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PLANTA DE MOLIENDA

## 3.7 BALL MILL

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# 3.7 Ø2.500x7.500 mm BALL MILL OPERATION AND MAINTENANCE MANUAL



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## 1. SAFETY PRECAUTIONS

### 1.1 Warnings in the user manual

Please read our user manual carefully before starting installation and operation. In order to help and guide the user, following warnings have been used in the user manual:

#### WARNING!!!

Significant information against serious work accidents that may result with death.

#### CAUTION!

Significant information about protection against defects in the machine or on the system that are related to Personnel and work safety.

#### NOTE!

It advises on more efficient operation and maintenance of the machine and the system.

### 1.2 General safety precautions

#### WARNING!!!

The following list of general safety precautions should be considered as a guide only. There may be other conditions and variations in the operation equipment that are not covered in this general safety precautions. The purpose of these general safety precautions is to make all personnel aware of the general hazards and dangerous situations that exist around the equipment and the work area.

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### 1.3 Personnel safety

Read and understand each of the warnings, cautions and instruction in the instruction manual and place all signs and information plates on and around equipment.

Report all accidents immediately to your supervisor. Consult a doctor or medical personnel as soon as possible if personal injury is involved.

Keep a list of emergency telephone numbers close to the telephone and inform all work area personnel about the location of the list.

Do not operate or work around machine while under the influence of alcohol, medicines, tranquilizers or other drugs that can make you less alert or affect your judgement.

Take precautions to keep hair or loose fitting clothing from being caught on moving parts.

Wear safety glasses whenever there is any danger of flying debris, metal and stone fragments, objects or dust that could enter the eyes, and then required by operating regulation. Be extra safe always wear eye protection. Take good care of your eyes.

Wear gloves whenever possible to protect hands and finger from cuts, scraps, burn and solvent.

Always wear a helmet and safety shoes when appropriate for the work being done and always when required by local or national regulation. Around and beneath material transfer points there can be risk of falling material. Make sure that suitable guards and warning sign are provided.

Remove rings, watches, necklaces and bracelets before working in the plant. In areas where noise levels are high, wear hearing protection devices.

Wear a breathing apparatus or mask whenever appropriate i.e. when painting or working with chemicals, solvents and other substances that may be hazardous to your health. Remember that there is a risk of silicosis when there is siliceous dust in the air.

Do not take chances with your back. Use lift with your legs, not with your back.



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#### 1.4 Work area safety

Keep the general work area clean and free of debris. Avoid material build-ups on walk ways, platforms and ladders.

Do not allow unauthorized personnel in or around the work area. Keep a check on who is in your work area all the time. In case of need, keep a list.

Keep equipment surfaces that will be touched by hands and feet clean, dry and free of oil or grease.

Keep hand rails, guard rails, ladders and platforms clean, dry free of oil or grease. Store parts and tools in the designated places when not in use.

Keep safety equipment in a designated place and ensure that work area personnel know the location and the proper use of the safety equipment.

Make a daily check of starting alarms and warning devices in the work area, and ensure that each device is working properly before starting or operating the equipment.

Do not overload walkways. They are intended for personnel, not equipment.

Be alert to conditions that may obscure vision in and around your work area.

Always isolate the drive motor(s) of equipment before removing guards or carrying out any inspection or maintenance work.

The machines operations are not allowed as the covers are unmounted (gear cover, coupling cover, tromel screen cover etc) **IN CASE OF NOT OBEY THIS WARNING CAN BE RESULTED SERIOUS INJURIES OR DEATH.**

During the maintenance or liner replacement of the ball mill, when the personnel needs to go inside the mill, voltage must strictly cut off and completely energised. And also mill body must be fixed. Mechanical lock must be fitted.

Without taking this cautions, personnel is not allowed to go inside the mill.

**IN CASE OF NOT OBEY THIS WARNING CAN BE RESULTED SERIOUS INJURIES OR DEATH.**



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### 1.5 Electrical safety

CAUTION!

Allow only trained and competent personnel to work on electrical components, in the plant or in any equipment.

Always assume that an electrical circuit is live until it is proven dead by proper testing procedure.

Lock out and tag on electrical controls before performing any inspection, maintenance, lubrication or adjustment procedure.

Repair or replace electrical wires, cable and connectors that are broken or damaged in any way.

Check that electrical earth wire, motor and power cable connections are securely connected before starting any equipment.

Make sure you know location of all power lines and underground cables. Use extreme caution when working around these areas. Memorize the location of all main electrical isolating switches.

Never work on electrical equipment while it is raining or while standing in water or on wet surface unless you know that the power is disconnected.

Be alert when working around or with electricity. Report any electrical hazard immediately to your supervisor.



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### 1.6 Flammable and hazardous material safety

Store flammable, combustible or hazardous material in a safe place and in containers specifically designed for that purpose and clearly marked in accordance with the relevant regulation.

Store used and oily cleaning rags in a properly designed container as required by national and local rules and regulations, and away from flammable and combustible material.

Do not store flammable and combustible materials in, on or around the equipment, electrical installation or personnel facilities.

**CAUTION!**

Do not allow smoking or an open flame around fuel tanks or other storage facilities for combustible material.

Keep several fully charged fire extinguishers located throughout the work area. Make sure that all personnel know how to operate them. Have them readily available during fueling operation or when other fire hazards are present. Check the charge on each fire extinguisher at least once a month or when otherwise specified.

Do not use flammable or combustible substance such as gasoline, kerosene or diesel fuel for cleaning parts. Always use a nonflammable solvent for cleaning.

When using epoxy-resin based materials, follow the manufacturer's recommended producer and precautions.

**WARNING!!!**

Mix and pour epoxy materials in an open or well ventilated area. Do not burn cured resin without adequate ventilation. Avoid skin contact with uncured epoxy-resin materials.

Always inspect and change batteries in an open or well-ventilated area. Do not permit smoking or open flames near batteries.



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**WARNING!!!**

Remember that batteries can contain explosive gas. Properly dispose of waste, drained fluids and hazardous material with due regard to an in full accordance with all national and local environmental, safety, transportation, and other regulation and ordinances.

Make sure all personnel are familiar with these regulations.

Wear the appropriate clothing and protection device, and follow the recommended procedure when working with hazardous, flammable and combustible materials.

### 1.7 Pressurized systems (air, hydraulic)

**CAUTION!!!**

Do not perform maintenance on pressurized system component without first relieving all pressure in the system.

Do not mark internal check on pressurized oil, air or fluid system reservoirs or levels until all pressure in the system has been relieved. Pressurized oil and air are dangerous if released incorrectly. Oil and air under pressure can be very hot: use extreme caution and allow the system to cool before working on it.

Do not attempt to disconnect an air line or hydraulic line from a cylinder or other component unless all pressure in the system has been relieved.

Do not operate pressurized system with worn or damaged hoses, valves or fittings. Replace defected component before pressurizing the system.

**CAUTION**

Do not adjust relief valves beyond the recommended value. Follow the manufacturer's recommended inspection and maintenance procedures for pressurized system to ensure that safe operating conditions exist at all times.

**WARNING**

Take extreme care when working with hydraulic accumulators. They must never be heated or subjected to welding or mechanical damage.



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### 1.8 General maintenance conditions

The person who carries out maintenance work on this machine must be well acquainted with its design.

The person who is responsible for the operation of the machine must have good knowledge of the machine and must know when and how adjustment should be made.

He must also be familiar with the machine's permissible load limits.

For this reason you should read carefully through this maintenance instruction manual and study the spare parts list and the drawings included therein before you install or operate the machine. In addition, make sure that the operator responsible for the machine has a copy of this manual.

It is especially important to read the safety regulations included in the instruction manual.

### 1.9 Lifting machines and equipment

The usual lifting machines during transportation, installation and maintenance are cranes, elevators/ lifts, hoists, the crane bridge and hydraulic jacks. Due to the nature of operation of these machines any misuse, failure to comply with instructions, any lack of planning or coordination, careless action, inappropriate stand or positioning of body, insufficient maintenance etc, can be serious sources of hazards in the work place.

**The main sources of hazards from the use of lifting equipment are:**

- Crashing of the load or the lifting mechanism onto employees or operators within the working range of the lifting equipment
- Fall of the load to be lifted due to the failure of the lifting gear
- Fall of the load to be lifted due to insufficient or inappropriate securing of the load
- Tilting of the load during its transportation

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- Crashing of the load on the building steel or any equipment and as a result the tilting, release and crushing down of the load

**In general for the safe use of lifting equipment it is necessary:**

- To allow their operation only by authorised and trained personnel having all necessary licenses
- To make sure that the operators comply with the necessary work instructions
- To make sure their safe operation and in particular the stopping mechanism, the breaks and the lifting lines
- To check on a routine basis the hook mechanism
- To always secure the load using the approved straps
- To always lift the load slowly upwards for several cm in order to make sure that the load is balanced and stable prior to its lifting
- To always avoid the lifting of loads overhead from working personnel. For this reason the lifting equipment must be equipped with a warning sound signal so that all persons are withdrawn from the area under the load.

**1.10 Hazards And Protection Measures  
During Normal Operations**

- For the safe operation of the mills all the necessary guards must be in place in order to isolate the mechanical movement from contact with the operators. Additionally where operatives need to be near moving parts of machinery the necessary emergency buttons must exist in case there is a need for to stop the machinery.
- For the purpose of supervising the mills the operators are having to walk on specific platforms equipped with protective railing so that falls from height are prevented.
- Due to the excess kinetic energy of material as it rotates and the continuous pounding of the material inside the mill there is a serious hazard from the frequent hurling of mill nuts. In order to minimise the risk of accidents it is necessary to wear the appropriate helmet as well as the periodic tightening of the nuts.
- Within the milling area due to steel balls hitting the liners , the employees are exposed to noise and dust. The sound level must be assessed and if in doubt it



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must be measured. The resulting corrective action first of all must involve the reduction of noise at source, then the isolation of noise and if then this is not possible to use the necessary and appropriate PPEs.

- Due to the nature of work there is risk of dust being released to the atmosphere and if the dust stays airborne for a long time it creates short and long term breathing problems to the employees. A dust collection system must be used and employees must use the appropriate PPEs.

The maintenance activities in the inside of the mills include:

The maintenance of mill linings

The replacement of the grinding balls

- As a result of the above activities a number of serious hazards are created for the workers at least as follows:

- Falls from height (from the mill platforms)
- Hurling of metallic fragments from the mills' shell
- Work in confined spaces with insufficient ventilation
- Exposure to dust
- Exposure to High temperatures
- Due to the nature of the hazards involved such high risk operations must necessarily be planned so that all the following preventive measures are adhered to:

- Securing of the plant in a place where there is easy access of the maintenance technician into the mill
- The maintenance activity must be conducted by authorised personnel
- The work must be carried out under continuous supervision
- Adherence to documented operating preventive procedures
- Assure the necessary ventilation of the work space
- Assure the reduction of temperature prior to access to the space

The use of the appropriate PPEs that must include:

- Special helmet equipped with eye protector and safety shoes
- Safety belt and harness connected to a tying rope
- Special work ware and foot ware able to withstand thermal load
- Heat retarding gloves

- Special mask equipped with ventilating fan or connected to a central ventilation system
- Portable torchlight

### 1.11 Accident prevention check list

S: Safe US : Unsafe

No	Control Points	S/US	Observations
	<b>Normal Operation</b>		
1	Check the existence of collective protection measures such as barriers, guards or access doors and the machinery guards.		
2	Check the existence and adherence to operating procedures dictating the method of cleaning and maintenance.		
3	Make sure that no maintenance activity is carried out during operation		
4	Check the protection measures undertaken during the removal of material		
5	Check the existence and adequacy of safety signage and labelling,(eg restricted passageways, use of PPEs)		
6	Check if the use and maintenance of the approved PPEs		
7	Check the passageways used by all personnel. Check the proper labelling of each passageway		
8	Check the noise isolation .		
	<b>Mill maintenance</b>		
9	Check the securing procedures before and after the maintenance of equipment including the guarding		
10	Check that all maintenance activity in the mills is carried out by authorised technicians and that there is continuous supervision by a third person		
11	Check the internal condition of the mill prior to entry for absence of material and absence of thermal load, slurry, gas		
12	Check the condition of the PPEs that must be used: Safety belt harness, Ventilation mask, Work ware, Safety shoes, Special helmet equipped with eye protector		
13	Check the access of the manholes – Positioning of the mill at stop		
14	Check the securing of the access door		
15	Check the proper use of the PPEs		



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### 1.12 Accident prevention check list-use of lifting

S: Safe US : Unsafe

No	Control Points	S/US	Observations
	General Protective Measures		
1	Check the existence of the necessary safety labelling on the lifting equipment		
2	Check that the moving parts of the lifting device is appropriately guarded Check the existence of a valid CE Marking certificate, including the lifting gear		
3	Check that all protective measures are in place		
4	Check that the lifting equipment operator is trained and authorised to use the equipment		
5	Check the existence and use of the work instructions for the particular lifting equipment		
6	Check the level of maintenance and the existence of operational integrity certificates or certificates of test for: -Transmission system -Breaking and isolation -Lifting lines -Load limiting device -Hook		
7	Check that the loads are properly secured prior to lifting		
8	Check that the loads are properly lifted (slow upward movement, slow side ways movement with no operatives underneath)		
9	Check that above the lifting area there are no electricity supply lines		
	Use of hoists		
10	Check the use of safety operating instructions: - Gradual tensioning of load - Gradual unwinding of rope from pulley - Appropriate connection (tying up) to the load		
11	Check the integrity of the hook		
12	Check the use of suppliers instructions Check the existence of a valid CE Marking certificate and labelling		
13	Always be aware of the load you are lifting and assess the lifting capabilities of the hoist		



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No	Control Points	S/US	Observations
	Use of overhead cranes		
14	Check the existence of the necessary safety labelling on the lifting equipment		
	General Protective Measures		
15	Check that the moving parts of the lifting device is appropriately guarded Check the existence of a valid CE Marking certificate		
16	Always be aware of the load you are lifting and assess the lifting capabilities of the hoist		
17	Check that the loads are properly secured prior to lifting		
18	Check the use of safety operating instructions		
19	Use of crane bridge		
20	Check the existence of the necessary safety labelling in the crane bridge area		
21	Check the rout of the load to be moved		
22	Check the existence of other organisational arrangements on the plant prior to moving the load		
23	Always be aware of the load you are lifting and assess the lifting capabilities of the hoist The operator responsible should know at all times		
24	Check the existence and use of the suppliers operation and maintenance instructions Check the existence of a valid CE Marking certificate		
25	Check that the all operators make use of the appropriate PPEs		

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### 1.13 Risk assessment in grinding operation

No	Specific Hazard Area	Hazard Description	Person	Harm	Current safety measures
1	Airborne dust	Airborne dust in the milling area	Operators	Breathing problems	PPEs, Dust suction systems
2	Mechanical moving parts of mills	Contact with moving parts	Operators	Serious injury	Proper guarding, PPEs.
3	Falling material	During transportation there a risk from falling material	Operators	Serious injury	Proper guarding, PPEs.
4	Operators falling from height	Operatives falling from height by not using approved passageways	Operators , Maintenance Technicians	Serious injury , Death	Proper guarding, Safety signage PPEs.
5	Maintenance/ cleaning activity on operating machinery	Increased risk if carried out by unauthorised personnel	Operators , Maintenance Technicians	Serious injury , Death	Proper guarding, PPEs, Supervised work
6	Exposed to excessive noise levels	Exposed to excessive noise levels in the milling areas due to the crushing of material inside the mill and mill fan	Operators , Maintenance Technicians	Maintenance Technicians Gradual hearing impairment	Minimise noise at source or isolate noise. PPEs. Secure the doors of the homogenisation rooms

1.14 Symbols



Flammable materials



Explosion risk



Corrosive



Danger overhead



Forklift trucks



High voltage



General Warning



Oxidising



Hot surface



Danger of entrapment



Irritant



Slippery floor



Watch your step



Cutting



Danger of suffocation



Watch for falling



Battery hazard



Low temperature



Hand injuries



Danger of death



High temperature



Rotating parts



Electricity



Danger for cut

Figure 1. Safety symbols

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## 2. GENERAL INFORMATION

<b>BALL MILL</b>	
Ersel Code	10 01 EBM 250 0062
Brand	Ersel
Model	Ø 2.500 x 7.500 mm
Quantity	1 Pc
<b>PROCESS INFORMATION</b>	
Material to be ground	Quartzite
Feeding Grain Size	d <sub>100</sub> -3,35 mm-d <sub>90</sub> : 850 mic
Product Size	d <sub>80</sub> -80 mic
Mill Capacity	~20 t/h
Bulk density of feeding material solid	2,6 t/m <sup>3</sup>
<b>MACHINE INFORMATION</b>	
Mill Size	ø 2.500x7.500 mm
Rim Gear Modul/Number of teeth	m: 22 / z: 158
Pinion Modul/Number of Teeth	m: 22 / z: 27
Mill Speed	19,65 rpm (72 Hz)
Liner Material	Rubber Liner
Grinding Media	Steel Ball
Feeding Type	Drum type feeding
Discharging Type	Overflow discharge
Number of Manhole	2
Number of chamber	No
Feeding side bearing diameter	238/850 (Ø850 x Ø1030x 136 mm)
Discharge bearing diameter	238/850 (Ø850 x Ø1030x 136 mm)
Pinion bearing diameter	Ø200 x Ø340 x 140 mm (24140)
Gear coupling	EGC100
Rubber Coupling	EFC360
<b>DRIVE UNIT – MOTOR</b>	
Motor Power	560 kW
Motor Brand and Code	ABB- M3BP 400 LB 4 3GBP402520-ADG
Motor Speed	1492 rpm
Rated Volatage	400 V
Frequency	50 Hz
Insulation Class	F
Protection Class	IP 55
Main Motor Serial No	3GBP402520-ADG+VC

## 2.1 Ball mill equipment

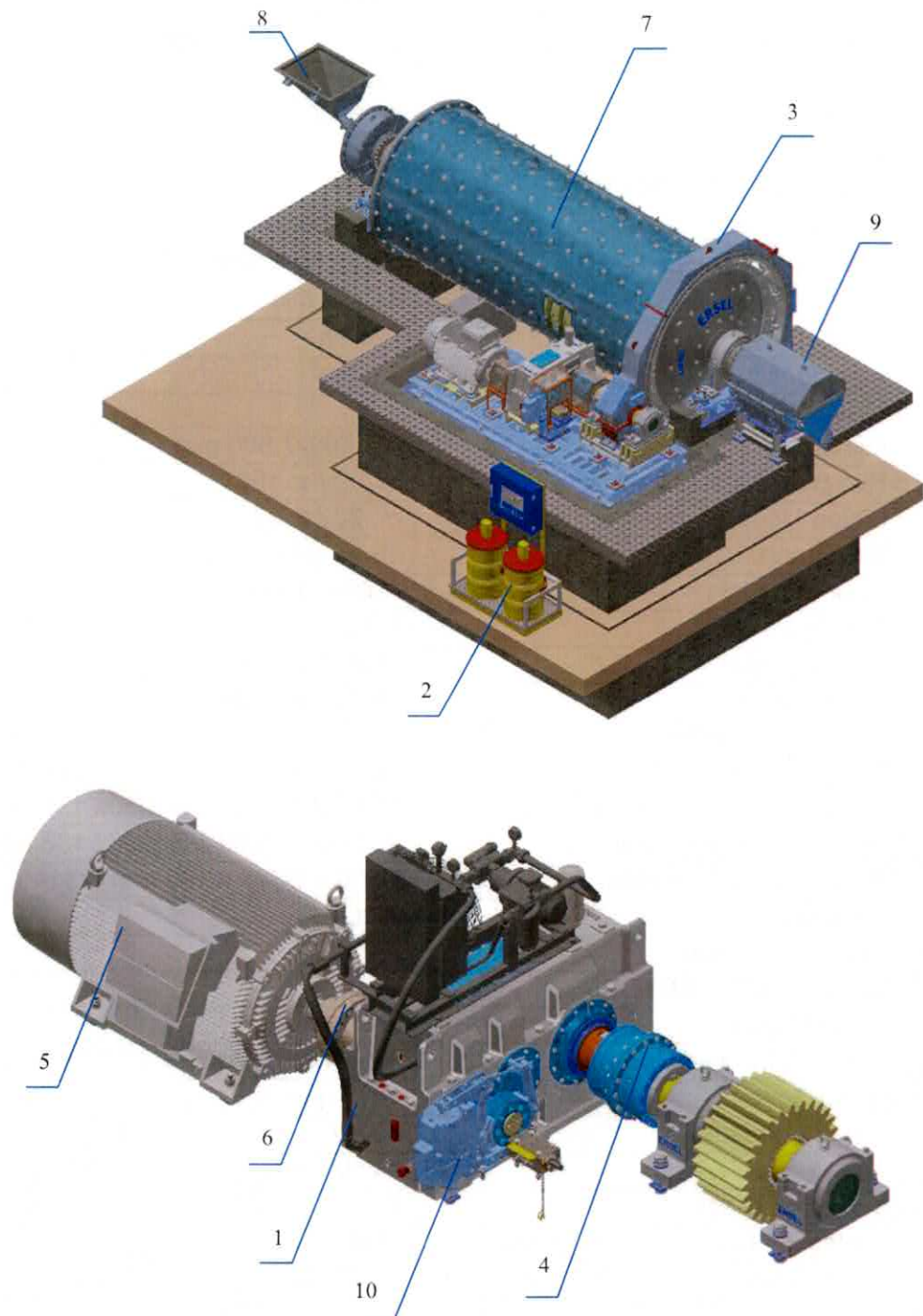


Figure 2. Ball mill and equipment

Basically, ball mill consists of components below;

- |                       |                     |
|-----------------------|---------------------|
| 1. Gearbox            | 6. Elastic coupling |
| 2. Lubrication system | 7. Ball mill body   |
| 3. Rim gear           | 8. Feeding groove   |
| 4. Gear coping        | 9. Trommel screen   |
| 5. Electric motor     |                     |

## 2.2 Name plate



Figure 3. Name plate

The name plate is located on the each equipment of body.

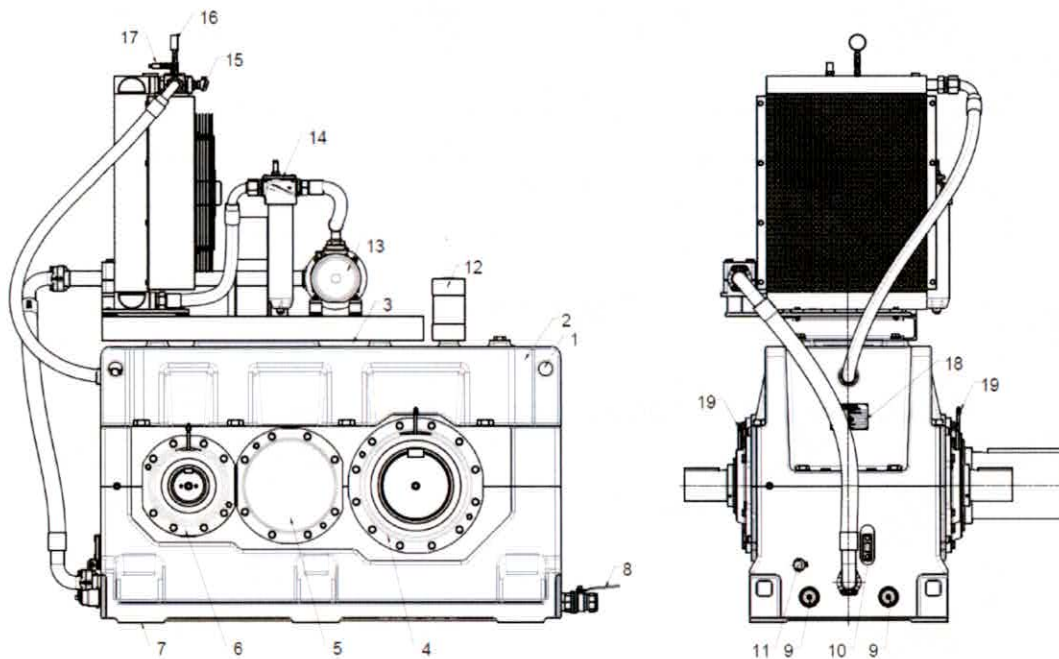
### 2.3.1 Main Gearbox

- THE FIRST OIL CHANGE must be done of the gearbox after 500 working hours. It must be noted that the additional oil or changing oil should be same brand as first fill lubricants with same viscosity and same ISO class. Mineral oil and Synthetic oil must not be mixed to each other. In case of mixture, even if the gearbox doesn't get sudden or direct damage, oil's chemical structure will be changed and protection level will be decreased.
- Gearbox oil must be changed for each 10.000 operating hours or at least once in 2 year

Following lines describe oil change process of gearbox:

- First oil inside the gearbox must be emptied from oil discharge plug (8)  
Oil is filled to the gearbox from oil filling plug (3 or 14)

The amount of total oil is 175 liters (This must be checked by oil level indicator)



**Figure 4. Gearbox view**

The oil types(ISO class: 320 Cst ) mentioned below must be used for Gearbox.



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Gearbox is consist ;

- |                       |                        |
|-----------------------|------------------------|
| 1. Lift holes         | 11. PT100 temperature  |
| 2. Gearbox body       | 12. Ventilation filter |
| 3. Inspection cover   | 13. Pump               |
| 4. Output chaft cover | 14. Oil filter         |
| 5. 2nd stage cover    | 15. PT100 temperature  |
| 6. Input shaft cover  | 16. Pressure manometer |
| 7. Connection holes   | 17. Flow switch        |
| 8. Oil drain valve    | 18. Gearbox tag        |
| 9. Oil heater         | 19. Grease nipple      |
| 10. Level indicator   |                        |

Gear Oil	Brand
Mobilgear SHC Gear	Mobil
Alphasyn EP	Castrol
Renolin Unisys CLP	Fuchs
Carter SH	Total
Shell Omala S4GVX/S4GX	Shell

The lubrication of gearbox shaft felts:

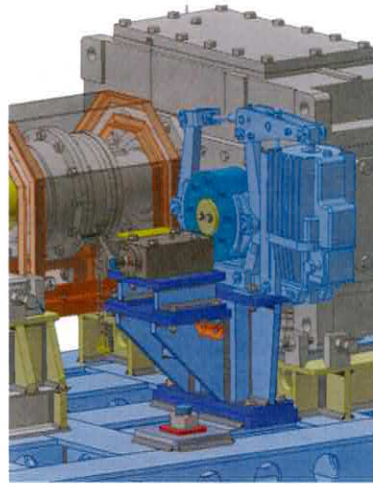
For the felts in the gearbox input and output shaft's covers must be greased by grease nipple once in a month . (The grease must be EP2 supported)

**2.3.2- Drum Brake and Mechanical Lock (TE / 250 30/5)**

Brake is assembled on a drum which mounted on to the shaft. If no power is supplied to the brake, brake shoes mounted to mechanism arms will press onto the drum and prevent rotating of the shaft. Brake pads are mostly made from organic materials in order to transfer pressure.

When the brakes are required to be opened, the electro-hydraulic brake motor should be supplied with energy and as a result of piston movement, shoes will be opened. Mill can turn freely after brakes pressure force eliminated.

When energy supply is turned off, piston moves down by spring force on the mechanism and brake shoes is closed onto the drum. The friction between pads and the drum will slow down the system and stop it in a short while.



**Figure 5 Drum Brake and Mechanical Lock**

### 2.3.3 Central lubrication system

- The ball mill has two air oil pumps. Rim gear lubrication has one electrical pump.
- Bearings are lubricated directly from barrel by air pump.
- Gear lubrication air pump is used for filling electrical pump reservoir.
- Gear spray system has one electrical pump.
- Gear lubrication is done by electrical pump.
- Electrical pump reservoir has level sensor.
- The barrels, lines and spray plate has heaters.
- Spray nozzles has inductive sensors.
- Lubrication systems company catalog is given attached.
- The oil barrels must be checked whether they are full of oil.
- The lubrication system works automatically. In case of any error in the lubrication system, ball mill will not operate.
- In case of any error, it strictly is not allowed to intervene to the lubrication system. Ersel must be informed about the error.
- Rim gear and housings must be checked everyday by eye control, whether they are being lubricated.

#### **ATTENTION!**

**IN CASES WHERE THESE CONDITIONS ARE NOT PROVIDED;  
LUBRICATION SYSTEM IS NOT UNDER MANUFACTURERS GUARANTEE.  
FURTHERMORE, HOUSINGS OR GEAR ARE NOT UNDER ERSEL'S  
GUARANTEE IN CASE OF DAMAGES AS A RESULT OF WRONG USAGE OF  
LUBRICATION SYSTEM.**

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**Lubrication air pressure setting:**

- Feeding air : 7 Bar
- Danfoss Pressure Switch : Will be set as; 5 Bar ±2.

**2.3.4 Pinion-Rim Gear Lubrication:**

**1. ALTERNATIVE:**

**HIGH VISCOSITY OIL APPLICATION IN NORMAL OPERATIONS**

Pinion-Rim Gear Lubricants	Brand Name	Viscosity 40 °c
Klüber CF3 Ultra	Klüber	16500 cst
Bechem Berugear HV20	Bechem	18500 cst
Bechem Berugear HV10	Bechem	10000 cst
Castrol Molub Alloy 8031-3000	Castrol	3000 cst
Whitmore Envirolube XE	Whitmore	5000 cst

**2. ALTERNATIVE:**

**GRAPHITE GREASE LUBRICATION**

- **Pre-Lubrication brush Application**
- Amount of grease: 25 kg ( 1 bucket)

Pinion-Rim Gear Lubricants	Brand Name	Viscosity 40 °C
Graflascon Ag-1 Ultra	Klüber	460 cst
Berulit EI 443	Bechem	260 cst
Ceplattyn 300	Fuchs	300 cst

This grease is applied with spatula or brush. Before applying the grease to the gears, the gear surface must be cleaned. Grease application should be applied after assembly and gear adjustments. The contact pattern on the gear surface is controlled by rotating the mill in auxiliary drive or JOG mode.

- **Running in Grease**
- Amount of grease: 180 kg ( 1 barrel)

Pinion-Rim Gear Lubricants	Brand Name	Viscosity 40 °C
Graflascon B-SG 00 Ultra	Klüber	500 cst
Berulit EI 420	Bechem	490 cst
Ceplattyn Gtrn	Fuchs	500 cst

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The mill commissioned with gear run in oil. After the first barrel is finished, the following greases are used suitable conditions in normal operation.

### **NORMAL OPERATION PINION-RIM GEAR LUBRICATORS**

**Due to the lubrication system requirement, oil should be supplied as a barrel (180 lt)**

#### **Lubrication air pressure setting:**

Feeding air : 7 Bar

Danfoss Pressure Switch : Will be set as; 5 Bar  $\pm$ 2.

<b>PINION-RIM GEAR LUBRICANTS</b>	<b>BRAND NAME</b>	<b>VISCOSITY 40 °C</b>
Bechem- Berulit GA 2500	Bechem	2000 cst
Fuchs-Ceplattyn Kg10 HMF-2500	Opet fuchs	2500 cst
Kluber- Graflascon C-SG 2000 Ultra	Klüber Lubrication	2500 cst
Castrol-Molub Alloy 9790	Castrol	2500 cst

**The lubrication system must be adapted to the following conditions of the existing system.**

- The grease barrels should be in a closed room and the barrels should be heated with a heat jacket. For lubrication ,the barrels must be kept at a temperature of 30-40 °C

- Heating should also be done in the lubricaton piping and spray plate.

A self –regulating heat tape should be used in the heating system.

- Working pressure of 3-7 bar in graphite grease application is sufficient to create the required surface area for spraying.

- In case of using transparent oils, the air pressure should not drop below 6 bar.

Because at low pressures, due to the nature of the oil, the desired number of, pulses is not received, but the gear is not sprayed from the nozzles, and the oil is poured down the casing in a fibrous structure beefore it reaches the gear

- For this, an air tank should be installed next to the lubrication unit and the air pressure flow rate, feeder (6 bar) should be provided under suitable conditions.

- Gear housing dust seals should be checked once a week and it should be ensured that dust does not enter through the seals.



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- It should be checked once in a week whether oil has accumulated under the gear housing.

### 2.3.5 Housing Lubrication:

Bearing housing lubricants	Brand	Viscosity 40 °C
Beruplex LI EP 2	Bechem	220 cst
Mobilgrease XHP 222	Mobil	220 cst
Unipolly 222 EP	Klüber Lubrication	180 cst
Spheerol EPLX 200-2	Castrol	200 cst
Shell Albida EP2	Shell	220 cst
Renolit Duraplex EP2	Fuchs	105 cst
Renolit GP2	Opet Fuchs	110 cst

#### a- Pinion-Rim Gear lubrication

##### ▪ Lubrication period:

- Set as 4 puls during 120 sec. operation 140 cc/h oil is given to the system with gear lubrication system.

##### ▪ Lubrication air pressure setting:

Feeding air : 7 Bar

Danfoss Pressure Switch : Will be set as; 5 Bar ±2.

Pinion-Rim Gear Lubricants	Brand Name
Ceplattyn Kg10 HMF-2500	Opet Fuchs
Klüber Graflascon C-SG 2000 Ultra	Klüber Lubrication
Bechem Berulit GA 2500	Bechem

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### b- Lubrication of bearing housings

- **Lubrication period:**

Set as 3 puls during 900 sec. operation 30 cc/h of oil is given to the system with housing lubrication system.

Bearing Housing Lubricants	Brand Name
Mobilgrease XHP 222	Mobil
Unipolly 222 EP	Kluber Lubrication
Beruplex LI EP 2	Bechem
Spheerol EPLX 200-2	Castrol
Shell Albida EP2	Shell
Renolit Duraplex EP2	Opet Fuchs
Renolit GP2	Opet Fuchs

### 2.4 Gear coupling

Model No: EGC100

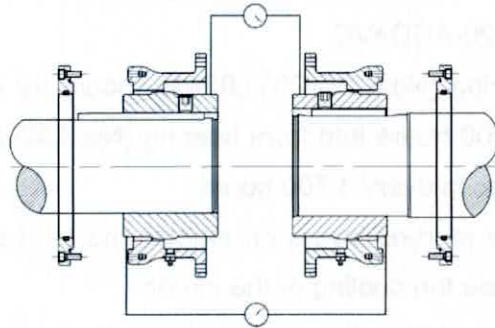
- Once in every 3 months grease should be fed from grease holders.
- While feeding grease; **BLIND CAPS WILL BE REMOVED** and feeding will continue till the old grease is thrown out.
- General maintenance should be done once a year.

In general maintenance; gears are checked, o-rings are changed and grease is refilled.

- Recommended grease types for gear coupling.

BP	CASTROL	FUCHS	MOBIL	SHELL
Energol GR-XF 680	Tribol 1100/680/Optigear BM 680	Renolin CLP 680 Plus	Mobilgear XMP 680	Shell Omala 680
Energol GR-XF 460	Tribol 1100/460/Optigear BM 680	Renolin CLP 460 Plus	Mobilgear XMP 460	Shell Omala 460

Run out of gear coupling should be max. 0,1 mm. :

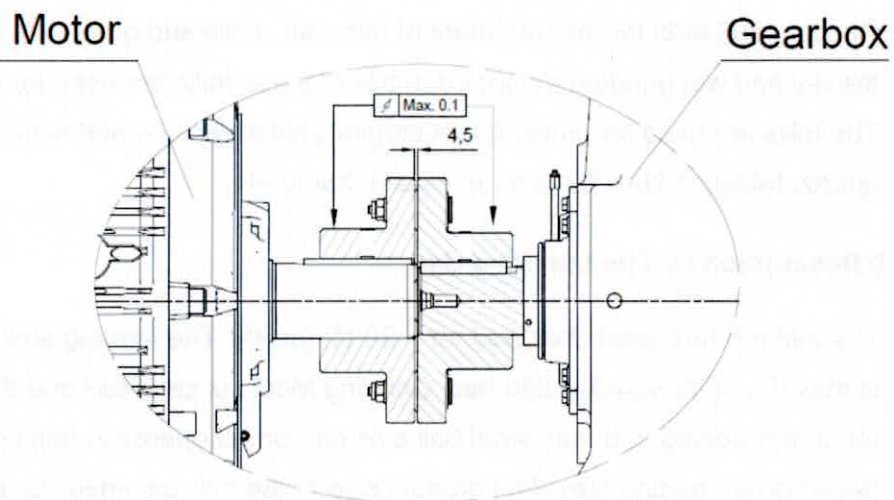


**Figure 6. Gear coupling section**

### 2.5 Elastic coupling

Model No: EFC360

- Elastic coupling is used between electric motor and gearbox.
- If rubber of the elastic coupling is damaged, it must be replaced with a new one.
- Run out of the elastic coupling should be maximum 0,1 mm.



**Figure 7. Elastic coupling section**

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## 2.6 Electric motor

MODEL NO : ABB- M3BP 400 LB 4 3GBP402520-ADG

SERIAL NO : 3GBP402520-ADG+VC

- Electric motor back bearing (No:6319/C3VL0241) should be fed with ~55 gr of grease once in every 4.700 hours and front bearing (No: 6324/C3) should be fed with ~85 gr of grease once in every 4.700 hours.
- There should not be any mud-oil layers on electric motor; it should be cleaned frequently. This would ease the cooling of the motor.
- Mill frame should be connected to the ground electrode which would be installed near to the mill concrete.
- Electric motor should be earthed by with a cable with suitable cross-section which will be connected to the earthing busbar coming to the electric panel.
- Grounding resistance must be in conformity with IEC 60364 standard.

## 2.7 General Functional Description Of The Machine

Grinding ball mills for the treatment of minerals, ores and other bulk materials for the dry and wet grinding. A large number of these mills are used for metal mining. The mills are used for grinding iron, copper, gold, silver, zinc and lead, cement, quartz, feldspar, lime, limestone, calcite, barite etc.

## 2.8 Description Of The Intended Use

The ball mill has been designed for ~ 20 t/h (solid). The feeding size of raw material is max  $d_{100}$ -3,35 mm- $d_{90}$ : 850 mic. Grinding Media is steel ball and the distribution for commissioning and max steel ball size for normal operation has been calculated based given feeding size. The product size of the mill assumed  $d_{80}$ -80 micron.

Water will be added continuously to the ball mill during grinding.

Mill discharge density will be ~2,7 t/m<sup>3</sup>.

An engineer from Ersel shall supervise during the assembly period and commissioning. The Ball mill will be charged with 50% grinding media at commissioning. The Ball mill will be controlled by an Ersel engineer after operating



**ERSEL**



**BAUBLOCK**

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with 50% grinding media. After about four (4) to six (6) days of run, all bolts should again be tightened and the gear and pinion alignment checked and adjusted if necessary.

Grinding media charge will be increased gradually after controls by Ersel's engineer.

The commissioning must not be done without Ersel's supervision.

The direction of rotation is important. Otherwise the gearbox can be damaged.

**ATTENTION!**

**THE COMMISSIONED MACHINE WITHOUT INFORMING ERSEL DOES NOT INCLUDE GUARANTEE.**

## **2.9 Guarantee and spare parts policies**

### Guarantee policy:

In addition to the information given in the general delivery conditions, we would like to point out the following;

Ersel undertakes to correct faults in machines sold by us, under the condition:

- The fault is due to defective design, material or manufacturing.
- The fault is reported to Ersel's representatives within the applicable guarantee period.
- The machine is used only in accordance with the operating conditions specified by Ersel and in applications for which it is intended.
- Maintenance works and repairs are carried out by competent service personnel, in accordance with Ersel's recommendations.
- Only genuine Ersel's parts are used.

Our obligation thus does not cover faults caused by the use of non-genuine parts, inadequate maintenance, incorrect installation, incorrect operation, incorrectly carried out repairs or normal wear.

Ersel takes no responsibility for damage beyond what is mentioned above—neither injuries to people, damage to property nor consequential damages.

We reserve the right to alter the design and specifications of our product without prior notice.

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## 2.10 Spare parts policy

In order to achieve optimal reliability and operating economics throughout the entire life of the machine, only genuine Ersel original parts may be used.

The use of genuine Ersel parts automatically gives access to development and quality advances constantly made by Ersel.

Ersel guarantees that spare parts will be supplied for at least 10 years after the cessation of manufacture of the machine in question.

To ensure that spare parts deliveries are correct, consult the applicable spare parts list and with all orders, specify the following:

- Machine type
- Serial Number
- Description, part number and quantity required.

## 2.11 Service assistance

Service work or service personnel can be ordered through directly from:

ERSEL HEAVY MACHINERY INC.

Adress: TOSB ORGANİZE SANAYİ BÖLGESİ 1.Cadde 15.Sokak No:2 41420  
Çayırova-Kocaeli/TÜRKİYE

Tel : +90 262 658 13 40

Fax : +90 262 658 05 27

e-mail : [info@ersel.com](mailto:info@ersel.com)

web page : [www.ersel.com](http://www.ersel.com)

### 3.INSTALLATION



When doing electric welding work, take care to ensure that the welding current does never pass the bearings, other moveable connections or measuring systems in order to eliminate damage to these parts.

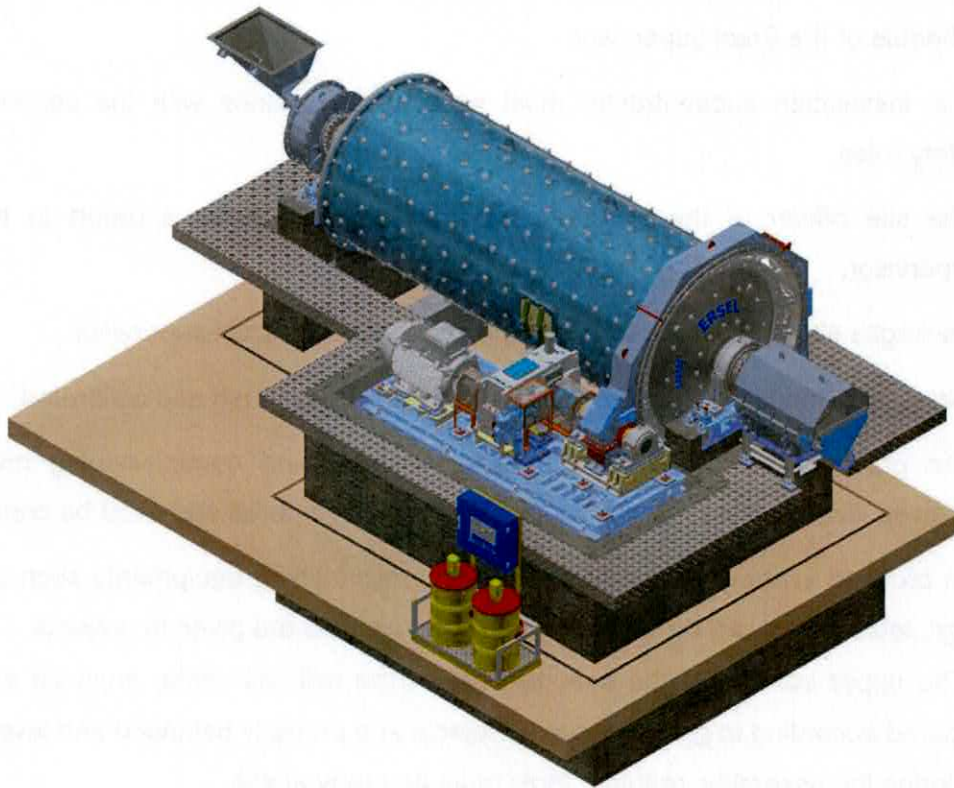


Figure 8. Ball mill view

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### 3.1 Requirement Before Installation And Commissioning

**The following items should be prepared on site for the assembly works to be carried out under the supervision of Ersel.**

-The installation subcontractor company should work in harmony with the personal supervisor and he qualified.

-Installation subcontractors should work in accordance with the direction and schedule of the Ersel supervisor.

-The installation subcontractor must work in accordance with the commissioning safety rules.

-The site officer of the subcontractor company will make a report to the Ersel Supervisor.

-Packages should be opened under the supervision of Ersel supervisor.

-Lifting and handling equipment to be used must be certified and calibrated.

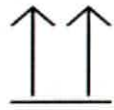
-The personnel who will work in the assembly and commissioning must have received OHS training in accordance with the rules in force and must be certified.

1. In order to assembly the mill and parts, suitable lifting equipments such as crane, slings, locks etc. must be ready at site. Lifting weights are given in projects
2. The upper surface of the concrete where the mill will settle, must be accurately prepared according to given concrete projects and properly balanced and levelled.
3. During the assembly, required tools must be ready at site.
4. Welding machines, welding electrodes and welding equipments must be supplied for welding process.
5. Required water and air, grease etc. consumables must be ready before commissioning.
6. The feeding material must be ready before commissioning.
7. 1 Mechanical engineer, 1 electrical engineer and at least 6 qualified assembly personnel must be assigned during installation and commissioning.
8. First filling lubricants must be provided before commissioning
9. First charge steel balls must be ready at site before commissioning. The grind balls diameters and quantity was given.

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10. Air installation must be applied as 1,6 m<sup>3</sup>/min with minimum 6 bar pressure up to lubrication panel on the mill layout with a 1/2" ball valve. (Continuous dry air)(Compressor+air tank+dryer in a compressor room under the customer scope)
11. Power and signal cable must be supplied and install. Ersel supervisor will check the connections. Ersel supervisor will do megger and earthing resistance control.
12. The cable type must be TTR multi wire cable between mill panel and lubrication panel and the cables must be shielded cable between mill panel and lubrication panel, the sensor cables between mill panel and motor must be shielded (screened) cable. Cable sections will be given by email. All cables, cable tray, cabling works are in customer scope and should be installed before commissioning.
13. The distance between the cables must be at least 400 mm.
14. In order connect the cables from the bottom of the panels, there must 400-500 mm height of panel supports.
15. Mill will be commissioning at unload and Ersel electrical and mechanical supervisors will inspect.
16. Mill will be commissioned %50 charge with 4-6 days. Ersel electrical and mechanical Supervisors will inspect.
17. Mill will be commissioned *gradually* under Ersel Supervisor inspections and charge will be completed gradually increased.
18. Note: The mill drive unit (motor, gearbox and pinion) must be covered with a tent(sheltered) or if possible mill completely locate in a close area to prevent sun and rain. Also The lubrication unit must be covered with a tent(sheltered) or a room.
19. Electrical panel room must be conditioned and dust proof.
20. 6.600 VAC power must be delivered up to Ersel panels.
21. Grounding resistance must be in conformity with IEC 60364 standard.
22. Installation and commissioning must be done under Ersel supervision.
23. The mill and plant equipment parts must be carefully unloaded to the site from the transportation trucks. The parts must not be stacked each other. The signs on the part boxes must be followed. Below signs must be followed. The parts must be stored in a close area, covered and dry place. The close area must be free from dust.

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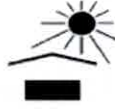
Top



Fragile



Keep dry



Keep cool



Centre of gravity



Use no hand hook



Attach here

### 3.2 Required Lubricants For Commissioning And Regular Operation

#### 3.2.1 Bearing Housing Grease

##### TOTAL ONE BARREL

The sistem automatically to the bearings. There must be supplied 1 barrel (180 lt) for the requirement of the lubrication system.

Grease	Brand
Beruplex LI EP 2	Bechem
Mobilgrease XHP 222	Mobil
Unipolly 222 EP	Klüber Lubrication
Energrease LCX 222	Bp
Shell Albida EP2	Shell
Renolit Duraplex EP2	Opet Fuchs
Renolit GP2	Opet Fuchs

#### 3.2.2 Gear Running-In Grease

▪ It will only be used for commissioning.( After consuming a barrel of run-in oil, it will be followed by nominal operating grease)

##### ▪ TOTAL ONE BARREL REQUIRED

Run-in grease	Brand
Grafloscon B-SG 00 ULTRA	Klüber
Ceplattyn GTRN	Fuchs
Berulit 420	Bechem



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**3.2.3 Pinion –Gear Grease**

- Normal operating grease

1 Barrel (180 lt) of grease should, be provided as a gear lubrication system requirement.

Gear	Brand
Bechem Berulit GA 2500	Bechem
Ceplattyn KG10 HMF-2500	Opet Fuchs
Klüber Graflascon C-SG 2000 Ultra	Klüber lubrication

**Note:** The air requirement of the lubrication system is 1,6 m<sup>3</sup>/min for a mill.

The compressed air supplied must be conditioned air.

The lubrication system must be brought to the cabinet with a ½" pipe

The required air pressure is 6 bar

**3.2.4 Gearbox Oil**

**Note :** Total amount of oil for gearbox ~175 liters.

Oil type : HLP HC 320 CST SHYNTETIC OIL PAO

Gear Oil	Brand
Mobilgear SHC Gear	Mobil
Alphasyn EP	Castrol
Renolin Unisys CLP	Fuchs
Carter SH	Total
Shell Omala S4GVX/S4GX	Shell

First oils to be changed after 500 hours of operation

**3.2.5 Gear Coupling Grease**

- First filling is ~3 kg.
- Lubrication interval is each 3 months.

BP	CASTROL	FUCHS	MOBIL	SHELL
Energol GR-XF 680	Tribol 1100/680/Optigear BM 680	Renolin CLP 680 Plus	Mobilgear XMP 680	Shell Omala 680
Energol GR-XF 460	Tribol 1100/460/Optigear BM 680	Renolin CLP 460 Plus	Mobilgear XMP 460	Shell Omala 460



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### 3.2.6 Motor Bearing Grease

First filling can be supplied 1 kg.

- 55 gr for NDE bearing in every 4700 hours.
- 85 gr for DE bearing in every 4700 hours

Brand	Grease	Constant Operating Temperature (.C)
Exxon Mobil	Unirex N3 (Lithium Complex Soap)	(-30 to 150)
Shell	Shell Alvania RL3 (Lithium Soap)	(-30 to 120)
Petrobras	Lubrux Industrial GMA-2 (Lithium Soap)	(0 to 130)
Shell	Stamina RL2 (Diurea Soap)	(-20 to 180)
SKF	LGHP 2 (Polyurea Soap)	(-40 to 150)

### 3.2.7 Gearbox Bearing Grease

First filling can be supplied 1 kg.

- 30 gr for NDE bearing in every 4500 hours.
- 30 gr for DE bearing in every 4500 hours.

Grease	Brand
Shell Gadus S5 V100 2	Shell
Mobilith SHC 100	Mobil
Unirex R2	Mobil

### 3.3 Required Tools For Installation And Maintenance

#### 3.3.1 Special tools

1. Torque pump (1 pc)  
9500 Nm pressure up to 700 bar  
With reaction arm+Sockets  
Gear Connection bolt: M42(4.800 Nm)  
Main housing anchor bolt M52(9.000 Nm)  
Drive unit anchor bolt M48: (7.000 Nm)  
Main housing connection M36: ( 2.800 Nm)



#### 2. Hydraulic Tork Socket (1 pc)

No	Socket size	Quantity	
1.	55 mm Min depth:80 mm	1 Pcs	 Recommended tool
2.	70 mm Min depth:90 mm	1 pc	
3.	75 mm Min depth:140 mm	1 Pcs	

Note: Sockets should be longer as the given dimensions, or they should be open end type.


Note: Must be with hydraulic torque reaction arm.

Note : Under the contract hydraulic torque and sockets were supplied by Ersel.

### 3.3.2 Standard tools


#### 3.3.2.1 Open end spanner

No	Spanner size	Quantity
1	18 mm	1 Pc
2	24 mm	1 Pc
3	30 mm	1 Pc
4	36 mm	1 Pc
5	46 mm	1 Pc
6	55 mm	1 Pc




#### 3.3.2.2 Slugging ring spanner

No	Spanner size	Quantity
1	55 mm	1 Pc
2	65 mm	1 Pc
3	75 mm	1 Pc
4	80 mm	1 Pc



#### 3.3.2.3 Slugging Open Jaw Wrench

No	Spanner size	Quantity
1	55 mm	1 Pc
2	65 mm	1 Pc
3	75 mm	1 Pc
4	80 mm	1 Pc



#### 3.3.2.4 Schim plates


No	Schim plates size	Quantity
1	0,05 mm	300mmx 5m
2	0,1 mm	300mmx 5m
3	0,25 mm	300mmx 5m
4	0,5 mm	300mmx 5m
5	1 mm	300mmx 5m



**3.3.2.5 Other tools**

No	Name	Quantity
1.	Mobil Welding Machine 	2 Pcs
2.	Socket spanner set / 25-60 set, with tightening torque 	1 Set
3.	Star spanner set 	1 set
4.	Allen set 	1 set

**3.3.2.6 Other equipment**






No	Name	Quantity
5.	Mobile Compressor 	1 Pc



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4.	Caliper		1 Pc
5.	Dial gauge (0,01)		3 pcs
6.	Grease Gun (If possible pneumatic one)		1 Pc
7.	Megger Control device		1 Pc
8.	Earthing tester device		1 Pc

No	Name	Quantity
1.	Drill	1 pc







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2.	Drill Bit $\varnothing 12,16$ mm 	1 Set
3.	Transparent silicon hose ( $\varnothing 12$ ) (for levelling)-15 m 	15 m
4.	Precious scale (0,02/1000) 	2 pcs
5.	GWS 9-115 Grinding cutting machine 	1 Pc
6.	180x8 Grinding disc 	10 pcs
7.	180x3 Cutting disc 	10 pcs








8.	Tape measure (5 m and 10 m) 	2 pcs
9.	Square (Te) 	1 Pc










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10.	Screwdriver set 	1 set
11.	Hammer 	2 pcs
12.	Construction string for axis alignments min 50 m 	1 set
13.	 <p>Unio Bilgi Fiyatı Dizaynleme 25/02/2007 Revizyon no: 0 Identifikasyon no: 01 03 02 02 203 0 00001 Sikadur®32</p> <p><b>Sikadur®32</b> Epoksi Reçine Esaslı Yapıştırma Malzemesi</p> <p>Alternative products: -Sicascreed 20 EBB -Masterbrace ADH 1420 -Sika armatec 110 Epocem</p>	For frame installation
14.	Bottle Jack (5 ton) or suitable ratchet jack hydraulic jack. 	2 Pcs
15.	Required crane with suitable lifting capacity. 	According to lifting weights
16.	Various lifting equipment with lock and slings 	1 set

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17.	Chain Block 	2 Pcs
18.	Chemical Peg (Tube epoxy for fixing iron bars to drilled hole) (Hilti RE500 etc.) –with the Gun 	48 pcs
19.	Manual torque wrench for gear super bolts (1500 Nm) 	1 pc
20.	Iron bars Ø16-18 mm for frame fixing. ( These will be cut certain lengths during frame installation.) 	30 meters
21.	Theodolite 	1 pc With topographer

### 3.4 Installation Sequence;

Below instructions are for Ersel mill installation procedure.

The application will be performed according to site situation, workman power and required tools .

The required tools for installation is given above.

General installation sequence is given below. It is aimed that to get idea for the installation planning and works to be done.

Specified works sequence can be vary according to Ersel supervisor at site.

Installation should be done under Ersel supervision.

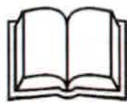
Installation sequence:

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1. Mill concrete application and dimensional check before C30 concrete.
2. C30 concrete application with the reinforcement according to given mill loads by customer.
3. Preparation for mill frame assembly.
4. Installation of mill main bearing frame and drive unit frame.
5. Rim gear and pinion guard lower part assembly.
6. Mill body assembly.
7. Rim gear assembly.
8. Drive unit assembly.
9. Rim gear guard assembly.
10. Feeding group, discharge group, coupling guard assembly.
11. Liner assembly.
12. Electrical connection installation.
13. Filling the gearbox oil.
14. Greasing gear coupling.
15. Tightening the bolts with torque.
16. Lubrication system assembly and piping installation.
17. Lubrication unit test.

### 3.4.1 Installation of the mill frame

Installation of ball mill is started with mill frame. Anchor bolts are placed into the foundation concrete. The mill bearings frame and drive unit frame are placed into the foundation concrete according to project. Frame adjusting supports is placed according to meets adjusting bolts.



Concrete works will be accordance with "mill frame procedures" instructions that has been given in below.

Anchor bolts are used between frame and foundation concrete to stabilize frame position and to prevent movement of the frame during the concrete filling process. One end of iron bars that come to concrete are fixed with chemical anchors to the foundation, the other end of iron bars are welded to the frame. The machined surfaces of mill frame are greased in order to keep it clean.

Mill concrete application and dimensional check before C30 concrete;

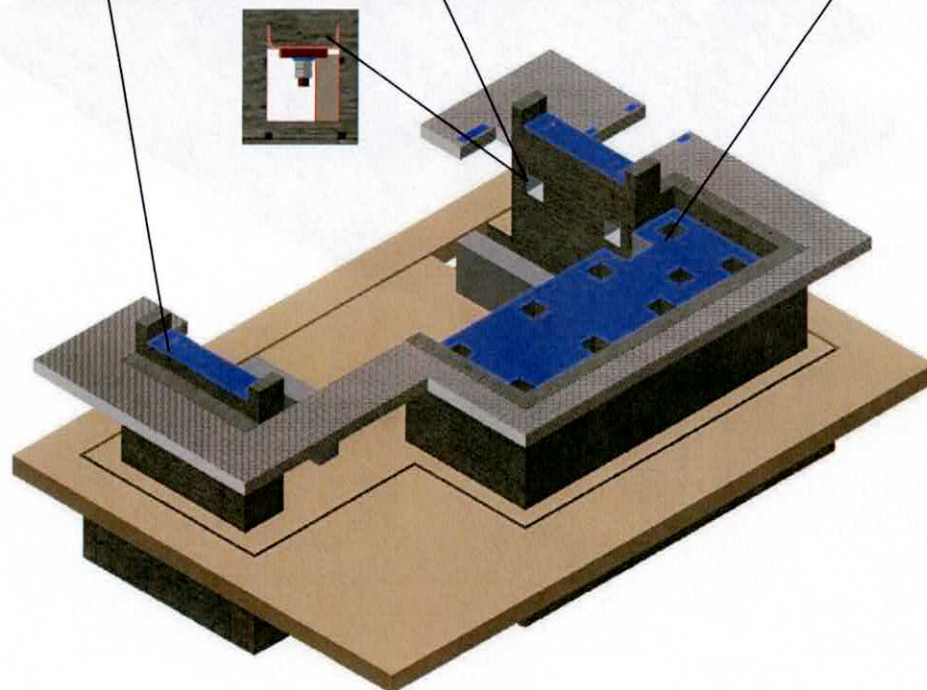
Concrete Plan

Frame layout plan

Mill concrete is checked as per drawing Concrete plan.

Mill frame installation is performed as per drawing Frame layout plan.

Detail demonstration is given below.



**Figure 9. Concrete check according to plan**

The pipes will be located as it shown on the project. These pipes will be used for main housings connection studs assembly.

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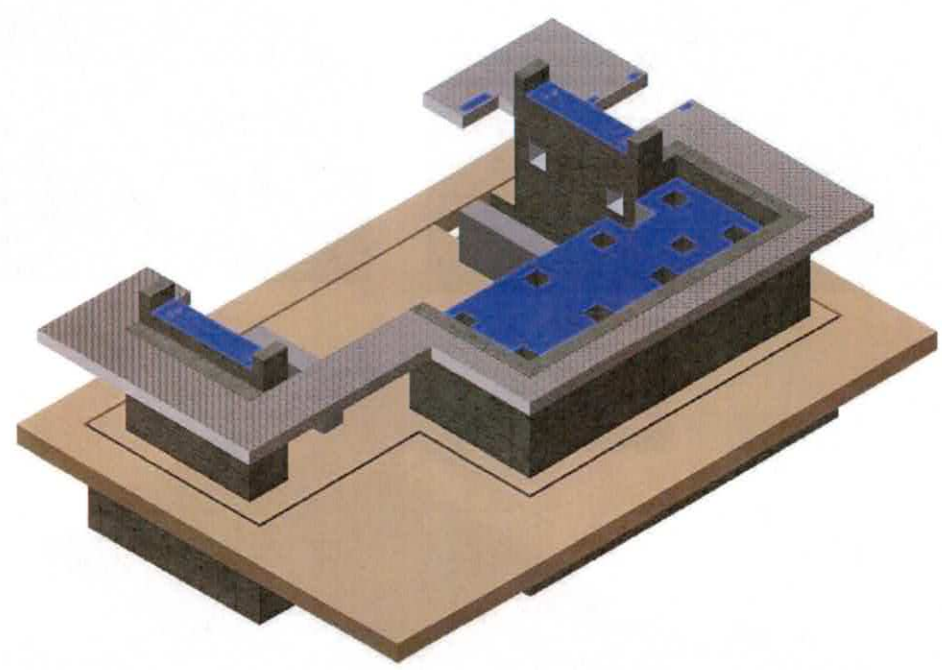
The sides for conical gaps must be removed after concrete get strengthened for anchors assembly.

C30 concrete application with the reinforcement according to given mill loads by customer;

Preparing C30 quality concrete according to Concrete plan by customer.

Note: Ersel supervisor will check critical dimensions before filling the concrete.

Customer should inform Ersel after customer prepare the reinforcement, putting the anchor pipes and boxes.



**Figure 10. Concrete plan**

Preparation for mill frame assembly.



**Figure 11. Concrete cleaning**

- The gaps where anchors will be located must be cleaned
- Concrete surface must be washed.
- Before grout concrete, there should not be any water on the foundation and anchor holes.



**Figure 12. Lifting frame**

- Main housing frames shall be lifted down onto the blocks which has been prepared before.
- These wedges are placed as to remain under frame.



**Figure 13. Main housing frame**

- According to ball mill middle axis, the axis of main housing frame and heights placed according to frame layout project

#### Preparation for mill frame assembly



**Figure 14. Drive unit frame assembly**

- The frames location are re-checked according to layout plan.
- The frames get fixed by tightining 8 pcs studs that connecting main housing frames and concrete.
- The final check shall be done after frames axis dimensions and precision scale are adjusted according to dimension and allowance on the drawing. After precision adjustment of axis dimensions and frames,
- it is welded to ready concrete with chemical pegs and irons and these irons are welded to the frame.

These iron rods must be placed with 50-60 cm intervals.

Check the horizontal and vertical level dimensions of “ Pinion ,Motor and gearbox Frames” by taking one of the Main Frames as a reference level(0,0) with the help of a topographer at site.

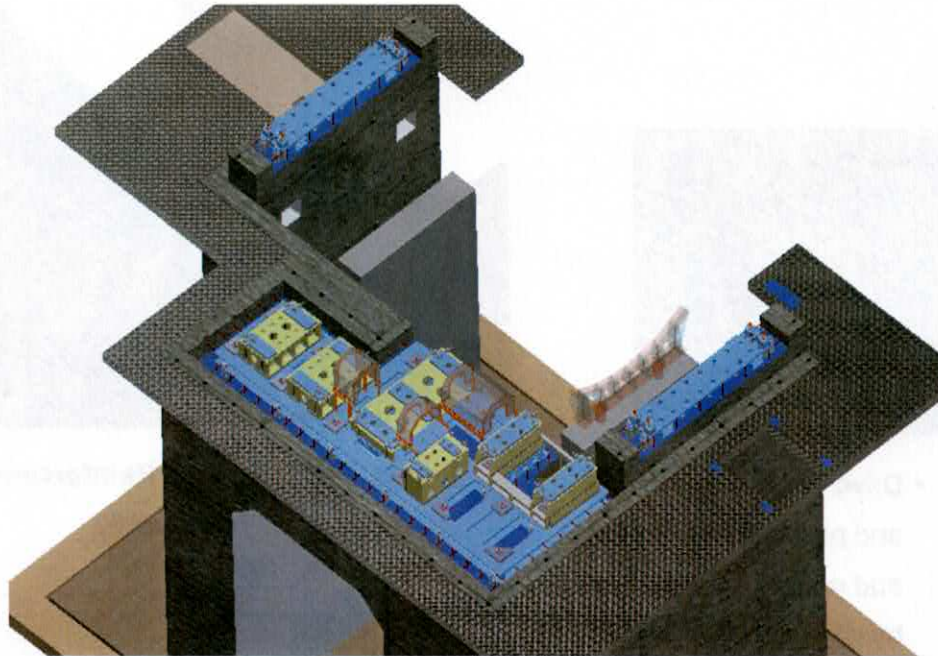


Figure 15. Fixing And Reinforcement After Assembly

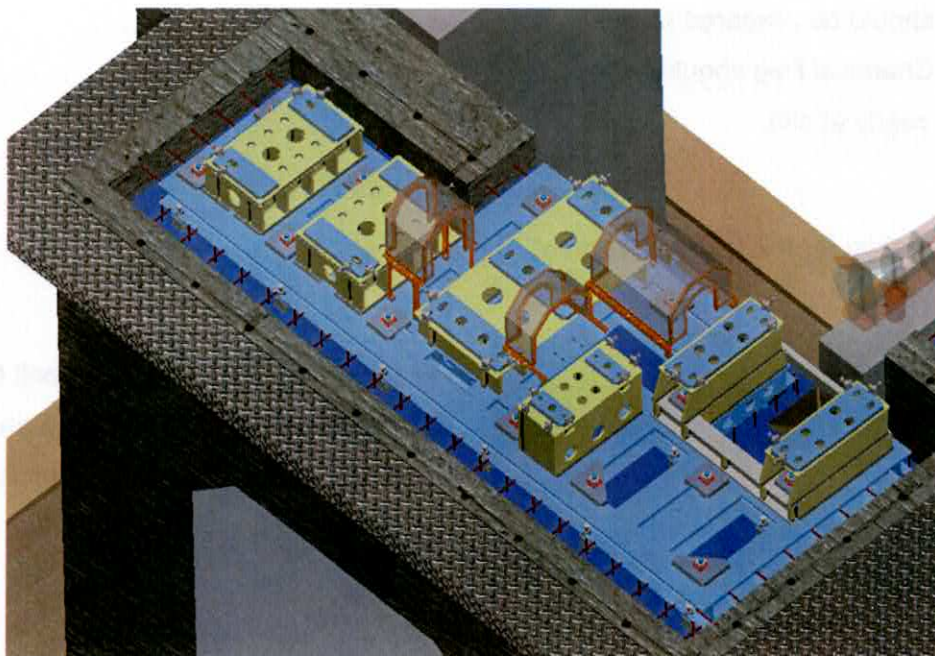
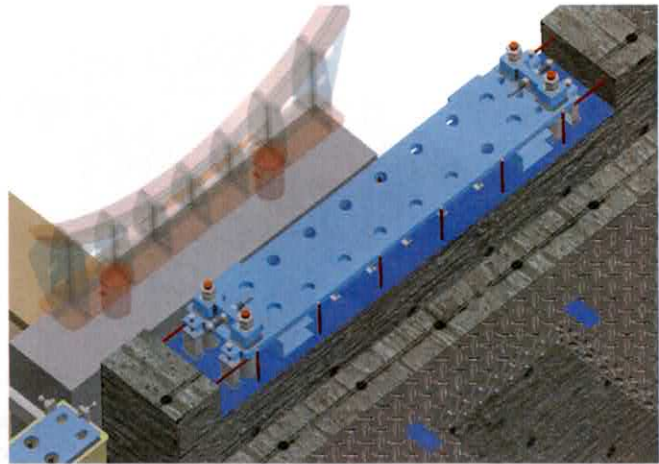
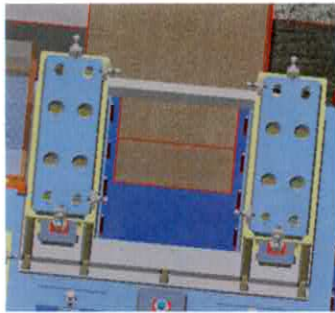


Figure 16. Fixing And Reinforcement After Assembly



**Figure 17. Fixing And Reinforcement After Assembly**

- Drive unit ,main housing and pinion frame are fixed and reinforced with welding by  $\varnothing 16$  Iron bars in direction of horizontal and vertical.
- Required no of Iron bars should be prepared at site.
- Chemical Peg should be ready at site.

Preparation for mill frame assembly;



**Figure 18. Preparation for frame**

-All the connection holes and bolt holes must be blocked with plastic tap and machined surface must be protected with grease.



**Figure 19. Sikadur 32 application**

-The forming applied where the additional grouting will be applied.

-Based on the bonding element Sikadur32. Before additional groute pouring, Sikadur must be applied with a brush where two different quality of the concrete will be bonded. Please see attached Sikadur 32 attachment.



**Figure 20. Concrete puring**

C45 EN206 Quality concrete apply to the top level of the frame. The new concrete must be protected until it frozen.

For the low temperature, there must be isolation. Minumum curing time for the additional concrete is 48 hours.

All the phase related concrete must be done with Ersel Supervision.

### 3.4.2 Concrete specification (C45 EN206)

BS EN 206 Strength class	$f_{ck,cylinder}$ [N/mm <sup>2</sup> ]	$f_{ck,cube}$ [N/mm <sup>2</sup> ]	$f_{ctm}$ [N/mm <sup>2</sup> ]	$f_{ctk,0.05}$ [N/mm <sup>2</sup> ]	Definition
C 12/15	12	15	1,6	1,1	Normal Strength Concrete
C 16/20	16	20	1,9	1,3	
C 20/25	20	25	2,2	1,5	
C 25/30	25	30	2,6	1,8	
C 30/37	30	37	2,9	2	
<b>C 35/45</b>	<b>35</b>	<b>45</b>	<b>3,2</b>	<b>2,2</b>	
C 40/50	40	50	3,5	2,5	
C 45/55	45	55	3,8	2,7	
C 50/60	50	60	4,1	2,9	
C 55/67	55	67	4,2	3	
C 60/75	60	75	4,4	3,1	High Strength Concrete
C 70/85	70	85	4,6	3,2	
C 80/95	80	95	4,8	3,4	
C 90/105	90	105	5	3,5	
C100/115	100	115	5,2	3,6	

$f_{ck,cylinder}$  = Specified characteristic cylinder compressive strength measure with cylinder

$f_{ck,cube}$  = Specified characteristic cylinder compressive strength measure with cube

$f_{ctm}$  = Mean axial tensile strength

$f_{ctk}$  = Characteristic axial tensile strength of concrete

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### 3.4.3 Sikadur32 bonding element

Construction

**Sikadur® 32**  
Epoxy Resin Bonding Agent

**Product Description**  
Sikadur 32 is a solvent-free, two-component bonding agent, based on selected epoxy resins.

**Fields of application**  
Sikadur 32 provides a bond of the greater strength than the tensile strength of the concrete itself. Therefore it is suitable for use whenever structural bonding of new to existing concrete is carried out.  
Sikadur 32 can also be used as a bonding agent on mortar, steel, iron, etc.

**Properties / Advantages**  
Sikadur 32 is available in two different grades of viscosity: normal and long pot life. Other benefits are:

- Easy to apply
- Solvent-free
- Unaffected by moisture
- Highly effective, even on damp surfaces
- Stable at low temperatures
- High tensile strength

**Product Data**

**Colour** Light Grey

**Mixing ratio** Parts by weight and volume: Comp. A: B: 1:1

**Potlife**

Temperature (°C)	Type Normal	Long Potlife
45	—	30 min
35	15 min	45 min
25	40 min	90 min
15	60 min	—
5	120 min	—

**Open Time**

Temperature (°C)	Type Normal	Long Potlife
45	—	240 min
35	60 min	320 min
25	180 min	—

**Storage Conditions / Shelf Life** 24 months from date of production if stored properly in undamaged and unopened, original sealed containers at temperatures between +5°C and +30°C. Protect from fire.

**Packaging** 1.2 kg units (A+B) 400gpc  
5 kg units (A+B)

**Physical Data**

**Density** ~ 1.4 kg/l

**Mechanical strengths**

Compressive Strength	60-70 N/mm <sup>2</sup>
Flexural Strength	35-38 N/mm <sup>2</sup>
Tensile Strength	10-20 N/mm <sup>2</sup>
Bond strength to concrete	2.5-3 N/mm <sup>2</sup> (concrete failure)
(Type Normal: 25 °C, 94% r.h.; 10 days, L.P.: 35 °C)	

**Application**

**Consumption** 0.5-0.8 kg / m<sup>2</sup>, depending on substrate condition

**Substrate Quality** All surfaces must be clean, free from free standing water and all loosely adhering particles. Cement balance must be removed and the surface to be treated must be mechanically roughened.

**Preparation** Add component B to component A and mix with a mixing paddle attached to a slow speed electric drill (max. 500 R.P.M.) until the mixture becomes smooth in consistency. Avoid breathing air.

**Mixing** After mixing apply directly to the prepared substrate by brush, roller or spray. On damp surfaces, ensure that it is well brushed in.

**Application** Pour new concrete within specified open time, as long as material is still tacky.

**Cleaning of Tools** Clean all tools and application equipment immediately after use with Sika Cleaner.

**Notes** All technical data stated in the Product Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control.

**Local Restrictions** Please note that as a result of specific local regulations the performance of this product may vary from country to country. Please consult the local Product Data Sheet for the exact description of the application facts.

**Health and Safety Information** For information and advice on the safe handling, storage and disposal of chemical products, users should refer to the most recent Material Safety Data Sheet containing product, ecological, toxicological and other safety-related data.

### APP-3 HILTI RE500 CHEMICAL PEG



Figure 21. Chemical anchor

- Required No of Iron bars:  
Ø 16; length: 300 mm  
Quantity: 140 pcs
- Required No of Hilti RE500:  
10 tube ( 1 tube 330 ml)

### 3.4.4 Installation of mill main bearing frame and drive unit frame

Note: This application will be done under Ersel supervisor as indicated as detail application above.

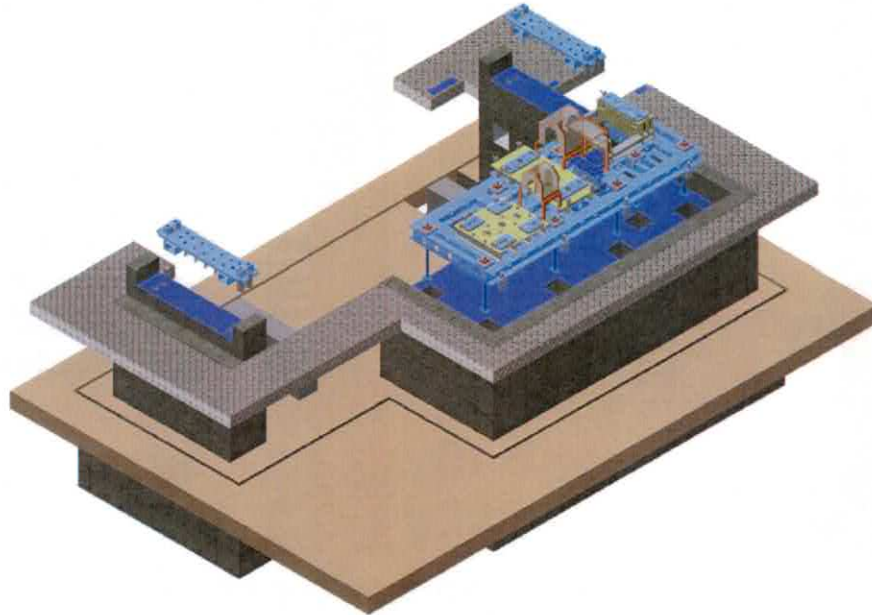


Figure 22. Assembly of main bearing and drive unit frame

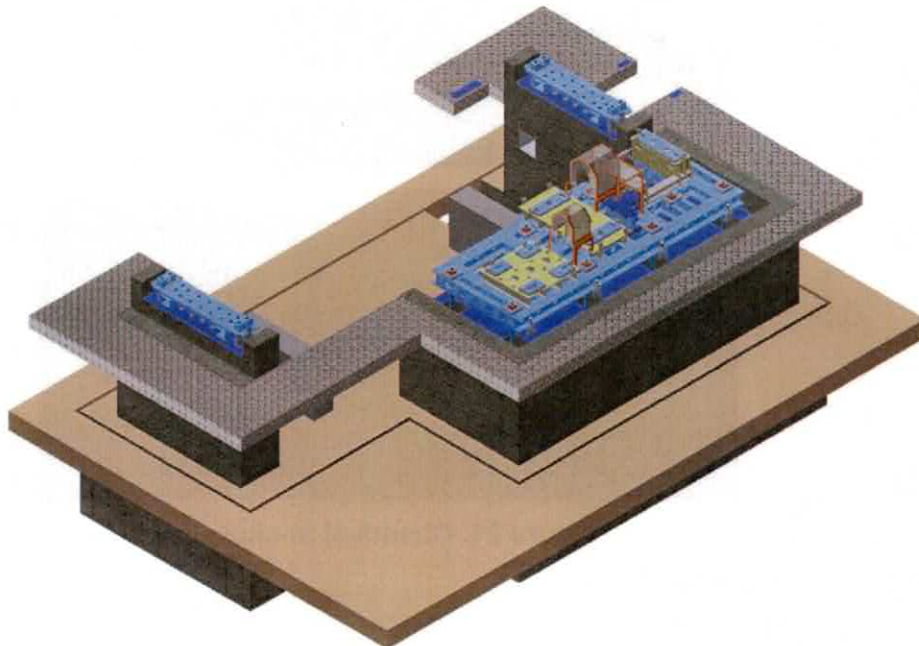


Figure 23. View after frame installation

### 3.4.5 Rim gear and pinion guard lower housing assembly.

First Lower part of the rim gear guard and pinion guard lower part is temporary located.

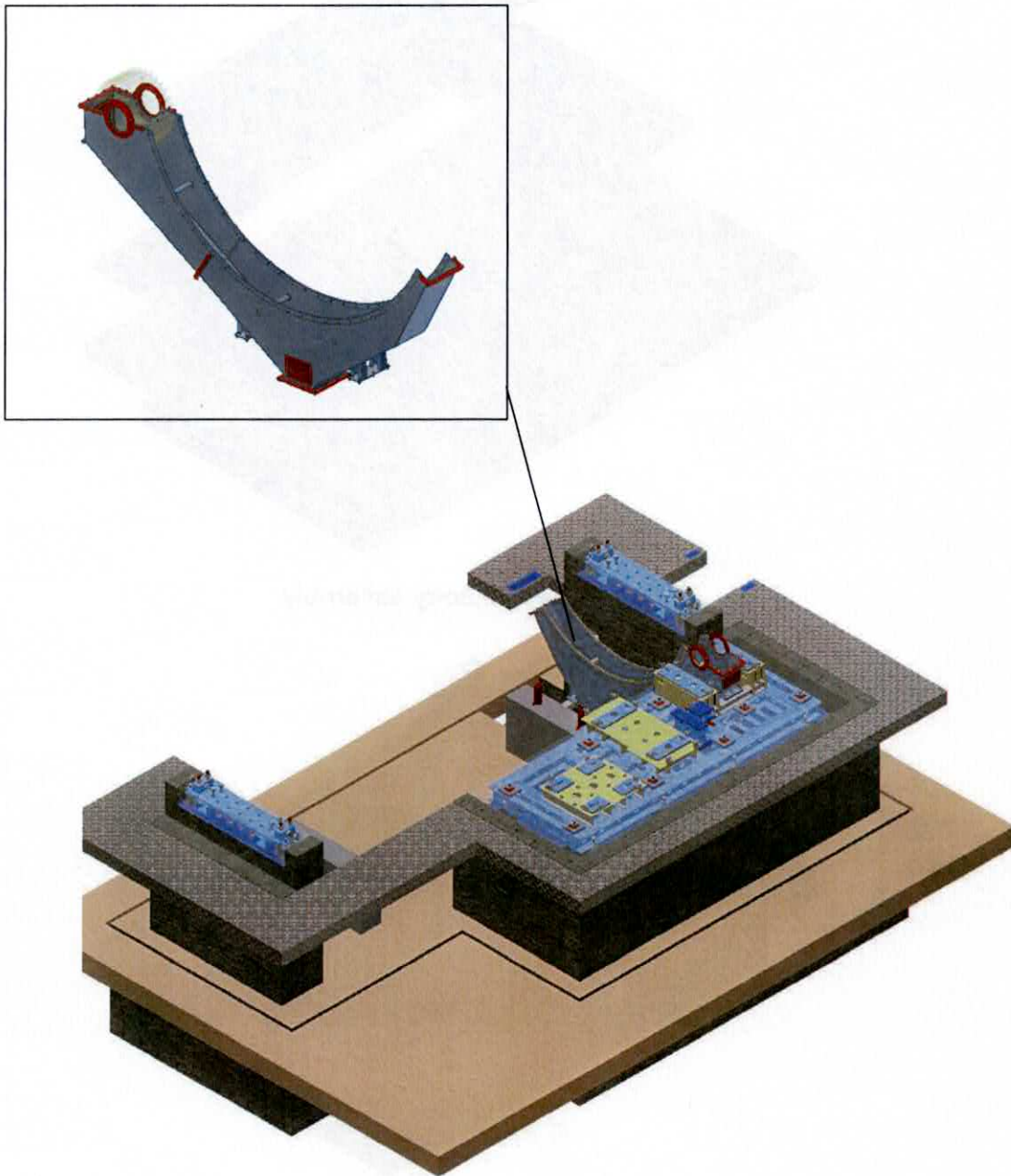


Figure 24. Rim gear and pinion guard lower housing assembly

### 3.4.6 Mill body assembly

Lifting mill body onto the housing frame should be done according to given scheme below.

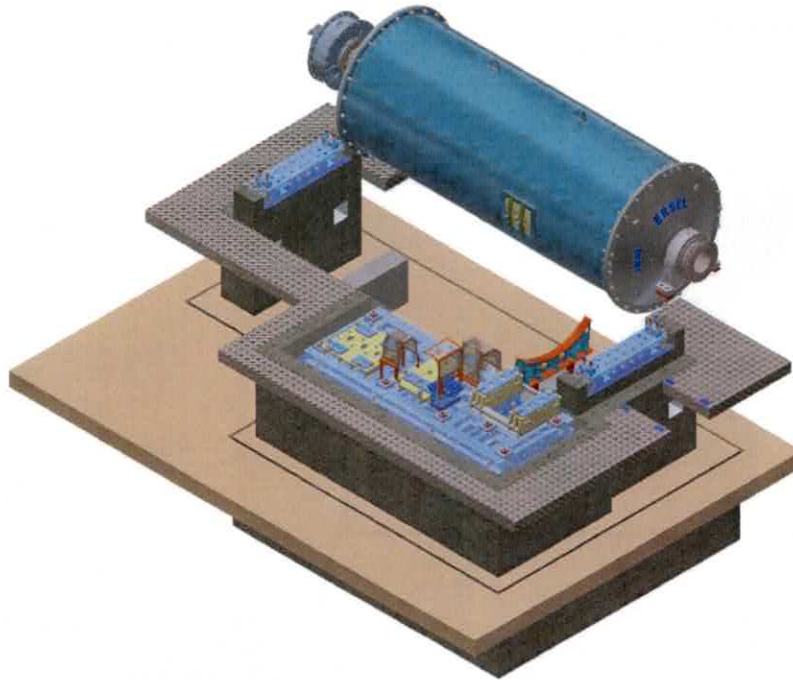


Figure 25. Mill body assembly

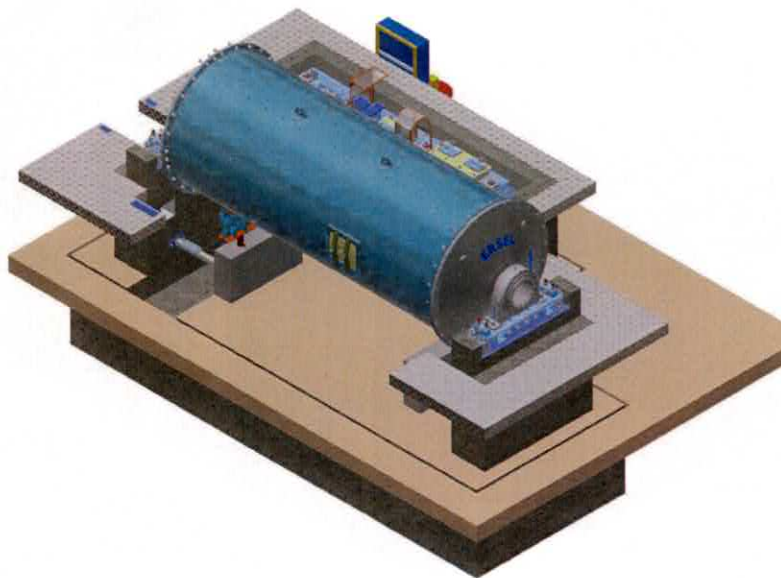


Figure 26. View after mill body assembly