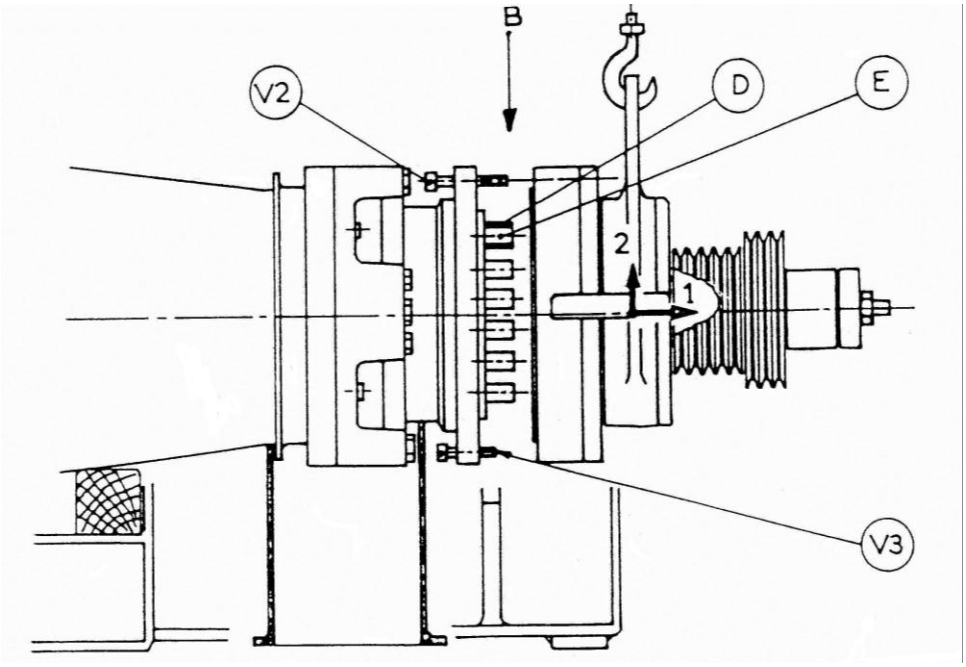


Figure 7-17. Partial Disassembly of the Cyclo Reducer

7.6.4 Reconnection of the Cyclo Reducer

Reassembly is carried out in reverse order. Before reassembling the Cyclo reducer, change the crown seals (11) in figure 7-16. Rotate the eccentric shaft so that the holes in the discs line up with the pins. Before re-assembling, fill with grease to the correct level.

Note: Set the rollers (D) in figure 7-17 on the pins (E) for easier assembly and not in the Cycloid disk.

7.7 CYCLO REDUCER UNIT

7.7.1 Dismantling the Reducer

Remove reducer block and place vertically on an appropriate support.
Removing the fixing screws (1), take down the unit (2).
The reducer is then accessible and can be dismantled following Figure 7-17. To clean the decanted grease, the outer pins and rollers must be removed.
Lift up the ring housing by means of the detaching holes.
Remove the pins from the rings by means of a punch.

7.7.2 Reassembling the Reducer.

All parts must be clean and undamaged. Polish if necessary, especially on the joining edges and centering. Examine the eccentric tracks for pitting or flaking if this is evident, change the eccentric.

The Cycloid disks must be changed in pairs. Assemble in the following order:

1. A new joint (11) on the lower hollow shaft.
2. The Cyclo ring.
3. The rollers (13) and their pins (12) to hold them.
4. The eccentric (4) fitted to slide correctly. The threaded holes for extraction must be visible while fitting.
5. The lock washer (11) and nut (12).
6. The lower Cycloid disk (6). The “X” mark must be visible. The lower cycloid disk is identified by a point under the ciphered annotation.
7. The upper cycloid disk (8). The mark “X” must be placed opposite the mark on the lower disk.
8. The rollers (9). At this stage, check the unit turns without difficulty by rotating the eccentric shaft (10).
9. Place a new joint (11) into the groove of the hub and assemble the unit (2) guiding it with a threaded rod screwed into the lower hollow shaft.
10. Turn the eccentric shaft so the pins correspond with the rollers.

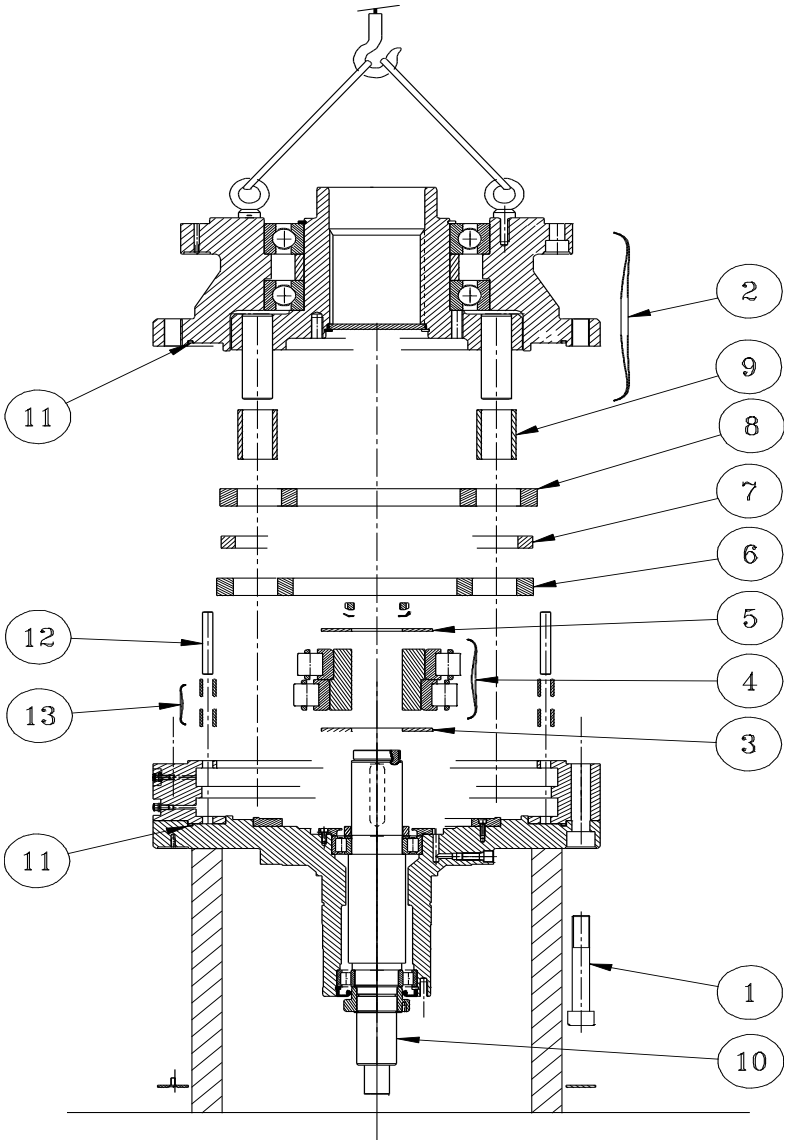


Figure 7-18 Dismantling the Cyclo Unit

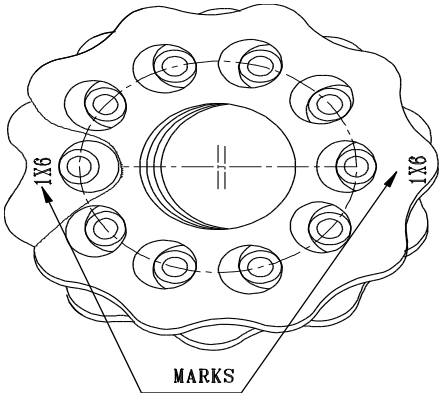


Figure 7-19 Cycloid Disk Showing X Marks

7.8 ADJUSTABLE SKIMMER

7.8.1 Dismantling the Skimmer

It is not necessary to dismantle the bearing block. Refer to figure 7.17.

Unscrew the block screw (1).

Rotate the wheel (2) in the direction of the arrow until screw is disengaged from nut.

Pull out the accordance with the axis, the whole skimmer and bearing housing.

7.8.2 Reassembly of the Skimmer

First check that the end of the skimmer is not damaged by abrasion, corrosion or a foreign body.

Change the two small gaskets (3).

Coat sliding part and gaskets with grease.

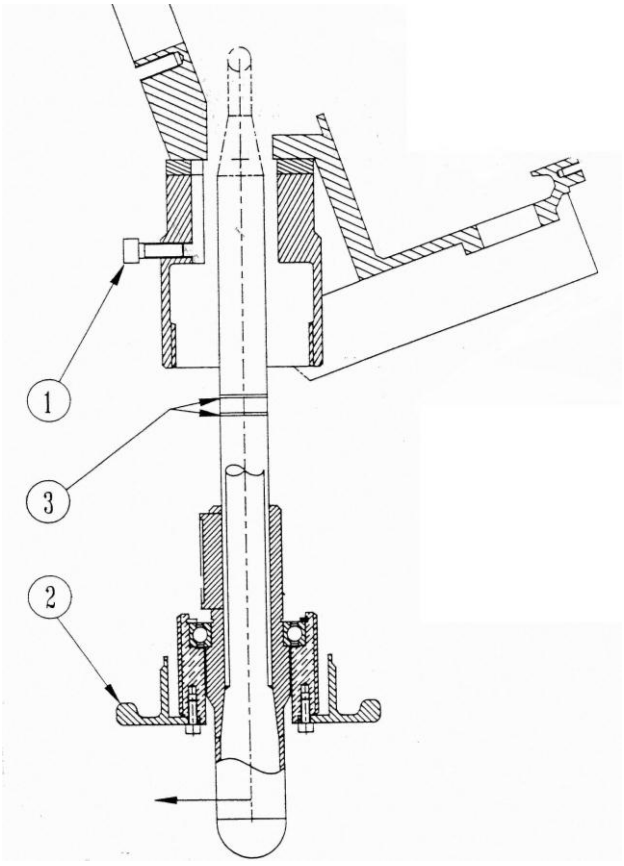


Figure 7-20 Dismantling the Adjustable Skimmer

CHAPTER 8

CENTRIFUGE TRANSMISSION

8.1 DESCRIPTION OF POWER CONFIGURATION

A centrifuge basically consists of a cylindrical cone-shaped bowl and a scroll that extracts sediment driven to the side of the bowl by centrifugal force. The centrifuge bowl and scroll are powered so that the scroll turns faster than the bowl to evacuate sediment at the end of the cone-shaped part of the bowl.

The Redex differential unit, an epicyclic reducer mounted between the scroll and the bowl, develops a significant torque on the outlet shaft attached to the scroll. This reducer creates a precise and variable differential speed between the scroll and the bowl by simple action on the inlet shaft. The main motor torque is applied to the exterior collar of the Cyclo reducer through the centrifuge pulley. This torque directly drives the bowl at high speed ("absolute speed") and indirectly drives the scroll at a higher speed in relation to the bowl (called "relative speed") and drives the Cyclo reducer inlet shaft at a secondary speed.

The torque of the secondary reaction exerted on the Cyclo reducer inlet shaft drives the secondary motor (scroll motor), which becomes a generator. The corresponding variable frequency inverter (VFD) allows for variation of the generator speed and transmission of energy to the main VFD. The energy is recycled (according to VFD efficiency N>0.8) and not perceived by the network.

Figure 8-1 shows the power configuration. Item ⑤is the main motor, and item ⑨ is the secondary motor.

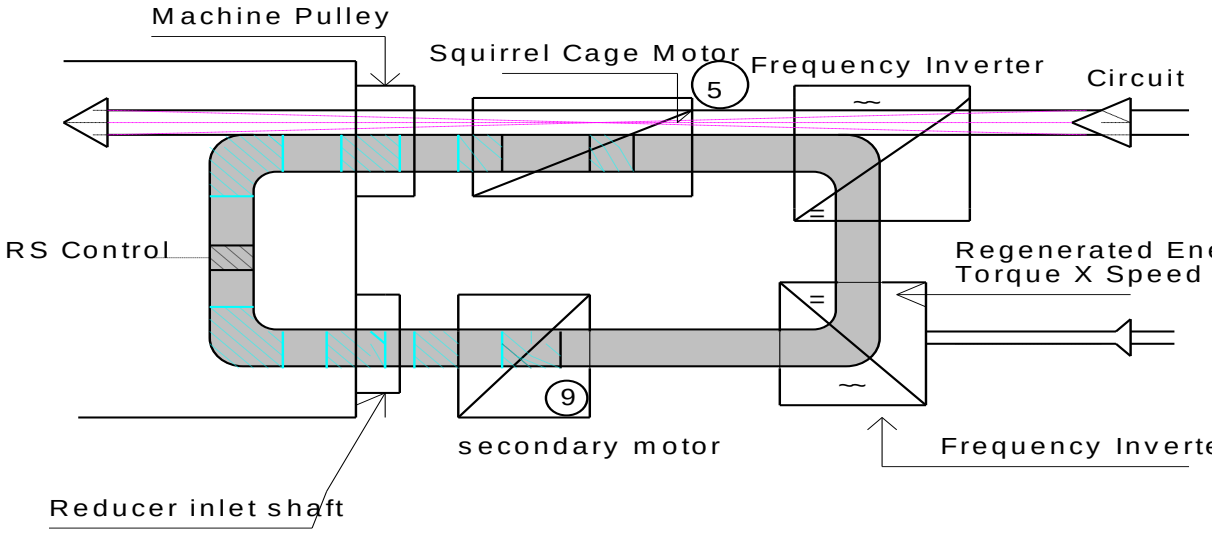


Figure 8-1. Centrifuge Power Configuration

8.2. ELECTRONIC FREQUENCY INVERTER COUPLING

Use the following diagram for cabling. Note the polarity.

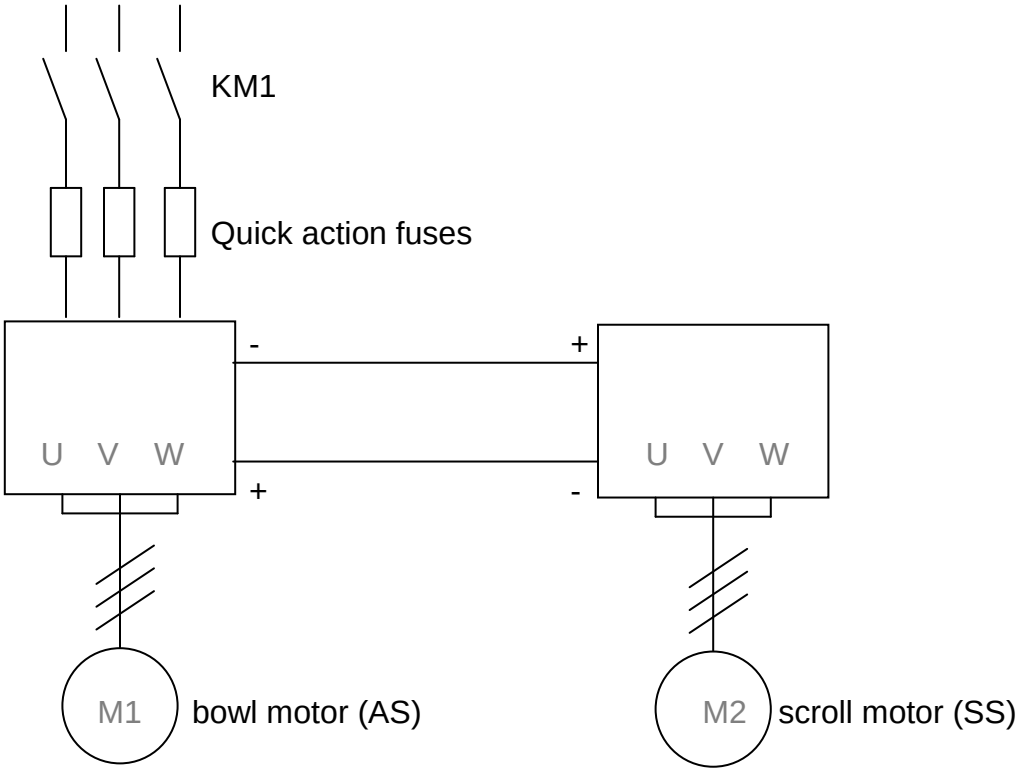


Figure 8-2. Cabling Principle

8.3 MECHANICAL PRINCIPLE — SAFETY PRINCIPLE

The relationship between the bowl speed (absolute speed, or AS), the speed of the scroll in relation to the bowl (relative speed, or RS), and the reduction gear inlet shaft speed (secondary speed, or SS) is established as follows. Refer to figure 8-3 (K=Cyclo reducer ratio).

$$RS = \frac{(AS - SS)}{k}$$

Where

k = Cyclo reducer inlet shaft speed

Or

$$SS = AS - (RS \times k)$$

Based on this relationship, it may be deduced that:

RS is zero for AS = SS

RS is positive for SS < AS

RS is negative for SS > AS

RS = maximum for SS minimum

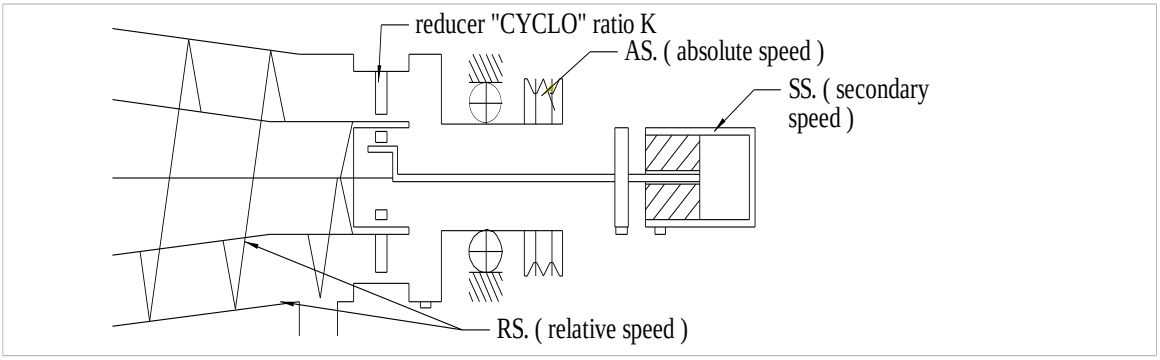


Figure 8-3. Relationships Among Bowl Speed, Scroll Speed, and Secondary Speed

To obtain the best operating conditions, it is necessary to adjust relative speed to balance the following three conditions:

- To evacuate solid matter towards the end of the cone shaped bowl, RS positive ---> SS < AS
- To avoid plugging, RS minimum ---> (AS - SS maximum) / k > 3 to 5 rpm
- To avoid excessive reduction gear grease mixing and to avoid excessive inlet shaft bearing speed, RS maximum ---> (AS - SS mini) / k with AS - SS mini < N_{limit}. N_{limit} is the maximum Cyclo reducer inlet speed.

See table 8-1 for the value of N_{limit} for your centrifuge.

TABLE 8-1. N VALUES FOR VARIOUS CENTRIFUGE SIZES

Centrifuge Model	D1L	D2L	D3L	D4L	D5L	D6L	D7L
N (rpm)	4,000	3,500	2,700	2,500	2,200	2,000	1,800

Let's look at a D4L centrifuge as an example and plug in the N_{limit} value from table 8-1 in terms of the three conditions just noted.

Given that

AS = 3,000 rpm

N_{limit} = 2,500 rpm

k = 71

secondary speed will be calculated as follows:

SS = 3,000 rpm (AS) – 2,500 rpm (N_{limit}) = 500

SS = 500 rpm minimum under normal operating conditions.

Therefore,

RS is positive: 500 rpm < 3,000 rpm

RS minimum ----> (AS - SS maximum) / k > 3 to 5 rpm or (3,000 rpm – 2,500 rpm)/71 = 7.04 rpm, which is > 3 to 5 rpm.

The maximum RS is N_{limit}/k or 2,500 rmp/71 = 35 rpm

In this design, the main motor and the secondary motor/generator are independent. In addition, the motor acceleration and deceleration ramps are different so the relative speed during startup or shutdown may be negative or even zero.

Controlling speed with VFDs allows for these control possibilities:

- After shutdown, restart two or three times in a row with low AS and negative SS to clean the bowl thoroughly.
- During the first threshold, increase the RS to make plug clearance easier, then recalibrate to the original speed.
- Plug clearance with AS at low speed and negative SS to increase the RS.
- Stationary cleaning: low-speed cleaning with slow AS speed and SS in one direction and then in the opposite direction.
- During the speed reduction phase, if the liquid is to be prevented from overflowing into the sediment case, the scroll must be made to turn more slowly than the bowl before the liquid ring collapses (under 100 rpm), to direct the liquid back into the head wall.
- During extended operation when empty, free the motor/generator to obtain a zero RS (avoid putting stress on the seals at relative speed and avoid operating the reduction gear when empty).

8.4 VARIABLE FREQUENCY INVERTERS

The variable frequency inverters control the centrifuge drive motors during startup and shutdown. There are quite a few setting considerations.

Number 1:

Frequency can be varied by hand using a potentiometer, by a 0–10 volt tension source, or a 4–20 mA current source.

Number 2:

Startup must always commence at the beginning of the programmed acceleration ramp, never in the middle of a ramp.

Number 3:

This acceleration ramp (for the main motor VFD) must be adjusted so that the energy absorbed is less than the nominal energy. The rotating assembly of a highly inert centrifuge mass requires a gradual increase ramp, a relatively long period of time, or a slope equal to one of the following:

- Approximately 150 s for a range of 0.5 to 50 Hz
- Approximately 260 s for a range of 0.5 to 87 Hz (150 x 87/50)=260 s
- Approximately 300 s for a range of 0.5 to 104 Hz
- Approximately 430 s for a range of 0.5 to 144 Hz

NOTE: 0.5-144 Hz is recommended for linear characteristics, in case of 0.10 volt or 4.20 mA control.

Number 4:

The main motor deceleration ramp must be adjusted so that the VFD uses almost no energy (approximately 15 to 20 % of the nominal force). If this limit is exceeded, the system may trip, except in special cases such as injection of direct current or braking resistance.

For the 0–50 Hz range, minimum time must be equal to 80 % of the speed reduction time. Here is a practical example adjustment, once again using the D4L model at 3,000 rpm (AS):

D4L at 3000 rpm

Speed reduction time: 8 min x 60 s/min = 480 s

Ramp time: 480 s x 80% = 384 s

For the 0–50 Hz range, this time (in seconds) equals

$$384 \times \left(\frac{144}{50} \right) = 1106$$

Number 5:

Concerning the generator, the acceleration and deceleration ramps must be adjusted according to the RS variation speed desired, rather than according to the inertia of the scroll after reduction, which remains low, viewed from the input shaft side.

For example, for the 0–144 Hz range, variable times from 30 s to 120 s and more may be necessary when adjusting for a product that is not responsive to the torque.

Number 6:

If the machine is in permanent use, the inverter must not be used under 10 Hz (except in a special case of low-speed rotor drive stationary cleaning cycle).

8.4.1 Maximum AS Switch Adjustment

Again, using the D4L centrifuge as an example, consider the following. Refer to figure 8-4.

Characteristics:

AS maximum speed = 3,200 rpm

Driving pulley/machine pulley ratio R1 = 1.8

Acceleration ramp: 0– 144 Hz

Motor N speed = 1,480 rpm (for 50 Hz)

Calculations:

$$MAX = 50Hz \times \frac{AS}{N_{motor}} \times \frac{1}{R_1}$$

$$MAX = 50 \times \frac{3200}{1480} \times \frac{1}{1.8} = 60Hz$$

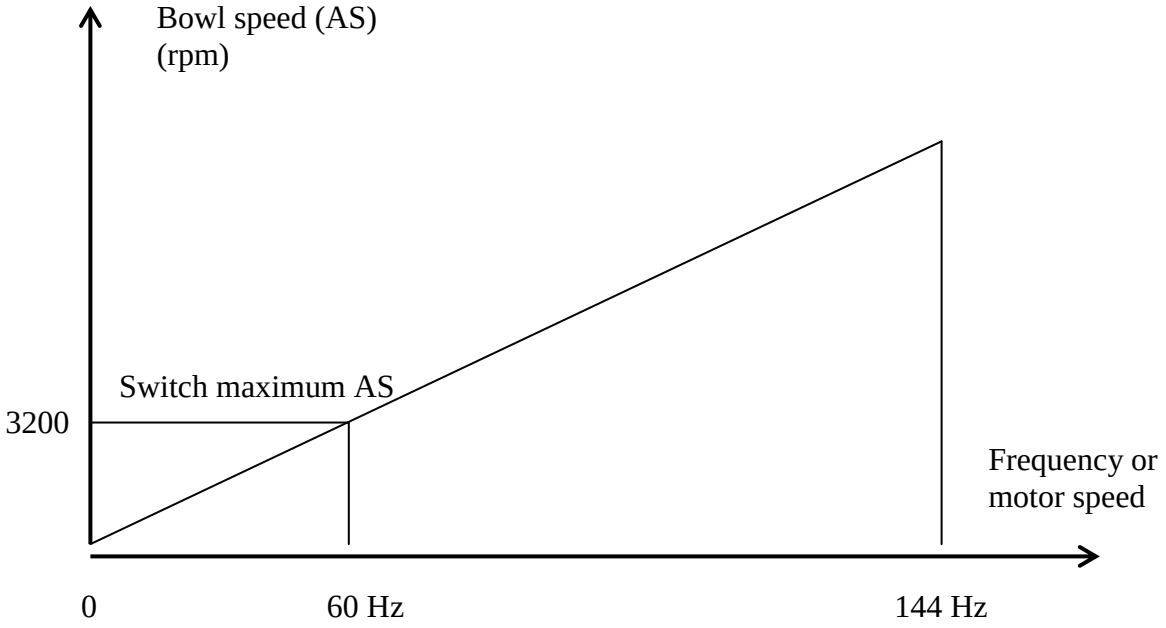


Figure 8-4. Main Motor VFD: Maximum AS Switch Adjustment

8.4.2 RS Maximum and RS Minimum Adjustment

Still using a D4L machine as an example, and referring to figure 8-5, we can determine how to adjust the RS maximum and minimum speeds.

Characteristics:

AS bowl speed = 3200 rpm

Value of N = 2500 rpm (according to the table)

k reduction ratio = 71

Generator speed = 1500 rpm (for 50 Hz)

Minimum relative speed = 3 rpm

Calculations:

$$SS\max = AS - (RS\min \times k)$$

Or

$$SS\,\max = 3200 - (3 \times 71) = 2987 rpm$$

$$\frac{50 \times 2987}{1500} = 100 Hz$$

$$SS\,\min = AS - N$$

$$SS\,\min = 3200 - 2500 = 700 rpm$$

$$\frac{50 \times 700}{1500} = 23 Hz$$

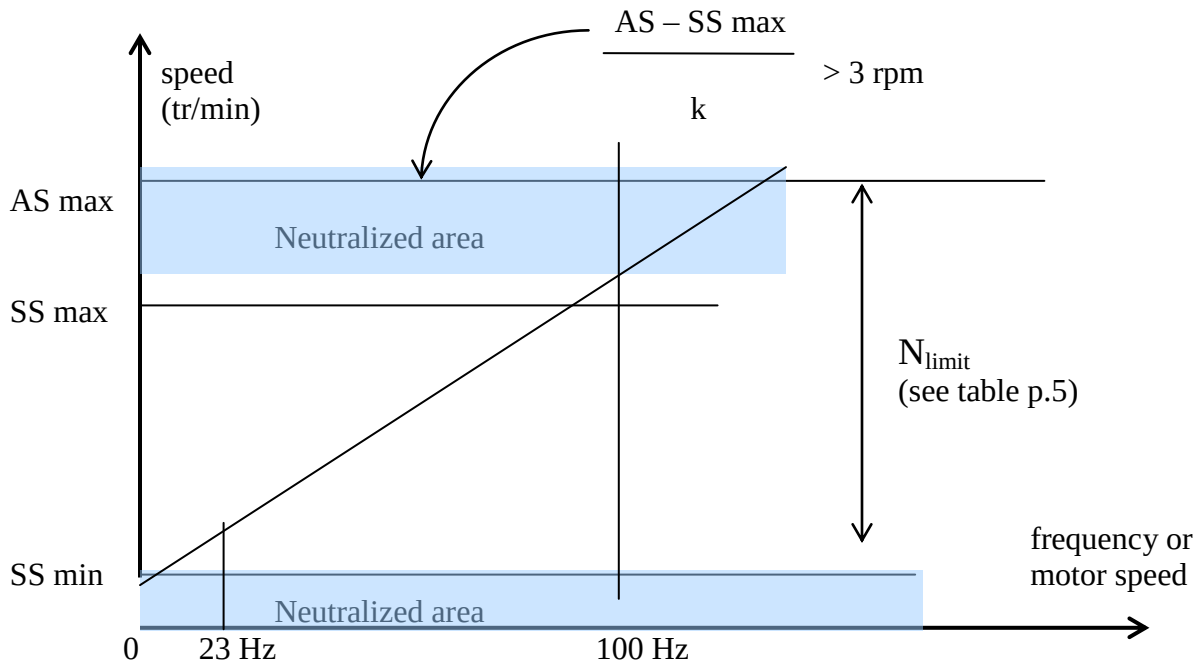


Figure 8-5. RS Maximum and RS Minimum Adjustment

8.5 MOTOR/GENERATOR (SCROLL MOTOR)

If an asynchronous motor is driven at a speed higher than its synchronized speed, and if it is connected to an electrical system, it will become an asynchronous generator. When operating as an asynchronous generator, the absolute value of the maximum torque is slightly higher than the absolute value of the operating motor, and the slippage will become negative.

In most cases, three-phase asynchronous squirrel cage motors are used; these motors are simple, but robust, and they require no special maintenance. Moreover, they do not require special current excitation. They are considerably less expensive than synchronized generators and easier to connect, because it is not necessary to synchronize the motors during coupling.

NOTE: The motor/generator works at a constant torque until it has reached its nominal speed and at constant power when it exceeds its nominal speed (see figure 8-6 below).

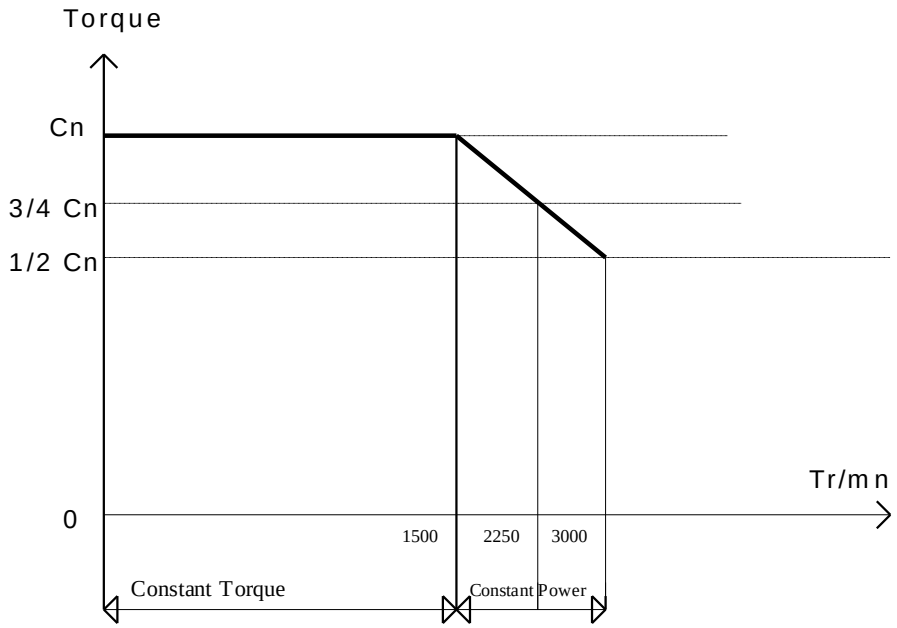


Figure 8-6. Relationship Between Generator Torque and Power

Example:

Motor/generator: 7.5 kw 1,500 rpm

Nominal torque, Cn: 35.4 lbf-ft

Torque at 2,250 rpm: 26.5 lbf-ft

8.6 AS/SS COMBINATIONS

8.6.1 Startup

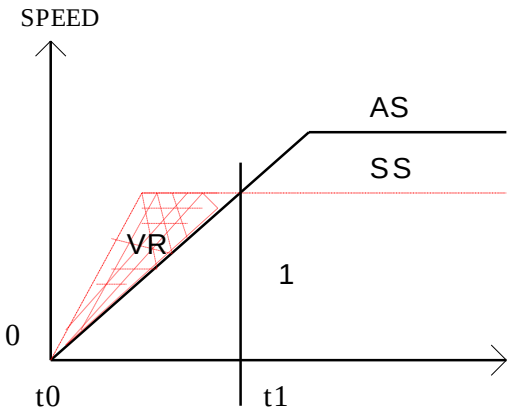


Figure 8-7. Simultaneous Startup (AS and SS) with RS

t_0: startup AS and SS

t_0 to t_1: the relative speed is negative

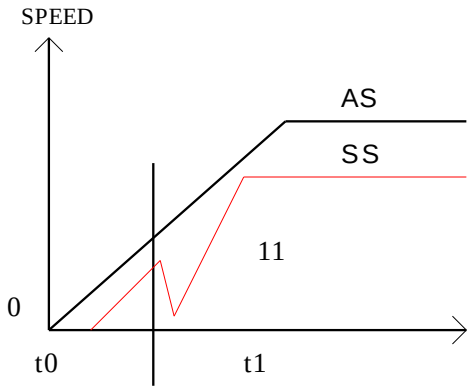


Figure 8-8. Delayed SS Startup with RS+

t_0: AS startup
SS is driven by AS

t_1: SS startup: the motor/generator takes control of the shaft first by reducing its speed to equal its own speed, then by accelerating the speed of the shaft according to its ramp.

8.6.2 Normal Operation with RS Minimum/Maximum Variation

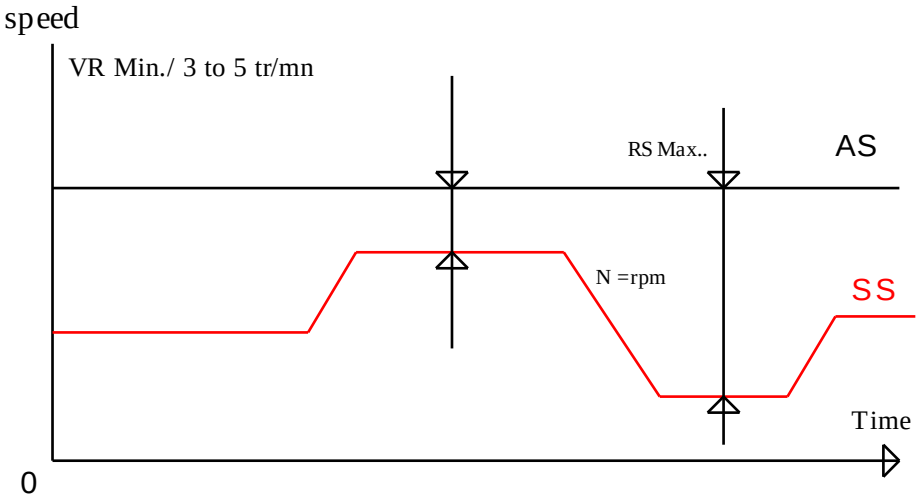


Figure 8-9. Normal Operation with RS Minimum/Maximum Variation

8.6.3 Simple Shutdown

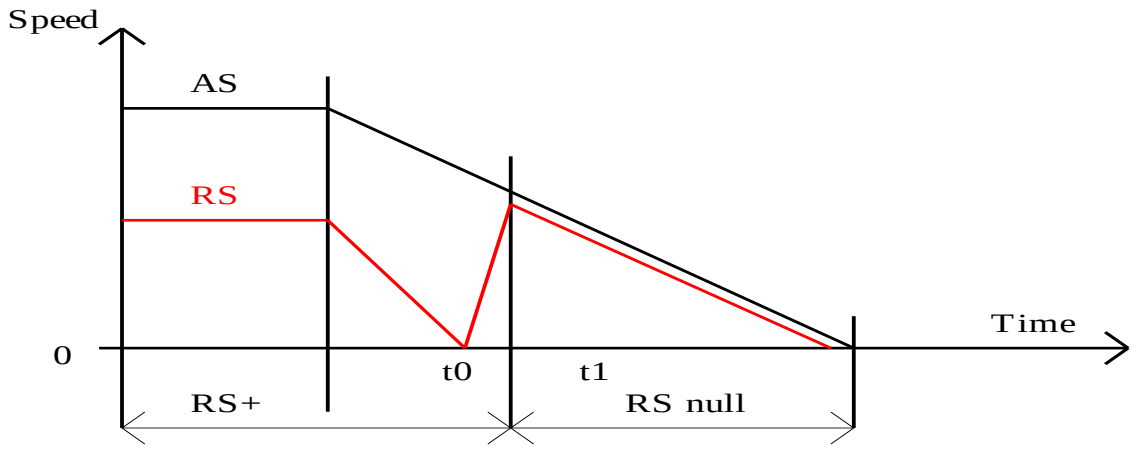


Figure 8-10. Simple Shutdown

t_0: Shutdown by deceleration AS and SS with a different ramp

t_1: The generator uncouples (under 2 Hz)

Speed of the input shaft meets speed of the bowl AS: the relative speed is reduced to zero. This means the bowl and the scroll are turning at the same speed.

8.6.4 Shutdown with Successive Restarting to Clean Bowl

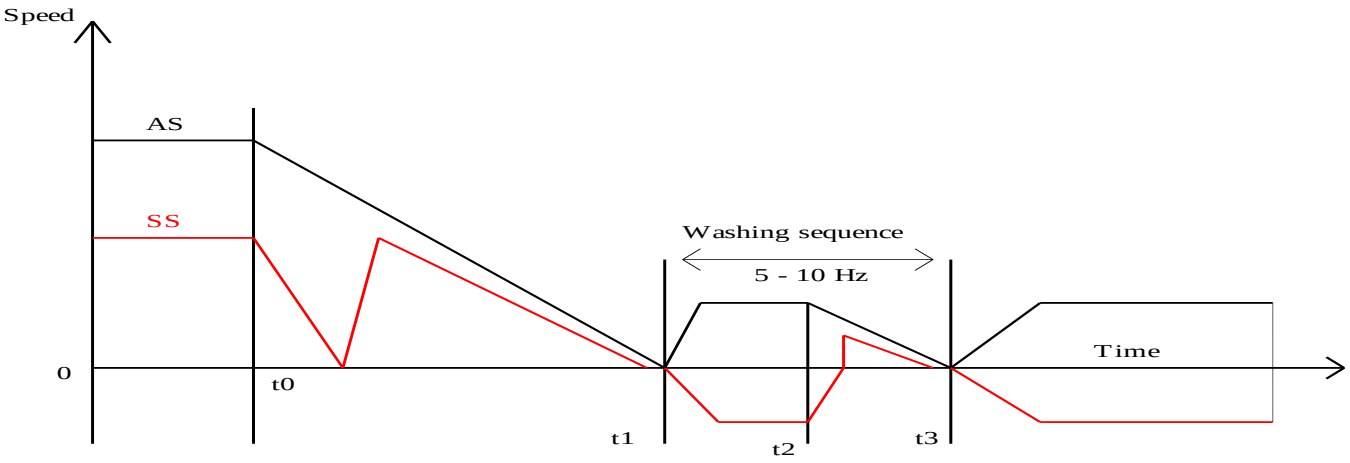


Figure 8-11. Shutdown with Successive Restarting to Clean Bowl

t_0: Simple shutdown

t_1: AS and SS restarting

t_2: Shutdown

t_3: Restarting sequence repeated n times (n = 2 to 3).

Note: AS: low speed 10 Hz

SS: negative (-10Hz) to increase the relative speed

8.6.5 Plug Clearing — First Trial

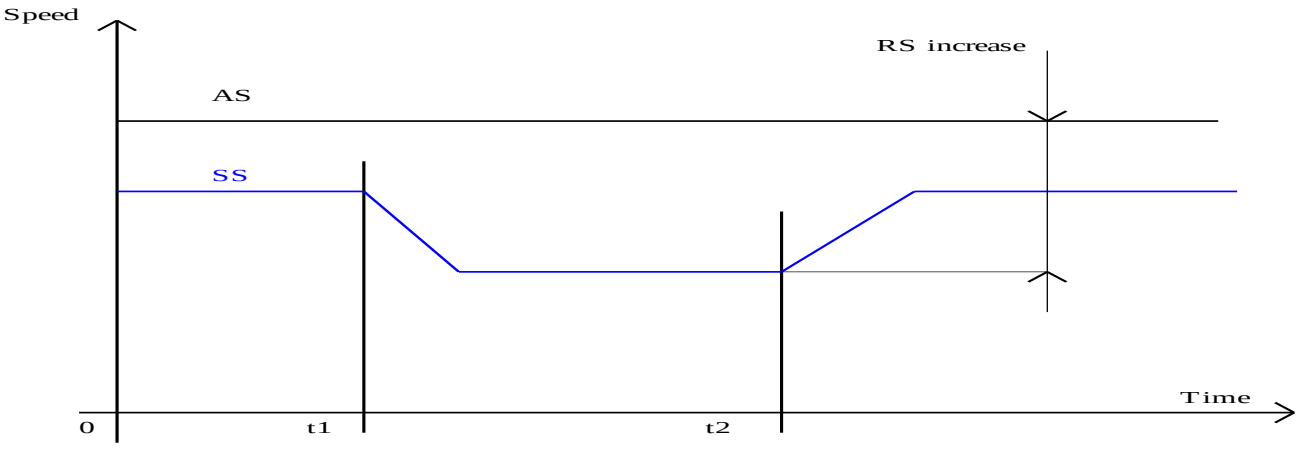


Figure 8-12. Plug Clearing — First Trial

t_1: Begin first trial. Reduce SS to increase RS.

t_2: Return to the original position

8.6.6 Plug Clearing — Low Speed

Note: If the bowl torque is too high, the bowl may be blocked while rotating by placing a wooden wedge between the diffusion apparatus tripping blade and the open sediment case. In this way, the bowl inverter will be neutralized.

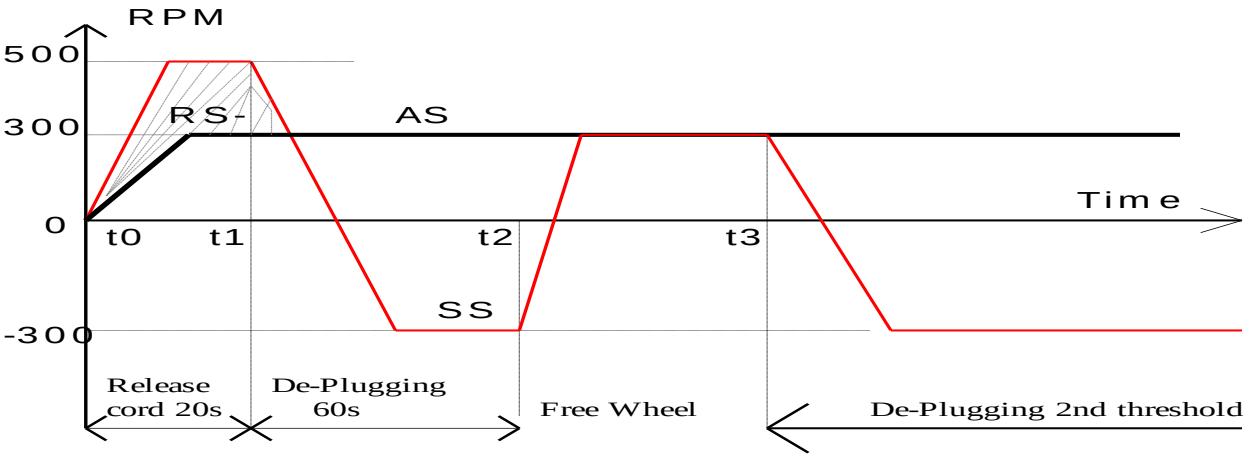


Figure 8-13. Plug Clearing — Low Speed

t_0: simultaneous restarting of AS and SS

t_0 to t_1: RS to compress the cord in the opposite direction

t_1: SS deceleration command until approximately 300 rpm

t_2: if the product is not extracted, give the order to stop the secondary motor.

t_3: return second operation

8.6.7 Stationary Cleaning

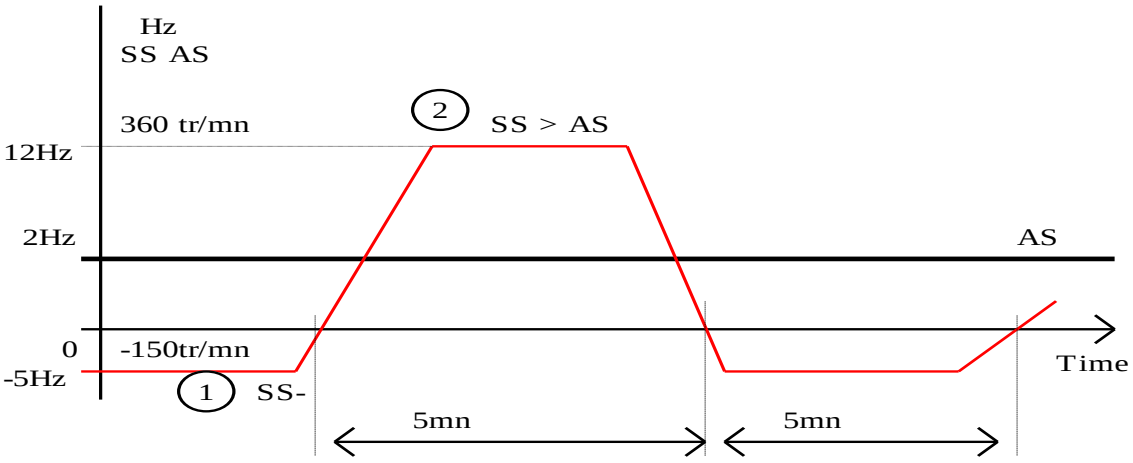


Figure 8-14. Wash Cycle Diagram

1) AS: low speed

   SS: negative for higher RS

   Ex: RS (1) = (AS - SS) / *k* = (106 - (- 150)) / 71 = + 3.6 rpm

2) AS: low speed

   SS > AS for low negative RS

   Ex : RS(2) = (AS - SS)/*k* = (106-360)/71 = -3.6 rpm

8.7 CONCLUSION

The centrifuge's double-speed variable transmission is as reliable and as robust as a short-circuit cage motor. It is well-protected by variable frequency inverters (VFDs) which have been selected for their dependability. This arrangement offers effective protection of the reducer which will not, under any circumstances, work under an excessive load, since the generator acts as the electromagnetic torque limiter.

A fair amount of energy is regenerated, even slightly more than the energy regenerated with a mechanical inverter. Maintenance is limited to lubrication of the motors, approximately every 3,000 hours.

Finally, the flexibility of the transmission allows the user to obtain the best AS/SS combination for any given product.

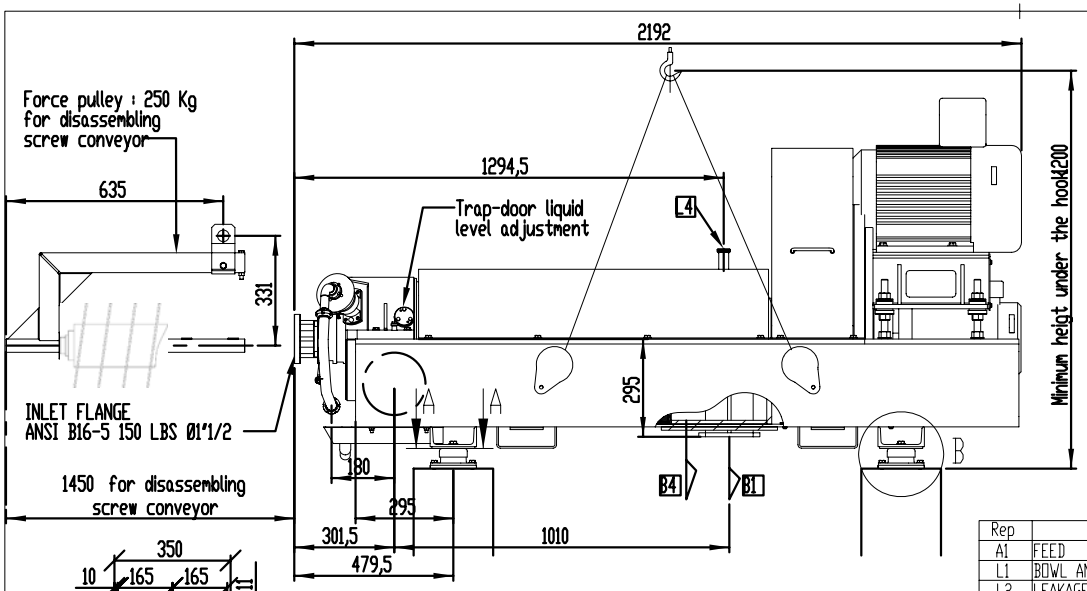
CHAPTER 9

PROJECT DRAWINGS

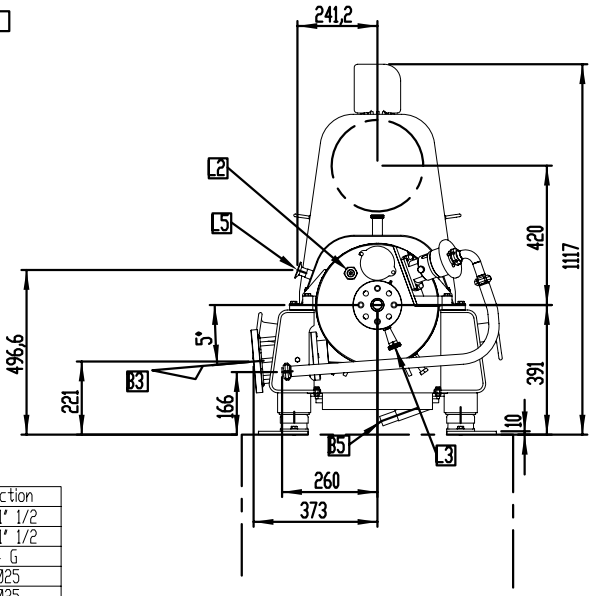
9.1 MECHANICAL DRAWINGS

The following mechanical drawing is included:

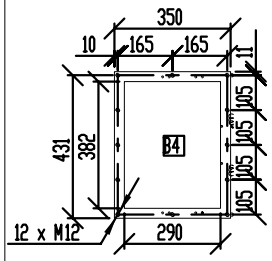
53958 Overall Dimensions Drawing

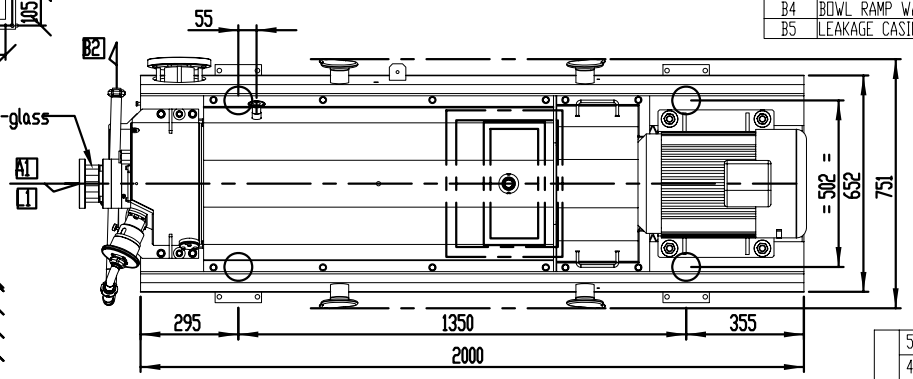


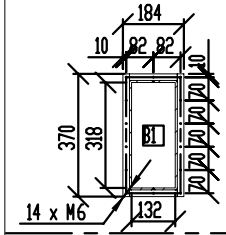
MACHINE WEIGHT 940 Kg



Rep	Description	Connection
A1	FEED	ANSI Ø1" 1/2
L1	BOWL AND SCREW WASHING	ANSI Ø1" 1/2
L2	LEAKAGE CASING	3/4 G
L3	SLEEVE WASHING	SMS Ø25
L4	SEDIMENTS CASING WASHING	SMS Ø25
L5	EXTERIOR BOWL RAMP	CLAMP Ø25/1"
B1	SOUDS OUTLET	318 x 132
B2	HEAVY PHASE OUTLET	SMS Ø25
B3	LIGHT PHASE OUTLET	PN10 DN80
B4	BOWL RAMP WASING WATER OUTLET	380 x 290
B5	LEAKAGE CASING	PIPE Ø30







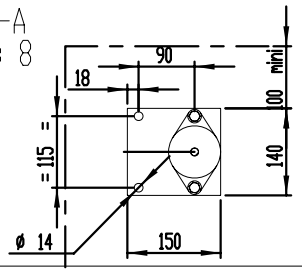
Theoretical total load distributed among the 4 shock absorbers (in normal situation)

Static load	Dynamic load in N. rotating force equivalent to the unbalance perpendicular to the rotor axis and exerted on the center of gravity.			
Machine weight x 1.2 = 11280 N	At normal working speed	Machine speed :	Before absorber	After absorber
		5000 rpm	1360 N	14 N
		4500 rpm	1000 N	13 N
		4000 rpm	720 N	11 N
	During machine slowdown	Max. resonnance speed: 400 rpm		300 N

Note : All connections to the machine must be flexible

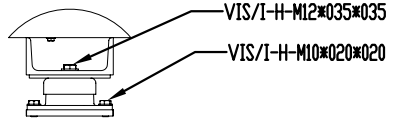
Note: take the dynamic load into account for the calculation of the decanter foundation block: 10% of its weight in both horizontal and vertical directions.

SECTION A-A
SCALE 1 : 8



VIBRATION ISOLATOR DETAIL

DETAIL B
SCALE 1 : 8



REVISION	REV	DESCRIPTION	DATE	DRAWN	CHECKED
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	4				
	3				
	2				
	1				
	0	FIRST ISSUE	10-05-12	AC Baumel	

ANDRITZ SAS
2-4 Avenue de l'Europe
78140 VELIZY VILLACOUBLAY - FRANCE -
ENVIRONMENT AND PROCESS TECHNOLOGIES

CLIENT :

FOLIO :

OVERALL DIMENSIONS DRAWING

No. : 53958

MACHINE : D2 L **NV 3 Ph**

SCALE : 1:15

EN58 rev 1

9.2 ELECTRICAL DRAWINGS

The following electrical drawings are included:

E814694-1 D2L Centrifuge Control Panel

E814694-2 D2L Centrifuge Electrical Schematic

E814694-3 D2L Centrifuge Electrical Schematic

E814694-4 Blank Page

E814694-5 Blank Page

E814694-6 D2L Centrifuge Electrical Schematic

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E814694-8 D2L Centrifuge Electrical Schematic

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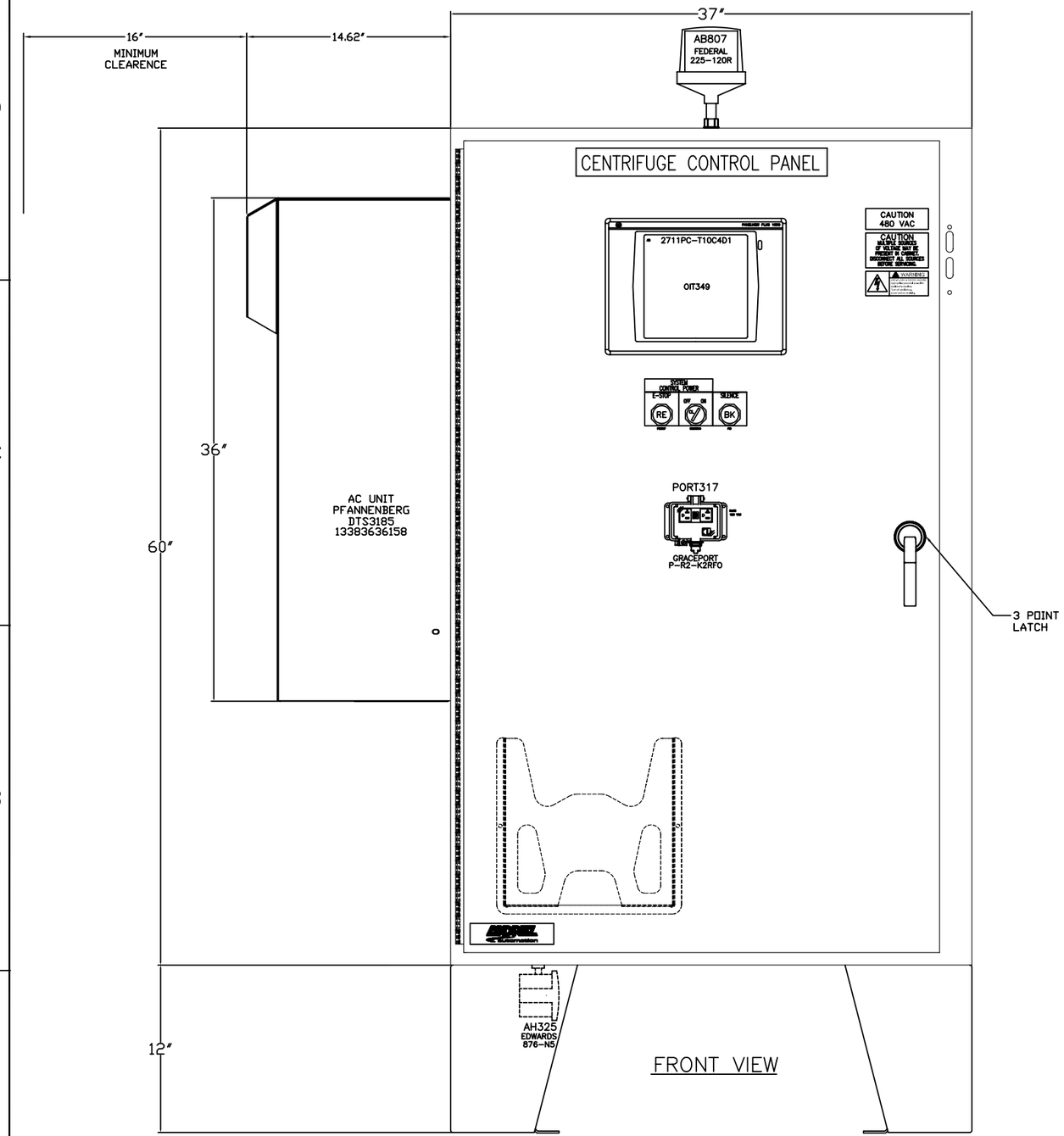
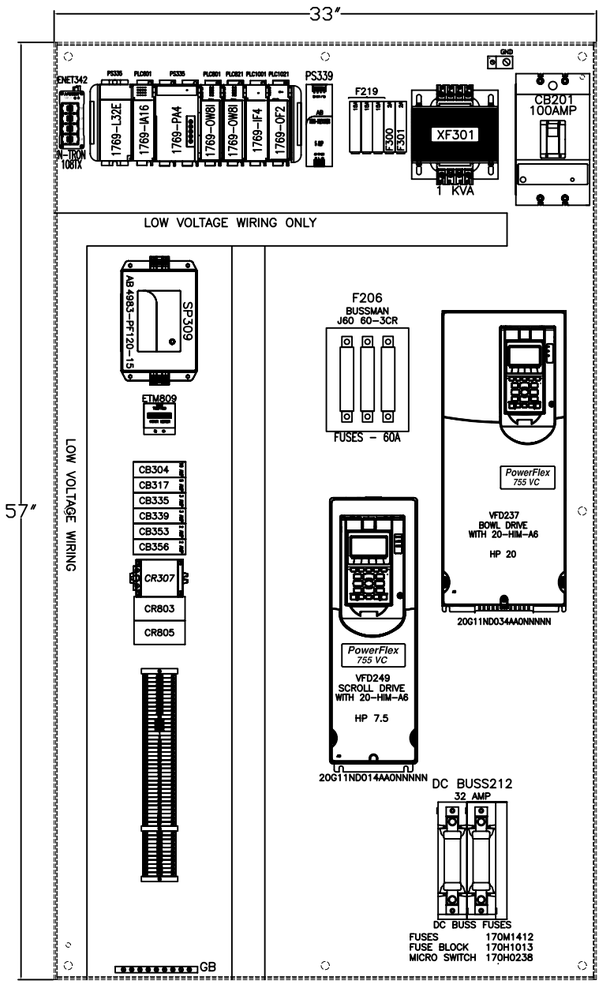
E814694-10 D2L Centrifuge Electrical Schematic

E814694-11 Blank Page

E814694-12 D2L Centrifuge Terminal Box

E814694-13 D2L Centrifuge Point to Point





SUBPANEL

NOTES:

1) ENCLOSURE IS NEMA 4X STAINLESS STEEL WITH FLANGE MOUNTED EXTERNAL DISCONNECT. PANEL DEPTH IS 14".
2) ALL PUSHBUTTON OPERATORS ARE HEAVYDUTY NEMA 4X RATED. CONTACTS ARE RATED 10 AMPS AT 600 VAC.
3) ALL WIRING TO CONFORM TO NATIONAL ELECTRIC CODE AND INCLUDES PERMANENT WIRE MARKERS.
4) **PROVIDE 20% SPARE TERMINALS.**
5) PANEL IS UL 508A LISTED.
6) CORROSION INHIBITORS PROVIDED.
7) NAMEPLATES TO BE BLACK LETTERS ON WHITE BACKGROUND.

300133842

REV	EIR	REVISION	BY	APVD	DATE
1		AS BUILT	DAK	MSV	9/13/12

1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
Phone: (817)465-5611
Telefax: (817)472-8589

APPROVED FOR CONSTRUCTION
BY: KV DATE: 7/18/12
PROJECT No. E814694

AS BUILT

1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
Phone: (817)465-5611
Telefax: (817)472-8589

CERTIFIED CORRECT FOR INSTALLATION
BY: KV DATE: 7/18/12
PROJECT No. E814694
THESE DWGS. REFLECT CUSTOMER'S CHANGES AND APPROVAL ON PREVIOUS DWG. TRANSMITTALS

ESTIMATED WEIGHT IN LBS:	DRAWN BY: DAK	DATE 7/16/12
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES	CHECKED BY: KV	DATE 7/18/12
FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020	APPROVED BY: KV	DATE 7/18/12
MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020	THIRD ANGLE PROJECTION	
MILL FINISH ALL OVER		

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TITLE: THEO CHOCOLATE
D2L CENTRIFUGE
CONTROL PANEL

SIZE	DRAWING NUMBER	REV
B	E814694-1	1

SCALE | FILE E814694-1 | SHEET 1 OF 13

CUSTOMER SUPPLIED POWER
480 VAC 3ϕ

200 L1 L2 L3 G

201 CB201
100AMP
202

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#4AWG
#6AWG
F206
80A
80A
80A
1L1
1L2
1L3

VFD
HP 20
BOWL DRIVE
L1
L2
L3
+
−
PE−B
U
V
W
PE

T-STATS
553
603
21
BOWL DRIVE
& TEMP SWITCH
M207
HP 20
FLA 27

2091
2101

DC BUSS212
DC BUSS FUSES
32 AMP
2121
2131
607

VFD249
HP 10
SCROLL DRIVE
−
+
PE−B
U
V
W
PE

T-STATS
553
605
22
SCROLL DRIVE
& TEMP SWITCH
M213
HP 7.5
FLA 11

#12AWG
F219
15A
15A
15A
2L1
2L2
2L3

L1
L2
L3
PANEL AIR
CONDITIONER
3.6 FLA

L1 231
L3 231

230 L1
230 L3

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L1 400
L3 400

VFD237
POWERFLEX 755
HP 20
BOWL DRIVE
WITH 20−HIM−A6
ENET
24VC
+24V
DiOdc
Di C
2392
2391
2393
MCR
CR307
VFD 337 ENET 344
NOTE: REMOVE
JUMPER J1 FOR
HARDWARE
ENABLE

VFD249
POWERFLEX 755
HP 7.5
SCROLL DRIVE
WITH 20−HIM−A6
ENET
24VC
+24V
DiOdc
Di C
2512
2511
2513
MCR
CR307
VFD 349 ENET 344
NOTE: REMOVE
JUMPER J1 FOR
HARDWARE
ENABLE

AS BUILT

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REV	EIR	REVISION	BY	APVD	DATE
1		AS BUILT	DAK	MSV	9/13/12

ESTIMATED WEIGHT IN LBS:	DRAWN BY: DAK	DATE 7/16/12	
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES	CHECKED BY: KV	DATE 7/18/12	
FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020	APPROVED BY: KV	DATE 7/18/12	
MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020	THIRD ANGLE PROJECTION		
MILL FINISH ALL OVER			

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ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE
THEO CHOCOLATE
D2L CENTRIFUGE
ELECTRICAL SCHEMATIC

SIZE	DRAWING NUMBER	REV
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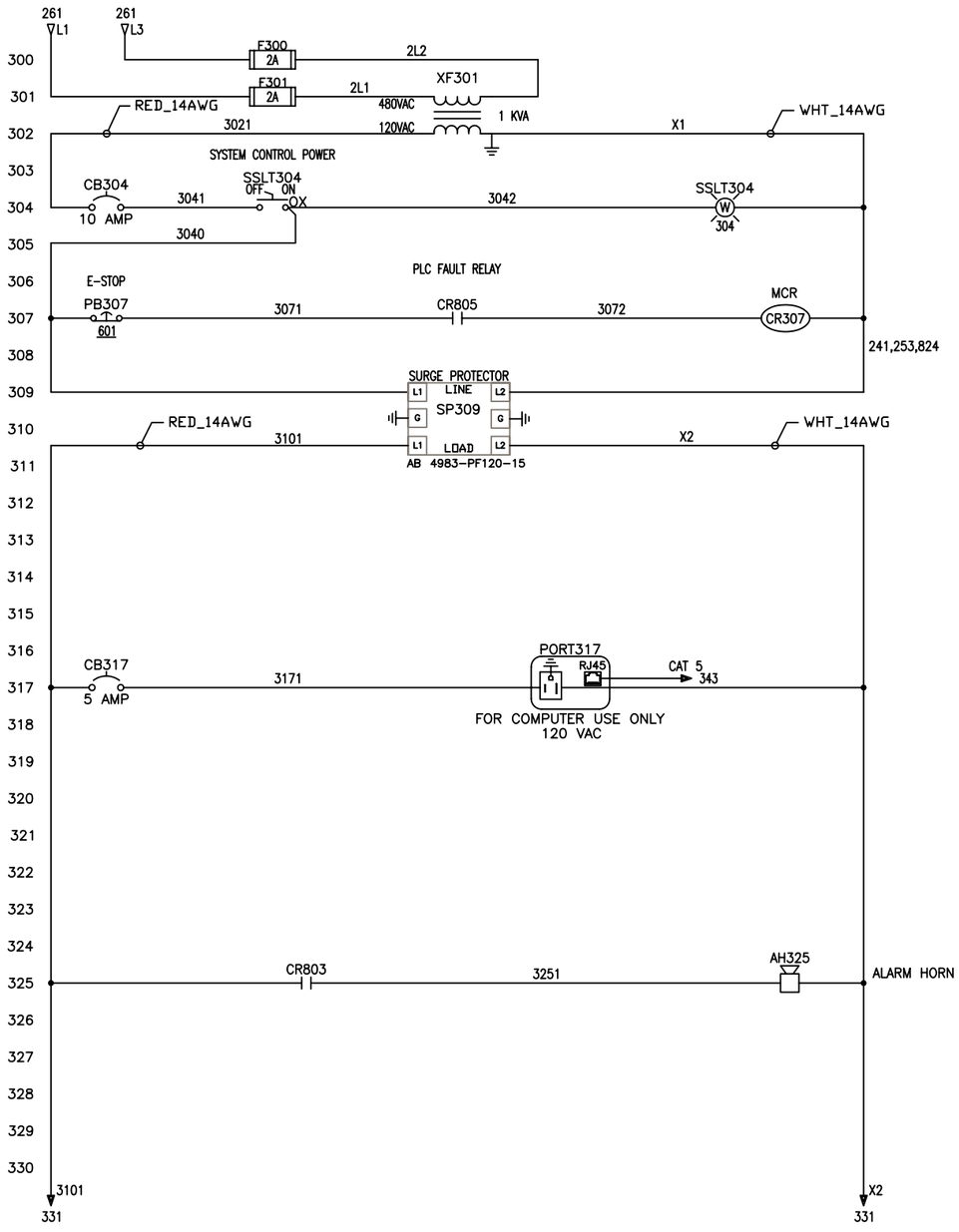
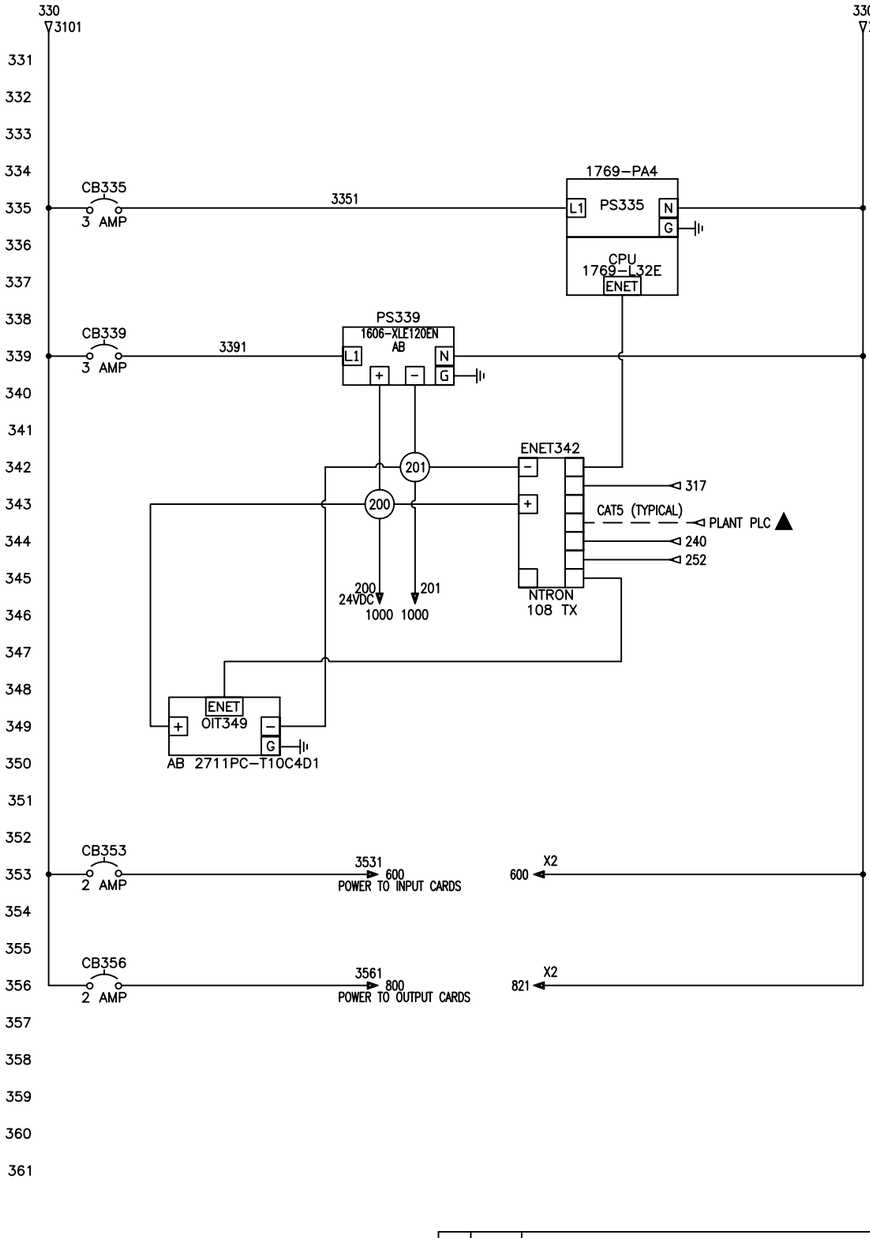
SCALE	FILE E814694-2	SHEET 2 OF 13





LEGEND:

CB-CIRCUIT BREAKER
CR-CONTROL RELAY
DISC-DISCONNECT
PB-PUSHBUTTON
PCS-PULL CORD STOP
F-FUSE
LS-LIMIT SWITCH
MS-MOTOR STARTER
OL-OVERLOAD
PS-PRESSURE SWITCH
SOL-SOLENOID VALVE
SP-SURGE PROTECTOR
SR-SAFETY RELAY
XF-TRANSFORMER
TAS-TEMPERATURE SWITCH

(#) -TERMINALS IN CENTRIFUGE CONTROL PANEL
<#> -TERMINALS IN FEED END TERMINAL BOX
[#] -TERMINALS ON PANEL MOUNTED COMPONENTS
2261 = PAGE NO, LINE NO, SERIES NO. WIRE NUMBERS
▲ -TO BE SUPPLIED BY OTHERS
– – -WIRING BY OTHERS

AS BUILT

1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
Phone: (817)465-5611
Telefax: (817)472-8589

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BY: KV DATE: 7/18/12
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Telefax: (817)472-8589

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BY: KV DATE: 7/18/12
PROJECT No. E814694

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UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES	CHECKED BY: KV	DATE 7/18/12
FABRICATION TOLERANCES .XXX±.040 ANG±1° HOLE±.020	APPROVED BY: KV	DATE 7/18/12
MACHINING TOLERANCES .XXX±.005 ANG±.5° HOLE±.020	THIRD ANGLE PROJECTION	
MILL FINISH ALL OVER		

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TITLE
THEO CHOCOLATE
D2L CENTRIFUGE
ELECTRICAL SCHEMATIC

SIZE	DRAWING NUMBER	REV
B	E814694-3	1

SCALE | FILE E814694-3 | SHEET 3 OF 13

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	E814694-4	4 OF 13

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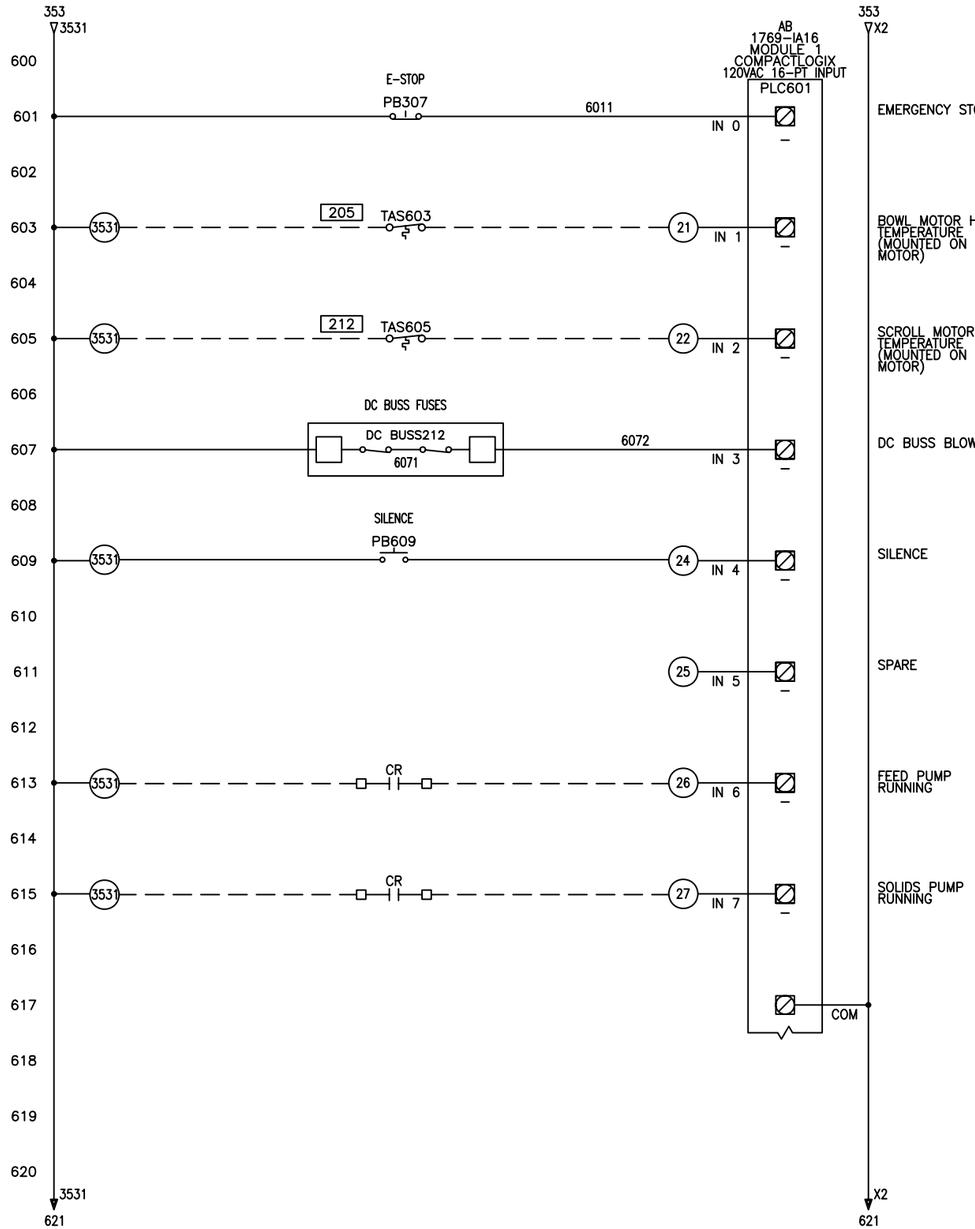
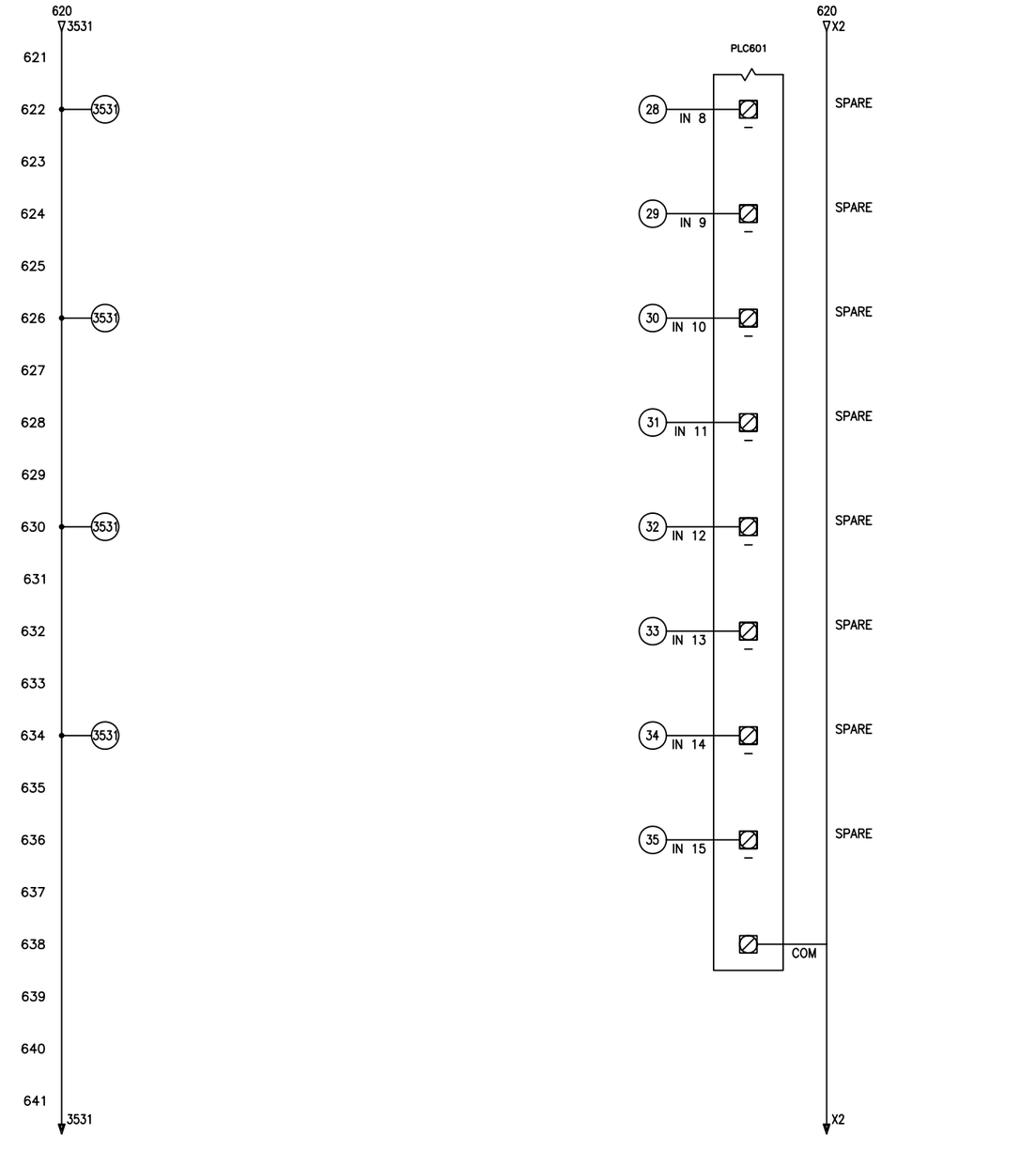
SCALE	FILE E814694-5	SHEET 5 OF 13





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ELECTRICAL SCHEMATIC

SIZE	DRAWING NUMBER	REV
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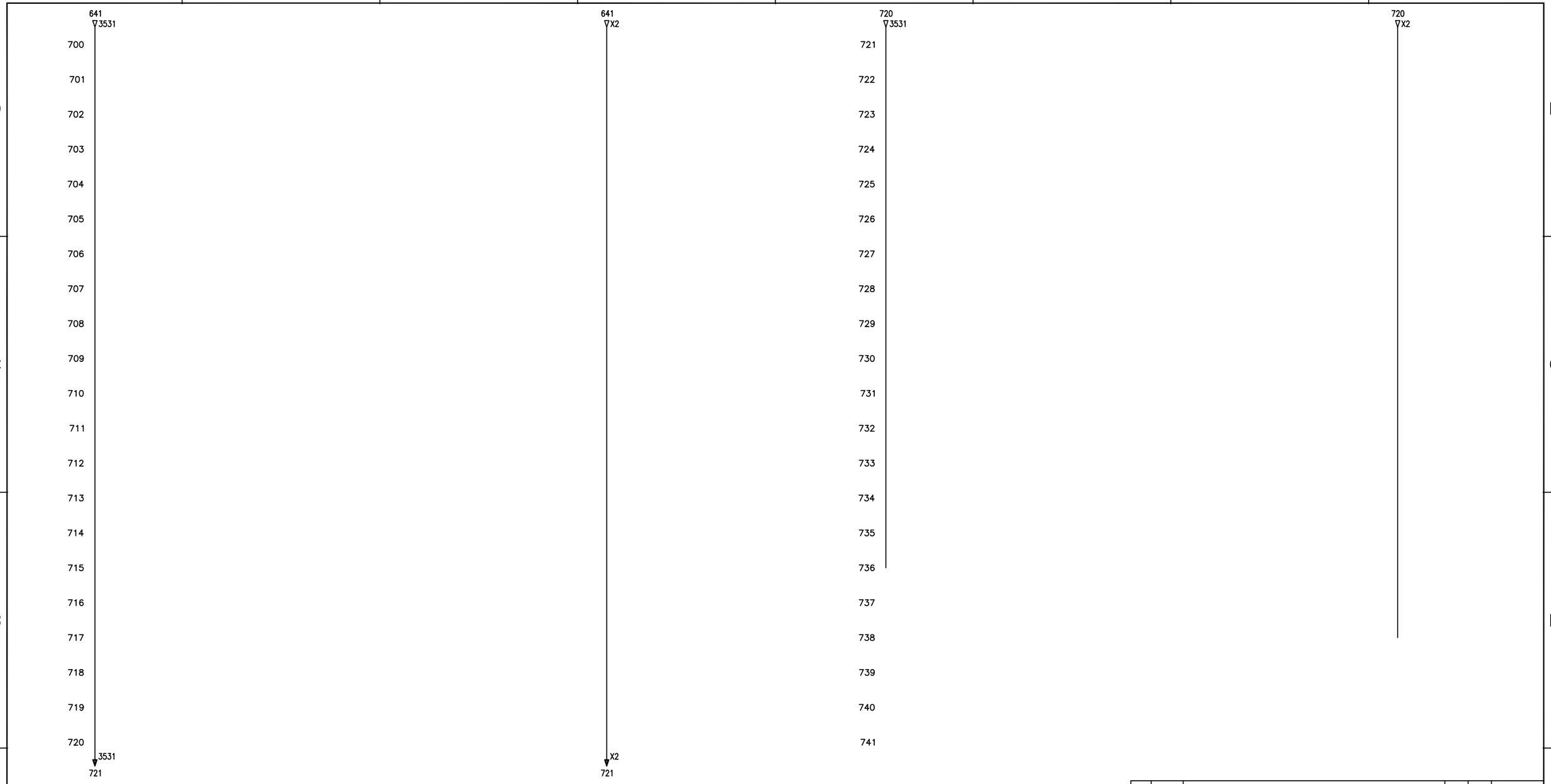
SCALE	FILE E814694-6	SHEET 6 OF 13



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D2L CENTRIFUGE
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SIZE	DRAWING NUMBER	REV
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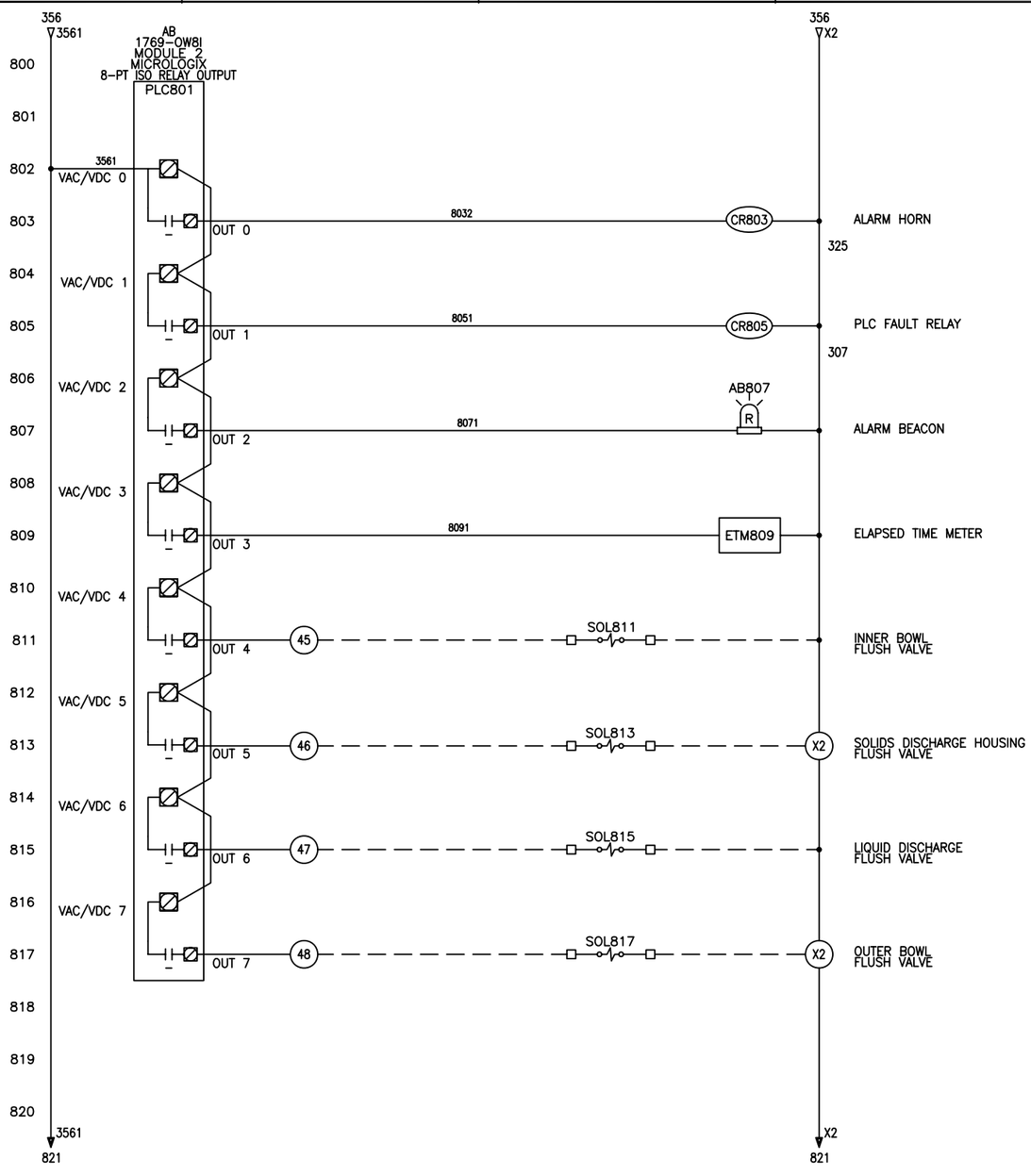
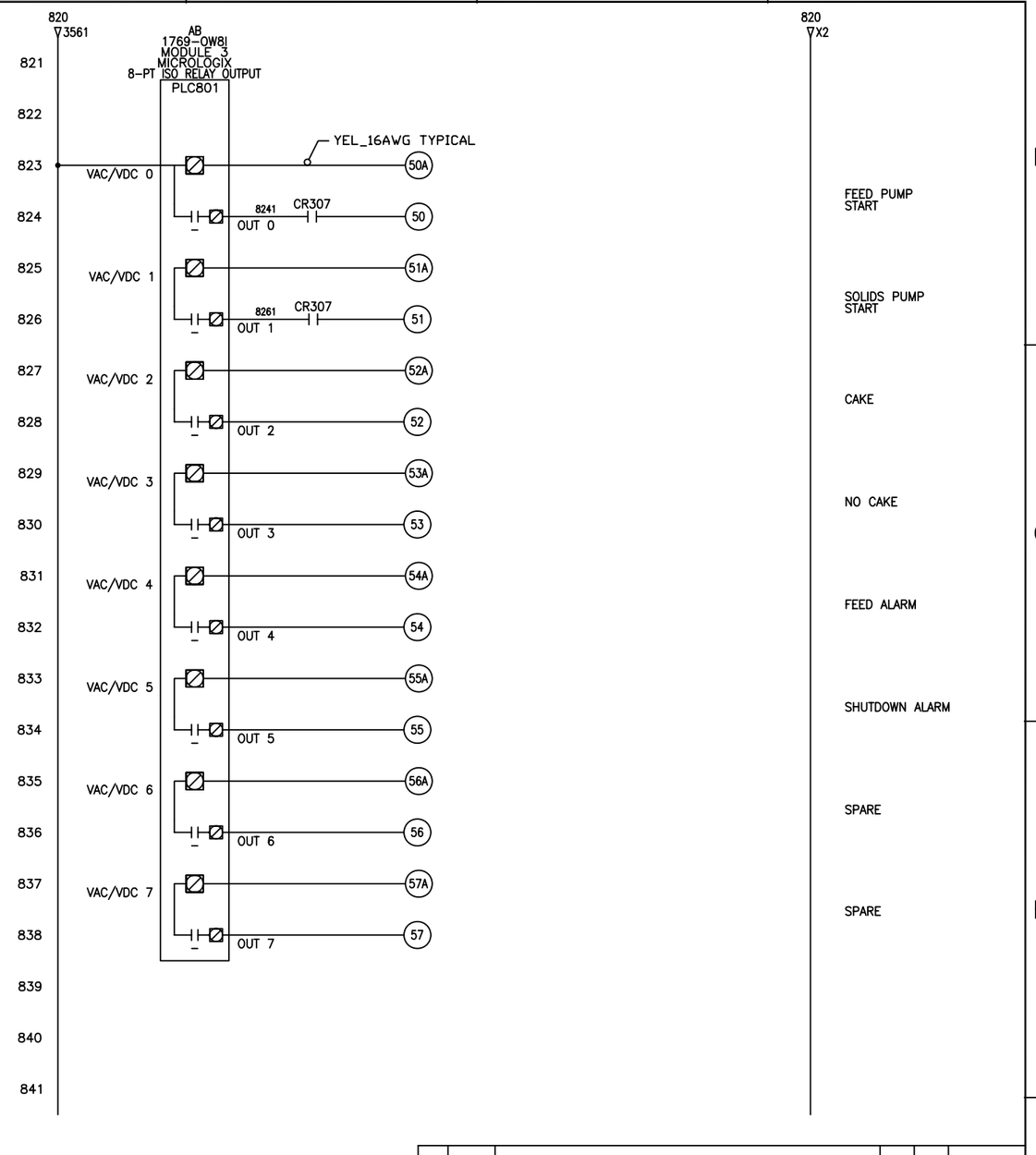
SCALE | FILE E814694-7 | SHEET 7 OF 13





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ELECTRICAL SCHEMATIC

SIZE	DRAWING NUMBER	REV
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1		AS BUILT	DAK	MSV	9/13/12
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SIZE	DRAWING NUMBER	REV
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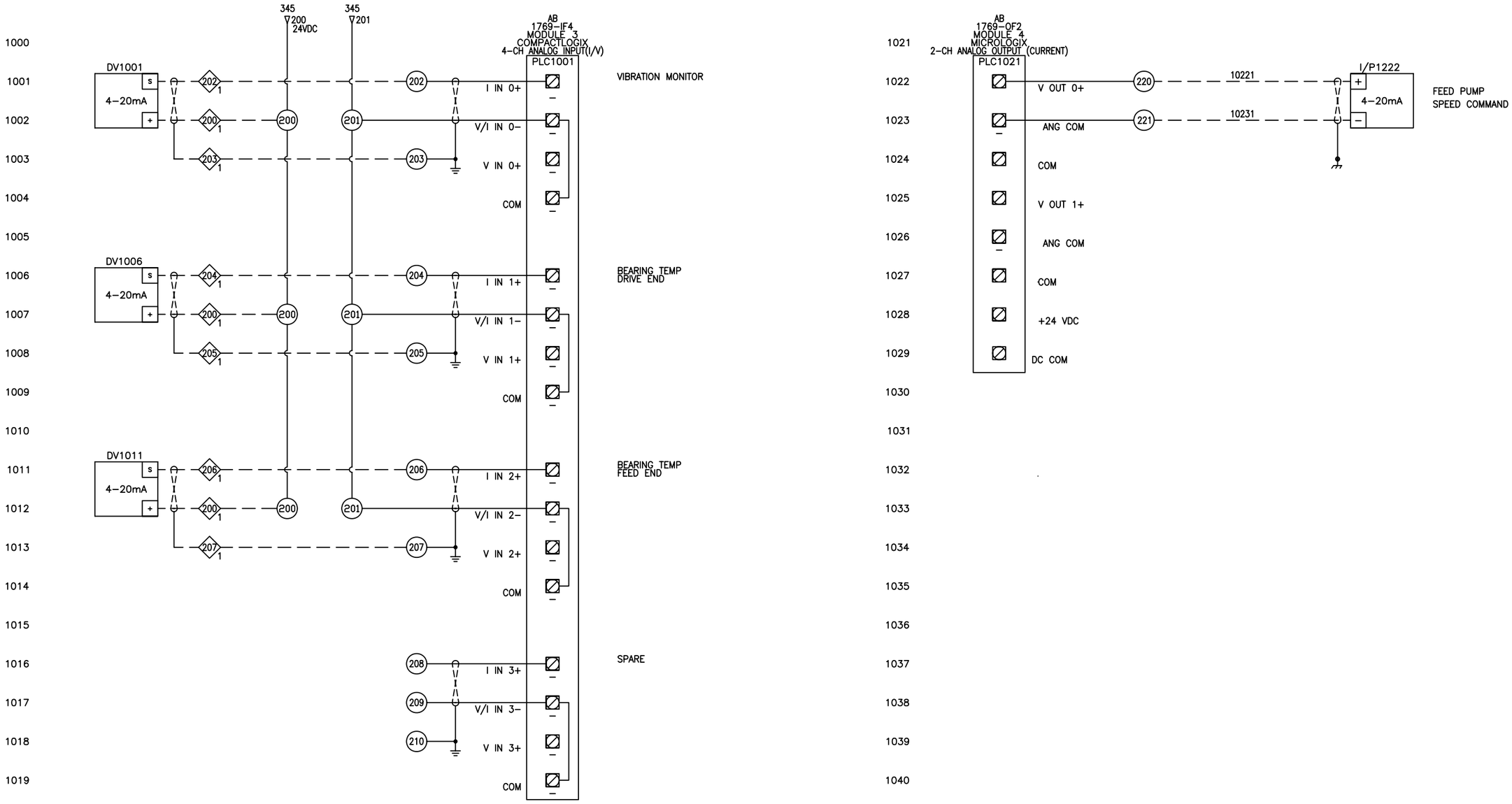
SCALE	FILE E814694-9	SHEET 9 OF 13



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SIZE	DRAWING NUMBER	REV
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SCALE | FILE E814694-10 | SHEET 10 OF 13

1100 1101 1102 1103 1104 1105 1106 1107 1108 1109 1110 1111 1112 1113 1114 1115 1116 1117 1118 1119 1120

1121 1122 1123 1124 1125 1126 1127 1128 1129 1130 1131 1132 1133 1134 1135 1136 1137 1138 1139 1140 1141

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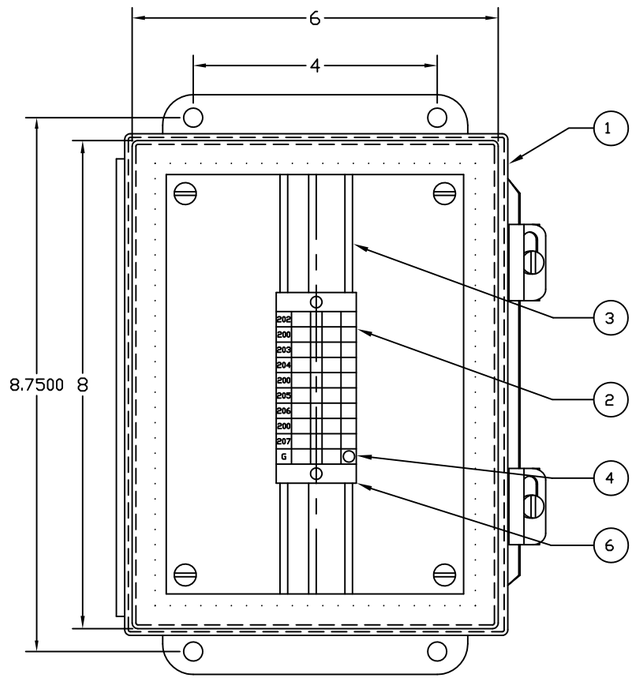
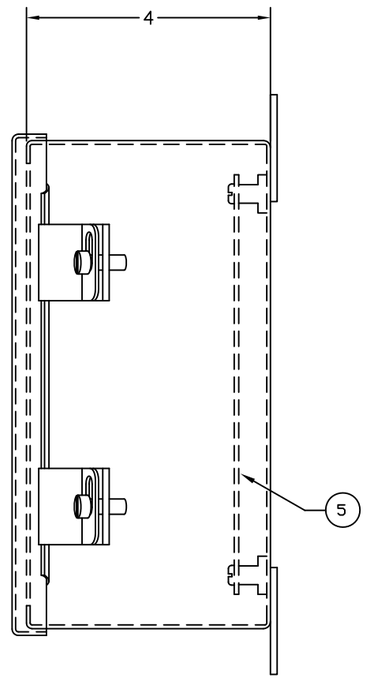
SCALE | FILE E814694-11 | SHEET 11 OF 13



FRONT VIEW
(COVER REMOVED)

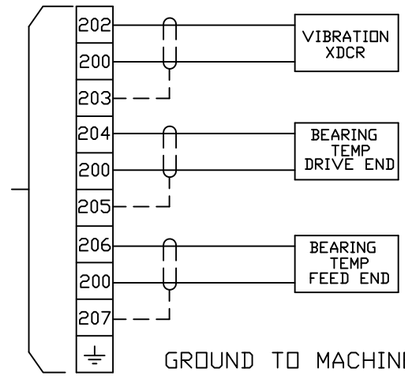
MOUNTED TO LOWER FRAME OF CFG
(SEE CFG CONNECTION DWGS FOR APPROX. LOCATION)



SIDE VIEW

PRE-WIRED ON CENTRIFUGE

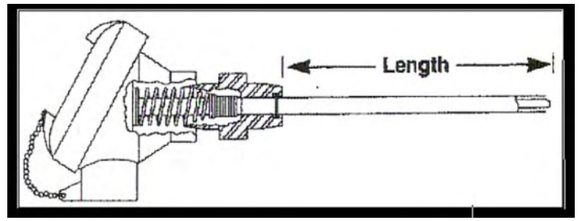
24V DC TERMINALS (TO CENTRIFUGE CCP PANEL)



GROUND TO MACHINE FRAME

TERMINAL CONNECTION DETAIL

RTD THERMOCOUPLES SEAL AROUND WIRES WITH HEAT SHRINK TUBE			
SERIES	BEARING END	MEASURE LENGTH FROM CLOSED END OF TUBE	+ NEEDED LENGTH FOR SPRING
D2L	DRIVE END	1 1/4"	2 5/8"
	FEED END	5"	2 5/8"



ITEM DESCRIPTION

1. -TERMINAL BOX-STEELINE SJB8064CH4SS6 NEMA 4X 316 STAINLESS STEEL.
2. -WIRING TERMINALS-ENTRELEC TYPE 115118.11, 50A @600 VAC, #8 AWG. MAX.
3. -TERMINAL MOUNTING TRACK-ENTRELEC PR5 101598.26.
4. -GROUND TERMINAL-ENTRELEC 165114.17.
5. -TERMINAL BOX SUBPANEL S-8P6.
6. -END BRACKET-ENTRELEC 103002.26.

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TERMINAL BOX

SIZE	DRAWING NUMBER	REV
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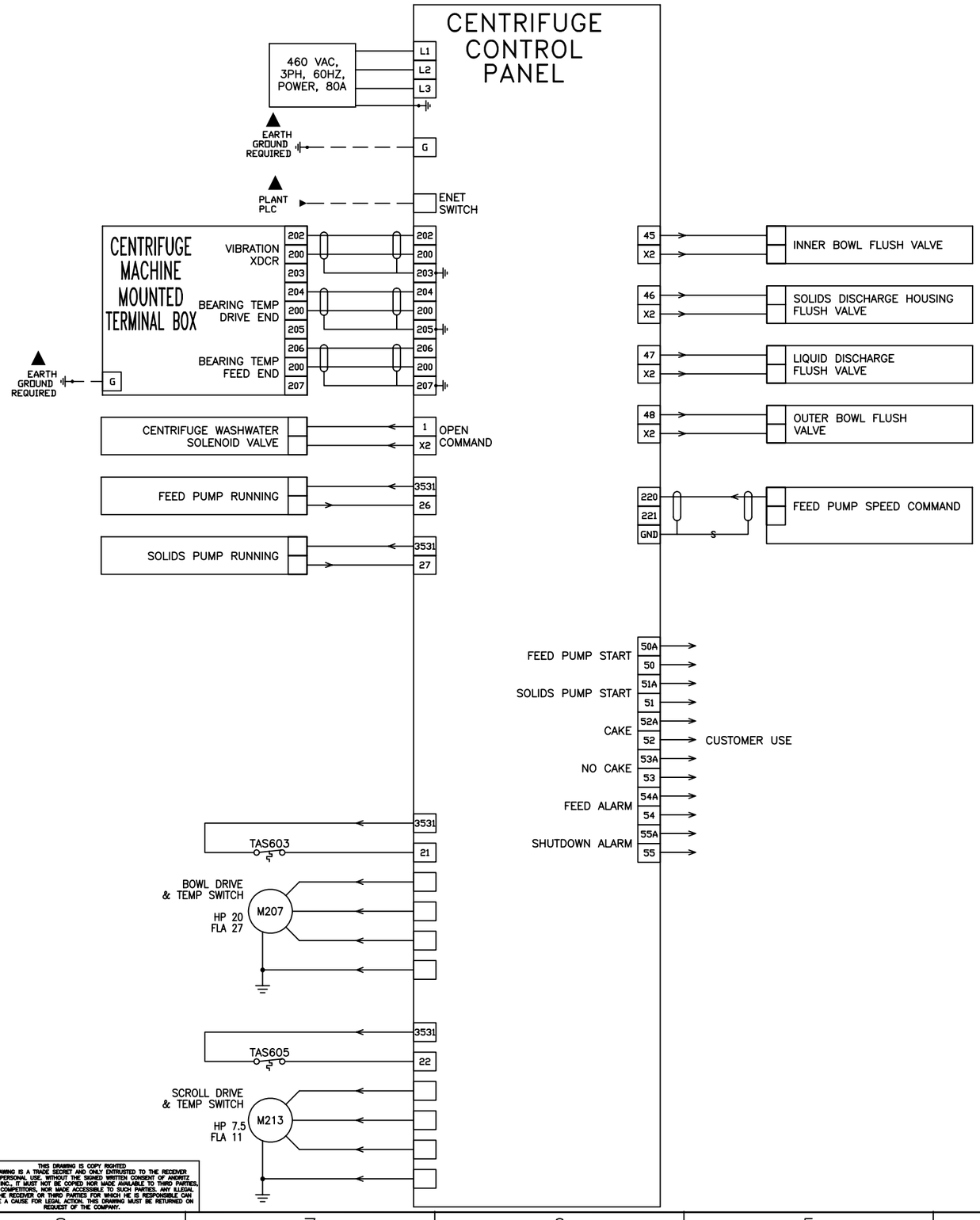
SCALE	FILE E814694-12	SHEET 12 OF 13



NOTES:

1) CONTROL PANEL MUST BE SUPPLIED WITH POWER SOURCE GROUND FOR PROPER OPERATION OF INSTRUMENTS.

2) MOTOR GROUND WIRE MUST GO DIRECTLY TO VFD GROUND TERMINAL "PE".

3) THIS POINT TO POINT DRAWING IS DERIVED FROM PROJECT SCHEMATICS.**REFER TO PROJECT SCHEMATICS FOR FURTHER CLARIFICATION.**

⇄ - ARROW DIRECTION INDICATES INPUT OR OUTPUT

RECOMMENDED MINIMUM WIRE SIZE REQUIRED TO HANDLE LOAD

- POWER WIRE 12GA
- CONTROL WIRE 14GA
- SHIELDED CABLE 18GA (SIGNAL)

RUN ALL SHIELDED CABLE IN SEPARATE CONDUIT FROM POWER OR CONTROL CONDUCTORS. ALL SHIELDED CABLE GROUND CONDUCTORS SHOULD BE GROUNDED AT 1 END ONLY.

✳ - IF TERMINAL NO'S ARE KNOWN FOR EQUIPMENT SUPPLIED BY OTHERS. PLEASE PROVIDE FOR COMPLETION OF DRAWING.

▲ - TO BE SUPPLIED BY OTHERS.

FOR REFERENCE ONLY

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POINT TO POINT

SIZE	DRAWING NUMBER	REV
B	E814694-13	1

SCALE | FILE E814694-13 | SHEET 13 OF 13

CHAPTER 10

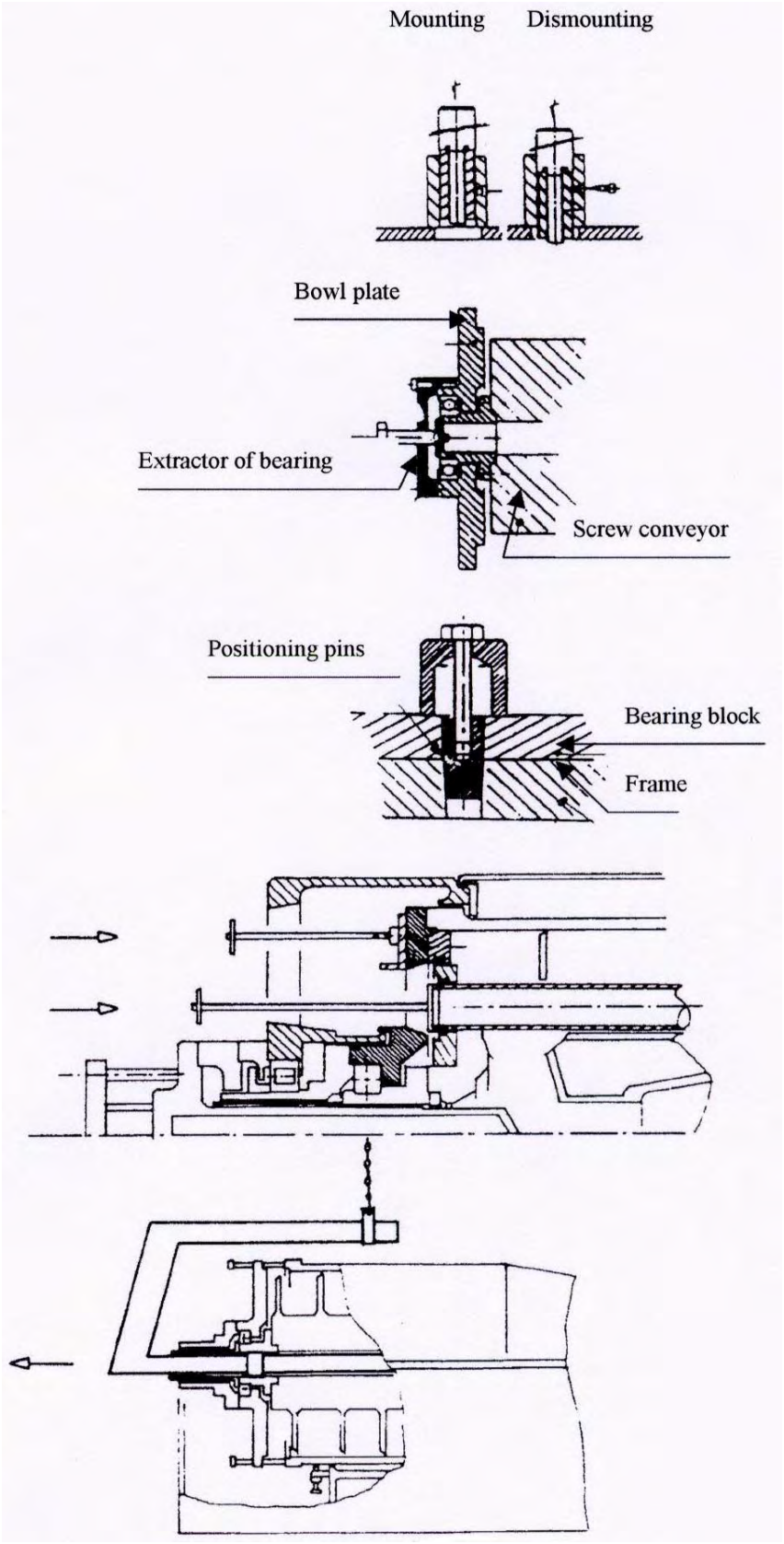
TOOLS AND PARTS

10.1 LIST OF TOOLS FOR THE CENTRIFUGE

The tools required for the centrifuge and listed in table 10-1 and are shown in the following diagrams.

TABLE 10-1. TOOL LIST
Item
Elastic ring extractor
Bearing extractor
Bearing block positioning pins extractor
Hexagonal spanner with extension piece for adjustment of liquid levels
Adjustment spanner for orientation of pipe
Scroll spreader bar
Tool box

* Elastic ring extractor



* Bearing extractor

* Bearing block positioning pins extractor

* Hexagonal spanner with extension piece for adjustment of liquid levels

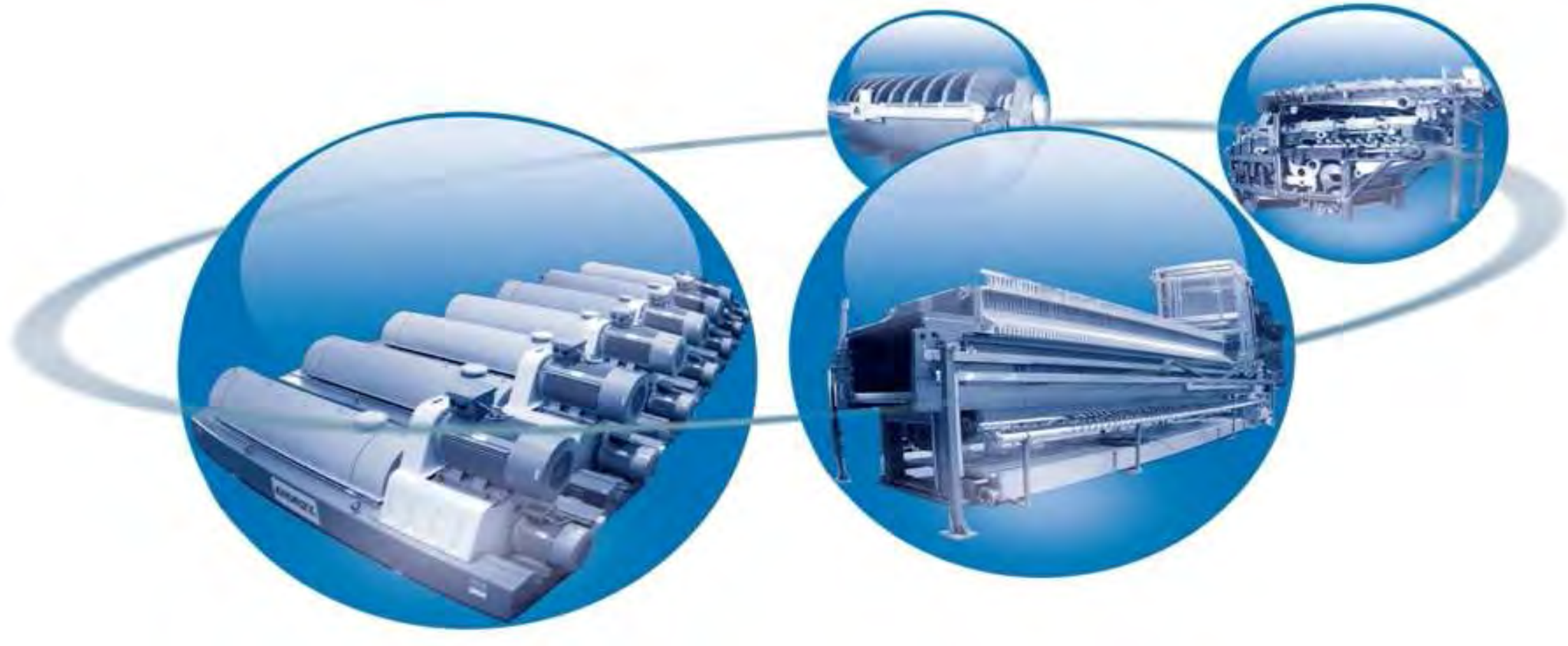
* Adjustment spanner for orientation of co-current pipe (not for PC and NV centrifuges)

* Screw conveyor spreader bar

10.2 PARTS LIST

The parts list for a D2L centrifuge follows.

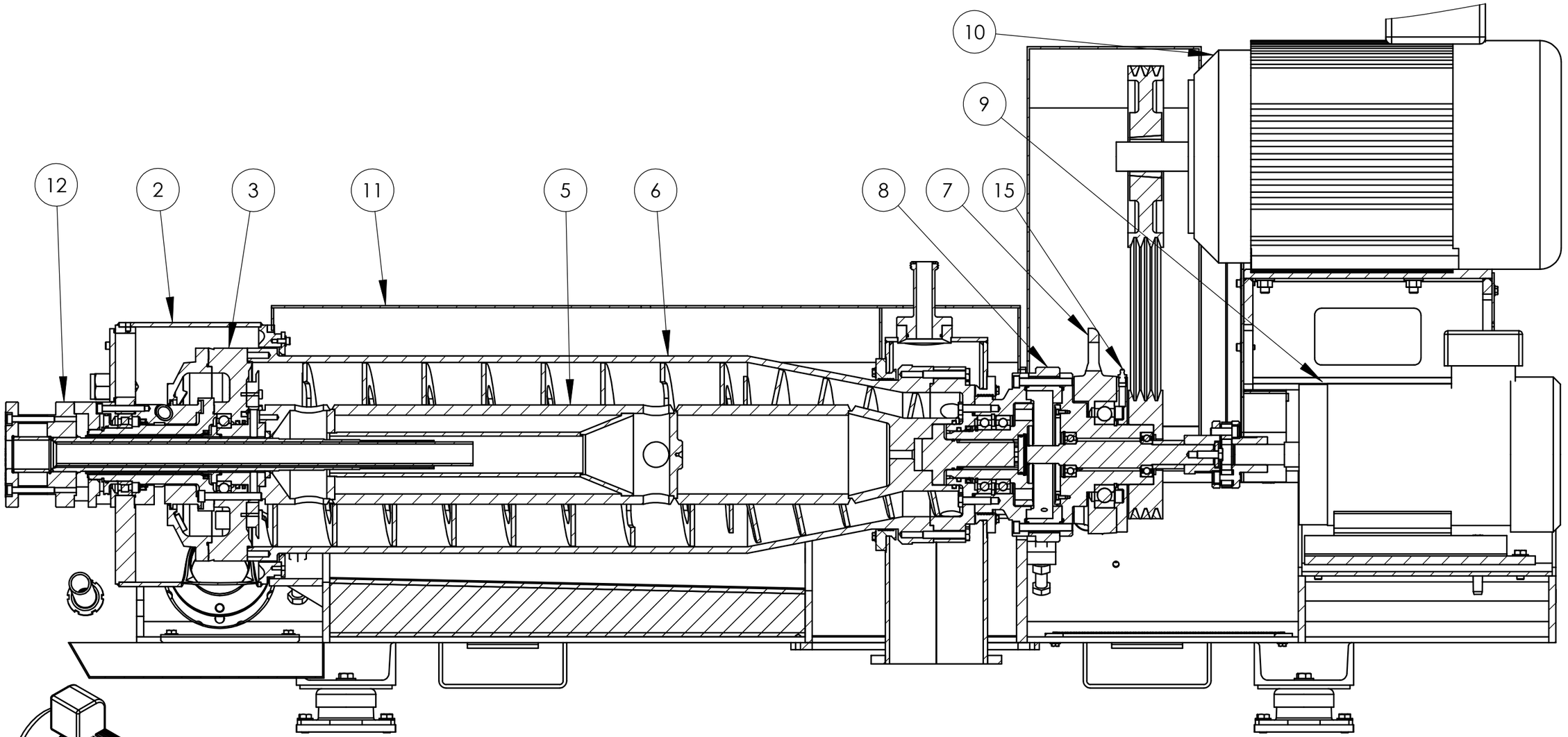
ANDRITZ Separation

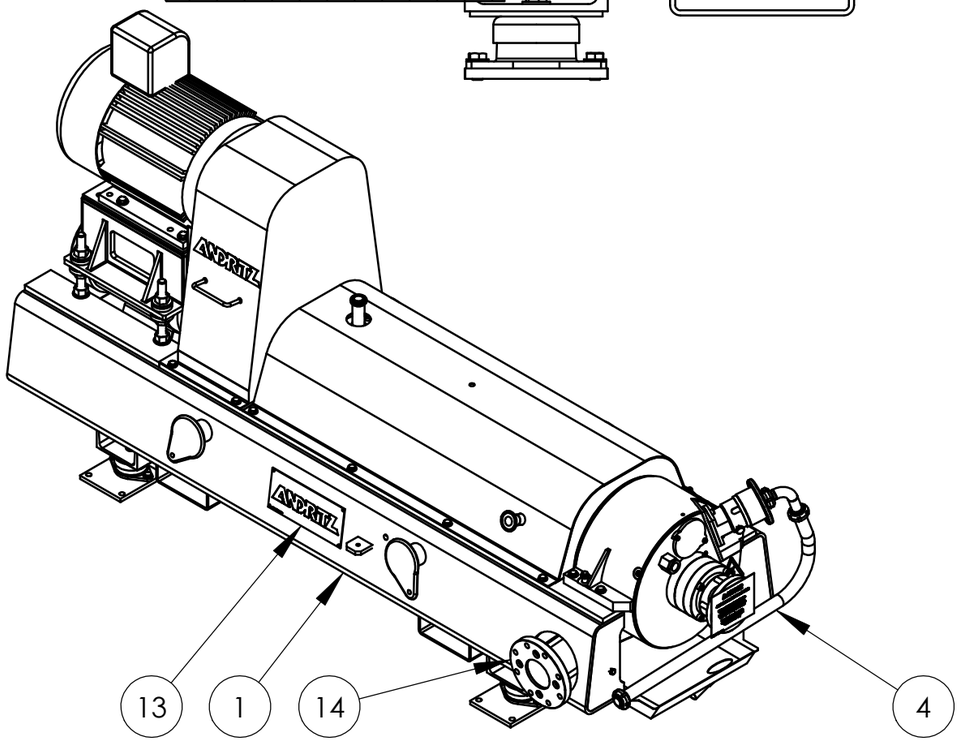


Centrifuge Parts List
Liste des Pièces Centrifugeuse

MODEL D2 L C 30 C NV 3 Ph Sa

SERIAL # 132171840 Rev 2





POS	P/N GPS	Désignation_FR	Désignation_AN	Qté
1	48803-1	ENSEMBLE BATI	FRAME ASSEMBLY	1
2	54196-0	ENSEMBLE PALIER ALIMENTATION - SANS SONDE	FRONT PILLOW BLOCK ASSEMBLY - WITHOUT SENSOR	1
3	53863-0	ENSEMBLE EVACUATION EFFLUENTS 3 PH	EFFLUENT EVACUATION ASSEMBLY 3 PH	1
4	32973-2	ENSEMBLE POMPE NIVEAU VARIABLE	ADJUSTABLE CENTRIPETAL PUMP ASSEMBLY	1
5	53923-0	ENSEMBLE VIS CONVOYEUSE 11°	11° SCREW CONVEYOR ASSEMBLY	1
6	51674-0	ENSEMBLE BOL	BOWL ASSEMBLY	1
7	51675-1	ENSEMBLE PALIER REDUCTEUR	REAR PILLOW BLOCK ASSEMBLY	1
8	48811-1	ENSEMBLE REDUCTEUR ZS 614/87	REDUCER ZS614/87 ASSEMBLY	1
9	53941-0	ENSEMBLE TRANSMISSION	TRANSMISSION ASSEMBLY	1
10	53942-0	ENSEMBLE MOTEUR PRINCIPAL	MAIN MOTEUR ASSEMBLY	1
11	53924-0	ENSEMBLE CAPOTS	COVER ASSEMBLY	1
12	48806-0	ENSEMBLE TUBE ALIMENTATION AVEC LAVAGE	FEED PIPE WASHING ASSEMBLY	1
13	48816-0	ENSEMBLE PLAQUES SIGNALETIQUES	NOTIFICATION SIGNS ASSEMBLY	1
14	51912-0	ENSEMBLE POT DE DEGAZAGE	DEAERATOR ASSEMBLY	1
15	46214-4	ENSEMBLE LUBRIFICATION GRAISSE	GREASE LUBRICATION ASSEMBLY	1

ANDRITZ SAS
2-4 Avenue de l'Europe
78140 VELIZY VILLACOUBLAY - FRANCE -
ENVIRONMENT AND PROCESS TECHNOLOGIES

FOLIO :

CLIENT :

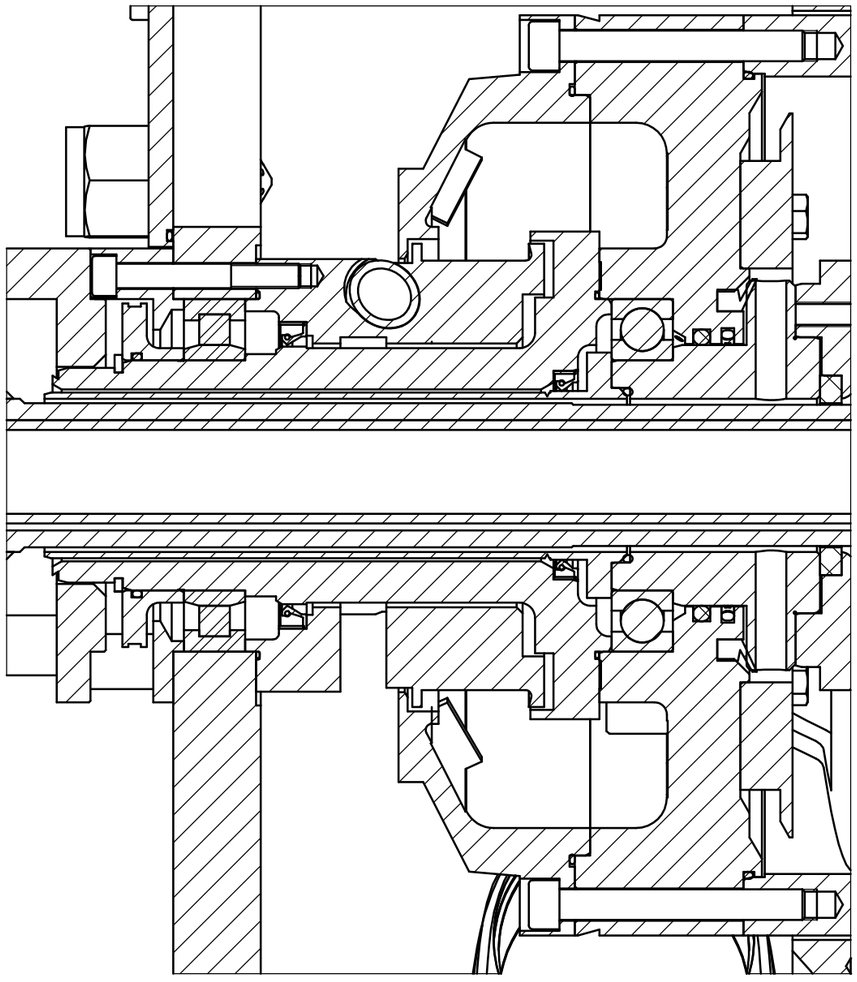
ENSEMBLE COUPE LONGITUDINALE
LONGITUDINALE SECTION ASSEMBLY

MACHINE : D2 L NV 3Ph

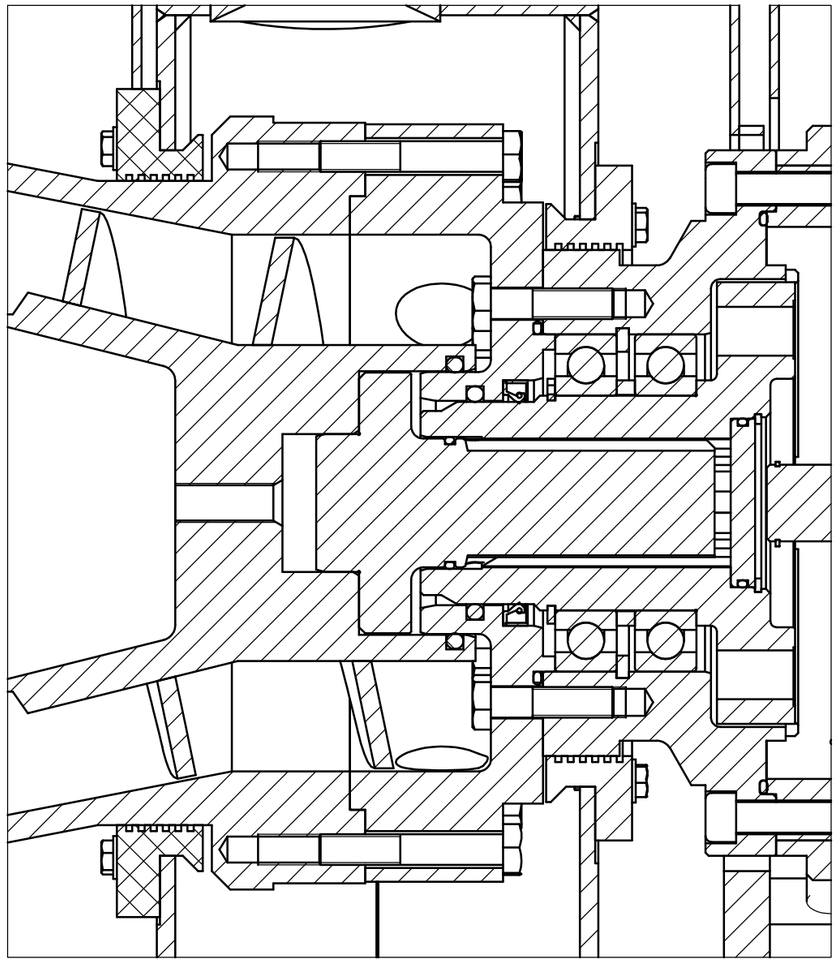
No. : 53862-0

DATE : 11-05-12

EN58 rev 1



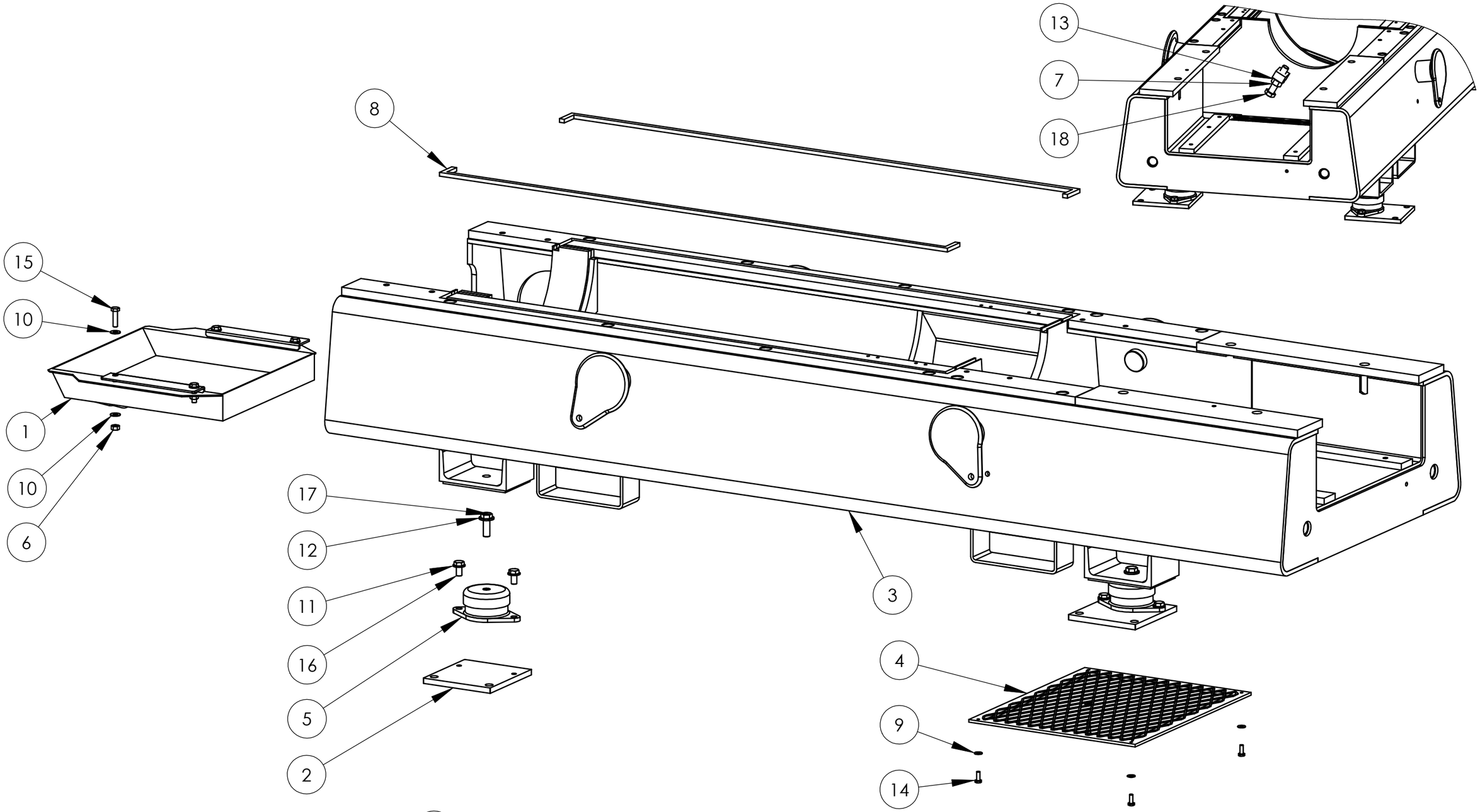
ALIMENTATION
FEED SIDE



REDUCTEUR
REDUCER SIDE

ANDRITZ SAS 2-4 Avenue de l'Europe 78140 VELIZY VILLACOUBLAY - FRANCE - ENVIRONMENT AND PROCESS TECHNOLOGIES	FOLIO : CLIENT :
ENSEMBLE COUPE LONGITUDINALE LONGITUDINALE SECTION ASSEMBLY	No. : 53862-0
MACHINE : D2 L NV 3 Ph	CLIENT :

EN58 rev 1



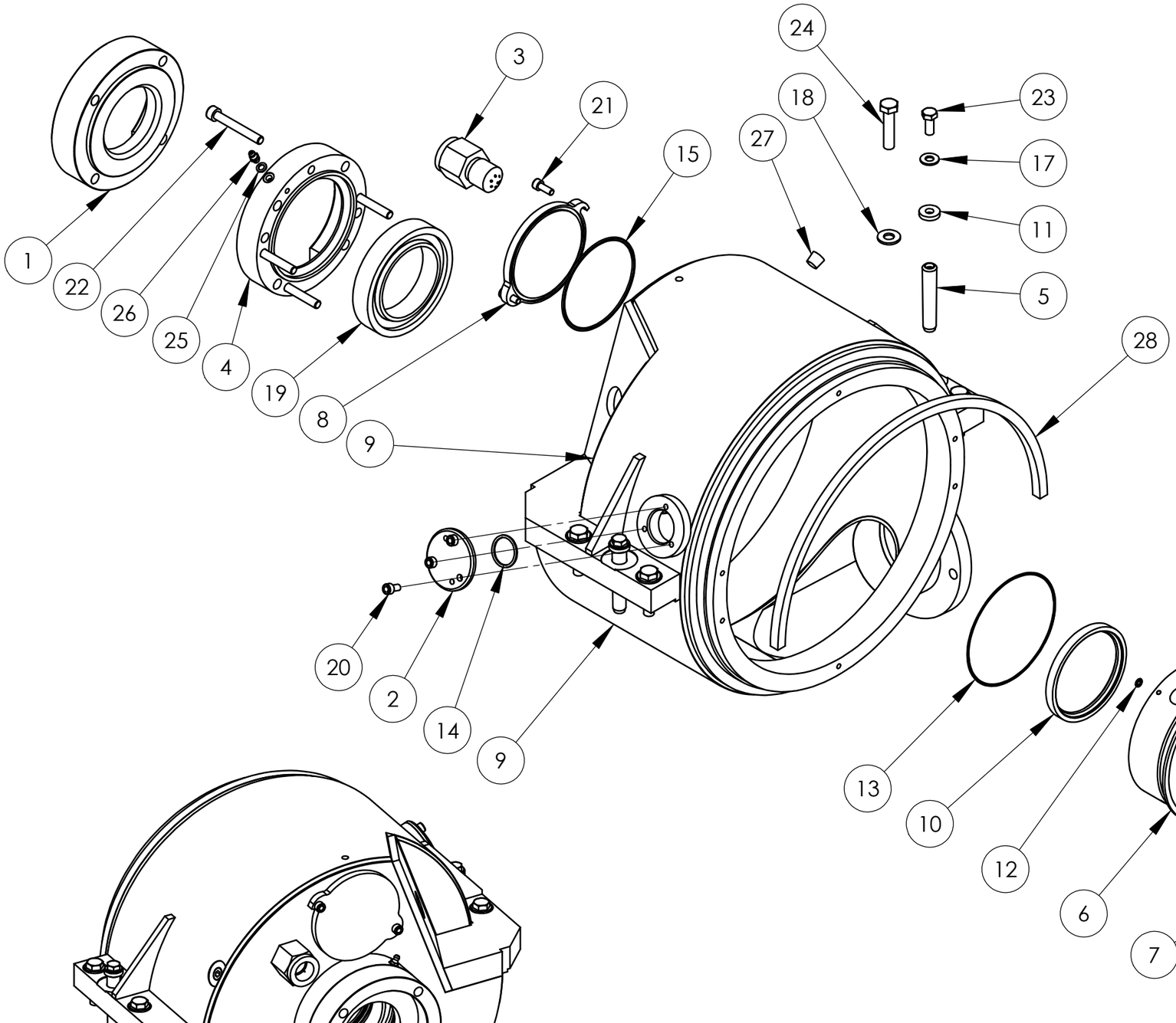
ANDRITZ SAS 2-4 Avenue de l'Europe 78140 VELIZY VILLACOUBLAY - FRANCE - ENVIRONMENT AND PROCESS TECHNOLOGIES	FOLIO : CLIENT :
ENSEMBLE BATI FRAME ASSEMBLY MACHINE : D2 L	No. : 48803-1 DATE : 08-07-11

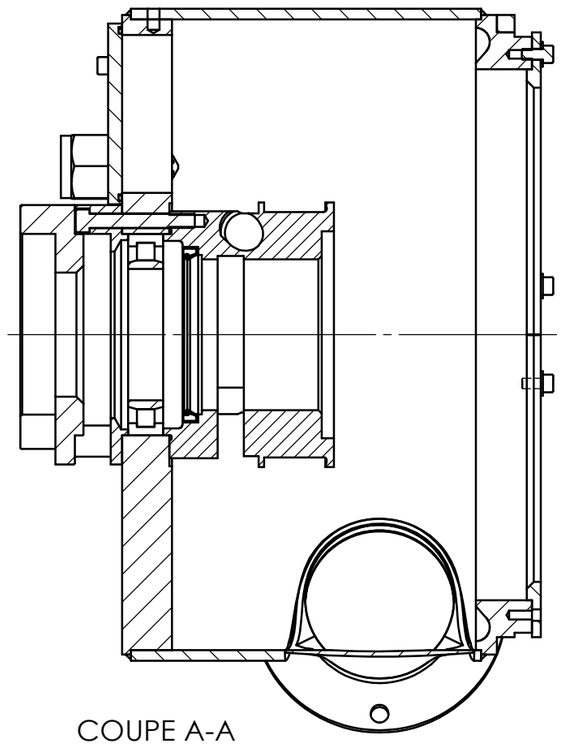
EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
D2 LC 30 C NV 48803-1

ANDRITZ Environment & Process

Level	FN	Qty	Name	Description (EN)	Description (FR)
0			**202510131**	**BASE FRAME SANITARY DEC-48803 D2L**	**BATI SANITAIRE DEC-48803 D2L**
.1	03-48803	1	202329807	BASE FRAME SANITARY DEC-48789 L 2000 W 661 H 330 MM D2L	BATI SANITAIRE DEC-48789 L 2000 W 661 H 330 MM D2L
.1	04-48803	1	201836472	PROTECTIVE ENCLOSURE DEC-41241 L 420 W 348 H 6.5 MM D2L-LL	ENCEINTE DE PROTECTION DEC-41241 L 420 W 348 H 6.5 MM D2L-LL
.1	07-48803	4	100002205	HEX NUT ISO4032 - M16 A2-50 ISO3506-2 AMC 1050 08 08 000	ECROU HEX ISO4032 - M16 A2-50 ISO3506-2 AMC 1050 08 08 000
.1	08-48803	1	202353475	SEALING TAPE CUTOUT / CUTOFF L 2300 MM	JOINT D'ETANCHEITE TAPE CUTOUT / CUTOFF L 2300 MM
.1	09-48803	4	100004668	PLAIN WASHER ISO7091 - 6 - 200HV A2 ISO3506-1 AMC 1990 02 00 000	RONDELLE PLATE ISO7091 - 6 - 200HV A2 ISO3506-1 AMC 1990 02 00 000
.1	13-48803	4	131042218	PLAIN WASHER ISO7090 - 16 - 200HV A2 ISO3506-1 AMC 1990 02 00 000	RONDELLE PLATE ISO7090 - 16 - 200HV A2 ISO3506-1 AMC 1990 02 00 000
.1	14-48803	1	131042279	HEX HEAD SCREW ISO4017 - M6X16 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M6X16 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	18-48803	4	131045659	HEX HEAD SCREW ISO4017 - M16X80 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M16X80 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	19-48803	1	131045569	HEX HEAD SCREW ISO4017 - M8X20 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M8X20 - A2-70 ISO3506-1 AMC 1050 02 07 000
0			**202518863**	**BASE FRAME ASSEMBLY D2 L SHIPMENT PARTS**	**CHASSIS ENSEMBLE D2 L SHIPMENT PARTS**
.1	01-48803	1	131198222	WATER COLLECTOR DEC-31879	COLLECTEUR D'EAU DEC-31879
.1	02-48803	4	201821544	ABSORBER ELEMENT DEC-35934	ELEMENT D'AMORTISSEUR DEC-35934
.1	05-48803	4	131204377	VIBRATION ABSORBER HUTCHINSON RUBBER (SUZHOU) 530613/45SH	AMORTISSEUR HUTCHINSON RUBBER (SUZHOU) 530613/45SH
.1	06-48803	4	100002235	HEX NUT ISO4032 - M8 A2-50 ISO3506-2 AMC 1050 08 08 000	ECROU HEX ISO4032 - M8 A2-50 ISO3506-2 AMC 1050 08 08 000
.1	10-48803	8	100004671	PLAIN WASHER ISO7091 - 8 - 200HV A2 ISO3506-1 AMC 1990 02 00 000	RONDELLE PLATE ISO7091 - 8 - 200HV A2 ISO3506-1 AMC 1990 02 00 000
.1	11-48803	8	100004621	PLAIN WASHER ISO7091 - 10 - 200HV A2 ISO3506-1 AMC 1990 02 00 000	RONDELLE PLATE ISO7091 - 10 - 200HV A2 ISO3506-1 AMC 1990 02 00 000
.1	12-48803	4	100004599	PLAIN WASHER ISO7090 - 12 - 200HV A2 ISO3506-1 AMC 1990 02 00 000	RONDELLE PLATE ISO7090 - 12 - 200HV A2 ISO3506-1 AMC 1990 02 00 000
.1	15-48803	4	131045570	HEX HEAD SCREW ISO4017 - M8X30 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M8X30 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	16-48803	8	131042306	HEX HEAD SCREW ISO4017 - M10X20 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M10X20 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	17-48803	4	131042310	HEX HEAD SCREW ISO4017 - M12X35 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M12X35 - A2-70 ISO3506-1 AMC 1050 02 07 000





COUPE A-A
ECHELLE 1 : 3.5

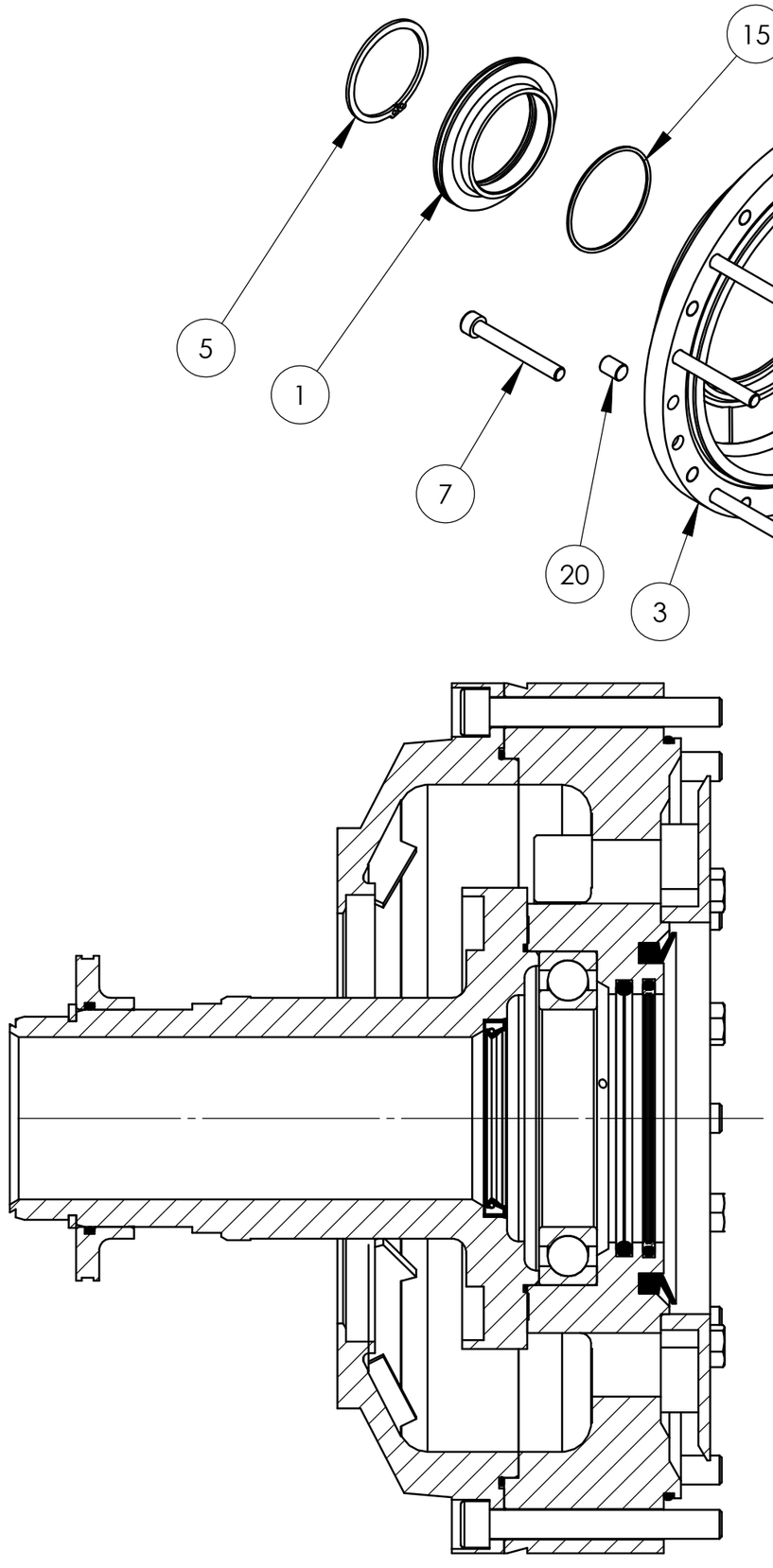
ANDRITZ SAS 2-4 Avenue de l'Europe 78140 VELIZY VILLACOUBLAY - FRANCE - ENVIRONMENT AND PROCESS TECHNOLOGIES	FOLIO : CLIENT :
ENSEMBLE PALIER ALIMENTATION - SANS SONDE FRONT PILLOW BLOCK ASSEMBLY - WITHOUT SENSOR MACHINE : D2 L	No. : 54196-0 DATE : 27-08-12

EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
D2L C 30 C NV Sa - 54196-0

ANDRITZ Environment & Process

Level	FN	Qty	Name	Description (EN)	Description (FR)
0			**202794705**	**FEED SIDE BEARING HOUSING DEC-54196 D2L NV SA**	**PALIER COTE ALIMENTATION DEC-54196 D2L NV SA**
.1	01-54196	1	201856052	FEED PIPE SUPPORT DEC-15209	SUPPORT TUBE ALIMENTATION DEC-15209
.1	02-54196	1	201828547	ACCESS DOOR DEC-15319	TRAPPE DE VISITE DEC-15319
.1	03-54196	1	201820532	SPRAY HEADER WASHING DEC-15454	RAMPE DE LAVAGE DE LAVAGE DEC-15454
.1	04-54196	1	201856058	CENTERING FLANGE DEC-21964	BRIDE DE CENTRAGE DEC-21964
.1	05-54196	2	201856059	POSITION PIN DEC-25090	GOUPILLE DE POSITION DEC-25090
.1	06-54196	1	201829216	SKIMMER HOUSING DEC-32412	PALIER D'ECUMOIRE DEC-32412
.1	07-54196	1	201829241	RING ON BEARING HOUSING DEC-32799	RING ON BEARING HOUSING DEC-32799
.1	08-54196	1	201988065	ACCESS DOOR FOR PLATES LEVEL DEC-48532 D2L-LL	TRAPPE DE VISITE POUR PLAQUETTES DE NIVEAU DEC-48532 D2L-LL
.1	09-54196	1	202329816	FEED SIDE BEARING HOUSING DEC-48790 L 450 W 400 H 234 MM D2L	PALIER ALIMENTATION / CARTER EFFLUENTS DEC-48790 L 450 W 400 H 234 MM D2L
.1	10-54196	1	131873064	ROTARY SHAFT SEAL DIN3760 - R -85X100X9 VITON DUPONT AMC 6007 00 00 000	BAGUE A LEVRES DIN3760 - R -85X100X9 VITON DUPONT AMC 6007 00 00 000
.1	11-54196	2	131127436	SEAL DEC-04144	JOINT D'ETANCHEITE DEC-04144
.1	12-54196	1	131128747	O-RING -4.47X1.78 NBR 70 SHORE A AMC 6001 00 00 000	JOINT TORIQUE -4.47X1.78 NBR 70 SHORE A AMC 6001 00 00 000
.1	13-54196	1	131750264	O-RING -107.67X1.78 VITON DUPONT 90 SHORE A AMC 6007 00 00 000	JOINT TORIQUE -107.67X1.78 VITON DUPONT 90 SHORE A AMC 6007 00 00 000
.1	14-54196	1	131750610	O-RING -26.64X2.66 VITON DUPONT 90 SHORE A AMC 6007 00 00 000	JOINT TORIQUE -26.64X2.66 VITON DUPONT 90 SHORE A AMC 6007 00 00 000
.1	15-54196	1	131751358	O-RING -88.57X2.62 VITON DUPONT AMC 6007 00 00 000	JOINT TORIQUE -88.57X2.62 VITON DUPONT AMC 6007 00 00 000
.1	16-54196	5	100004669	PLAIN WASHER ISO7091 - 6 - 200HV A4 ISO3506-1 AMC 1990 04 00 000	RONDELLE PLATE ISO7091 - 6 - 200HV A4 ISO3506-1 AMC 1990 04 00 000
.1	17-54196	2	100004672	PLAIN WASHER ISO7091 - 8 - 200HV A4 ISO3506-1 AMC 1990 04 00 000	RONDELLE PLATE ISO7091 - 8 - 200HV A4 ISO3506-1 AMC 1990 04 00 000
.1	18-54196	4	100004622	PLAIN WASHER ISO7091 - 10 - 200HV A4 ISO3506-1 AMC 1990 04 00 000	RONDELLE PLATE ISO7091 - 10 - 200HV A4 ISO3506-1 AMC 1990 04 00 000
.1	19-54196	1	131198076	ROLLER BEARING NSK - NU1015J/C3	ROLLER BEARING NSK - NU1015J/C3
.1	20-54196	8	100020397	SOCKET HEAD CAP SCREW ISO4762 - M6X12 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M6X12 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	21-54196	2	100020211	SOCKET HEAD CAP SCREW ISO4762 - M6X16 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M6X16 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	22-54196	4	131045964	SOCKET HEAD CAP SCREW ISO4762 - M8X60 - A4-80 ISO3506-1 AMC 1000 03 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M8X60 - A4-80 ISO3506-1 AMC 1000 03 07 000
.1	23-54196	2	100003158	HEX HEAD SCREW ISO4017 - M8X20 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M8X20 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	24-54196	4	100020318	SOCKET HEAD CAP SCREW ISO4762 - M10X60 - A4-80 ISO3506-1 AMC 1000 03 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M10X60 - A4-80 ISO3506-1 AMC 1000 03 07 000
.1	25-54196	1	131945141	SEAL TRELLEBORG GM500 / U-SEAL DDM000067 - 4V4E D6.7X10X1MM 316 / FKM 75 SHORE A AMC 60	JOINT D'ETANCHEITE TRELLEBORG GM500 / U-SEAL DDM000067 - 4V4E D6.7X10X1MM 316 / FKM 75 S
.1	26-54196	1	131130248	GREASE NIPPLE ALGI 7014006	GRAISSEUR ALGI 7014006
.1	27-54196	1	131198075	PLUG KAPSTO K-GPN720/1602-1/4" 18NPT	BOUCHON KAPSTO K-GPN720/1602-1/4" 18NPT
.1	28-54196	1	202794717	SEALING TAPE CUTOUT/CUTOFF ATC SILICON 10 X 10 255 KG/M3 L 1000 MM	JOINT D'ETANCHEITE CUTOUT/CUTOFF ATC SILICON 10 X 10 255 KG/M3 L 1000 MM

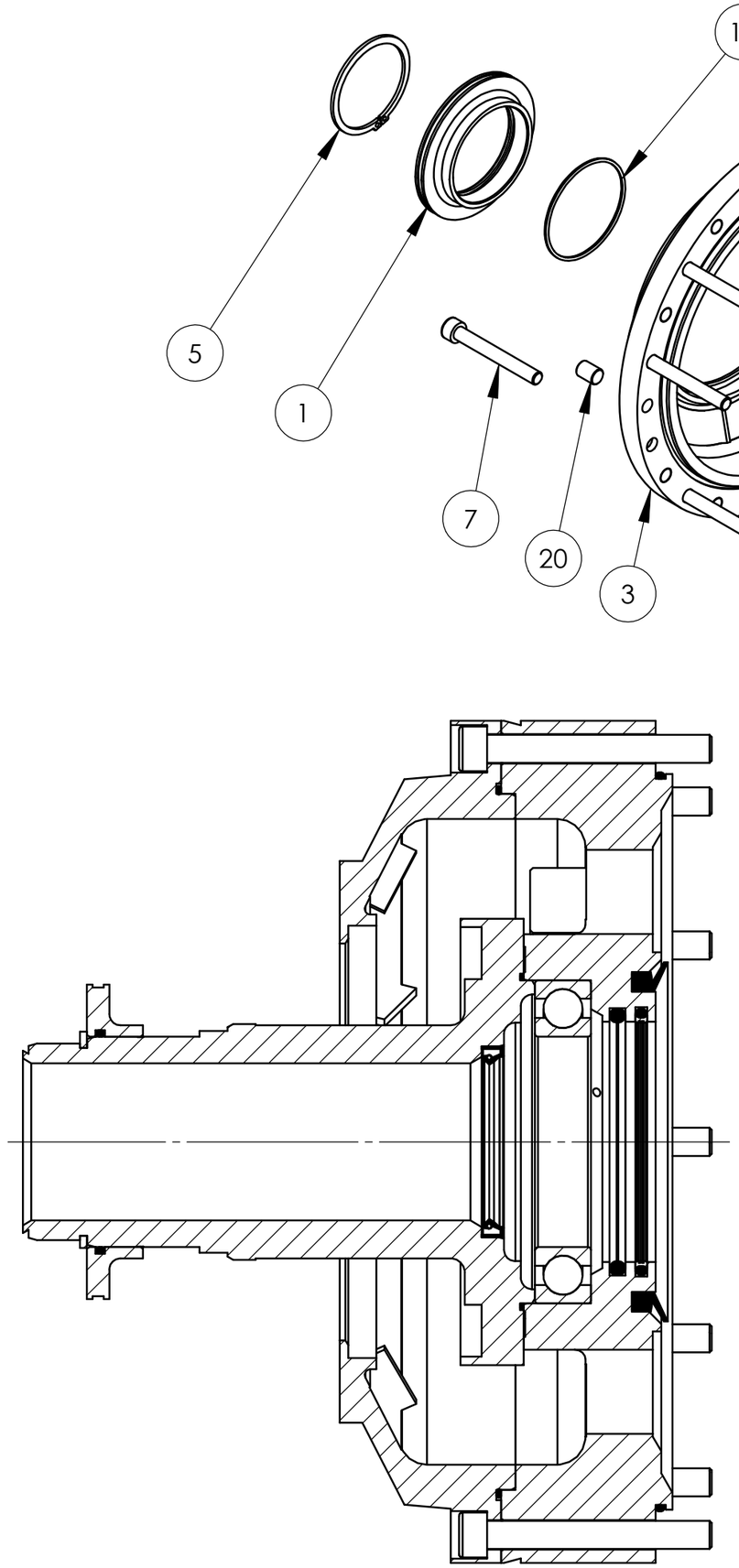


ANDRITZ SAS 2-4 Avenue de l'Europe 78140 VELIZY VILLACOUBLAY - FRANCE - ENVIRONMENT AND PROCESS TECHNOLOGIES	FOLIO : CLIENT :
ENSEMBLE EVACUATION EFFLUENTS 3 PH EFFLUENT EVACUATION ASSEMBLY 3 PH MACHINE : D2 L	No. : 53863-0 DATE : 25-04-12

EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
D2 LC 30 C NV Sa 3PH 53863-0

Level	FN	Qty	Name	Description (EN)	Description (FR)
0			**202721244**	**EXTERNAL BOWL LIQUIDE END ASSEMBLY DEC-53863 D2L NV SA 3PH**	**BOL COTE EFFLUENT DEC-53863 D2L NV SA 3PH**
.1	01-53863	1	131194065	DEFLECTOR DEC-15210	DEFLECTEUR DEC-15210
.1	02-53863	1	202379228	HUB BOWL NV SANITARY DEC-32434 D 159 T 183	MOYEU BOL NV SANITAIRE DEC-32434 D 159 T 183
.1	03-53863	1	201829221	COVER FOR CENTRIPETAL PUMP DEC-32442	COUVERCLE DE POMPE CENTRIPETE DEC-32442
.1	04-53863	1	202721176	FRONT WALL PLATE DEC-32427 D2 L Sa 3PH	PLATEAU BOL DEC-32427 D2 L Sa 3PH
.1	05-53863	1	100022179	RETAINING RING DIN471 -70X2.5 AMC 3100 00 00 000	CIRCLIP DIN471 -70X2.5 AMC 3100 00 00 000
.1	06-53863	1	131828678	SEAL SIMRIT USIT RING D10,7X16X1,5MM AMC 6007 00 00 000	JOINT D'ETANCHEITE SIMRIT USIT RING D10,7X16X1,5MM AMC 6007 00 00 000
.1	07-53863	12	131544185	SOCKET HEAD CAP SCREW ISO4762 - M10X80 - A4-80 ISO3506-1 AMC 1000 03 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M10X80 - A4-80 ISO3506-1 AMC 1000 03 07 000
.1	08-53863	6	100020375	SOCKET HEAD CAP SCREW ISO4762 - M8X25 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M8X25 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	09-53863	1	100020378	SOCKET HEAD CAP SCREW ISO4762 - M10X20 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M10X20 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	10-53863	1	131752555	DEEP GROOVE BALL BEARING DIN625-1 6015/C3 SKF 6015/C3 ID=75 OD=115 W=20	ROULEMENT A BILLE A GORGE PROFONDE DIN625-1 6015/C3 SKF 6015/C3 ID=75 OD=115 W=20
.1	19-53863	7	131325087	SET SCREW ISO4026 - M10X50 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS DE PRESSION ISO4026 - M10X50 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	20-53863	12	131874269	SET SCREW ISO4026 - M12X12 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS DE PRESSION ISO4026 - M12X12 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	22-53863	1	201829220	WEIR RING DEC-32435	WEIR RING DEC-32435
.1	23-53863	8	100003791	HEX HEAD SCREW ISO4017 - M8X25 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M8X25 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	24-53863	4	202721249	LEVEL NOZZLE DEC-32591	BUSE DE REGLAGE DE NIVEAU DEC-32591
0			**202721239**	**EXTERNAL BOWL PRODUCT RELATED SEALS DEC-53863 D2L NV SA**	**BOL EN CONTACT AVEC LE PRODUIT DEC-53863 D2L NV SA**
.1	11-53863	1	131750242	ROTARY SHAFT SEAL DIN3760 A - 55X68X8 VITON DUPONT AMC 6007 00 00 000	BAGUE A LEVRES DIN3760 A - 55X68X8 VITON DUPONT AMC 6007 00 00 000
.1	12-53863	1	131829414	TURCON-GLYD-RING FRANCE JOINT SAS B-TG3200850-T10	JOINT ROTO GLYD FRANCE JOINT SAS B-TG3200850-T10
.1	13-53863	1	131170929	V-RING-V-A-110 VITON DUPONT AMC 6007 00 00 000	JOINT V-RING-V-A-110 VITON DUPONT AMC 6007 00 00 000
.1	14-53863	1	131750264	O-RING -107.67X1.78 VITON DUPONT 90 SHORE A AMC 6007 00 00 000	JOINT TORIQUE -107.67X1.78 VITON DUPONT 90 SHORE A AMC 6007 00 00 000
.1	15-53863	1	131572538	O-RING -75.87X2.65 VITON DUPONT AMC 6007 00 00 000	JOINT TORIQUE -75.87X2.65 VITON DUPONT AMC 6007 00 00 000
.1	16-53863	2	131694681	O-RING -247.32X2.65 VITON DUPONT 70 SHORE A AMC 6007 00 00 000	JOINT TORIQUE -247.32X2.65 VITON DUPONT 70 SHORE A AMC 6007 00 00 000
.1	17-53863	1	131751415	O-RING -88.49X3.53 VITON DUPONT AMC 6007 00 00 000	JOINT TORIQUE -88.49X3.53 VITON DUPONT AMC 6007 00 00 000
.1	18-53863	1	131868620	O-RING -88.3X5.33 HNBR 90 SHORE A AMC 6002 00 00 000	JOINT TORIQUE -88.3X5.33 HNBR 90 SHORE A AMC 6002 00 00 000
.1	21-53863	4	131750607	O-RING -21.89X2.62 VITON DUPONT 90 SHORE A AMC 6007 00 00 000	JOINT TORIQUE -21.89X2.62 VITON DUPONT 90 SHORE A AMC 6007 00 00 000
.1	25-53863	4	131750256	O-RING -12.42X1.78 VITON DUPONT 90 SHORE A AMC 6007 00 00 000	JOINT TORIQUE -12.42X1.78 VITON DUPONT 90 SHORE A AMC 6007 00 00 000

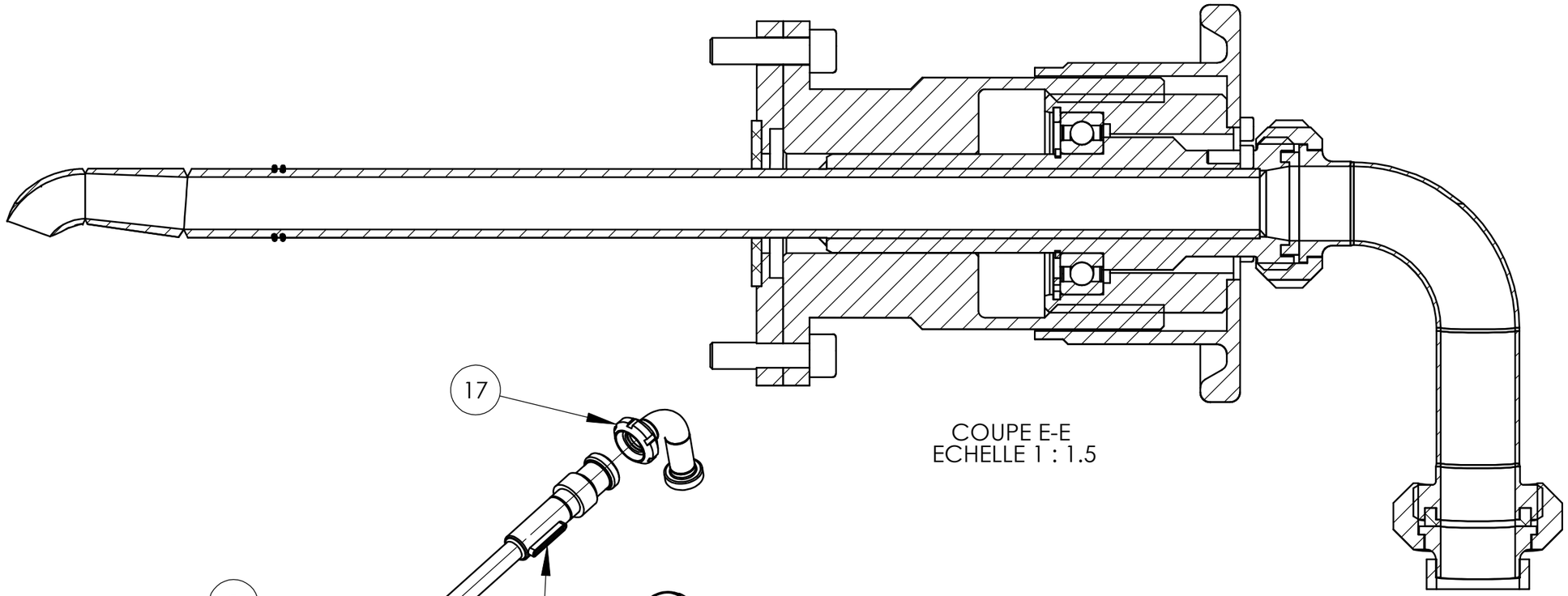


ANDRITZ SAS 2-4 Avenue de l'Europe 78140 VELIZY VILLACOUBLAY - FRANCE - ENVIRONMENT AND PROCESS TECHNOLOGIES	FOLIO : CLIENT :
ENSEMBLE EVACUATION EFFLUENTS 2 PH EFFLUENT EVACUATION ASSEMBLY 2 PH MACHINE : D2 L	No. : 51673-1 DATE : 25-04-12

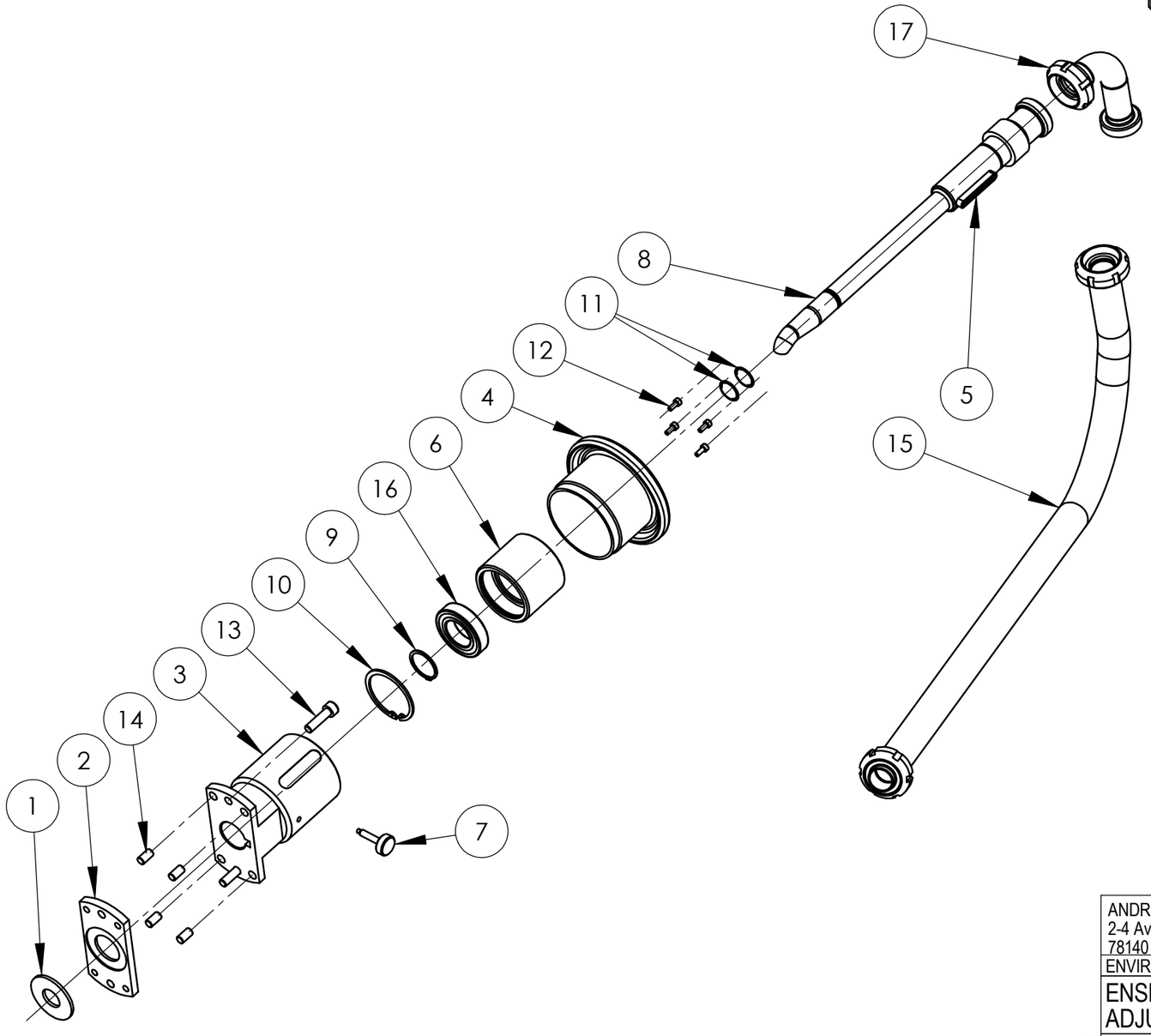
EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
D2 LC 30 C NV Sa 51673-1

Level	FN	Qty	Name	Description (EN)	Description (FR)
0			**202355581**	**EXTERNAL BOWL LIQUIDE END ASSEMBLY DEC-51673 D2L NV SA**	**BOL COTE EFFLUENT DEC-51673 D2L NV SA**
.1	01-51673	1	131194065	DEFLECTOR DEC-15210	DEFLECTEUR DEC-15210
.1	02-51673	1	202379228	HUB BOWL NV SANITARY DEC-32434 D 159 T 183	MOYEU BOL NV SANITAIRE DEC-32434 D 159 T 183
.1	03-51673	1	201829221	COVER FOR CENTRIPETAL PUMP DEC-32442	COUVERCLE DE POMPE CENTRIPETE DEC-32442
.1	04-51673	1	201824631	FRONT WALL PLATE DEC-51545 L 61 D 300 MM	PLATEAU BOL DEC-51545 L 61 D 300 MM
.1	05-51673	1	100022179	RETAINING RING DIN471 -70X2.5 AMC 3100 00 00 000	CIRCLIP DIN471 -70X2.5 AMC 3100 00 00 000
.1	06-51673	1	131828678	SEAL SIMRIT USIT RING D10,7X16X1,5MM AMC 6007 00 00 000	JOINT D'ETANCHEITE SIMRIT USIT RING D10,7X16X1,5MM AMC 6007 00 00 000
.1	07-51673	12	131544185	SOCKET HEAD CAP SCREW ISO4762 - M10X80 - A4-80 ISO3506-1 AMC 1000 03 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M10X80 - A4-80 ISO3506-1 AMC 1000 03 07 000
.1	08-51673	6	100020375	SOCKET HEAD CAP SCREW ISO4762 - M8X25 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M8X25 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	09-51673	1	100020378	SOCKET HEAD CAP SCREW ISO4762 - M10X20 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M10X20 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	10-51673	1	131752555	DEEP GROOVE BALL BEARING DIN625-1 6015/C3 SKF 6015/C3 ID=75 OD=115 W=20	ROULEMENT A BILLE A GORGE PROFONDE DIN625-1 6015/C3 SKF 6015/C3 ID=75 OD=115 W=20
.1	19-51673	12	131325087	SET SCREW ISO4026 - M10X50 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS DE PRESSION ISO4026 - M10X50 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	20-51673	12	131874269	SET SCREW ISO4026 - M12X12 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS DE PRESSION ISO4026 - M12X12 - A2-70 ISO3506-1 AMC 1050 02 07 000
0			**202355736**	**EXTERNAL BOWL PRODUCT RELATED SEALS DEC-51673 D2L NV SA**	**BOL EN CONTACT AVEC LE PRODUIT DEC-51673 D2L NV SA**
.1	11-51673	1	131750242	ROTARY SHAFT SEAL DIN3760 A - 55X68X8 VITON DUPONT AMC 6007 00 00 000	BAGUE A LEVRES DIN3760 A - 55X68X8 VITON DUPONT AMC 6007 00 00 000
.1	12-51673	1	131829414	TURCON-GLYD-RING FRANCE JOINT SAS B-TG3200850-T10	JOINT ROTO GLYD FRANCE JOINT SAS B-TG3200850-T10
.1	13-51673	1	131170929	V-RING-V-A-110 VITON DUPONT AMC 6007 00 00 000	JOINT V-RING-V-A-110 VITON DUPONT AMC 6007 00 00 000
.1	14-51673	1	131750264	O-RING -107.67X1.78 VITON DUPONT 90 SHORE A AMC 6007 00 00 000	JOINT TORIQUE -107.67X1.78 VITON DUPONT 90 SHORE A AMC 6007 00 00 000
.1	15-51673	1	131572538	O-RING -75.87X2.65 VITON DUPONT AMC 6007 00 00 000	JOINT TORIQUE -75.87X2.65 VITON DUPONT AMC 6007 00 00 000
.1	16-51673	2	131694681	O-RING -247.32X2.65 VITON DUPONT 70 SHORE A AMC 6007 00 00 000	JOINT TORIQUE -247.32X2.65 VITON DUPONT 70 SHORE A AMC 6007 00 00 000
.1	17-51673	1	131751415	O-RING -88.49X3.53 VITON DUPONT AMC 6007 00 00 000	JOINT TORIQUE -88.49X3.53 VITON DUPONT AMC 6007 00 00 000
.1	18-51673	1	131868620	O-RING -88.3X5.33 HNBR 90 SHORE A AMC 6002 00 00 000	JOINT TORIQUE -88.3X5.33 HNBR 90 SHORE A AMC 6002 00 00 000



COUPE E-E
ECHELLE 1 : 1.5



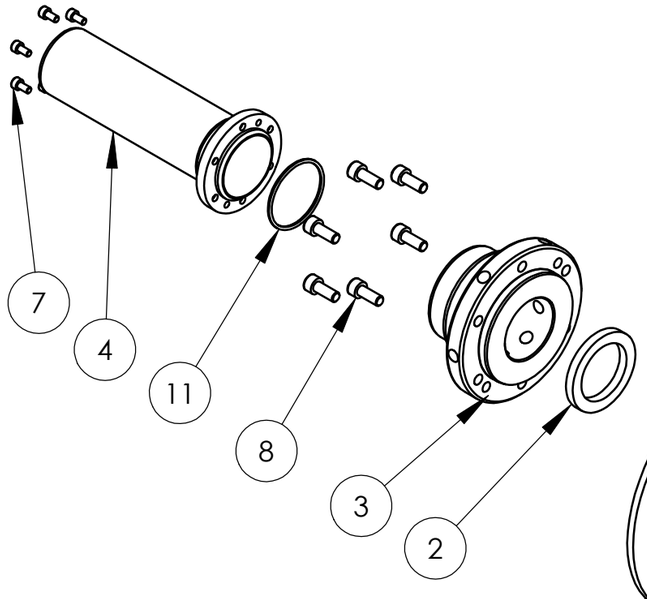
ANDRITZ SAS 2-4 Avenue de l'Europe 78140 VELIZY VILLACOUBLAY - FRANCE - ENVIRONMENT AND PROCESS TECHNOLOGIES	FOLIO : CLIENT :
ENSEMBLE POMPE NIVEAU VARIABLE ADJUSTABLE CENTRIPETAL PUMP ASSEMBLY MACHINE : D2 L	No. : 32973-2 DATE : 08-07-11

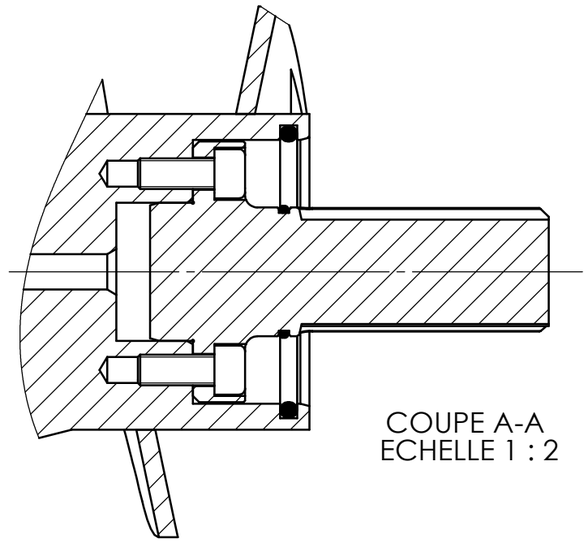
EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
D2 LC 30 C NV (Sa) 32973-2

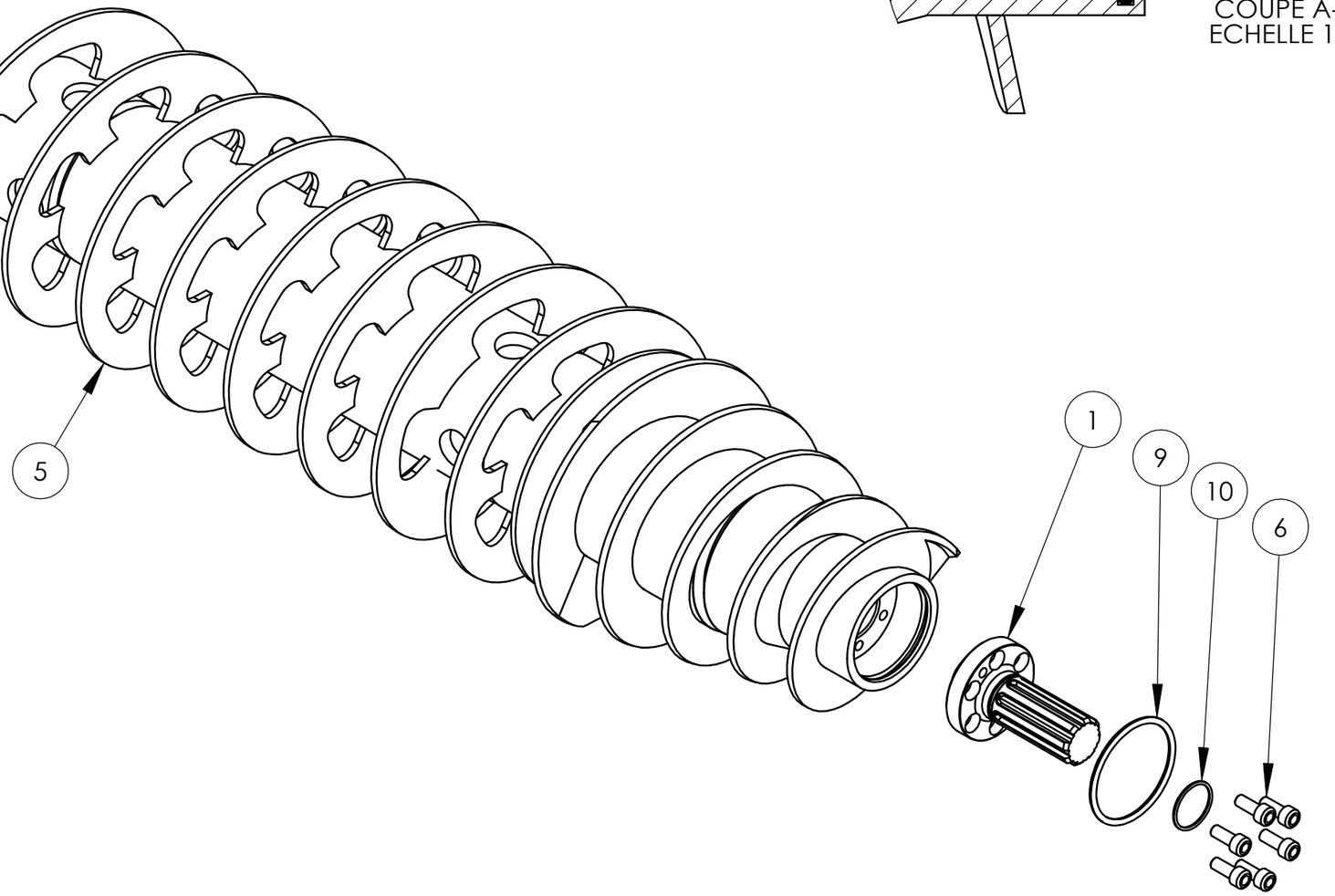
ANDRITZ Environment & Process

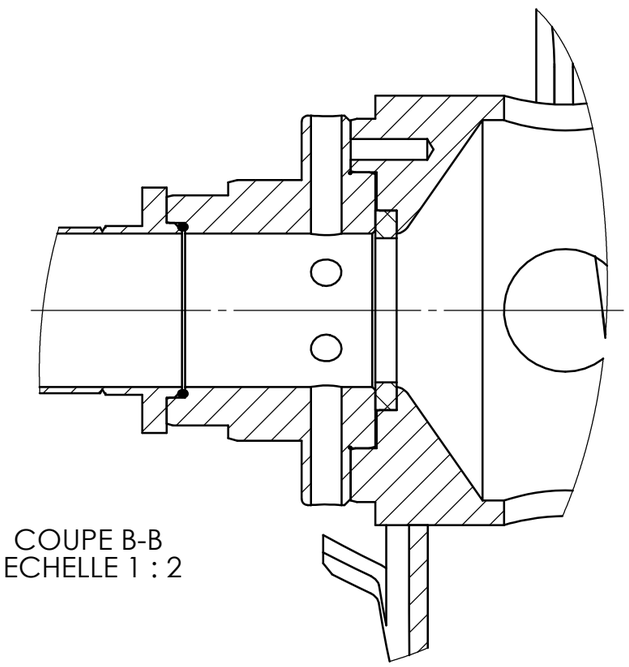
Level	FN	Qty	Name	Description (EN)	Description (FR)
0			**202351661**	**EXTERNAL BOWL LIQUIDE END ASSEMBLY DEC-32973 D2L**	**BOL COTE EFFLUENT DEC-32973 D2L**
.1	01-32973	1	201828293	GASKET DEC-22020	JOINT PLAT DEC-22020
.1	02-32973	1	201828713	SPACER DEC-21959	ENTRETOISE DEC-21959
.1	03-32973	1	201828972	HUB THREADED DEC-29385	HUB THREADED DEC-29385
.1	04-32973	1	201828973	HAND WHEEL DEC-29386	HAND WHEEL DEC-29386
.1	05-32973	1	201828974	PARALLEL KEY DEC-29387	CLAVETTE PARALLELE DEC-29387
.1	06-32973	1	201828975	SUPPORTING BOLT DEC-29388	VIS DE SOUTIEN DEC-29388
.1	07-32973	1	201820831	SET SCREW DEC-22019	SET SCREW DEC-22019
.1	08-32973	1	202410815	PUMP CENTRIPETAL DEC-52032 D 40 T 388.5 D2L-LL	POMPE CENTRIPETE DEC-52032 D 40 T 388.5 D2L-LL
.1	09-32973	1	100022174	RETAINING RING DIN471 - 30X1.5 SPRING STEEL AMC 3100 00 00 000	CIRCLIP DIN471 - 30X1.5 SPRING STEEL AMC 3100 00 00 000
.1	10-32973	1	131045742	RETAINING RING DIN472 - 55X2 STEEL AMC 3990 00 00 000	CIRCLIP DIN472 - 55X2 STEEL AMC 3990 00 00 000
.1	11-32973	2	131802874	O-RING -9.25X1.78 VITON DUPONT 90 SHORE A AMC 6007 00 00 000	JOINT TORIQUE -9.25X1.78 VITON DUPONT 90 SHORE A AMC 6007 00 00 000
.1	12-32973	4	131122217	SOCKET HEAD CAP SCREW ISO4762 - M4X10 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M4X10 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	13-32973	2	131044467	SOCKET HEAD CAP SCREW ISO4762 - M8X30 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M8X30 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	14-32973	4	131538070	SET SCREW ~ISO4026 - M8X15 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS DE PRESSION ~ISO4026 - M8X15 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	15-32973	1	202371900	FLEXIBLE CONNECTION SANITARY DEC-54475 L800mm SMS union DN25 D2LNV	CONNEXION FLEXIBLE SANITARY DEC-54475 L800mm SMS union DN25 D2LNV
.1	16-32973	1	131243830	DEEP GROOVE BALL BEARING DIN625-1 6006-2RS1 SKF 6006-2RS1 ID=30 OD=55 W=13	ROULEMENT A BILLE A GORGE PROFONDE DIN625-1 6006-2RS1 SKF 6006-2RS1 ID=30 OD=55 W=13
.1	17-32973	1	202410802	ELBOW FITTINGS WITH SMS TO PUMP DEC-52031 D2L	ELBOW FITTINGS WITH SMS TO PUMP DEC-52031 D2L





COUPE A-A
ECHELLE 1 : 2





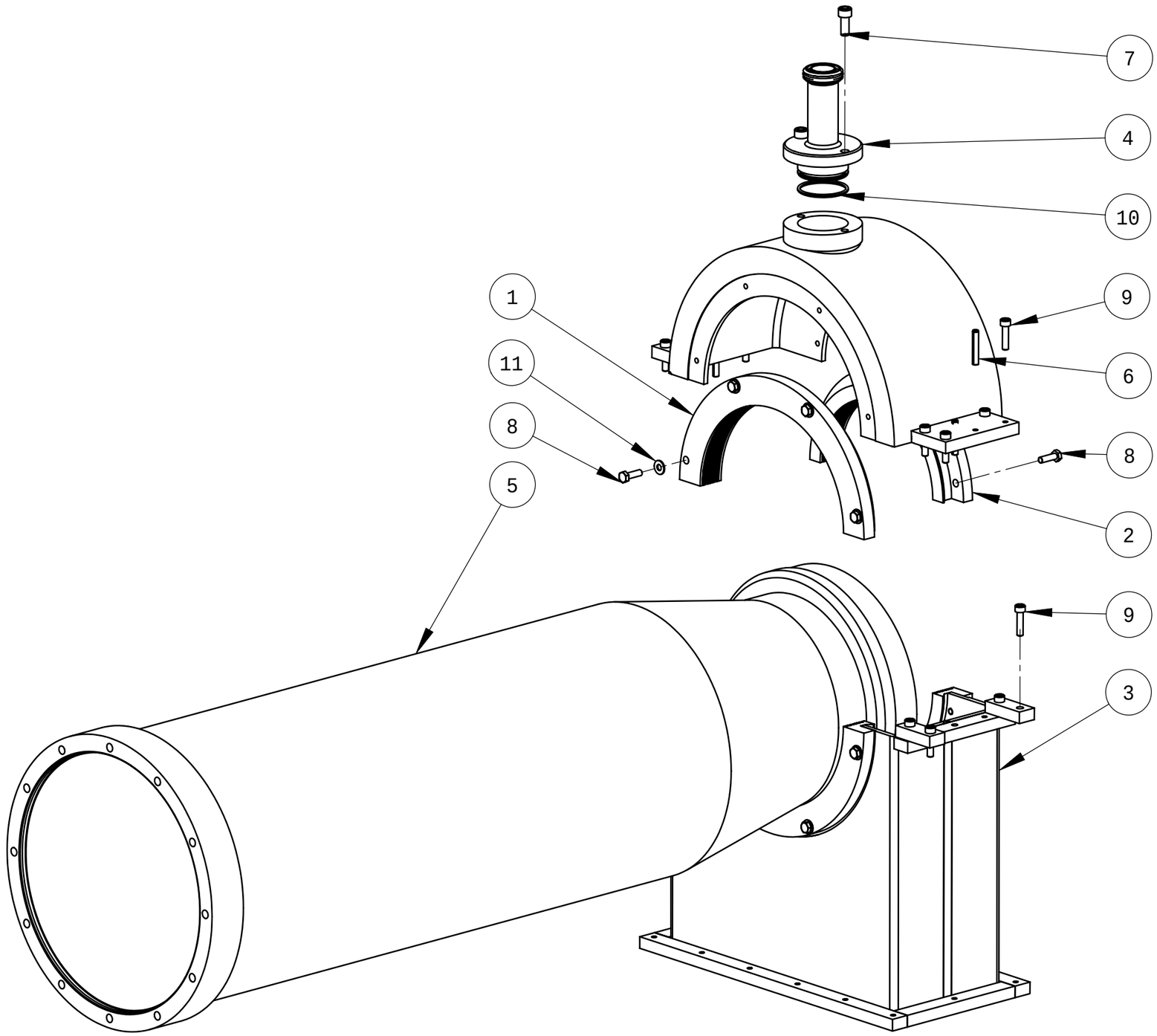
COUPE B-B
ECHELLE 1 : 2

ANDRITZ SAS 2-4 Avenue de l'Europe 78140 VELIZY VILLACOUBLAY - FRANCE - ENVIRONMENT AND PROCESS TECHNOLOGIES	FOLIO : CLIENT :
ENSEMBLE VIS CONVOYEUSE 11° 11° SCREW CONVEYOR ASSEMBLY	No. : 53923-0 DATE : 24-04-12
MACHINE : D2 L	

EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
D2 LC 30 NV Sa 53923-0

Level	FN	Qty	Name	Description (EN)	Description (FR)
0			**202714492**	**SCREW CONVEYOR ASSEMBLY DEC-53923 D2 L Sa**	**VIS CONVOYEUSE ENSEMBLE DEC-53923 D2 L Sa**
.1	01-53923	1	201820413	TRUNNION GROOVED DEC-12156	ARBRE D'UNION / TOURILLON CANNELE DEC-12156
.1	02-53923	1	131193979	TEFLON RING DEC-15041	BAGUE TEFLON DEC-15041
.1	03-53923	1	201820506	HUB SCREW CONVEYOR DEC-15204	HUB SCREW CONVEYOR DEC-15204
.1	04-53923	1	201820827	SLEEVE SCREW CONVEYOR HUB DEC-22000	SLEEVE SCREW CONVEYOR HUB DEC-22000
.1	05-53923	1	202720199	SCREW CONVEYOR DEC-53870 D2 L Sa	VIS CONVOYEUSE DEC-53870 D2 L Sa
.1	06-53923	6	131754608	SOCKET HEAD CAP SCREW DIN6912 - M10X25 - A4-80 ISO3506-1 AMC 1000 03 07 000	VIS TETE CYL. A SIX PANS CREUX DIN6912 - M10X25 - A4-80 ISO3506-1 AMC 1000 03 07 000
.1	07-53923	6	131752328	SOCKET HEAD CAP SCREW ISO4762 - M5X10 - A4-80 ISO3506-1 AMC 1000 03 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M5X10 - A4-80 ISO3506-1 AMC 1000 03 07 000
.1	08-53923	6	100020212	SOCKET HEAD CAP SCREW ISO4762 - M8X20 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M8X20 - A4-70 ISO3506-1 AMC 1000 02 07 000
0			**202352080**	**SCREW CONVEYOR PRODUCT RELATED SEALS D2L-LL**	**VIS CONVOYEUSE JOINTS SUR PRODUIT D2L-LL**
.1	09-53923	1	131751296	O-RING -36.17X2.62 VITON DUPONT AMC 6007 00 00 000	JOINT TORIQUE -36.17X2.62 VITON DUPONT AMC 6007 00 00 000
.1	10-53923	1	131751352	O-RING -52.07X2.62 VITON DUPONT AMC 6007 00 00 000	JOINT TORIQUE -52.07X2.62 VITON DUPONT AMC 6007 00 00 000
.1	11-53923	1	131749880	O-RING -88.3X5.33 VITON DUPONT AMC 6007 00 00 000	JOINT TORIQUE -88.3X5.33 VITON DUPONT AMC 6007 00 00 000



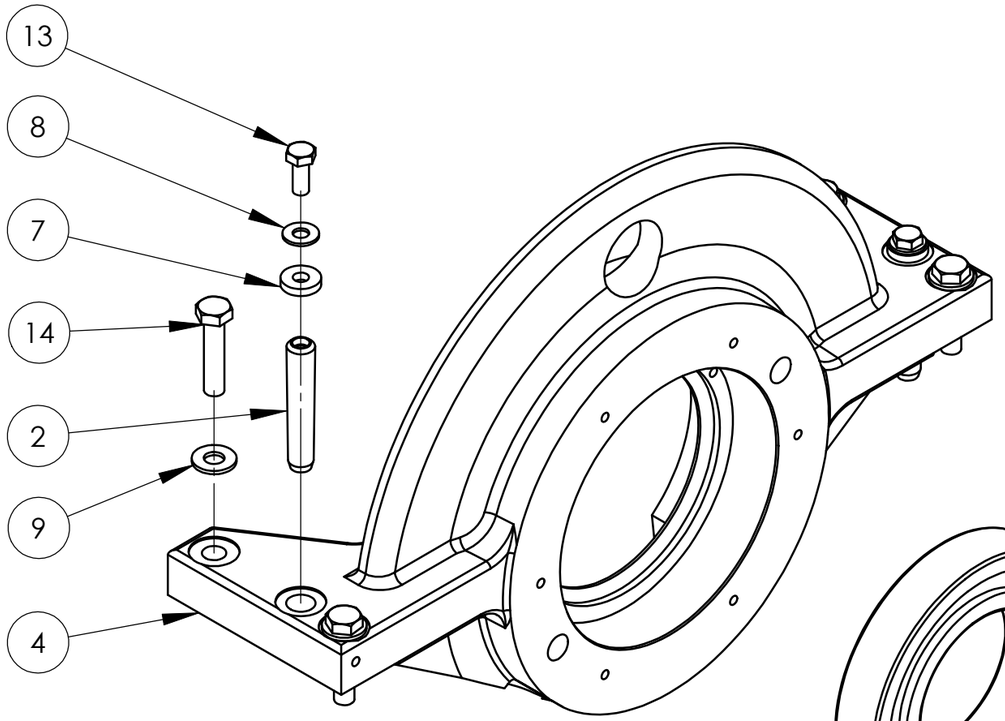
ANDRITZ SAS 2-4 Avenue de l'Europe 78140 VELIZY VILLACOUBLAY - FRANCE - ENVIRONMENT AND PROCESS TECHNOLOGIES	FOLIO : CLIENT :
ENSEMBLE BOL 11° 11° BOWL ASSEMBLY MACHINE : D2 L	No. : 51674-0 DATE : 09/10/08

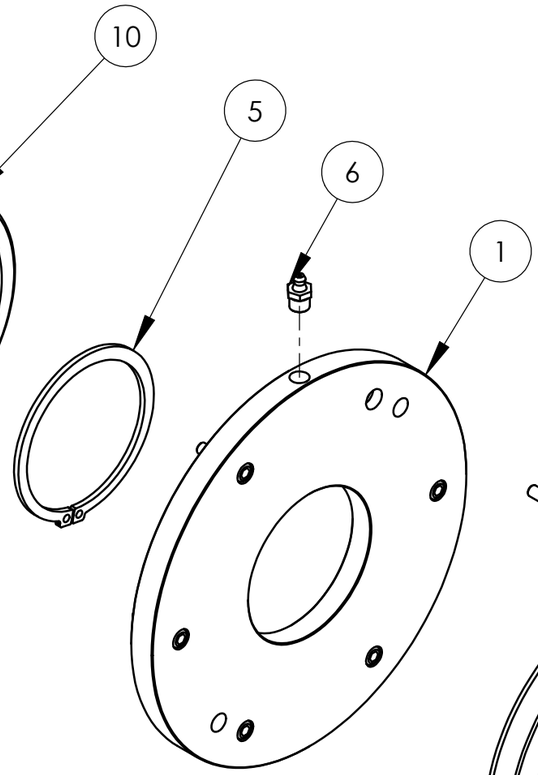
EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
D2L C30C NV Sa - 51674-0

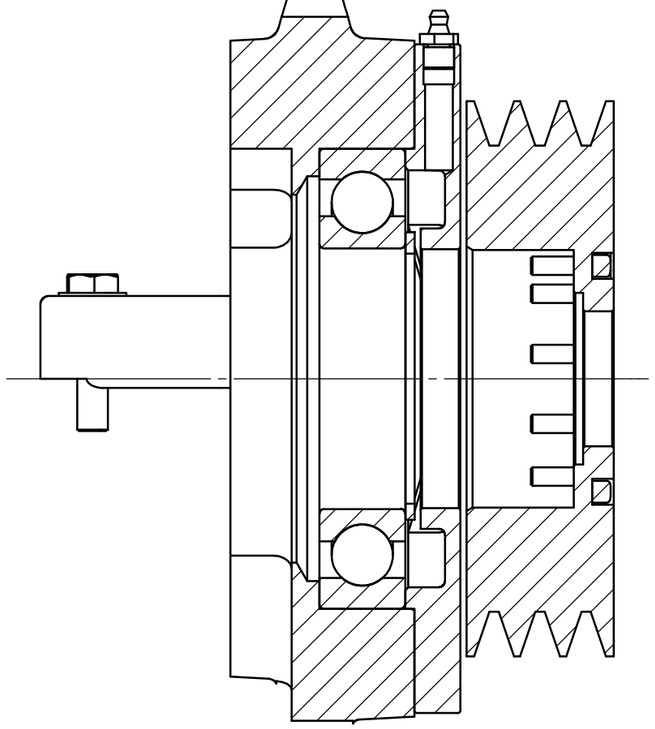
ANDRITZ Environment & Process

Level	FN	Qty	Name	Description (EN)	Description (FR)
0			202356374	EXTERNAL BOWL DEC-51674 D2L NV SA	BOL DEC-51674 D2L NV SA
.1	01-51674	1	201822297	SEALING RING DEC-32395 D 270 T 28 D2L-LL	BAGUE D'ETANCHEITE DEC-32395 D 270 T 28 D2L-LL
.1	02-51674	1	202369602	SEALING RING DEC-32396 D 200 T 28 D2L-LL	BAGUE D'ETANCHEITE DEC-32396 D 200 T 28 D2L-LL
.1	03-51674	1	201829236	SEDIMENT CASING DEC-32620	CARTER SEDIMENT DEC-32620
.1	04-51674	1	202356627	FLANGE FOR WASHING SEDIMENTCASING DEC-32649 D 78 T 120 D2L NV sa	BRIDE POUR LAVAGE CARTER SEDIMENT DEC-32649 D 78 T 120 D2L NV sa
.1	05-51674	1	202434664	CONICAL BOWL 11° SANITARY DEC-52101 D2L D 300 T 967	BOL CONIQUE 11° SANITAIRE DEC-52101 D2L D 300 T 967
.1	06-51674	4	131398147	SPRING TYPE STRAIGHT PIN ~ISO8752 - 6X35 A2 ISO3506-1 AMC 1990 02 00 000	GOUPILLES CYLINDRIQUES CREUSES ~ISO8752 - 6X35 A2 ISO3506-1 AMC 1990 02 00 000
.1	07-51674	2	100020212	SOCKET HEAD CAP SCREW ISO4762 - M8X20 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M8X20 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	08-51674	16	100003153	HEX HEAD SCREW ISO4017 - M6X20 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M6X20 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	09-51674	16	100020208	SOCKET HEAD CAP SCREW ISO4762 - M6X25 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M6X25 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	11-51674	16	100004669	PLAIN WASHER ISO7091 - 6 - 200HV A4 ISO3506-1 AMC 1990 04 00 000	RONDELLE PLATE ISO7091 - 6 - 200HV A4 ISO3506-1 AMC 1990 04 00 000
0			202356655	EXTERNAL BOWL PRODUCT RELATED SEALS D4L-LL D2L NV SA	BOL EN CONTACT AVEC LE PRODUIT D2L NV SA
.1	10-51674	1	131751298	O-RING -42.52X2.65 VITON DUPONT AMC 6007 00 00 000	JOINT TORIQUE -42.52X2.65 VITON DUPONT AMC 6007 00 00 000





COUPE A-A
ECHELLE 1 : 2



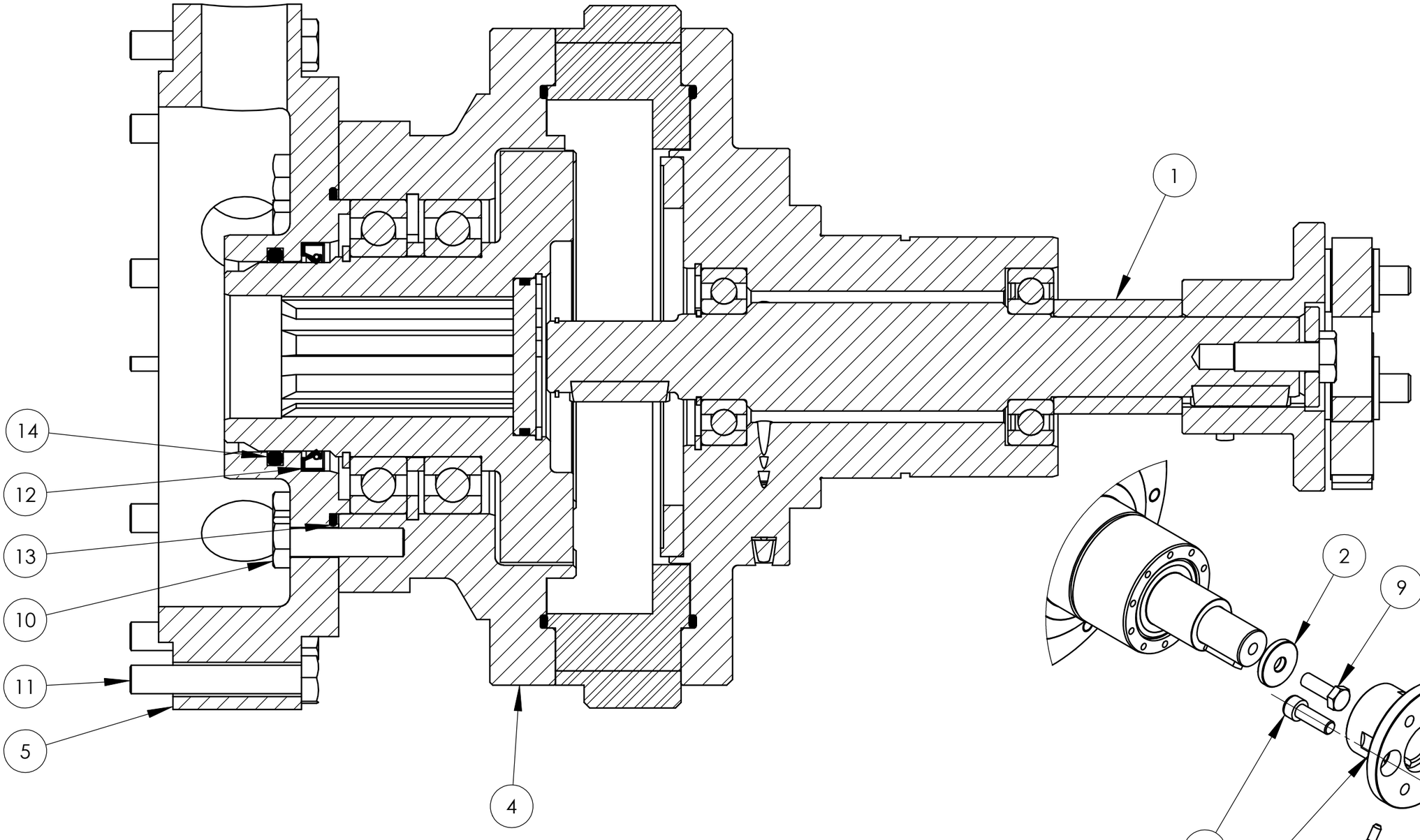
ANDRITZ SAS 2-4 Avenue de l'Europe 78140 VELIZY VILLACOUBLAY - FRANCE - ENVIRONMENT AND PROCESS TECHNOLOGIES	FOLIO : CLIENT :
ENSEMBLE PALIER REDUCTEUR REAR PILLOW BLOCK ASSEMBLY MACHINE : D2 L	No. : 51675-1 DATE : 12-07-11

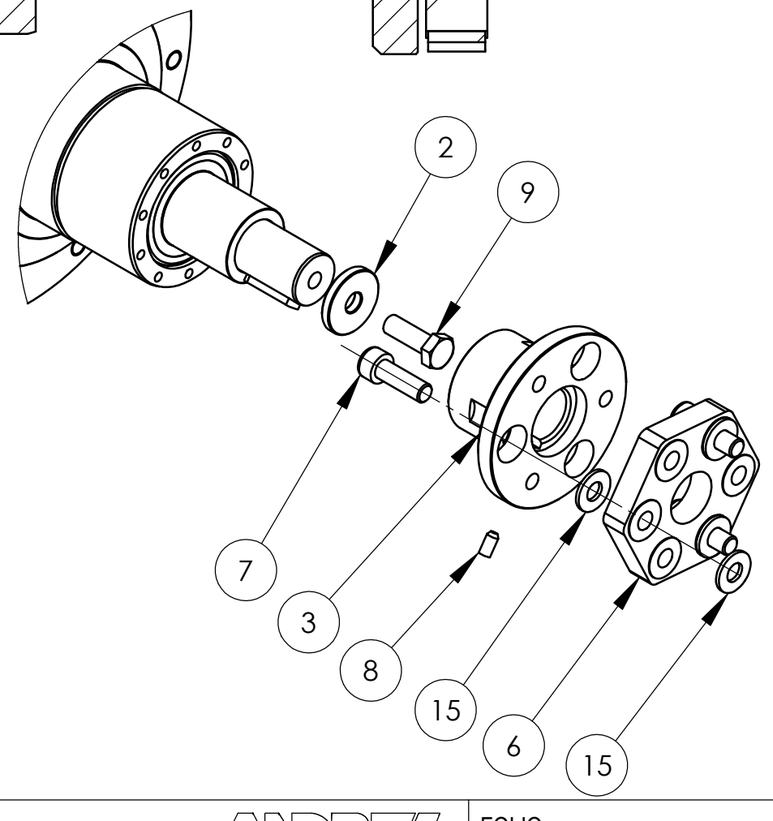
EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
D2L C30C NV Sa - 51675-1

ANDRITZ Environment & Process

Level	FN	Qty	Name	Description (EN)	Description (FR)
0			**202357605**	**REDUCER SIDE BEARING HOUSING DEC-51675 D2L-LL**	**PALIER COTE REDUCTEUR DEC-51675 D2L-LL**
.1	01-51675	1	131194129	HOUSING COVER DEC-21925	COUVERCLE DE PALIER DEC-21925
.1	02-51675	2	201856059	POSITION PIN DEC-25090	GOUPILLE DE POSITION DEC-25090
.1	03-51675	1	131194130	V-BELT PULLEY DEC-29126	POULIE COURROIE TRAPEZOIDALE DEC-29126
.1	04-51675	1	201829489	REDUCER SIDE BEARING HOUSING DEC-41602	PALIER COTE REDUCTEUR DEC-41602
.1	05-51675	1	100022195	RETAINING RING DIN471 - 85X3 SPRING STEEL AMC 3100 00 00 000	CIRCLIP DIN471 - 85X3 SPRING STEEL AMC 3100 00 00 000
.1	06-51675	1	131130249	GREASE NIPPLE ALGI 7021012	GRAISSEUR ALGI 7021012
.1	07-51675	2	131127436	SEAL DEC-04144	JOINT DEC-04144
.1	08-51675	2	100004672	PLAIN WASHER ISO7091 - 8 - 200HV A4 ISO3506-1 AMC 1990 04 00 000	RONDELLE PLATE ISO7091 - 8 - 200HV A4 ISO3506-1 AMC 1990 04 00 000
.1	09-51675	4	100004622	PLAIN WASHER ISO7091 - 10 - 200HV A4 ISO3506-1 AMC 1990 04 00 000	RONDELLE PLATE ISO7091 - 10 - 200HV A4 ISO3506-1 AMC 1990 04 00 000
.1	10-51675	1	131045577	DEEP GROOVE BALL BEARING DIN625-1 6217/C3 SKF 6217/C3 ID=85 OD=150 W=28	ROULEMENT A BILLE A GORGE PROFONDE DIN625-1 6217/C3 SKF 6217/C3 ID=85 OD=150 W=28
.1	11-51675	10	131014977	SOCKET HEAD CAP SCREW ISO4762 - M6X20 - A4-80 ISO3506-1 AMC 1000 03 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M6X20 - A4-80 ISO3506-1 AMC 1000 03 07 000
.1	12-51675	6	131016187	SOCKET HEAD CAP SCREW ISO4762 - M6X25 - A4-80 ISO3506-1 AMC 1000 03 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M6X25 - A4-80 ISO3506-1 AMC 1000 03 07 000
.1	13-51675	2	100020212	SOCKET HEAD CAP SCREW ISO4762 - M8X20 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M8X20 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	14-51675	4	100003236	HEX HEAD SCREW ISO4017 - M10X60 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M10X60 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	15-51675	1	131130060	PLUG POPPLEMAN PLASTIQUES 720/1768 1/2" 14NPT KAPSTO-GPN	BOUCHON POPPLEMAN PLASTIQUES 720/1768 1/2" 14NPT KAPSTO-GPN



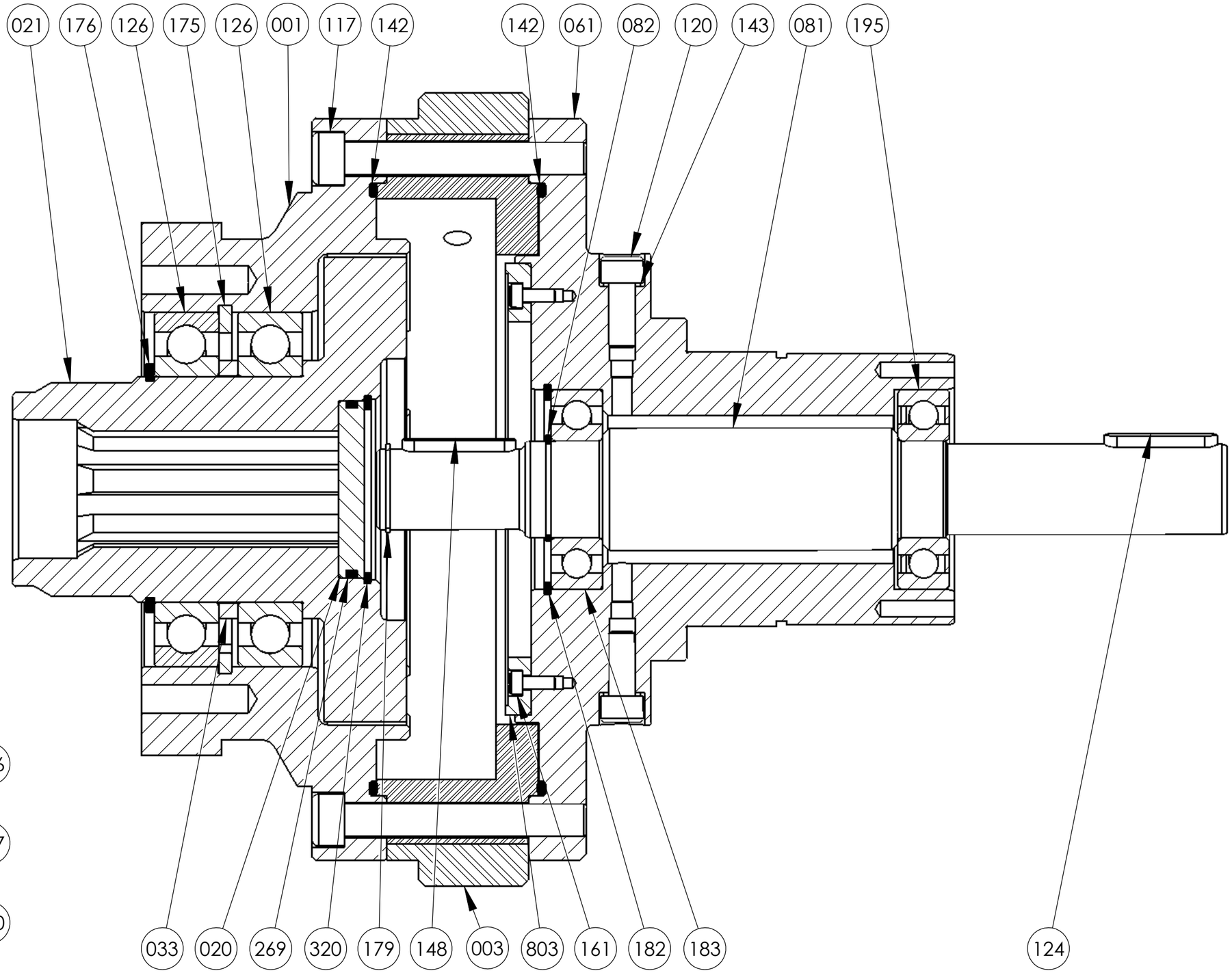


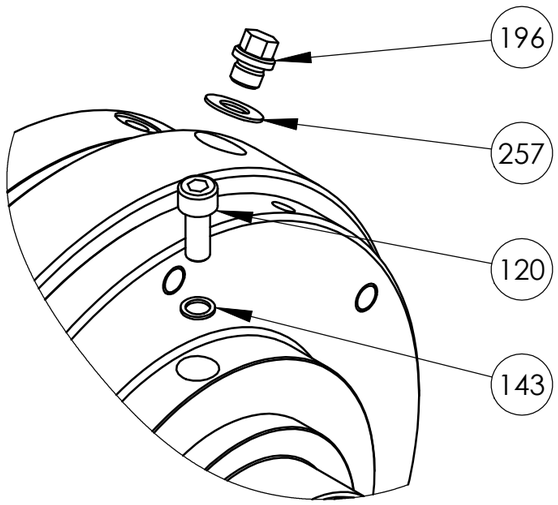
ANDRITZ SAS 2-4 Avenue de l'Europe 78140 VELIZY VILLACOUBLAY - FRANCE - ENVIRONMENT AND PROCESS TECHNOLOGIES	FOLIO : CLIENT :
ENSEMBLE REDUCTEUR ZS 614/87 REDUCER ZS614/87 ASSEMBLY	No. : 48811-1
MACHINE : D2 tous modèles	DATE : 03-10-11

EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
D2

Level	FN	Qty	Name	Description (EN)	Description (FR)
0			**202366972**	**REDUCER ASSEMBLY ZS614-87 REINFORCED DEC-48811 D2L-LL**	**REDUCTEUR ENSEMBLE ZS614-87 RENFORCE DEC-48811 D2L-LL**
.1	01-48811	1	131197402	SPACER DEC-34526	ENTRETOISE DEC-34526
.1	02-48811	1	131194206	WASHER DEC-34527	RONDELLE DEC-34527
.1	03-48811	1	131194207	COUPLING SHAFT DEC-41229	ARBRE D'ACCOUPPLEMENT DEC-41229
.1	04-48811	1	202366228	REDUCER CYCLO ZS614/87 WITHOUT REDEX DEC-48812 D2L-LL	REDUCTEUR CYCLO ZS 614/87 SANS REDEX DEC-48812 D2L-LL
.1	05-48811	1	201829860	DIFFUSER DEC-51701	DIFFUSER DEC-51701
.1	06-48811	1	131198105	FLEXIBLE COUPLING HUTCHINSON RUBBER ACC-635632	ACCOUPLEMENT ELASTIQUE HUTCHINSON RUBBER ACC-635632
.1	07-48811	3	131000800	SOCKET HEAD CAP SCREW ISO4762 - M10X30 - A4-80 ISO3506-1 AMC 1000 03 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M10X30 - A4-80 ISO3506-1 AMC 1000 03 07 000
.1	08-48811	1	131157770	SET SCREW ISO4026 - M6X10 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS DE PRESSION ISO4026 - M6X10 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	09-48811	1	100003168	HEX HEAD SCREW ISO4017 - M10X30 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M10X30 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	10-48811	12	100003170	HEX HEAD SCREW ISO4017 - M10X40 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M10X40 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	11-48811	12	100003236	HEX HEAD SCREW ISO4017 - M10X60 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M10X60 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	15-48811	6	100004621	PLAIN WASHER ISO7091 - 10 - 200HV A2 ISO3506-1 AMC 1990 02 00 000	RONDELLE PLATE ISO7091 - 10 - 200HV A2 ISO3506-1 AMC 1990 02 00 000
0			**202367185**	**REDUCER PRODUCT RELATED SEALS VITON D2L-LL**	**REDUCTEUR EN CONTACT AVEC LE PRODUIT VITON D2L-LL**
.1	12-48811	1	131748647	ROTARY SHAFT SEAL DIN3760 AS - 65X80X8 VITON DUPONT AMC 6007 00 00 000	BAGUE A LEVRES DIN3760 AS - 65X80X8 VITON DUPONT AMC 6007 00 00 000
.1	13-48811	1	131751418	O-RING -104.37X3.53 VITON DUPONT 90 SHORE A AMC 6007 00 00 000	JOINT TORIQUE -104.37X3.53 VITON DUPONT 90 SHORE A AMC 6007 00 00 000
.1	14-48811	1	131749874	O-RING -69.2X5.33 VITON DUPONT AMC 6007 00 00 000	JOINT TORIQUE -69.2X5.33 VITON DUPONT AMC 6007 00 00 000





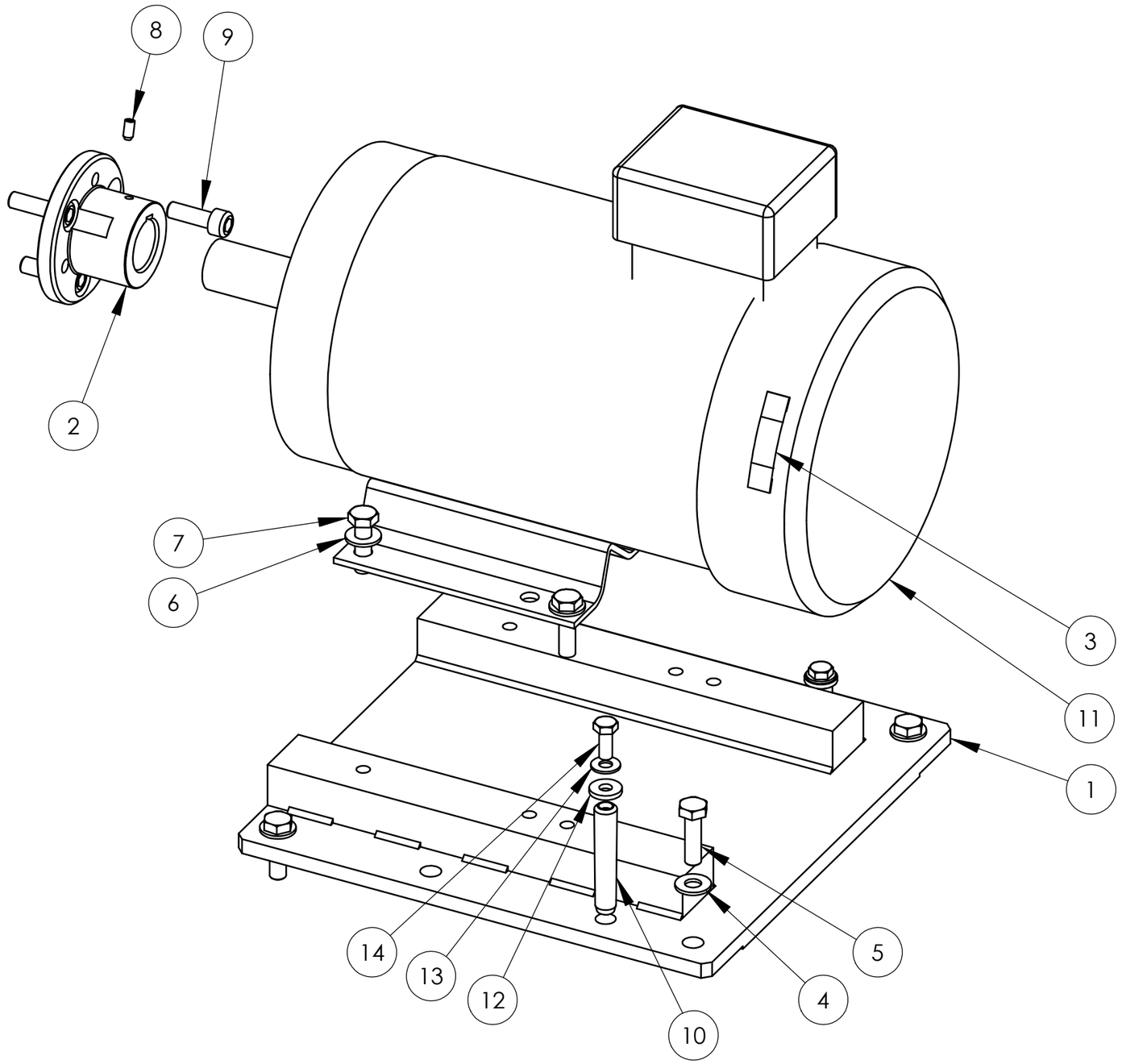
ANDRITZ SAS 2-4 Avenue de l'Europe 78140 VELIZY VILLACOUBLAY - FRANCE - ENVIRONMENT AND PROCESS TECHNOLOGIES	FOLIO : CLIENT :
REDUCTEUR CYCLO ZS 614/87 SANS REDEX GEAR BOX CYCLO ZS 614/87 WITHOUT REDEX MACHINE : D2 L	No. : 48812-1 DATE : 03-10-11

EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
CYCLO ZS 614/87 48812-1

ANDRITZ Environment & Process

Level	FN	Qty	Name	Description (EN)	Description (FR)
0			**202366228**	**REDUCER CYCLO ZS614/87 WITHOUT REDEX DEC-48812 D2L-LL**	**REDUCTEUR CYCLO ZS 614/87 SANS REDEX DEC-48812 D2L-LL**
.1	001	1	202365440	HOLLOW SHAFT DEC-48797 D 230 T 83.2 D2L-LL	ARBRE CREUX DEC-48797 D 230 T 83.2 D2L-LL
.1	020	1	131194158	COVER DISK DEC-29155	DISQUE COUVERCLE DEC-29155
.1	021	1	131194156	REDUCER GROOVED HUB DEC-29091	MOYEU CANNELE REDUCTEUR DEC-29091
.1	033	1	131194154	SPACER DEC-12166	ENTRETOISE DEC-12166
.1	061	1	202365385	HOLLOW SHAFT DEC-29093 D 230 T 136.2 D2L-LL	ARBRE CREUX DEC-29093 D 230 T 136.2 D2L-LL
.1	081	1	201821509	ECCENTRIC SHAFT DEC-34519	ARBRE D'EXCENTRIQUE DEC-34519
.1	082	6	100022174	RETAINING RING DIN471 - 30X1.5 SPRING STEEL AMC 3100 00 00 000	CIRCLIP DIN471 - 30X1.5 SPRING STEEL AMC 3100 00 00 000
.1	117	6	132049183	SOCKET HEAD CAP SCREW ~ISO4762 - M10X75 - A4-80 ISO3506-1 AMC 1000 03 07 000	VIS TETE CYL. A SIX PANS CREUX ~ISO4762 - M10X75 - A4-80 ISO3506-1 AMC 1000 03 07 000
.1	120	2	131044320	SOCKET HEAD CAP SCREW ISO4762 - M8X20 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M8X20 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	124	1	131194153	PARALLEL KEY DEC-08754. 80735	CLAVETTE PARALLELE DEC-08754. 80735
.1	126	2	131198080	DEEP GROOVE BALL BEARING 6014	ROULEMENT A BILLES 6014
.1	142	2	131749837	O-RING -183.75X3.53 VITON DUPONT AMC 6007 00 00 000	JOINT TORIQUE -183.75X3.53 VITON DUPONT AMC 6007 00 00 000
.1	143	2	131874489	SEAL SIMRIT USIT RING D9,3X13,3X1MM	JOINT D'ETANCHEITE SIMRIT USIT RING D9,3X13,3X1MM
.1	148	1	201828457	PARALLEL KEY DEC-08754.07035	CLAVETTE PARALLELE DEC-08754.07035
.1	161	7	131122217	SOCKET HEAD CAP SCREW ISO4762 - M4X10 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M4X10 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	175	1	131078362	RETAINING RING DIN472 - 110X4 SPRING STEEL AMC 3100 00 00 000	CIRCLIP DIN472 - 110X4 SPRING STEEL AMC 3100 00 00 000
.1	176	1	100022179	RETAINING RING DIN471 -70X2.5 AMC 3100 00 00 000	CIRCLIP DIN471 -70X2.5 AMC 3100 00 00 000
.1	179	1	100022173	RETAINING RING DIN471 -25X1.2 AMC 3100 00 00 000	CIRCLIP DIN471 -25X1.2 AMC 3100 00 00 000
.1	182	1	100022289	RETAINING RING DIN472 - 62X2 STEEL AMC 3990 00 00 000	CIRCLIP DIN472 - 62X2 STEEL AMC 3990 00 00 000
.1	183	1	131198101	DEEP GROOVE BALL BEARING 6206	ROULEMENT A BILLES 6206
.1	195	1	131198102	DEEP GROOVE BALL BEARING NSK 6206/2RS 6206/2RS	ROULEMENT A BILLES NSK 6206/2RS 6206/2RS
.1	196	2	131364823	HEX HEAD PLUG DIN910 - M10X1 A4-70 ISO3506-1 AMC 1000 02 07 000	BOUCHON A TETE HEX DIN910 - M10X1 A4-70 ISO3506-1 AMC 1000 02 07 000
.1	257	2	131828678	SEAL SIMRIT USIT RING D10,7X16X1,5MM AMC 6007 00 00 000	JOINT D'ETANCHEITE SIMRIT USIT RING D10,7X16X1,5MM AMC 6007 00 00 000
.1	269	1	131751300	O-RING -50.47X2.65 VITON DUPONT 90 SHORE A AMC 6007 00 00 000	JOINT TORIQUE -50.47X2.65 VITON DUPONT 90 SHORE A AMC 6007 00 00 000
.1	320	1	131045742	RETAINING RING DIN472 - 55X2 STEEL AMC 3990 00 00 000	CIRCLIP DIN472 - 55X2 STEEL AMC 3990 00 00 000
.1	803	1	131194157	SEALING RING DEC-29094	BAGUE D'ETANCHEITE DEC-29094
.1		**1**	**202360563**	**CYCLO GEAR BOX INTERNAL PARTS ZS 614/87 KIT PB033751**	**REDUCTEUR CYCLO PIECES INTERNE ZS 614/87 KIT PB033751**
..2	003	1	132049572	RING CYCLO GEAR BOX SUMITOMO CYCLO CYC-ZS/614/87-03 CYC-136351A INOX 316TI (1.4571)	COURONNE REDUCTEUR CYCLO SUMITOMO CYCLO CYC-ZS/614/87-03 CYC-136351A INOX 316TI (1.45
..2	005	1	131828406	DRIVE FINGER CYCLO GEAR BOX SUMITOMO CYCLO CYC-AU7822G SET OF 8	DOIGT D'ENTRAINEMENT REDUCTEUR CYCLO SUMITOMO CYCLO CYC-AU7822G SET OF 8
..2	006	1	131828407	DRIVE BUSHING CYCLO GEAR BOX SUMITOMO CYCLO CYC-ZS/214/87-06 SET OF 8	DOUILLE D'ENTRAINEMENT REDUCTEUR CYCLO SUMITOMO CYCLO CYC-ZS/214/87-06 SET OF 8
..2	041	1	131828409	CAM DISC CYCLO GEAR BOX SUMITOMO CYCLO CYC-AN9386G SET OF 2	DISQUE CAME REDUCTEUR CYCLO SUMITOMO CYCLO CYC-AN9386G SET OF 2
..2	044-045	1	131828410	ECCENTRIC CYCLO GEAR BOX SUMITOMO CYCLO AN0662G-6 AP9477G POS.44+POS.45	EXCENTRIQUE REDUCTEUR CYCLO SUMITOMO CYCLO AN0662G-6 AP9477G POS.44+POS.45
..2	050	1	131831949	SPACER CYCLO GEAR BOX SUMITOMO CYCLO CYC-ZS/214/87-50	ENTRETOISE REDUCTEUR CYCLO SUMITOMO CYCLO CYC-ZS/214/87-50
..2	196	2	131364823	HEX HEAD PLUG DIN910 - M10X1 A4-70 ISO3506-1 AMC 1000 02 07 000	BOUCHON A TETE HEX DIN910 - M10X1 A4-70 ISO3506-1 AMC 1000 02 07 000
..2	257	2	131828678	SEAL SIMRIT USIT RING D10,7X16X1,5MM AMC 6007 00 00 000	JOINT D'ETANCHEITE SIMRIT USIT RING D10,7X16X1,5MM AMC 6007 00 00 000



ANDRITZ SAS
2-4 Avenue de l'Europe
78140 VELIZY VILLACOUBLAY - FRANCE -
ENVIRONMENT AND PROCESS TECHNOLOGIES

FOLIO :

CLIENT :

ENSEMBLE TRANSMISSION
TRANSMISSION ASSEMBLY

No. : 53941-0

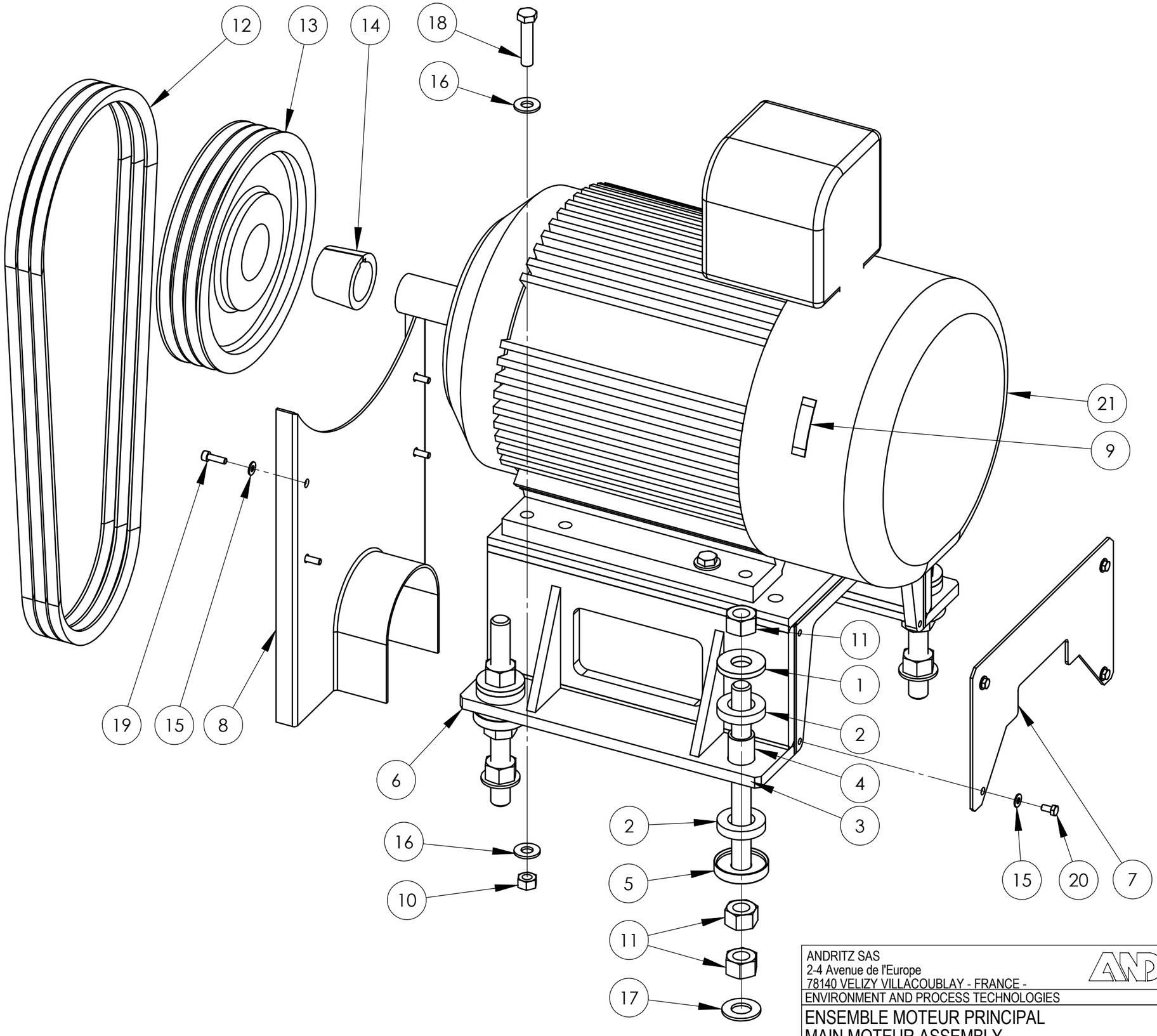
DATE : 10-05-12

MACHINE : D2 L

EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
D2 LC 30 C NV 53941-0

Level	FN	Qty	Name	Description (EN)	Description (FR)
0			**202729510**	**SECONDARY MOTOR ASSEMBLY D2 DEC-53941 D2**	**MOTEUR SECONDAIRE ENSEMBLE D2 DEC-53941 D2**
.1	01-53941	1	202729480	MOTOR BASE SECONDARY MOTOR DEC-53947 D2L-LL	SUPPORT MOTEUR MOTEUR SECONDAIRE DEC-53947 D2L-LL
.1	02-53941	1	-	COUPLING SHAFT (DEC-53954)- **CUSTOMER SUPPLY**	MOYEU ACCOUPLEMENT MOTEUR (DEC-53954) - **FOURNITURE CLIENT**
.1	03-53941	1	202501168	ROTATION INDICATOR DEC-60599	INDICATEUR DE ROTATION DEC-60599
.1	04-53941	4	100004622	PLAIN WASHER ISO7091 - 10 - 200HV A4 ISO3506-1 AMC 1990 04 00 000	RONDELLE PLATE ISO7091 - 10 - 200HV A4 ISO3506-1 AMC 1990 04 00 000
.1	05-53941	4	100003169	HEX HEAD SCREW ISO4017 - M10X35 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M10X35 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	06-53941	4	100004621	PLAIN WASHER ISO7091 - 10 - 200HV A2 ISO3506-1 AMC 1990 02 00 000	RONDELLE PLATE ISO7091 - 10 - 200HV A2 ISO3506-1 AMC 1990 02 00 000
.1	07-53941	4	131045599	HEX HEAD SCREW ISO4017 - M10X35 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M10X35 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	08-53941	1	131157770	SET SCREW ISO4026 - M6X10 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS DE PRESSION ISO4026 - M6X10 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	09-53941	3	100020207	SOCKET HEAD CAP SCREW ISO4762 - M10X30 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M10X30 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	10-53941	2	201856059	POSITION PIN DEC-25090	GOUPILLE DE POSITION DEC-25090
.1	11-53941	1	-	MOTOR BALDOR 36LYJ047- 184T - **CUSTOMER SUPPLY**	MOTEUR BALDOR 36LYJ047- 184T - **FOURNITURE CLIENT**
.1	12-53941	2	131127436	SEAL DEC-04144	JOINT DEC-04144
.1	13-53941	2	100004672	PLAIN WASHER ISO7091 - 8 - 200HV A4 ISO3506-1 AMC 1990 04 00 000	RONDELLE PLATE ISO7091 - 8 - 200HV A4 ISO3506-1 AMC 1990 04 00 000
.1	14-53941	2	100003158	HEX HEAD SCREW ISO4017 - M8X20 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M8X20 - A4-70 ISO3506-1 AMC 1000 02 07 000



ANDRITZ SAS
2-4 Avenue de l'Europe
78140 VELIZY VILLACOUBLAY - FRANCE -
ENVIRONMENT AND PROCESS TECHNOLOGIES

FOLIO :
CLIENT :

ENSEMBLE MOTEUR PRINCIPAL
MAIN MOTEUR ASSEMBLY

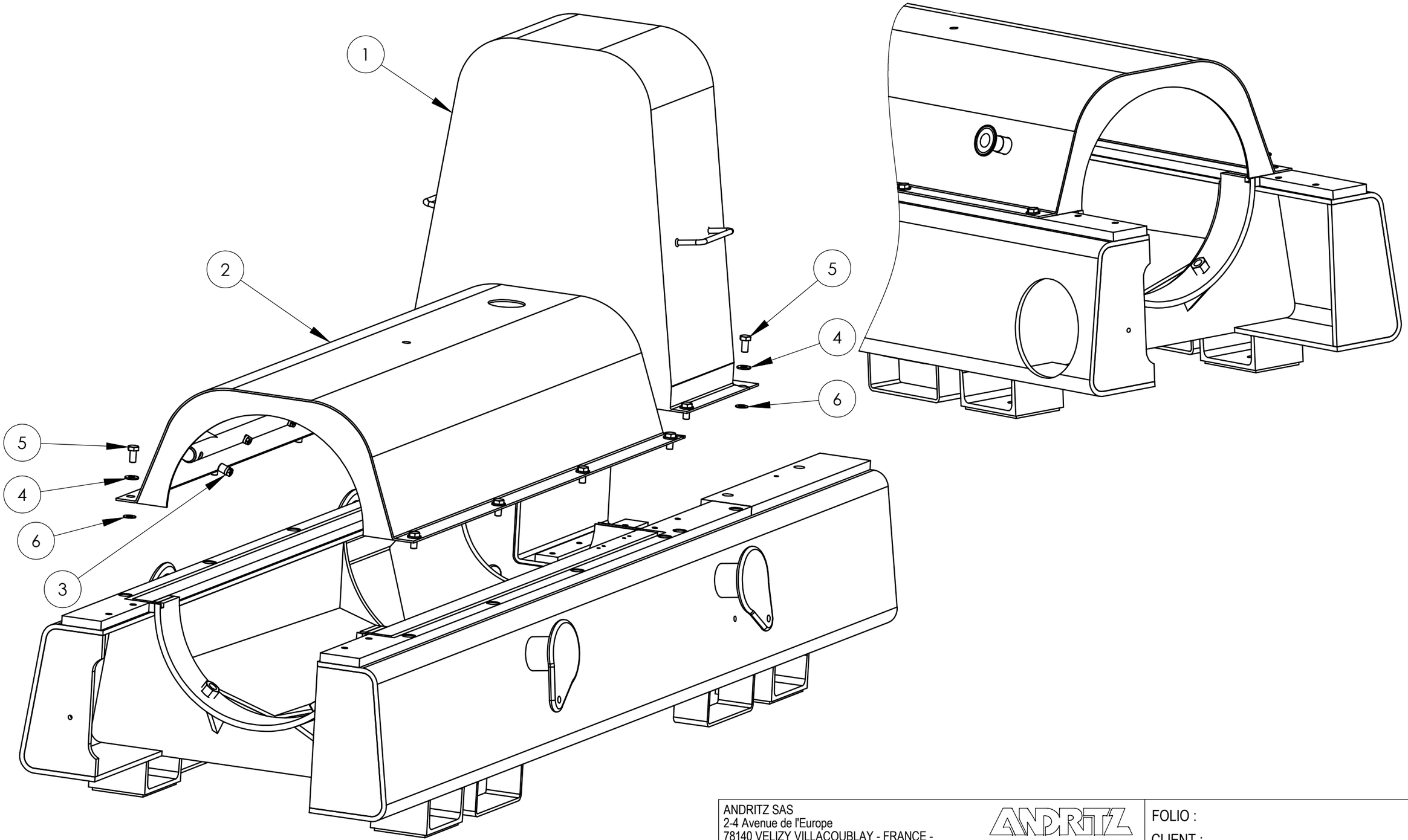
No. : 53942-0
DATE : 10-05-12

MACHINE : D2

EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
D2 LC 30 C NV 53942-0

Level	FN	Qty	Name	Description (EN)	Description (FR)
0			**202729522**	**MAIN MOTOR ASSEMBLY DEC-53942 D2**	**MOTEUR PRINCIPAL ENSEMBLE DEC-53942 D2**
.1	01-53942	4	131125233	WASHER DEC-24236	RONDELLE DEC-24236
.1	02-53942	8	131127438	SPACER (COURBHANE) DEC-24237 D 26 D1 45 T 10	ENTRETOISE EN COURBHANE DEC-24237 D 26 D1 45 T 10
.1	03-53942	4	131194200	THREADED ROD DEC-29080	TIGE FILETEE DEC-29080
.1	04-53942	4	131169825	SPACER DEC-29081	ENTRETOISE DEC-29081
.1	05-53942	4	131169826	WASHER DEC-29082	RONDELLE DEC-29082
.1	06-53942	1	131203718	MOTOR BASE DEC-34515	EMBASE MOTEUR DEC-34515
.1	07-53942	1	202729503	CLOSING PLATE DEC-53955	PLAQUE DE FERMETURE DEC-53955
.1	08-53942	1	202351576	CE PROTECTION SECONDARY MOTOR DEC-51872 D2	PROTECTION CE MOTEUR SECONDAIRE DEC-51872 D2
.1	09-53942	1	202501168	ROTATION INDICATOR DEC-60599	INDICATEUR DE ROTATION DEC-60599
.1	10-53942	4	100002236	HEX NUT ISO4032 - M12 A2-50 ISO3506-2 AMC 1050 08 08 000	ECROU HEX ISO4032 - M12 A2-50 ISO3506-2 AMC 1050 08 08 000
.1	11-53942	12	100002206	HEX NUT ISO4032 - M20 A2-50 ISO3506-2 AMC 1050 08 08 000	ECROU HEX ISO4032 - M20 A2-50 ISO3506-2 AMC 1050 08 08 000
.1	12-53942	3	-	V-BELT TEXROPE TRA-SPA-1500 - **CUSTOMER SUPPLY**	COURROIE TRAPEZOIDALE TEXROPE TRA-SPA-1500 - **FOURNITURE CLIENT**
.1	13-53942	1	-	V-BELT PULLEY BROOK HANSEN SPA250/3-2517 - **CUSTOMER SUPPLY**	POULIE P. COURROIE TRAP. BROOK HANSEN SPA250/3-2517 - **FOURNITURE CLIENT**
.1	14-53942	1	-	PULLEY HUB BROOK HANSEN MOY-2517-Ø42 - **CUSTOMER SUPPLY**	MOYEU AMOVIBLE BROOK HANSEN MOY-2517-Ø42 - **FOURNITURE CLIENT**
.1	15-53942	8	100004668	PLAIN WASHER ISO7091 - 6 - 200HV A2 ISO3506-1 AMC 1990 02 00 000	RONDELLE PLATE ISO7091 - 6 - 200HV A2 ISO3506-1 AMC 1990 02 00 000
.1	16-53942	8	100004626	PLAIN WASHER ISO7091 - 12 - 200HV A4 ISO3506-1 AMC 1990 04 00 000	RONDELLE PLATE ISO7091 - 12 - 200HV A4 ISO3506-1 AMC 1990 04 00 000
.1	17-53942	4	100004644	PLAIN WASHER ISO7091 - 20 - 200HV A2 ISO3506-1 AMC 1990 02 00 000	RONDELLE PLATE ISO7091 - 20 - 200HV A2 ISO3506-1 AMC 1990 02 00 000
.1	18-53942	4	100003255	HEX HEAD SCREW ISO4017 - M12X60 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M12X60 - A4-70 ISO3506-1 AMC 1000 02 07 000
.1	19-53942	4	131044383	SOCKET HEAD CAP SCREW ISO4762 - M6X20 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M6X20 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	20-53942	4	131042278	HEX HEAD SCREW ISO4017 - M6X12 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M6X12 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	21-53942	1	-	MOTOR BALDOR 09LYH562 - 254T - **CUSTOMER SUPPLY**	MOTEUR BALDOR 09LYH562 - 254T - **FOURNITURE CLIENT**

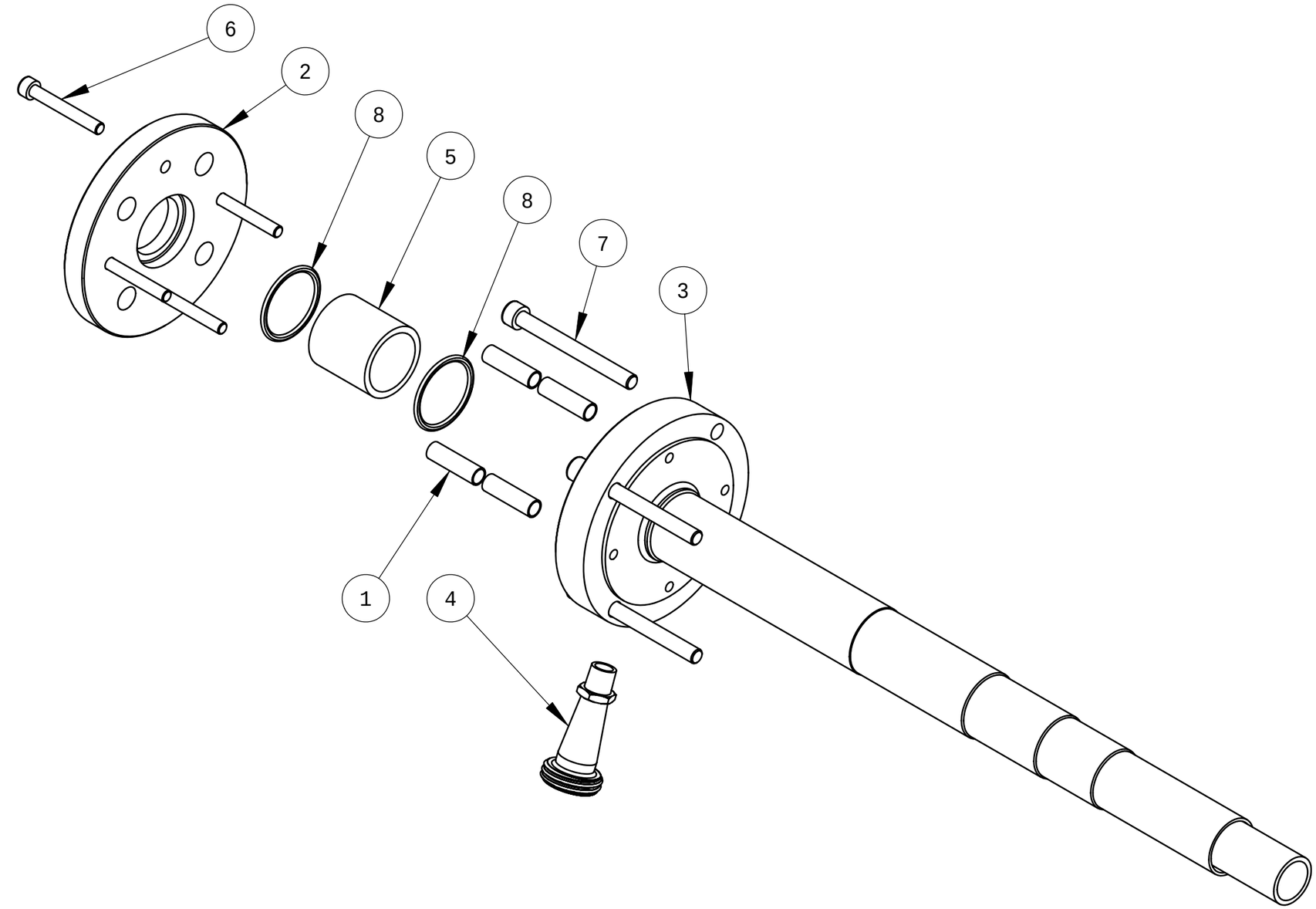


ANDRITZ SAS 2-4 Avenue de l'Europe 78140 VELIZY VILLACOUBLAY - FRANCE - ENVIRONMENT AND PROCESS TECHNOLOGIES	FOLIO : CLIENT :
ENSEMBLE CAPOTS COVER ASSEMBLY	No. : 53924-0
MACHINE : D2 L	DATE : 25-04-12

EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
D2 LC 30 C NV Sa 53924-0

Level	FN	Qty	Name	Description (EN)	Description (FR)
0			**202720505**	**COVER ASSEMBLY DEC-53924 D2L**	**CAPOT ENSEMBLE DEC-53924 D2L**
.1	01-53924	1	202521568	COVERING HOOD DEC-53531 L 575 W 530 H 280 MM D2L-LL	CAPOT DEC-53531 L 575 W 530 H 280 MM D2L-LL
.1	02-53924	1	202720441	COVERING HOOD DEC-53925 D2L	CAPOT DEC-53925 D2L
.1	03-53924	5	131560113	SPRAY NOZZLE LECHLER 632.566.17.CC	BUSE A JET LECHLER 632.566.17.CC
.1	04-53924	12	100004621	PLAIN WASHER ISO7091 - 10 - 200HV A2 ISO3506-1 AMC 1990 02 00 000	RONDELLE PLATE ISO7091 - 10 - 200HV A2 ISO3506-1 AMC 1990 02 00 000
.1	05-53924	12	131042306	HEX HEAD SCREW ISO4017 - M10X20 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M10X20 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	06-53924	12	131938157	WASHER CAPTIVE BULTE 80599110 NYLON M10-8.4X20X1	RONDELLE IMPERDABLE BULTE 80599110 NYLON M10-8.4X20X1



ANDRITZ SAS
2-4 Avenue de l'Europe
78140 VELIZY VILLACOUBLAY - FRANCE -
ENVIRONMENT AND PROCESS TECHNOLOGIES

FOLIO : Défaut
CLIENT : Défaut

ENSEMBLE TUBE ALIMENTATION AVEC LAVAGE
FEED PIPE WASHING ASSEMBLY

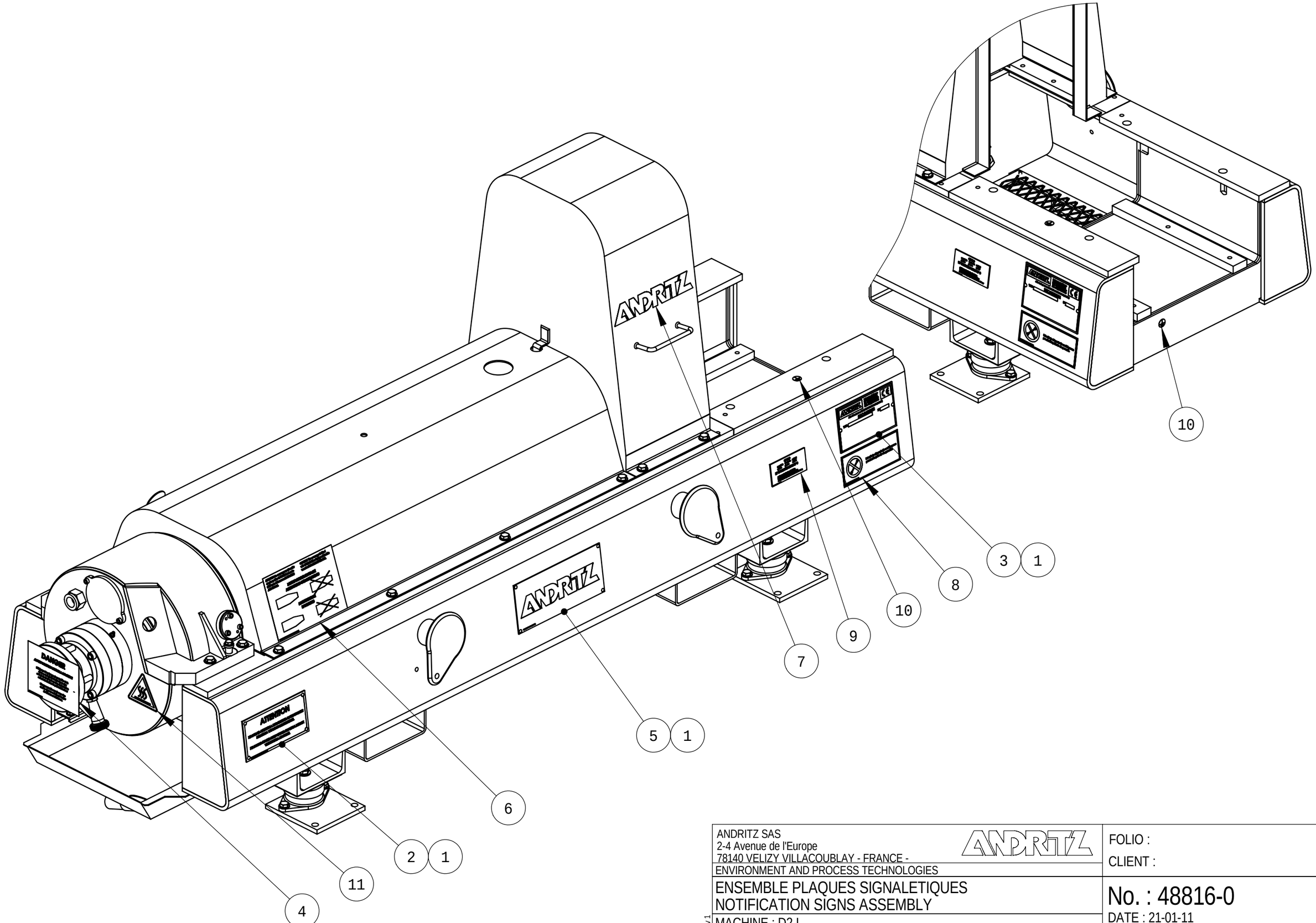
MACHINE : D2 L

No. : 48806-0
DATE : 20-01-11

EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
D2 LC 30 C NV (Sa) 48806-0

Level	FN	Qty	Name	Description (EN)	Description (FR)
0			**202359778**	**FEED PIPE WASHING DEC-48806 D2L-LL**	**TUBE D'ALIMENTATION AVEC LAVAGE DEC-48806 D2L-LL**
.1	01-48806	4	131169468	SPACER DEC-09246.10X12X41	ENTRETOISE DEC-09246.10X12X41
.1	02-48806	1	201828881	FLANGE FEEDING DEC-27184	BRIDE D'ALIMENTATION DEC-27184
.1	03-48806	1	201819273	FEED PIPE DEC-32402	TUBE D'ALIMENTATION DEC-32402
.1	04-48806	1	201821627	SPRAY HEADER WASHING DEC-40223	RAMPE DE LAVAGE DE LAVAGE DEC-40223
.1	05-48806	1	131194062	FEED FLANGE INDICATOR DEC-09243/13	VOYANT ALIMENTATION DEC-09243/13
.1	06-48806	4	131045964	SOCKET HEAD CAP SCREW ISO4762 - M8X60 - A4-80 ISO3506-1 AMC 1000 03 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M8X60 - A4-80 ISO3506-1 AMC 1000 03 07 000
.1	07-48806	4	100020282	SOCKET HEAD CAP SCREW ISO4762 - M10X100 - A4-70 ISO3506-1 AMC 1000 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M10X100 - A4-70 ISO3506-1 AMC 1000 02 07 000
0			**202367258**	**FEED PIPE PRODUCT RELATED SEALS VITON D2-D3**	**TUBE D'ALIMENTATION JOINTS RELATIFS AU PRODUIT VITON D2-D3**
.1	08-48806	2	131751407	O-RING -44.05X3.53 VITON DUPONT 90 SHORE A AMC 6007 00 00 000	JOINT TORIQUE -44.05X3.53 VITON DUPONT 90 SHORE A AMC 6007 00 00 000



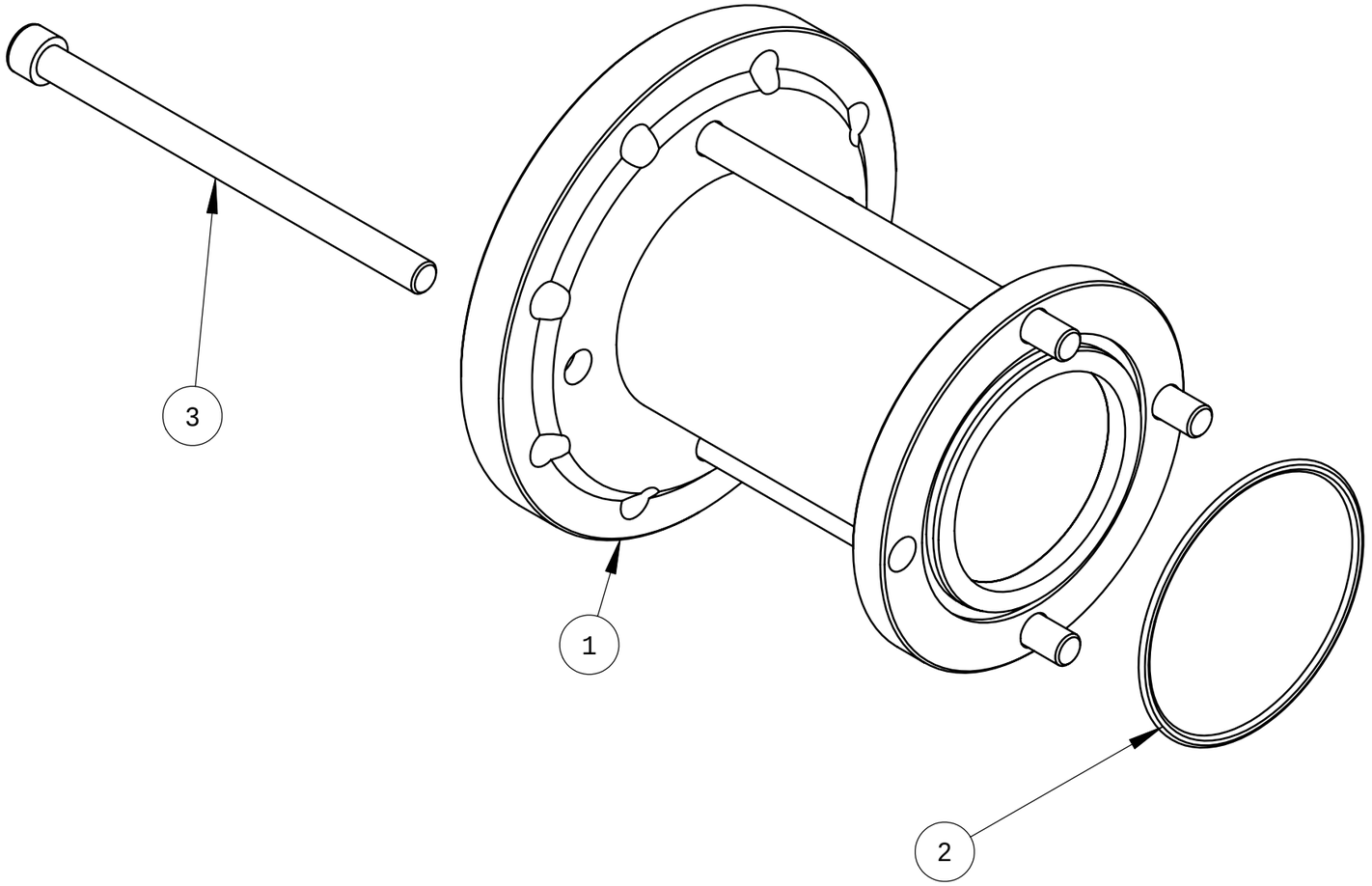
ANDRITZ SAS 2-4 Avenue de l'Europe 78140 VELIZY VILLACOUBLAY - FRANCE - ENVIRONMENT AND PROCESS TECHNOLOGIES	FOLIO : CLIENT :
ENSEMBLE PLAQUES SIGNALETIQUES NOTIFICATION SIGNS ASSEMBLY MACHINE : D2 L	No. : 48816-0 DATE : 21-01-11

EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
D2 LC 30 C NV (Sa)

ANDRITZ Environment & Process

Level	FN	Qty	Name	Description (EN)	Description (FR)
0			**202360702**	**ENGLISH NOTIFICATION SIGNS NO CE**	**PLAQUE SIGNALETIQUES ANGLAISE NON CE**
.1	01-48816	14	131901202	GROOVED PIN ISO8746 - 4X10 AMC 1990 02 00 000	GROOVED PIN ISO8746 - 4X10 AMC 1990 02 00 000
.1	02-48816	1	202024980	INSTRUCTION LABEL ENGLISH DEC-05570	NOTE D'INSTRUCTION ANGLAISE DEC-05570
.1	03-48816	1	131127105	IDENTIFICATION PLATE DEC-08232 AN	PLAQUE D'IDENTIFICATION DEC-08232 AN
.1	04-48816	1	131369607	INSTRUCTION LABEL DEC-18592	NOTE D'INSTRUCTION DEC-18592
.1	05-48816	2	131169973	COMPANY LOGO DEC-22103	PLAQUE DE FIRME DEC-22103
.1	06-48816	1	131125234	INSTRUCTION LABEL FRENCH ASSEMBLY & DISMANTLING DEC-25765	NOTE D'INSTRUCTION FRANCAISE ASSEMBLAGE ET DEMONTAGE DEC-25765
.1	07-48816	2	201823883	COMPANY LOGO STICKER DEC-35191-042 L 224 H 42 MM	PLAQUE DE FIRME AUTOCOLLANT DEC-35191-042 L 224 H 42 MM
.1	08-48816	1	131369604	STICKER NEVER DISMANTLE DURING THE GUARANTEE PERIOD DEC-42818 DECANTER	AUTOCOLLANT NE JAMAIS DEMONTER DURANT LA PERIODE DE GARANTIE DEC-42818 DECANTER
.1	09-48816	1	201847363	INSTRUCTION LABEL GREASE BP ENERGREASE LS EP 0 DEC-52840 DECANTER	NOTE D'INSTRUCTION GRAISSE BP ENERGREASE LS EP 0 DEC-52840 DECANTER
.1	10-48816	2	132027365	STICK-ON LABEL SETON EEQ1 IEC 60417-5019	ETIQUETTE ADHESIVE SETON EEQ1 IEC 60417-5019
.1	11-48806	1	131832072	STICKERS FOR HIGH TEMPERATURE SETON SIG - P - PDL T2 - 315	AUTOCOLLANT ADHESIF HAUTE TEMPER. SETON SIG - P - PDL T2 - 315



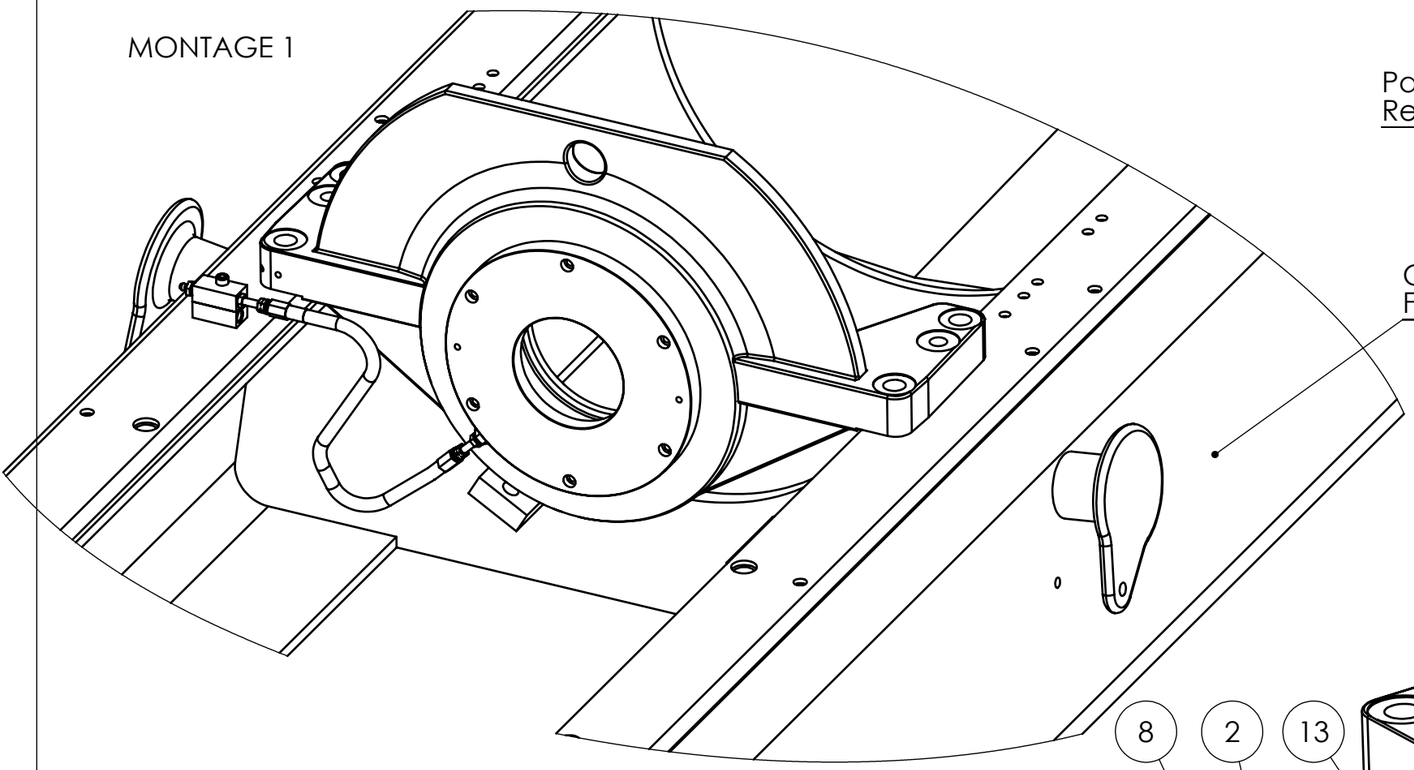
ANDRITZ SAS 2-4 Avenue de l'Europe 78140 VELIZY VILLACOUBLAY - FRANCE - ENVIRONMENT AND PROCESS TECHNOLOGIES	FOLIO : Défaut CLIENT : Défaut
ENSEMBLE POT DE DEGAZAGE DEAERATOR ASSEMBLY MACHINE : D2 tous modèles	No. : 51912-0 DATE : 20-01-11

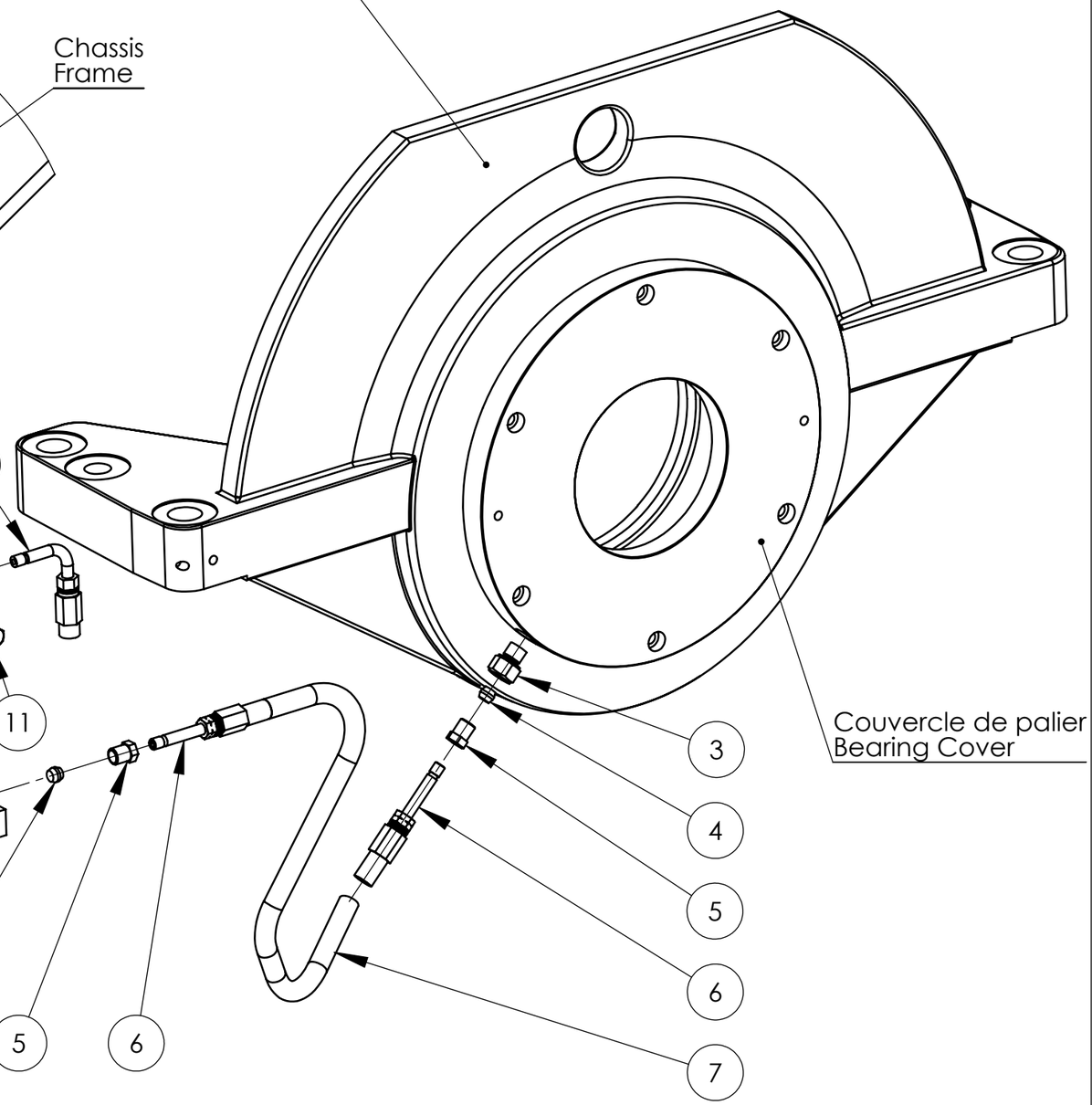
EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
D2L C 30 C NV sa - 51912-0

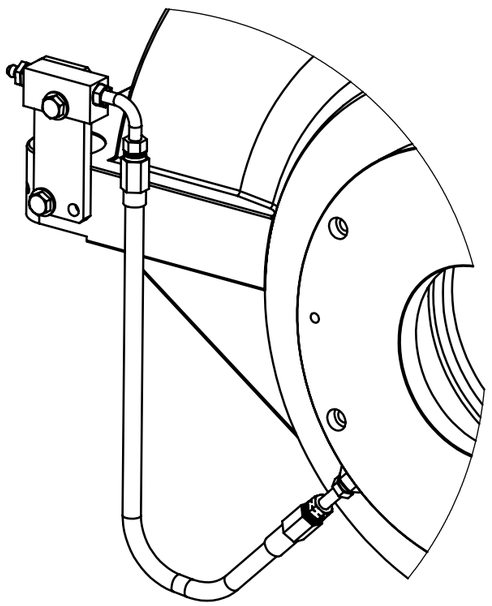
Level	FN	Qty	Name	Description (EN)	Description (FR)
0			**202359677**	**DEAERATOR DEC-51912 D2L-LL**	**POT DE DEGAZAGE DEC-51912 D2L-LL**
.1	1	1	202582417	FLANGE CONNECTION SANITARY DEC-53599	BRIDE RACCORDEMENT SANITAIRE DEC-53599
.1	2	1	131751417	O-RING -98.02X3.53 - 90 SHORE A FPM/FKM AMC 6007 00 00 000	JOINT TORIQUE -98.02X3.53 - 90 SHORE A FPM/FKM AMC 6007 00 00 000
.1	3	4	131044904	SOCKET HEAD CAP SCREW ISO4762 - M12X180 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS TETE CYL. A SIX PANS CREUX ISO4762 - M12X180 - A2-70 ISO3506-1 AMC 1050 02 07 000

MONTAGE 1





MONTAGE 2



TYPE MONTAGE	MACHINE
1	
2	D2-D3-D4

ANDRITZ SAS
2-4 Avenue de l'Europe
78140 VELIZY VILLACOUBLAY - FRANCE -
ENVIRONMENT AND PROCESS TECHNOLOGIES

FOLIO :
CLIENT :

ENSEMBLE LUBRIFICATION GRAISSE
GREASE LUBRICATION ASSEMBLY

No. : 46214-4
DATE : 11-05-11

MACHINE : D1 to D7 tous modèles

EN58 rev 1

CENTRIFUGE PARTS LIST / LISTE DE PIECES CENTRIFUGEUSE
D1 TO D7 MONTAGE 2

ANDRITZ Environment & Process

Level	FN	Qty	Name	Description (EN)	Description (FR)
0			201830594	LUBRICATION DEC-46214	LUBRIFICATION DEC-46214
.1	01-46214	1	131130249	GREASE NIPPLE ALGI 7021012	GRAISSEUR ALGI 7021012
.1	02-46214	1	131157878	RACCORD VOGEL MECAFLUID DAR506	RACCORD SUR BI-CONE VOGEL MECAFLUID DAR506
.1	03-46214	1	131158042	INTERMEDIATE UNION VOGEL MECAFLUID 406-004	RACCORD INTERMEDIAIRE VOGEL MECAFLUID 406-004
.1	04-46214	2	131157876	DOUBLE TAPERED SLEEVE VOGEL MECAFLUID 406.001	BICONE VOGEL MECAFLUID 406.001
.1	05-46214	2	131158041	SOCKET UNION VOGEL MECAFLUID 406002	RACCORD BICONE VOGEL MECAFLUID 406002
.1	06-46214	1	131157877	STUD FITTING VOGEL MECAFLUID 853-540-010 + 853-380-002-VS	RACCORD TUYAUTERIE VOGEL MECAFLUID 853-540-010 + 853-380-002-VS
.1	07-46214	1	131173442	GREASE HOSE VOGEL MECAFLUID SAE 100 R7	TUYAU DE GRAISSE VOGEL MECAFLUID SAE 100 R7
.1	09-46214	1	131127160	FIXING PART DEC-30966	ELEMENT DE FIXATION DEC-30966
.1	10-46214	2	100004668	PLAIN WASHER ISO7091 - 6 - 200HV A2 ISO3506-1 AMC 1990 02 00 000	RONDELLE PLATE ISO7091 - 6 - 200HV A2 ISO3506-1 AMC 1990 02 00 000
.1	11-46214	1	131045600	HEX HEAD SCREW ISO4017 - M6X20 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M6X20 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	12-46214	1	131042278	HEX HEAD SCREW ISO4017 - M6X12 - A2-70 ISO3506-1 AMC 1050 02 07 000	VIS A TETE HEXAGONALE ISO4017 - M6X12 - A2-70 ISO3506-1 AMC 1050 02 07 000
.1	13-46214	1	132062187	STUD FITTING VOGEL MECAFLUID 853-390-004 + 853-540-010	RACCORD TUYAUTERIE VOGEL MECAFLUID 853-390-004 + 853-540-010

10.3 DRIVE LIST

BOWL DRIVE:

Manufacturer:	Baldor
Model:	Premium Efficiency Custom similar to ECP4106T
Motor Data:	20 hp, 460 v, 60Hz, 3600 rpm 256T frame, F3 mount, 40 ºC ambient, cast iron frame with severe duty construction. NC thermostats Similar to ECP4106T-4 except in F3 mount (Ref 09LYK229), inverter duty NP marks, 3 NC thermostats.
Paint:	RAL 9010

SCROLL DRIVE:

Manufacturer:	Baldor
Model:	Premium Efficiency Custom similar to EM3616T
Motor Data:	7.5 hp, 460 v, 60Hz, 3600 rpm 184T frame, F3 mount, 40 ºC ambient, rolled steel frame with dirty duty construction, NC thermostats. Similar to EM3616T except in F3 mount (Ref 36LYJ047), 460 volt only connection, dirty duty construction (Ref S/P 32-2), Inverter duty NP marks & 3 NC thermostats.
Paint:	RAL 9010

10.4 RECOMMENDED SPARE PARTS LIST

Table 10-2 gives the recommended spare parts to keep on hand for the D2L centrifuge.

TABLE 10-2. RECOMMENDED SPARE PARTS		
PART NUMBER	**DESCRIPTION**	**QUANTITY**
Lubricants		
Grease: AGRO EP2 (131828603)	Feed, Drive End and Scroll Thrust Bearings Grease	1 x 14-oz cartridges
Grease: BP LS EP 0 (131883309)	Cyclo Reducer Grease	1 15-kilogram drum
V-Belts		
132134709	V-Belt (3 belts = 1 set), SPB-1500	1 set
Front Pillow Block Assembly (Feed Side Bearing Housing)– 54196-0		
131128747	O-Ring, NBR	1
131750264	O-Ring, Viton	1
131750610	O-Ring, Viton	1
131751358	O-Ring, Viton	1
131198076	Roller bearing	1
131873064	Rotary shaft seal, Viton	1
131945141	Seal, Trelleborg	1
Bowl Assembly (Liquid End Assembly) – 53863-0		
202721239	Set of product related seals	1
131752555	Deep groove ball bearing	1
Bowl Assembly (Centrate End Assembly) – 51673-1		
202355736	Set of product related seals	1
131752555	Deep groove ball bearing	1
Adjustable Centripetal Pump Assembly – 32973-2		
131802874	O-Ring, Viton	2
131243830	Deep groove ball bearing	1
Scroll Assembly (Screw Conveyor)– 53923-0		
202352080	Set of product related seals	1
External Bowl Assembly – 51674-0		
131751298	Set of product related seals	1
Rear Pillow Block Assembly – 51675-1		
131127436	Seal	2

TABLE 10-2. RECOMMENDED SPARE PARTS		
PART NUMBER	**DESCRIPTION**	**QUANTITY**
131045577	Deep groove roller bearing	1

TABLE 11-2. RECOMMENDED SPARE PARTS (CONT)		
PART NUMBER	**DESCRIPTION**	**QUANTITY**
Reducer Assembly – 48811-1		
202367185	Set of product related seals	1
Cyclo Reducer – 48812-1		
131198080	Deep groove ball bearing	2
131749837	O-Ring, Viton	2
131198101	Deep groove ball bearing	1
131198102	Deep groove ball bearing	1
131828678	Seal	2
131751300	O-Ring, Viton	1
202360563	Cyclo Gear Box internal parts	1
131157860	Copper seals (not shown)	4
Feed Pipe Assembly – 48806-0		
202367258	Set of product related seals (Viton)	1
Deaerator – 51912-0		
13151417	O-Ring	1

CHAPTER 11

DRIVE SYSTEM INFORMATION

The O&M manual from Baldor (bowl and scroll drive motors) is included in this chapter.

BALDOR · RELIANCE

Integral Horsepower
AC Induction Motors

Installation & Operating Manual

Table of Contents

Section 1
General Information

Overview This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements.
A Warning statement indicates a possible unsafe condition that can cause harm to personnel.
A Caution statement indicates a condition that can cause damage to equipment.

Important: **This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.**

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- The National Electrical Code
- Local codes and Practices

Limited Warranty

www.baldor.com/support/warranty_standard.asp

Safety Notice: This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment.

Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: **Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.**

WARNING: **Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.**

WARNING: **Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.**

WARNING: **Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.**

WARNING: **Surface temperatures of motor enclosures may reach temperatures which can cause discomfort or injury to personnel accidentally coming into contact with hot surfaces. When installing, protection should be provided by the user to protect against accidental contact with hot surfaces. Failure to observe this precaution could result in bodily injury.**

WARNING: **This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.**

WARNING: **Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.**

WARNING: **Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.**

WARNING: **Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.**

WARNING: **Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.**

WARNING: **Thermostat contacts automatically reset when the motor has slightly cooled down. To prevent injury or damage, the control circuit should be designed so that automatic starting of the motor is not possible when the thermostat resets.**

Safety Notice Continued

WARNING: **UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.**

WARNING: **Pacemaker danger – Magnetic and electromagnetic fields in the vicinity of current carrying carrying conductors and permanent magnet motors can result result in a serious health hazard to persons with cardiac pacemakers, metal implants, and hearing aids. To avoid risk, stay way from the area surrounding a permanent magnet motor.**

WARNING: **Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.**

WARNING: **Use only UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust.**

WARNING: **Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo. Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.**

WARNING: **Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.**

Caution: **To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.**

Caution: **Do not over–lubricate motor as this may cause premature bearing failure.**

Caution: **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

Caution: **If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.**

Caution: **To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.**

Caution: **If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.**

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.

Receiving

Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

Handling

The motor should be lifted using the lifting lugs or eye bolts provided.

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft or the hood of a WPII motor.
2. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.
3. When lifting a WPII (Weather Proof Type 2) motor, do not lift the motor by inserting lifting lugs into holes on top of the cooling hood. These lugs are to be used for hood removal only. A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame.

4. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation.

   Do not lift the assembly using the motor lugs or eye bolts provided. Lugs or eye bolts are designed to lift motor only. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting. If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

Storage

Storage requirements for motors and generators that will not be placed in service for at least six months from date of shipment.

Improper motor storage will result in seriously reduced reliability and failure. An electric motor that does not experience regular usage while being exposed to normally humid atmospheric conditions is likely to develop rust in the bearings or rust particles from surrounding surfaces may contaminate the bearings. The electrical insulation may absorb an excessive amount of moisture leading to the motor winding failure.

A wooden crate “shell” should be constructed to secure the motor during storage. This is similar to an export box but the sides & top must be secured to the wooden base with lag bolts (not nailed as export boxes are) to allow opening and reclosing many times without damage to the “shell”.

Minimum resistance of motor winding insulation is 5 Meg ohms or the calculated minimum, which ever is greater. Minimum resistance is calculated as follows: **Rm = kV + 1**

where: (Rm is minimum resistance to ground in Meg−Ohms and
kV is rated nameplate voltage defined as Kilo−Volts.)

Example: For a 480VAC rated motor Rm =1.48 meg−ohms (use 5 MΩ).
For a 4160VAC rated motor Rm = 5.16 meg−ohms.

Preparation for Storage

1. Some motors have a shipping brace attached to the shaft to prevent damage during transportation. The shipping brace, if provided, must be removed and stored for future use. The brace must be reinstalled to hold the shaft firmly in place against the bearing before the motor is moved.
2. Store in a clean, dry, protected warehouse where control is maintained as follows:
   a. Shock or vibration must not exceed 2 mils maximum at 60 hertz, to prevent the bearings from brinelling. If shock or vibration exceeds this limit vibration isolation pads must be used.
   b. Storage temperatures of 10°C (50°F) to 49°C (120°F) must be maintained.
   c. Relative humidity must not exceed 60%.
   d. Motor space heaters (when present) are to be connected and energized whenever there is a possibility that the storage ambient conditions will reach the dew point. Space heaters are optional.

   Note: Remove motor from containers when heaters are energized, reprotect if necessary.
3. Measure and record the resistance of the winding insulation (dielectric withstand) every 30 days of storage.
   a. If motor insulation resistance decreases below the minimum resistance, contact your Baldor District office.
   b. Place new desiccant inside the vapor bag and re−seal by taping it closed.
   c. If a zipper−closing type bag is used instead of the heat−sealed type bag, zip the bag closed instead of taping it. Be sure to place new desiccant inside bag after each monthly inspection.
   d. Place the shell over the motor and secure with lag bolts.
4. Where motors are mounted to machinery, the mounting must be such that the drains and breathers are fully operable and are at the lowest point of the motor. Vertical motors must be stored in the vertical position. Storage environment must be maintained as stated in step 2.

5. Motors with anti−friction bearings are to be greased at the time of going into extended storage with periodic service as follows:
   a. Motors marked “Do Not Lubricate” on the nameplate do not need to be greased before or during storage.
   b. Ball and roller bearing (anti−friction) motor shafts are to be rotated manually every 3 months and greased every 6 months in accordance with the Maintenance section of this manual.
   c. Sleeve bearing (oil lube) motors are drained of oil prior to shipment. The oil reservoirs must be refilled to the indicated level with the specified lubricant, (see Maintenance). The shaft should be rotated monthly by hand at least 10 to 15 revolutions to distribute oil to bearing surfaces.
   d. “Provisions for oil mist lubrication” − These motors are packed with grease. Storage procedures are the same as paragraph 5b.
   e. “Oil Mist Lubricated” − These bearings are protected for temporary storage by a corrosion inhibitor. If stored for greater than 3 months or outdoor storage is anticipated, connected to the oil mist system while in storage. If this is not possible, add the amount of grease indicated under “Standard Condition” in Section 3, then rotate the shaft 15 times by hand.
6. All breather drains are to be fully operable while in storage (drain plugs removed). The motors must be stored so that the drain is at the lowest point. All breathers and automatic “T” drains must be operable to allow breathing and draining at points other than through the bearings around the shaft. Vertical motors should be stored in a safe stable vertical position.
7. Coat all external machined surfaces with a rust preventing material. An acceptable product for this purpose is Exxon Rust Ban # 392.

Non−Regreaseable Motors

Non−regreasable motors with “Do Not Lubricate” on the nameplate should have the motor shaft rotated 15 times to redistribute the grease within the bearing every 3 months or more often.

All Other Motor Types

Before storage, the following procedure must be performed.

1. Remove the grease drain plug, if supplied, (opposite the grease fitting) on the bottom of each bracket prior to lubricating the motor.
2. The motor with regreasable bearing must be greased as instructed in Section 3 of this manual.
3. Replace the grease drain plug after greasing.
4. The motor shaft must be rotated a minimum of 15 times after greasing.
5. Motor Shafts are to be rotated at least 15 revolutions manually every 3 months and additional grease added every nine months (see Section 3) to each bearing.
6. Bearings are to be greased at the time of removal from storage.

Removal From Storage

1. Remove all packing material.
2. Measure and record the electrical resistance of the winding insulation resistance meter at the time of removal from storage. The insulation resistance must not be less than 50% from the initial reading recorded when the motor was placed into storage. A decrease in resistance indicates moisture in the windings and necessitates electrical or mechanical drying before the motor can be placed into service. If resistance is low, contact your Baldor District office.
3. Regrease the bearings as instructed in Section 3 of this manual.
4. Reinstall the original shipping brace if motor is to be moved. This will hold the shaft firmly against the bearing and prevent damage during movement.

Section 2
Installation & Operation

Overview Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

Location It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

1. **Open Drip−Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non−corrosive.
2. **Totally Enclosed and WPII** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service.

Hazardous Locations are those where there is a risk of ignition or explosion due to the presence of combustible gases, vapors, dust, fibers, or flyings. Facilities requiring special equipment for hazardous locations are typically classified in accordance with local requirements. In the US market, guidance is provided by the National Electric Code.

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load (gears, pumps, compressors, or other driven equipment) from the motor shaft before lifting the motor.**

Mounting The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

After installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

Alignment Accurate alignment of the motor with the driven equipment is extremely important. The pulley, sprocket, or gear used in the drive should be located on the shaft as close to the shaft shoulder as possible. It is recommended to heat the pulley, sprocket, or gear before installing on the motor shaft. Forcibly driving a unit on the motor shaft will damage the bearings.

1. **Direct Coupling**
   For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.
2. **End-Play Adjustment**
   The axial position of the motor frame with respect to its load is also extremely important. The motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.
3. **Pulley Ratio**
   The pulley ratio should not exceed 8:1.

Caution: **Do not over tension belts. Excess tension may damage the motor or driven equipment.**

4. **Belt Drive**
   Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.
5. Sleeve bearing motors are only suitable for coupled loads.

Doweling & Bolting After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor motors are designed for doweling.)

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment. Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure. Flanged nuts or bolts may be used as an alternative to washers.

WARNING: Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions, should be permanently guarded to prevent accidental contact by personnel. Accidental contact with body parts or clothing can cause serious or fatal injury.

Guarding Guards must be installed for rotating parts such as couplings, pulleys, external fans, and unused shaft extensions. This is particularly important where the parts have surface irregularities such as keys, key ways or set screws. Some satisfactory methods of guarding are:

1. Covering the machine and associated rotating parts with structural or decorative parts of the driven equipment.
2. Providing covers for the rotating parts. Covers should be sufficiently rigid to maintain adequate guarding during normal service.

Power Connection Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices. Flying leads must be insulated with two full wraps of electrical grade insulating tape or heat shrink tubing.

Conduit Box For ease of making connections, an oversize conduit box is provided.
The box can be rotated 360° in 90° increments.
Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

AC Power Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

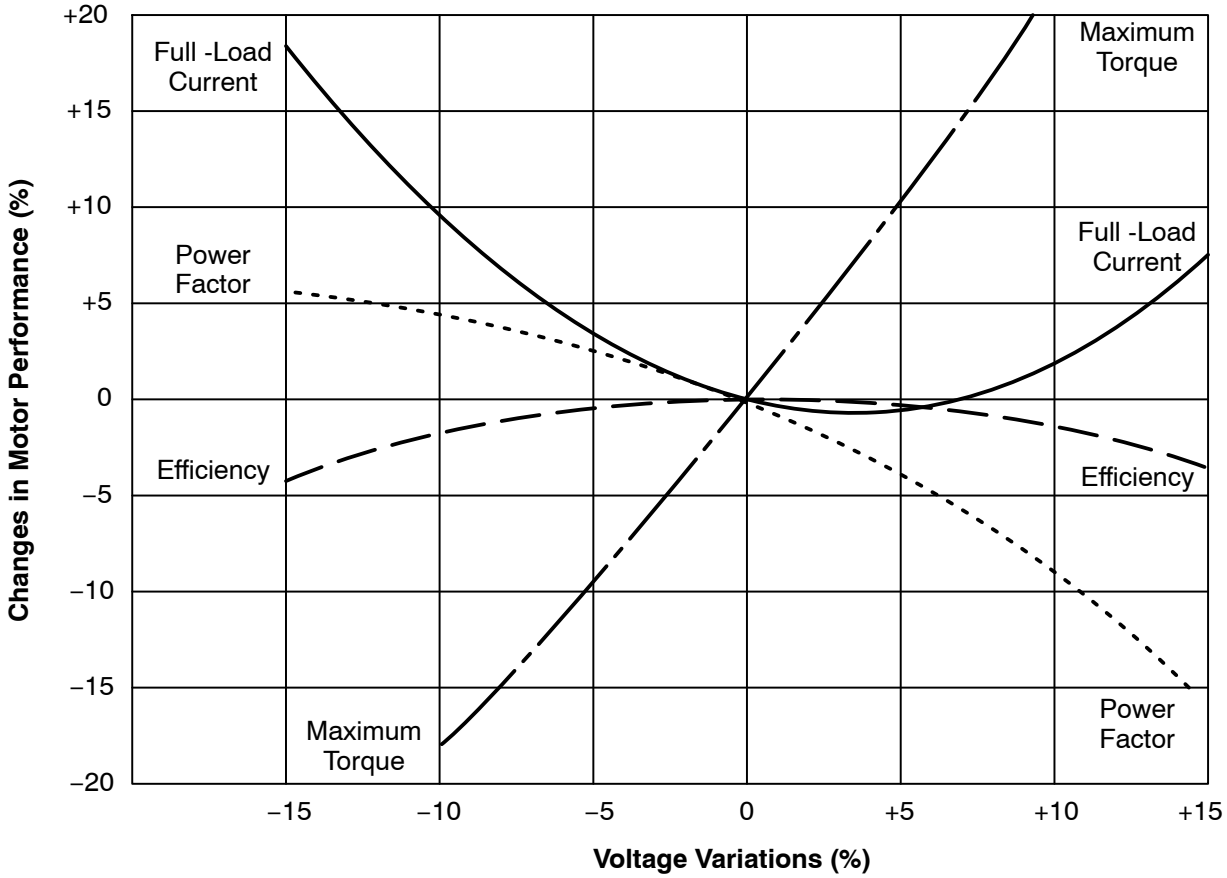
1. AC power is within ±10% of rated voltage with rated frequency. (See motor name plate for ratings).
   OR
2. AC power is within ±5% of rated frequency with rated voltage.
   OR
3. A combined variation in voltage and frequency of ±10% (sum of absolute values) of rated values, provided the frequency variation does not exceed ±5% of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-2.

Figure 2-1 Accessory Connections

HEATERS H1 — H2 H1 — H2	One heater is installed in each end of motor. Leads for each heater are labeled H1 & H2. (Like numbers should be tied together).
THERMISTORS T1 — T2	Three thermistors are installed in windings and tied in series. Leads are labeled T1 & T2.
WINDING RTDS RED RED WHITE	Winding RTDs are installed in windings (2) per phase. Each set of leads is labeled W1, W2, W3, W4, W5, & W6.
BEARING RTD RED RED WHITE	* One bearing RTD is installed in Drive endplate (PUEP), leads are labeled RTDDE. * One bearing RTD is installed in Opposite Drive endplate (FREP), leads are labeled RTDODE. * Note RTD may have 2–Red/1–White leads; or 2–White/1–Red Lead.

Figure 2-2 Typical Motor Performance VS Voltage Variations



Rotation All three phase motors are reversible. To reverse the direction of rotation, disconnect and lock out power and interchange any two of the three line leads for three phase motors. For single phase motors, check the connection diagram to determine if the motor is reversible and follow the connection instructions for lead numbers to be interchanged. Not all single phase motors are reversible.

Adjustable Frequency Power Inverters used to supply adjustable frequency power to induction motors produce wave forms with lower order harmonics with voltage spikes superimposed. Turn−to−turn, phase−to−phase, and ground insulation of stator windings are subject to the resulting dielectric stresses. Suitable precautions should be taken in the design of these drive systems to minimize the magnitude of these voltage spikes. Consult the drive instructions for maximum acceptable motor lead lengths, and proper grounding.

First Time Start Up Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.

Coupled Start Up This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor though the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor District Office or Baldor Service Center.

Section 3
Maintenance & Troubleshooting

WARNING: UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

General Inspection Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Use a “Megger” periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

Relubrication & Bearings Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

Type of Grease A high grade ball or roller bearing grease should be used. Recommended grease for standard service conditions is **Polyrex EM (Exxon Mobil)**. Do not mix greases unless compatibility has been checked and verified.

Equivalent and compatible greases include:
Texaco Polystar, Rykon Premium #2, Pennzoil Pen 2 Lube and Chevron SRI.

Relubrication Intervals Recommended relubrication intervals are shown in Table 3-1. It is important to realize that the recommended intervals of Table 3-1 are based on average use.

Refer to additional information contained in Tables 3-2, 3-3 and 3-4.

Table 3-1 Relubrication Intervals *

NEMA / (IEC) Frame Size	Rated Speed - RPM					
	10000	6000	3600	1800	1200	900
Up to 210 incl. (132)	**	2700 Hrs.	5500 Hrs.	12000 Hrs.	18000 Hrs.	22000 Hrs.
Over 210 to 280 incl. (180)		**	3600 Hrs.	9500 Hrs.	15000 Hrs.	18000 Hrs.
Over 280 to 360 incl. (225)		**	* 2200 Hrs.	7400 Hrs.	12000 Hrs.	15000 Hrs.
Over 360 to 5800 incl. (300)		**	*2200 Hrs.	3500 Hrs.	7400 Hrs.	10500 Hrs.

* Relubrication intervals are for ball bearings.
For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

Table 3-2 Service Conditions

Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination
Standard	8	40° C	Clean, Little Corrosion
Severe	16 Plus	50° C	Moderate dirt, Corrosion
Extreme	16 Plus	>50° C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration
Low Temperature		<–29° C **	

* Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

Table 3-3 Relubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

Table 3-4 Bearings Sizes and Types

Frame Size NEMA (IEC)	Bearing Description (These are the "Large" bearings (Shaft End) in each frame size)			
	Bearing	Weight of Grease to add * oz (Grams)	Volume of grease to be added	
			in^3	teaspoon
56 to 140 (90)	6203	0.08 (2.4)	0.15	0.5
140 (90)	6205	0.15 (3.9)	0.2	0.8
180 (100–112)	6206	0.19 (5.0)	0.3	1.0
210 (132)	6307	0.30 (8.4)	0.6	2.0
250 (160)	6309	0.47 (12.5)	0.7	2.5
280 (180)	6311	0.61 (17)	1.2	3.9
320 (200)	6312	0.76 (20.1)	1.2	4.0
360 (225)	6313	0.81 (23)	1.5	5.2
400 (250)	6316	1.25 (33)	2.0	6.6
440 (280)	6319	2.12 (60)	4.1	13.4
5000 to 5800 (315–450)	6328	4.70 (130)	9.2	30.0
5000 to 5800 (315–450)	NU328	4.70 (130)	9.2	30.0
360 to 449 (225–280)	NU319	2.12 (60)	4.1	13.4
AC Induction Servo				
76 Frame 180 (112)	6207	0.22 (6.1)	0.44	1.4
77 Frame 210 (132)	6210	0.32 (9.0)	0.64	2.1
80 Frame 250(160)	6213	0.49 (14.0)	0.99	3.3

* Weight in grams = .005 DB of grease to be added

Note: Not all bearing sizes are listed. For intermediate bearing sizes, use the grease volume for the next larger size bearing.

Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.

Relubrication Procedure Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

Caution: Do not over−lubricate motor as this may cause premature bearing failure.

With Grease Outlet Plug

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.

Caution: Over−lubricating can cause excessive bearing temperatures, premature lubrication breakdown and bearing failure.

3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed. This allows excess grease to purge.
5. Re-install grease outlet plug.

Without Grease Provisions

Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed explosion proof motor to maintain it's UL/CSA listing.

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.

Sample Relubrication Determination

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

1. Table 3-1 list 9500 hours for standard conditions.
2. Table 3-2 classifies severity of service as "Severe".
3. Table 3-4 shows that 1.2 in^3 or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

Table 3-5 Troubleshooting Chart

Symptom	Possible Causes	Possible Solutions
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter.	Check source of power. Check overloads, fuses, controls, etc.
Excessive humming	High Voltage.	Check input line connections.
	Eccentric air gap.	Have motor serviced at local Baldor service center.
Motor Over Heating	Overload. Compare actual amps (measured) with nameplate rating.	Locate and remove source of excessive friction in motor or load. Reduce load or replace with motor of greater capacity.
	Single Phasing.	Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation.	Check external cooling fan to be sure air is moving properly across cooling fins. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage.	Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator.	Check air gap clearance and bearings.
		Tighten “Thru Bolts”.
	Over voltage or under voltage.	Check input voltage at each phase to motor.
	Open stator winding.	Check stator resistance at all three phases for balance.
	Grounded winding.	Perform dielectric test and repair as required.
	Improper connections.	Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram.
Bearing Over Heating	Misalignment.	Check and align motor and driven equipment.
	Excessive belt tension.	Reduce belt tension to proper point for load.
	Excessive end thrust.	Reduce the end thrust from driven machine.
	Excessive grease in bearing.	Remove grease until cavity is approximately $^3/_4$ filled.
	Insufficient grease in bearing.	Add grease until cavity is approximately $^3/_4$ filled.
	Dirt in bearing.	Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled.
Vibration	Misalignment.	Check and align motor and driven equipment.
	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Rotor out of balance.	Have rotor balance checked are repaired at your Baldor Service Center.
	Resonance.	Tune system or contact your Baldor Service Center for assistance.
Noise	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.
Growling or whining	Bad bearing.	Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled.

Suggested bearing and winding RTD setting guidelines

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80°C) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

Winding RTDs – Temperature Limit In °C (40°C Maximum Ambient)

Motor Load	Class B Temp Rise ≤ 80°C (Typical Design)		Class F Temp Rise ≤ 105°C		Class H Temp Rise ≤ 125°C	
	Alarm	Trip	Alarm	Trip	Alarm	Trip
≤ Rated Load	130	140	155	165	175	185
Rated Load to 1.15 S.F.	140	150	160	165	180	185

Note: • Winding RTDs are factory production installed, not from Mod–Express.
• When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

Bearing RTDs – Temperature Limit In °C (40°C Maximum Ambient)

Bearing Type Oil or Grease	Anti–Friction		Sleeve	
	Alarm	Trip	Alarm	Trip
Standard*	95	100	85	95
High Temperature**	110	115	105	110

Note: * Bearing temperature limits are for standard design motors operating at Class B temperature rise.
** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as “standard” lubricants) include the following:

- Texaco Polystar
- Rykon Premium #2
- Chevron SRI #2
- Mobilith SHC–100
- Pennzoil Pennzlube EM–2
- Chevron Black Pearl
- Darmex 707
- Darmex 711
- Petro–Canada Peerless LLG

See the motor nameplate for replacement grease or oil recommendation.
Contact Baldor application engineering for special lubricants or further clarifications.

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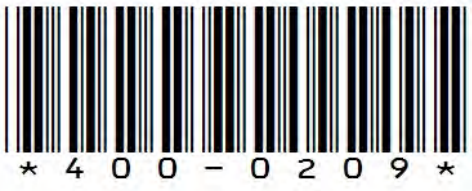

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