NP SERIES IMPACT CRUSHERS

CONTENTS

Preface - Section 0
Safety - Section 1
General Information - Section 2
Installation - Section 3
Operation - Section 4
Lubrication - Section 5
Replacing Wear Parts - Section 6
Scheduled Maintenance - Section 7
Servicing - Section 8
Trouble Shooting - Section 9
Optional Equipments - Section 10
Hydraulic Power Unit - Section 11
Hydraulic Powerpack for Hydraulic Setting Option - Section 12
Section 0

PREFACE
This instruction manual is intended to assist owners and users of Metso Minerals products in the proper use of the equipment. It includes important references to safe, proper and economical operation of the equipment. Following these instructions will help to avoid possible danger, reduce repair costs and breakdowns and to increase the reliability and life of the equipment.

This manual must be completed if necessary by those instructions relating to existing local or national mandatory rules for accident prevention and environmental protection.

A copy of this manual must be kept at the equipment’s location and made available to the operators as required.

In addition to this manual and accident prevention regulations mandatory in the country of use and at the equipment’s place of operation, generally recognised rules for safe and professional operation must be observed.

This instruction manual must be read and used by each person who works with the equipment, typically:

- operations, including installation, startup, operation, application, engineering, materials handling, site labour, environmental engineering and safety departments.
- maintenance, including inspection and repair.
- transport, materials handling and rigging.

Note that this instruction manual contains information and instructions on several alternative and optional equipment. Normally the machines have only some of them. Before maintaining and servicing, find out which alternative and optional equipment your machine has.

See separate instruction manuals for more detailed instructions when servicing the main components.

There may be optional equipment which have separate instruction manuals. Those manuals must be read and used by each person who works with the equipment.
Section 1

SAFETY

1.1 - Control symbols ............................................ 1-1
1.2 - Equipment purpose ........................................... 1-1
1.3 - Instruction manual .......................................... 1-2
1.4 - Personnel ..................................................... 1-2
  1.4.1 - General instructions .................................... 1-2
  1.4.2 - Are you familiar with your employer's safety program? 1-2
  1.4.3 - Are you wearing the right clothes for the job? .... 1-2

1.5 - Your job ...................................................... 1-3
  1.5.1 - Do you understand your machine? ...................... 1-3
  1.5.2 - Do you know the places where you work? ............. 1-3
  1.5.3 - Are you prepared for emergencies? ................... 1-3
  1.5.4 - Checking before startup ................................ 1-3
  1.5.5 - Startup in total safety ................................... 1-4
  1.5.6 - Report defective machines ............................ 1-4
  1.5.7 - Machine shutdown in safety ......................... 1-4

1.6 - Maintenance and repairs .................................. 1-4
  1.6.1 - Read and understand .................................... 1-4
  1.6.2 - Warning Panels .......................................... 1-4
  1.6.3 - Turn OFF the electricity .................................. 1-4
  1.6.4 - Clothing - Safety habits ................................ 1-4
  1.6.5 - Alcohol and medication ................................ 1-5
  1.6.6 - Workplace ................................................ 1-5
  1.6.7 - Equipment ................................................. 1-5
  1.6.8 - Fire hazard ................................................ 1-5
  1.6.9 - Pressurized Systems - hydraulic and pneumatic ... 1-6
  1.6.10 - Use good quality parts ............................... 1-6
  1.6.11 - Report all repairs required ......................... 1-6

1.7 - Plant safety ................................................ 1-6
  1.7.1 - General recommendations ............................. 1-6
  1.7.2 - Control Protection ...................................... 1-6
  1.7.3 - Operator platform ...................................... 1-7
  1.7.4 - Turn OFF the electrical power supply ............... 1-7
  1.7.5 - Hoist gear ................................................ 1-7
  1.7.6 - Mobile cranes .......................................... 1-7
  1.7.7 - Welding equipment ..................................... 1-7
  1.7.8 - Conveyor belts ......................................... 1-8
  1.7.9 - Backing .................................................. 1-8
  1.7.10 - Sound level ............................................. 1-8
  1.7.11 - Open frame crushers and access doors .......... 1-8
  1.7.12 - Clearing the crusher if it stalls when loaded .... 1-9
  1.7.13 - Crushing plant dust ................................... 1-9
  1.7.14 - General maintenance work ......................... 1-9
The principal rules concerning safety in and around a crushing plant are shown in the chapter entitled SAFETY.

The safety of operators and others depends on care and judgement when using the machine. Attentive operators do not have accidents!

The majority of accidents are caused by failure to observe and respect simple fundamental rules and precautions. Most accidents can be avoided by identifying the risks and taking measures to prevent them before an accident occurs.

Although great care is taken when designing and building this type of equipment, there are conditions in which safety cannot be 100% without inhibiting reasonable accessibility and effective use. To underline these conditions, warnings are included in this instruction manual.

1.1 Control symbols

The following symbols are used in this handbook for particularly important instructions:

**Reference**

Special instructions concerning equipment operation productivity.

**Caution**

Special instructions to prevent incorrect and possibly dangerous operations.

Read these instructions attentively.

**Danger**

Special instructions to prevent physical injury and/or damage to equipment.

Read these instructions attentively.

1.2 Equipment purpose

Metso Minerals products are designed and manufactured in compliance with recognized technical regulations and safety requirements. Nevertheless, incorrect or careless use can endanger operators and other people. The personnel in charge of operations and other people must understand the dangers inherent in the use of this type of equipment.

The equipment must be used only in suitable operating conditions, for the purpose for which it was designed and in the respect of safety requirements and with full awareness of possible dangers and in strict compliance with the instruction manual. Life-threatening malfunctions and site conditions must be eliminated immediately.

The equipment is only designed to crush ore, rock, and materials containing rock. Any other use not complying with or exceeding the limits of equipment design would not be regarded as normal. The manufacturer will not be held liable for damage resulting from product misuse. Only the user can be held liable.

Normal use also implies compliance with the instruction manual for a correct and safe use and strict observance control and maintenance rules.
1.3 Instruction manual

The instruction manual must be permanently available at the place where the equipment is used.

In addition to the instruction manual, laws and any other regulation concerning safety, accident prevention and environmental protection must be respected.

This also applies to, for example, the transport of dangerous or flammable substances, the supply and the wearing of individual protective clothing and the highway code.

This instruction manual must be read completely. Correct training rules must be introduced for the instruction and training of operators, for control and reporting, for monitoring, for the supervision of personnel, etc...

---

DANGER

Before start-up or site preparation, the personnel whose activity is related to the equipment must read the instruction manual and in particular the chapter concerning safety. This particularly concerns safety precautions is activities with which the personnel is not familiar, personnel only working with the equipment and its application occasionally, for example for assembly, start-up or maintenance.

---

1.4 Personnel

1.4.1 General instructions

This part of the instruction manual only illustrates elementary safety procedures. Additional precautions may be necessary during crusher operation. The information in this handbook does not replace the safety practice stipulated by Insurance companies, nor national, regional or local laws.

The safety of operators and maintenance personnel must be your top priority. These paragraphs are a useful guide for personnel working with the equipment and address some daily problems encountered during day to day working.

Operator are responsible for understand the regulations, the precautions to be taken, the dangers which exist and for discussing them with their supervisors if doubt exists.

All personnel must use the same procedures to ensure a safe operation when using the equipment.

The operator is the key person in safe work execution and must study safety instructions to prevent serious injury and damage to the equipment.

Even the safest machines must be used carefully and with full knowledge of all operating restrictions. This implies the introduction of an in-depth safety program.

Point out that in every job, the operator is central to safety. Good safety practices not only protect the people around you but are also the best way to protect yourself.

---

IMPORTANT!

Make sure your co-workers are aware of the dangers before problems occur and remember that... Safety depends on you.

1.4.2 Are you familiar with your employer's safety program?

Safety reports from manufacturing companies reveal that most accidents are caused by failure to respect safety rules. You must fully understand the general program and ask your superior for specific instructions when you start work.

1.4.3 Are you wearing the right clothes for the job?

Perhaps you need special items like hard hats, safety shoes, safety glasses, safety goggles, special gloves, ears protectors, etc. For your own safety, find out the items required and wear them!

Loose clothing can be caught in moving parts. Button the wrist, belt your jacket and wear your special safety equipment. Warm clothing must not restrict your movements. Bracelets, watches and rings are dangerous. Do not put objects in your pockets which could fall out.

---

1-2 AP SERIES IMPACT CRUSHERS
1.5 Your job

1.5.1 Do you understand your machine?

Read this instruction manual completely to learn about operating and maintenance features, flows and equipment limits. Learn the position and function of all the controls, indicators, warning devices and safety instructions. Learn how to recognize and control the machine safety servo system.

1.5.2 Do you know the places where you work?

Learn as much as possible about your workplace in advance:

- Keep it clean. Clean the ground, eliminate grease, oil, rags, cables, chains, buckets, stones and other hazards. Keep spare parts in a toolbox. Only use non-flammable detergents and solvents.
- Find out which spaces the operating area must remain uncrowded. A little time spent checking the height and width of open spaces as well as power line positions, if any, can avoid difficulties subsequently.
- Watch out for dust, smoke and fume which could prevent you from seeing what you are doing.

1.5.3 Are you prepared for emergencies?

If you anticipate, concentrate on what you are doing and take care while you are working you will avoid injuring yourself or someone else and protect the equipment from damage. If one moment of carelessness creates an emergency, take rapid action with the tools and resources you have.

- Know where you can find a fire extinguisher - and how to use it!
- Know where you can find the first aid kit - and how to use it too!
- Know where you can find help immediately. Always act fast in an emergency.

However, these are just basic rules and you need to know much more!

Specific working conditions and equipment always imply additional safety precautions.

1.5.4 Checking before startup

DANGER

For the machines with opening lids, a system must be installed to prevent the opening of the lid when the crushing elements are moving, as well as during startup if the lid is not closed.

Equipment which is not carefully prepared for work is dangerous. Make a careful inspection when you start work. If you find something which requires attention DO NOT START THE MACHINE. Even minor mechanical defects can lead to injuries and accidents.

1. DO NOT PERMIT unauthorized personnel to use the machine.
2. CHECK that all safety devices are in place, well fixed and undamaged.
3. CHECK hydraulic systems: are the oil levels correct and leak-free?
4. CHECK each air bleed cock and valve, linings and that all are correctly used and fitted.
5. LOSS OF PRESSURE due to falls in oil levels can lead to serious hydraulic failures.
6. MACHINES THAT SEIZE UP due to lack of grease can cause accidents.
7. NEVER CHANGE the settings of pressure relief valves to obtain higher operating pressures than those recommended by the manufacturer are the original settings have been optimized for reliable operation and prolonged service life.
8. NEVER modify safety device.
9. CHECK the machine thoroughly to detect visible defects such as leaks, worn pipes and loose parts.
10. INSPECT your machine in compliance with the procedures in the operator handbook and instructions from your supervisor.
11. BEFORE STARTUP walk all the way around your machine. Make sure there is nobody close to, in, on or under the machine. Warn everyone in the vicinity that you are going to start your machine up.

IMPORTANT

Report all defects to your superior.
1.5.5 Startup in total safety
1. CHECK the equipment and see if any warning panels are visible.
2. FOLLOW the procedure recommended for start-up in the USE Section.
3. AFTER machine start-up, check all pressure gauges and instruments to ensure that all systems are 'GO'.
4. SHUT DOWN the machine immediately if the indicators show that something is not right.
5. CHECK all controls to see if they function correctly.
6. LISTEN to the machine and report any unusual noises.
7. RECHECK warning devices and other safety accessories.
8. DO NOT STAND UPRIGHT on the machine when it is operating.
9. DO NOT TAKE ANY RISKS if the machine is defective, REPORT PROBLEMS TO YOUR SUPERIOR IMMEDIATELY.
10. DO NOT LOOK inside the crusher when running.

1.5.6 Report defective machines
Inspect your machine every day; check for loose, worn and damaged parts. Report or repair all dangerous conditions immediately and do not start the machine before everything is serviceable. Even minor defects can become serious, so report every problem to your superior.

1.5.7 Machine shutdown in safety
Make sure that the machine is completely OFF before cleaning, regristation, lubrication, check belt tension, removing box lids, working on the hydraulic system and/or replacing screening equipment. DO NOT IMPLEMENT ANY CHECKS, REGULATIONS OR REPAIR WHILE THE MACHINE IS MOVING.

1.6 Maintenance and repairs
WEAR out maintenance work carefully.

1.6.1 Read and understand
1. The instruction manual supplied with the machine, and specifically the USE section.
2. Inspection and maintenance instructions in the USE section.
5. The greasing guide for routine maintenance in the LUBRICATION section.

1.6.2 Warning Panels
Before starting to work inside a machine, label and lock electric controls so that nobody else can use them. Attach warning panels to prevent accidents:
1. If the machine cannot be used safely.
2. If controls are in progress.
3. If the machine is being repaired.

1.6.3 Turn OFF the electricity
1. Always lock electrical controls before carrying out maintenance work on the machine.
2. Give every maintenance person a personal lock with a SINGLE key.

1.6.4 Clothing - Safety habits
1. NEVER PUT HANDS OR CLOTHING NEAR MOVING PARTS. Do not take risks by wearing flowing sleeves, floating ties, watches and rings.
2. WEAR SAFETY GLASSES to protect your eyes when handling fuel, detergents, oil or brake fluid. ALL CAN INJURE YOUR EYES.
3. WEAR a RESPIRATOR when recommended.
4. WEAR SAFETY GLASSES when you
   drill, grind or hammer metal.
5. DO NOT FILL YOUR POCKETS with
   objects which can fall into the machine.
6. WEAR HARD HATS AND SAFETY
   SHOES when necessary.
7. WEAR GLOVES to protect you the
   hands when you handle cables.
8. WEAR SAFETY GLASSES AND
   PROTECTIVE CLOTHING when using
   compressed air.
9. WEAR SAFETY GLASSES AND
   PROTECTIVE CLOTHING when
   handling molten metal: zinc, babbit
   metal, lead, etc...
10. WEAR EAR PROTECTORS when,
    necessary and LIMIT exposure to noise
    to a minimum.

1.6.5 Alcohol and medication
1. NEVER DRINK ALCOHOL before or
   during work.
2. BE CAREFUL with medication like
   tranquilizers which could send you to
   sleep or reduce your vigilance.

1.6.6 Workplace
1. ENCOURAGE CLEANLINESS, take
   care that the ground is clean and dry,
   free of all rubbish and tools. Greasy or
   wet floors, steps and ramps are slippery.
   In winter, wash out for ice and snow.
   Wet surfaces are dangerous, especially
   close to electrical equipment.
2. DO NOT LET materials build up on or
   around the machine.
3. STORE dangerous liquids in a suitable,
   safe place, out of reach of unauthorized
   personnel.
   PROHIBIT SMOKE IN THIS STORE.
4. NEVER START to a diesel or petrol
   engine in a closed place unless there is
   sufficient ventilation. Exhaust fumes
   can kill.

1.6.7 Equipment
1. Always use the right tools for the job
   and handle tools and heavy parts with
   care.
2. Keep tools and equipment perfectly
   clean and free of dust, oil and grease. Do
   not drop them and do not throw them.
3. Use a hoist to lift heavy loads. Save
   your back.
4. Lower parts gradually. Never drop them.
5. To avoid slips, wipe levers and handles
   to remove oil and grease.
6. Never use pulleys with broken or
   cracked edges or arms.
7. Check drive belts see if any are missing,
   split or worn.
8. Check for broken, defective or missing
   parts and replace them. Keep equipment
   clean and free of oil and dust to ensure
   detection of loose or defective parts.
9. When you use slings to move a load,
   check they are strong enough for the job
   and replace any which worn, frayed,
   broken or twisted.

1.6.8 Fire hazard
1. DO NOT SMOKE when filling with fuel
   or when handling fuel containers
2. SHUT DOWN the engine when filling
   the tank and be extremely careful if the
   engine is hot.
3. WHEN pouring fuel into the tank, press
   the funnel or spout against the filler pipe
   to avoid sparks of static electricity.
4. DO NOT CLEAN parts with gasoline or
   the fuel oil. Good quality commercial
   non flammable solvents are preferable.
5. DO NOT SMOKE when use solvents for
   cleaning.
6. DO NOT LET greasy, oily rags
   accumulate in a badly ventilated place.
   Store greasy rags and other combustible
   materials in a safe place.
7. NEVER USE a naked flame to check fuel, battery electrolyte or cooling fluid levels... nor to look for leaks in any part of the hydraulic system. Use a flashlight.

8. KNOW where the extinguishers are used, how to use them and the type of fire for which they are designed. Check regularly, at least once a month, that they are effectively in the operating area.

1.6.9 Pressurized Systems - hydraulic and pneumatic

1. Release ALL the pressure from hydraulic and pneumatic systems before opening or removing conduits, valves, stoppers, joints, seals, etc...

2. Check pipes and conduits for wear and damage.

3. Oil under high pressure can be dangerous.

1.6.10 Use good quality parts

Spare parts must always be of the same SIZE, TYPE and QUALITY as the parts to be replaced.

1.6.11 Report all repairs required

If your daily check reveals something which attracts your attention and needs repair, replacement or adjustment IT MUST BE REPORTED IMMEDIATELY.

The smallest defect can cause serious problems IF THE MACHINE IS STARTED.

Only do work you have been authorized to do.

Do not try to make repairs for which you are not qualified.

Only work on equipment you fully understand. Accidental pressure release can injure and kill. Remember that you are responsible for the operation and maintenance of a very valuable machine. TREAT IT LIKE IT MERITS.

1.7 Plant safety

1.7.1 General recommendations

The safety procedures mentioned here do not eliminate all the dangers encountered in the operating area of a machine. However, they emphasize practices based on long experience which improve safety conditions in the use of machines and auxiliary equipment. Metso Minerals is happy to make and receive suggestions concerning the use of its machines and auxiliaries.

1.7.2 Control Protection

Proper safety precautions start with machine installation. Crushers are driven either by V-belts or direct coupling to a hydraulic power pack or electric motor (universal drive).

⚠️ DANGER

Drive belts and couplings must be protected by casings.

Machine pulleys, in particular, have a speed limit (linear velocity at the rim). If this speed is exceeded, the pulley can explode and cause serious and even fatal injuries.

Because of the importance of machine speed for correct operation, transmission casings usually have a small opening just opposite the shaft center so that a tachometer can be inserted to check shaft rpm from time to time.
1.7.3 Operator platform

DANGER
As it is important to carry out routine inspection and maintenance on each machine, a PLATFORM MUST BE ERECTED AT A SUITABLE HEIGHT FOR THE OPERATORS WHO INSPECT AND WORK ON THE MACHINE. A good operator platform has a solid floor, full railings i.e. top rail, mid-rail and a foot guard to strain tools which could fall from the platform and injure someone working underneath.

1.7.4 Turn OFF the electrical power supply

DANGER
The electrical power supply to the machine must be turned OFF and locked every time somebody works on it.

Every mechanic who normally works on a machine must be provided with a personal padlock which must have ONLY ONE KEY. When working on part of the machine the mechanic padlocks the electrical circuit controls which is why he has the only key to open it. Everyone working on the machine must have a personal padlock and key. Accidental machine start-up when there are people in the immediate vicinity can cause accidents, so the machine must be made safe.

1.7.5 Hoist gear

Machine parts must be handled with hoist gear enabling slow, regular movements.

DANGER
ALWAYS RESPECT HOIST GEAR MAXIMUM LOAD LIMITS. Remember to include the weight of hoisting accessories (chains, hooks, swing bars...) in the maximum weight calculation.

1.7.6 Mobile cranes

DANGER
When you use a mobile crane, always work inside machine capacity to ensure the crane does not collapse.

Safe loads are calculated for cranes used on level, firm ground, stabilizers must be correctly extended and/or lowered whenever possible. Avoid fast slewing and sudden stops as they can cause dynamic overloads. Do not handle big or heavy loads in string winds.

When you move your crane, check bridges can support the machine weight before crossing over. Check out bridge heights before moving under and for electrical cables and other obstacles.

Check with the operator responsible for slinging that all is well before starting the hoisting operation. Check that the load is attached correctly.

All the crasher pressures must be released, all sensitive devices must be protected from the sparks.

1.7.7 Welding equipment

One of the most frequently used tools around the Crusher is the cutting torch. Touched high pressure hydraulic lines will quickly vaporize the hydraulic fluid as it reaches the atmosphere. This vaporized fluid can quickly become a mass of flames, resulting in severe burns of personnel in the immediate area.

DANGER
All maintenance personnel who normally use torch cutting equipment should be advised if there are hydraulic components in the immediate area in which they are working.

Then adequate precautions should be made to avoid contact with these components. Rubber lined hoses are not immune to the torch cutting equipment which is used in normal plant maintenance procedures.
1.7.8 Conveyor belts

**IMPORTANT!**

Do not use conveyor belts as walkways.

Conveyor belts should be provided with walkways alongside the conveyor.

1.7.9 Backing

All crushers require some type of backing when replacing the crushing members. Epoxy resins such as "Nordback Backing Compound" have all, but eliminated the possibility of workmen being accidentally burned due to molten zinc either spilling or exploding when it comes in contact with wet surfaces.

**IMPORTANT!**

The enormous degree of convenience as well as the high safety factor involved when using plastic backing agents has made the use of molten zinc for crusher liner backing obsolete.

When epoxy backings are used, care should be taken when removing the lasts with a cutting torch.

**IMPORTANT!**

The area should be well ventilated because epoxy fumes can cause nausea or possible eye or skin irritation.

1.7.10 Sound level

The various machines making up a finished product treatment installation have operating principles (breaking, screening, etc...) which generate noise. Moreover, this is intensified by the noise caused by the materials being poured into the chutes, hoppers, etc...

Furthermore, the sound levels vary according to the rock treated, the product discharge rate, the machine adjustments, the regularity with which it is fed, etc...

It is thus impossible to accurately determine the noise generated by a machine in a precise operating and application context. Nevertheless after making measurements in place we can indicate a range of noise level values between 110 and 125 dB (A).

![DANGER](image)

In accordance with these values, the directives of the work inspection department must be complied with as regards personal protection for muffs, duration of exposure, booth, etc...

1.7.11 Open frame crushers and access doors

A system must be installed to open-frame crushers to prevent the frame from being opened when the crushing components are moving and to prevent crusher components from being started up when the frame is open.

For machines fitted with access doors, chute the doors must require the use of a tool. Doors must only be opened by personnel qualified to service this type of machine.
1.7.12 Clearing the crusher if it stalls when loaded

DANGER
The unexpected always happens - like power cuts, sudden crusher overloads, etc., which can jam the crusher and make it stall. CLEARING THE CRUSHER CAN BECOME EXTREMELY DANGEROUS IN THESE CONDITIONS. In many cases the only way to restart the crusher is to remove the material obstructing the crushing cavity by hand.

1.7.13 Crushing plant dust

By their nature, crushing equipment and auxiliary equipment such as chutes, transfer stations, screens, etc., can create dust. Breathing dust may be hazardous to the health of anyone working at, on, or around the equipment. In general, high levels of dust create a hazard of lung disease, depending upon the concentrations of dust, the length of exposure, and the type of material being crushed.

Metso Minerals highly recommends that dust-protective devices such as a respirator be worn by anyone exposed to airborne dust to prevent its inhalation.

It is the responsibility of the operator to determine the necessity and adequacy of such protective devices and warnings, to provide them, and to ensure that they are used and followed.

It is possible to reduce the amount of airborne dust by making alterations to the crushing circuit, such as the addition of a dust collection system, or the use of water spray bars at the feed and/or discharge conveyor.

CAUTION
Optional, machines can also be equipped with guards (vibrating or not) which seal dust inside. Ask Metso Minerals for details.

1.7.14 General maintenance work

Every day, some work must be carried out close to the machine when it is running. Use the recommended procedures below when working near the machine.

1. NEVER CARRY OUT maintenance work on moving machine parts. This includes adding oil or the greasing machine components.

2. REFER TO manufacturer recommendations for procedures and routine maintenance. Procedures prevent damage to the machine and operator injury.

3. DO NOT LEAVE materials lying around the machine. Machines seem to attract stones, gravel, etc., and so operators should regularly clean up the space around machines to remove these materials as they can cause falls.

4. NEVER look into the crushing cavity while the crusher is in operation without protection from possible flying material.

REMEMBER THAT SAFETY ALSO DEPENDS ON YOU!
Section 2

GENERAL INFORMATION

2.1 - Terminology ........................................... 2-1
2.2 - NP impact crushers .................................. 2-2
2.3 - How the crusher works ............................. 2-2
2.4 - Main components .................................. 2-3
   2.4.1 - NP1520, NP1315, NP1213, NP1110 and NP1007 ............. 2-3
   2.4.2 - NP2023, NP1620, NP1415, NP1313 and NP1210 .......... 2-4
2.5 - Main dimensions .................................. 2-5
   2.5.1 - NP1520, NP1315, NP1213, NP1110 and NP1007 ......... 2-5
   2.5.2 - NP2023, NP1620, NP1415, NP1313 and NP1210 .......... 2-5
2.6 - Technical features .................................. 2-5
2.7 - Crusher output estimation ........................ 2-8
   2.7.1 - NP1520, NP1315, NP1213, NP1110, NP1007 ................. 2-9
   2.7.2 - NP1620, NP1415, NP1313, NP1210 ..................... 2-12
2.8 - Initial inspection .................................. 2-15
2.9 - Spare parts book ................................... 2-15
2.10 - Spare parts ......................................... 2-15
2.1 Terminology

In this manual some terms are used to describe the crusher and crusher operation. To prevent confusion and improve understanding, these terms are defined as follows:

**Feed**
Raw materials to be crushed.

**Product size**
The size of the product after crushing.

**Output or capacity**
The output of the crusher in metric tons per hour (MTPH) or in short tons per hour (STPH).

**Feed opening (FO)**
Opening through which the materials are fed into the crusher. Generally speaking, maximum feed size is 80% of the feed opening but this also depends on the raw materials being crushed.

**Opening gape (G)**
Effective gape of the crusher feed opening which enables feed materials to enter the crusher.

**Feed gape dimensions or size (D)**
Raw material block size is assessed visually by its three main dimensions: length, thickness (D) and width. Feed size is defined by the size of the largest feed block.

**Crushing cavity (C)**
Crusher volume inside the cavity formed by the breaker plates, frame liners and the cylinder described by the ends of the hammers as they rotate.

**Crusher settings (S)**
The shortest distance between the breaker plates and the end of the hammer when it is facing the last breaker plate liner.

**Hammers (H)**
Wear parts fitted on the rotor (R). Hammers strike the materials in the crushing cavity.

**Breaker plate liners (BPL)**
Wear parts fitted on the breaker plates (BP) on which the materials are crushed by the hammers.

*Figure 2-1 Terminology*
2.2 NP impact crushers

There are 10 different crusher sizes:
- NP1007
- NP1110
- NP1210
- N1213
- NP1313
- NP1315
- NP1415
- NP1520
- NP1620
- NP2033

The first two figures indicate the diameter of the rotor. The last two figures indicate the feed opening width.

2.3 How the crusher works

The way the crusher works is shown in Figure 2-2.

Feed enters the crusher via the feed opening and is expelled through the bottom end of the crusher.

The crusher rotor (R) is driven by an electric motor (M) or a diesel engine via drive belts (B) and pulleys. Materials are crushed by hammers (H), breaker plates (BP1, BP2) and side liners (SL).

The Tennon Spring System (TSS) withdraws the second breaker plate (BP2) in case of crushing overload or uncrushable material; then the breaker plate returns automatically to its initial position.

Figure 2-2 The way it works
2.4 Main components
2.4.1 NP1520, NP1315, NP1213, NP1110 and NP1007

![Diagram of main components](image)

Figure 2-3 Main components NP1520, 1315, 1213, 1110 and 1007

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Front frame</td>
</tr>
<tr>
<td>2</td>
<td>Rear frame</td>
</tr>
<tr>
<td>3</td>
<td>Frame hinge</td>
</tr>
<tr>
<td>4</td>
<td>Frame cross beam</td>
</tr>
<tr>
<td>5</td>
<td>Rotor shaft</td>
</tr>
<tr>
<td>6</td>
<td>Rotor</td>
</tr>
<tr>
<td>7</td>
<td>Hammer</td>
</tr>
<tr>
<td>8</td>
<td>Hammer locking system</td>
</tr>
<tr>
<td>9</td>
<td>1st Breaker plate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>2nd Breaker plate</td>
</tr>
<tr>
<td>11</td>
<td>Breaker plate liner</td>
</tr>
<tr>
<td>12</td>
<td>Breaker plate nuts</td>
</tr>
<tr>
<td>13</td>
<td>2nd Breaker plate return springs</td>
</tr>
<tr>
<td>14</td>
<td>Breaker plate adjustment system</td>
</tr>
<tr>
<td>15</td>
<td>Side liners</td>
</tr>
<tr>
<td>16</td>
<td>Feed plate</td>
</tr>
<tr>
<td>17</td>
<td>Access door</td>
</tr>
</tbody>
</table>

NP SERIES IMPACT CRUSHERS 2/3
2.4.2 NP2023, NP1620, NP1415, NP1313 and NP1210

Figure 2-4 Main components NP2023, 1620, 1415, 1313 and 1210

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Front frame</td>
</tr>
<tr>
<td>2</td>
<td>Rear frame</td>
</tr>
<tr>
<td>3</td>
<td>Frame hinge</td>
</tr>
<tr>
<td>4</td>
<td>Frame cross beam</td>
</tr>
<tr>
<td>5</td>
<td>Rotor shaft</td>
</tr>
<tr>
<td>6</td>
<td>Rotor</td>
</tr>
<tr>
<td>7</td>
<td>Hammer</td>
</tr>
<tr>
<td>8</td>
<td>Hammer locking system</td>
</tr>
<tr>
<td>9</td>
<td>1st Breaker plate</td>
</tr>
<tr>
<td>10</td>
<td>2nd Breaker plate</td>
</tr>
<tr>
<td>11</td>
<td>Breaker plate liner</td>
</tr>
<tr>
<td>12</td>
<td>Breaker plate rods</td>
</tr>
<tr>
<td>13</td>
<td>2nd Breaker plate return springs</td>
</tr>
<tr>
<td>14</td>
<td>Breaker plate adjustment system</td>
</tr>
<tr>
<td>15</td>
<td>Side liners</td>
</tr>
<tr>
<td>16</td>
<td>Feed plate</td>
</tr>
<tr>
<td>17</td>
<td>Access door</td>
</tr>
<tr>
<td>18</td>
<td>Feed box</td>
</tr>
<tr>
<td>19</td>
<td>Chain curtain</td>
</tr>
<tr>
<td>20</td>
<td>Rubber curtain</td>
</tr>
</tbody>
</table>

NP SERIES IMPACT CRUSHERS
### 2.5 Main dimensions

#### 2.5.1 NP1520, NP1315, NP1213, NP1110 and NP1007

![Diagram of NP1520, NP1315, NP1213, NP1110 and NP1007](Image)

**Figure 2-5 Main dimensions NP1520, 1315, 1213, 1110 and 1007**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>NP1520</th>
<th>NP1315</th>
<th>NP1213</th>
<th>NP1110</th>
<th>NP1007</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (mm)</td>
<td>850</td>
<td>830</td>
<td>750</td>
<td>710</td>
<td>650</td>
</tr>
<tr>
<td>B (mm)</td>
<td>33.5</td>
<td>31.5</td>
<td>29.5</td>
<td>28.0</td>
<td>25.6</td>
</tr>
<tr>
<td>C (in.)</td>
<td>995</td>
<td>930</td>
<td>879</td>
<td>820</td>
<td>800</td>
</tr>
<tr>
<td>D (in.)</td>
<td>39.2</td>
<td>36.6</td>
<td>34.6</td>
<td>32.3</td>
<td>32.0</td>
</tr>
<tr>
<td>E (mm)</td>
<td>2040</td>
<td>1540</td>
<td>1220</td>
<td>1020</td>
<td>750</td>
</tr>
<tr>
<td>F (mm)</td>
<td>1368</td>
<td>1172</td>
<td>1020</td>
<td>1105</td>
<td>1050</td>
</tr>
<tr>
<td>G (mm)</td>
<td>880</td>
<td>765</td>
<td>705</td>
<td>652</td>
<td>652</td>
</tr>
<tr>
<td>H (mm)</td>
<td>415</td>
<td>36.1</td>
<td>27.8</td>
<td>25.6</td>
<td>25.7</td>
</tr>
<tr>
<td>K (mm)</td>
<td>2057</td>
<td>1984</td>
<td>1840</td>
<td>1800</td>
<td>1671</td>
</tr>
<tr>
<td>L (mm)</td>
<td>1516</td>
<td>1284</td>
<td>1152</td>
<td>1192</td>
<td>1067</td>
</tr>
<tr>
<td>M (mm)</td>
<td>1055</td>
<td>915</td>
<td>844</td>
<td>796</td>
<td>751</td>
</tr>
<tr>
<td>N (mm)</td>
<td>3950</td>
<td>3350</td>
<td>3122</td>
<td>3055</td>
<td>2900</td>
</tr>
<tr>
<td>O (mm)</td>
<td>3600</td>
<td>3095</td>
<td>2840</td>
<td>2790</td>
<td>2575</td>
</tr>
<tr>
<td>P (mm)</td>
<td>2383</td>
<td>2170</td>
<td>1945</td>
<td>1970</td>
<td>1860</td>
</tr>
<tr>
<td>Q (mm)</td>
<td>2763</td>
<td>2305</td>
<td>2306</td>
<td>2200</td>
<td>2070</td>
</tr>
<tr>
<td>R (mm)</td>
<td>3549</td>
<td>3055</td>
<td>2842</td>
<td>2800</td>
<td>2647</td>
</tr>
<tr>
<td>S (mm)</td>
<td>1068</td>
<td>112.4</td>
<td>113.5</td>
<td>117.0</td>
<td>104.2</td>
</tr>
</tbody>
</table>

A, B, C, D, E, F: Dimensions are inside liners.
Figure 2-6 Main dimensions NP 2023, 1620, 1415, 1313 and 1210

| A (mm)  | B (mm)  | C.D (mm) | E (mm) | F (mm) | G (mm) | H (mm) | I (mm) | J (mm) | K (mm) | L (mm) | M (mm) | N (mm) | Q (mm) | P (mm) |
|---------|---------|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| NP2023  | 1720    | 1965     | 2310   | 2210   | 1140   | .      | 2273   | 89.5   | .      | .      | 6000   | 3930   | 4424   | 3525   | 4100   |
|         | 87.7    | 78.1     | 90.9   | 87     | 44.9   | 99.5   | 238.2  | 154.7  | 174.2  | 138.8  | 95.1   | 81.4   | 517.1  |         |
| NP1620  | 1400    | 1635     | 2040   | 1650   | 920    | 803    | 1772   | 2194   | 4200   | 4950   | 3000   | 3600   | 2635   | 3085   |
|         | 55.1    | 64.3     | 80.3   | 63.0   | 36.2   | 29.5   | 69.8   | 86.4   | 160.3  | 194.9  | 118.1  | 141.7  | 102.5  | 121.5  |
| NP1415  | 1140    | 1320     | 1540   | 1305   | 800    | 605    | 1430   | 1770   | 3775   | 4007   | 2296   | 2790   | 2790   | 3600   |
|         | 44.9    | 52.0     | 60.6   | 51.4   | 31.5   | 23.8   | 56.3   | 69.7   | 122.9  | 107.6  | 90.3   | 109.6  | 93.7   | 109.8  |
| NP1313  | 1350    | 1225     | 1320   | 1304   | 760    | 632    | 1386   | 1749   | 3300   | 3765   | 2100   | 2600   | 2340   | 2794   |
|         | 41.3    | 48.2     | 52     | 51.4   | 30     | 24.9   | 24.5   | 68.7   | 129.9  | 148.2  | 92.7   | 100.8  | 92.1   | 108.8  |
| NP1210  | 950     | 1080     | 1200   | 1200   | 700    | 583    | 1282   | 1610   | 3030   | 3485   | 1805   | 2126   | 2115   | 2475   |
|         | 37.4    | 42.5     | 40.2   | 47.2   | 27.5   | 23     | 50.5   | 63.4   | 119.3  | 137.2  | 76.9   | 83.7   | 83.3   | 97.4   |

A, B, C, D, E, F: Dimensions are inside liners
## 2.6 Technical features

<table>
<thead>
<tr>
<th>HP1007</th>
<th>HP1100</th>
<th>HP1210</th>
<th>HP1313</th>
<th>HP1515</th>
<th>HP1620</th>
<th>HP2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed opening Width x height (mm)</td>
<td>700 x 900</td>
<td>900 x 900</td>
<td>1200 x 900</td>
<td>1200 x 1000</td>
<td>1250 x 900</td>
<td>1250 x 1250</td>
</tr>
<tr>
<td></td>
<td>28 x 35.5</td>
<td>36 x 36.5</td>
<td>48 x 52.5</td>
<td>52 x 52.5</td>
<td>52 x 67.5</td>
<td>52 x 77.5</td>
</tr>
<tr>
<td>Thrust (mm)</td>
<td>650</td>
<td>710</td>
<td>820</td>
<td>1060</td>
<td>1140</td>
<td>1140</td>
</tr>
<tr>
<td></td>
<td>25.6</td>
<td>28.1</td>
<td>32.6</td>
<td>41.3</td>
<td>44.9</td>
<td>44.9</td>
</tr>
<tr>
<td>Maximum feed size (mm) (in)</td>
<td>500</td>
<td>600</td>
<td>800</td>
<td>900</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td></td>
<td>19.7</td>
<td>23.6</td>
<td>31.5</td>
<td>36.0</td>
<td>39.4</td>
<td>39.4</td>
</tr>
<tr>
<td>Rotor diameter (mm) (in)</td>
<td>1500</td>
<td>1100</td>
<td>1200</td>
<td>1200</td>
<td>1200</td>
<td>1200</td>
</tr>
<tr>
<td></td>
<td>59.1</td>
<td>43.3</td>
<td>47.2</td>
<td>47.2</td>
<td>47.2</td>
<td>47.2</td>
</tr>
<tr>
<td>Number of hammers</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Power (kW / HP)</td>
<td>55 / 75</td>
<td>77 / 100</td>
<td>110 / 150</td>
<td>132 / 180</td>
<td>132 / 180</td>
<td>132 / 220</td>
</tr>
<tr>
<td>Standard crusher pulley (mm)</td>
<td>650</td>
<td>600</td>
<td>650</td>
<td>650</td>
<td>650</td>
<td>650</td>
</tr>
<tr>
<td>Work load and section (*)</td>
<td>6 - 24.6</td>
<td>8 - 31.5</td>
<td>8 - 31.4</td>
<td>8 - 31.4</td>
<td>8 - 31.4</td>
<td>8 - 31.4</td>
</tr>
<tr>
<td>Rotation speed (rpm)</td>
<td>800 / 710</td>
<td>900 / 800</td>
<td>900 / 800</td>
<td>900 / 800</td>
<td>900 / 800</td>
<td>900 / 800</td>
</tr>
<tr>
<td>Primary (rpm)</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>Secondary (rpm)</td>
<td>850 / 750</td>
<td>900 / 800</td>
<td>900 / 800</td>
<td>900 / 800</td>
<td>900 / 800</td>
<td>900 / 800</td>
</tr>
<tr>
<td>Recycle (rpm)</td>
<td>400 / 350</td>
<td>450 / 375</td>
<td>450 / 375</td>
<td>450 / 375</td>
<td>450 / 375</td>
<td>450 / 375</td>
</tr>
<tr>
<td>Rotor assembly welded &amp; (kg) (lb-mass)</td>
<td>4,400</td>
<td>5,200</td>
<td>5,700</td>
<td>5,700</td>
<td>5,700</td>
<td>5,700</td>
</tr>
<tr>
<td>Weight of crusher (without frame)</td>
<td>2,740 kg</td>
<td>3,255 kg</td>
<td>3,600 kg</td>
<td>4,250 kg</td>
<td>4,700 kg</td>
<td>4,700 kg</td>
</tr>
<tr>
<td></td>
<td>10,500 lbs</td>
<td>11,500 lbs</td>
<td>14,500 lbs</td>
<td>14,500 lbs</td>
<td>14,500 lbs</td>
<td>14,500 lbs</td>
</tr>
</tbody>
</table>

(*) Standard crusher pulley is in some cases replaced by a pulley having different diameter and different V-belt section.

Power rating and rotor speed are chosen according to the application.

Table 2-1: Technical features
2.7 Crusher output estimation

Crusher output primarily depends on feed specifications (size, crushability, hardness, moisture content, etc.) and the way the crusher settings are controlled.

To estimate output, refer to Figure 2-7, Figure 2-8, Figure 2-9, Figure 2-10, Figure 2-11 and Figure 2-12. Outputs in Figure 2-7, Figure 2-8, Figure 2-9, Figure 2-10, Figure 2-11 and Figure 2-12 are averages based on results obtained with crushers all over the world processing a wide range of different ores, rocks, concretes, asphalts and demolition products.

For specific application, consult the manufacturer.

The output charts have been developed for use as an application tool to correctly use the capabilities of the impact crusher. The crusher is one component of the circuit. As such, its performance is in part dependant on the proper selection and operation of feeders, conveyors, screens, supporting structures, electric motors, drive components and surge bins.

The following factors will enhance crusher performances:

1. Correct selection of wear parts material.
2. Correct rotation speed.
3. Correct breaker plate adjustment.
4. Correct feed distribution; feed materials flow must have a width of at least 75% of the crushing chamber width and it must be regular.
5. In recycling application of concrete with rebars, the feed blocks must be reduced hydraulically or in any other way to a maximum length of 1 metre.

The following factors reduce crusher performances.

1. Sticky materials in the crusher feed.
2. Fines in the crusher feed.
3. Excessive feed moisture.
4. Incorrect feed distribution; excessive crusher feed rate.
5. Extremely hard and tough material.
6. In recycling application, rebar that is too long.
2.7.1 NP1520, NP1315, NP1213, NP1110, NP1007

The values shown should only be used for reference purposes and are valid for dry crushing of rock having an average gradation for the considered crusher opening and density of 1.6 t/cu.m (100 lb/cu.ft).

![Graph](image)

Production obtained in closed circuit

**DISCHARGE PRODUCT SIZE**

Figure 2-7 Outputs for NP crushers in quarry
The values shown should only be used for reference purposes and are valid for recycling of concrete and demolition materials having an average gradation for the considered crusher opening and density of 1.6 t/m³ (90 L/ft³).

Figure 2-8 Outputs for NP crushers in recycling application of concrete and demolition materials.
The values shown should only be used for reference purposes and are valid for dry crushing of asphalt having an average gradation for the considered crushe opening and density of 1.65t/m³ (100 Lbcu.ft).

OUTPUT (STPH) (MTPH) Production obtained in closed circuit

DISCHARGE PRODUCT SIZE

Figure 2-9 Outputs for NP crushers in recycling application of asphalt
The values shown should only be used for reference purposes and are valid for dry crushing of rock having an average gradation for the considered crusher opening and density of 1.6 t/cu.m (100 Lbs/cu.ft).

![Graph showing output vs discharge product size for NP series impact crushers](image)

**DISCHARGE PRODUCT SIZE**

Figure 2-10 Outputs for NP crushers in quarry

2-12 NP SERIES IMPACT CRUSHERS
The values shown should only be used for reference purposes and are valid for recycling of concrete and demolition materials having an average gradation for the considered crusher opening and density of 1.6 t/m³ (100 Lbs/cu.ft).

**OUTPUT (STPP) (MTPH)**

Production obtained in closed circuit

![Graph of NP 1620, NP 1415, NP 1313, NP 1210,
NP 1620, NP 1415, NP 1313, NP 1210,
NP 1620, NP 1415, NP 1313, NP 1210,
NP 1620, NP 1415, NP 1313, NP 1210,
NP 1620, NP 1415, NP 1313, NP 1210,]

**DISCHARGE PRODUCT SIZE**

Figure 2-11 Outputs for NP crushers in recycling application of concrete and demolition materials
The values shown should only be used for reference purposes and are valid for dry crushing of asphalt having an average gradation for the considered crushe opening and density of 1.6 t/cm³ (100 lb/ft³).

Production obtained in closed circuit

**OUTPUT**

(STPH) (MTPH)

**DISCHARGE PRODUCT SIZE**

Figure 2.12 Outputs for NP crushers in recycling application of asphalt

2-14 NP SERIES IMPACT CRUSHERS
2.8 Initial inspection
It is recommended that as soon as possible after receipt of the Crusher, a careful check be made for any possible damage which might have been incurred during transit. A careful check should also be made to be sure that nothing has been ommitted and that all items on the bill of lading, freight bill or manifest can be accounted for. If any shortages or damages are discovered, these should immediately be brought to the attention of the respective carrier so that necessary claims can be processed without any undue delay.

2.9 Spare parts book
A parts manual containing the various assembly drawings pertaining to your crusher will be sent under separate cover at a later date; usually immediately after the crusher has been shipped.

This manual illustrates and identifies each and every part used in the assembly of the crusher.

2.10 Spare parts
Metso Minerals endeavours to carry an ample supply of parts in stock to provide prompt and efficient service on all orders for repairs and replacements.

To avoid delay, and the possibility of incorrect parts being furnished, the following information must be given:
- Crusher size.
- The serial number of the crusher which is stamped on the crusher name plate as well as on the cover of the parts manual.
- Exact quantity of each part ordered.
- Complete name and part code number as shown in the parts manual.
- Complete shipping instructions.

Advise whether shipment is desired by water, train, road or air freight.

If your crusher parts manuals have been lost or destroyed, ask Metso Minerals for another set.

For correct operation, only genuine Metso Minerals parts must be installed. These are guaranteed as to accuracy, workmanship and material.
Section 3

INSTALLATION

3.1 - Installation .......................................................... 3-1
3.2 - Foundations .......................................................... 3-2
3.3 - Service platform ....................................................... 3-2
3.4 - Lifting the crusher .................................................... 3-2
3.5 - Safety device for frame opening (slave systems to be executed by the installer) .................................................... 3-4
  3.5.1 - In case of mechanical setting with or without optional hydraulic assistance .................................................... 3-4
  3.5.2 - In case of hydraulic setting ........................................ 3-4
3.6 - Crusher feeder ............................................................ 3-4
3.7 - Discharge of crushed product ........................................ 3-5
3.8 - Drive ........................................................................ 3-5
  3.8.1 - Type of drive ......................................................... 3-5
  3.8.2 - Tensioning the V-belt drive ....................................... 3-8
  3.8.3 - Tension-deflexion .................................................. 3-8
  3.8.4 - Elongation method ................................................ 3-10
  3.8.5 - Drive safety guard .................................................. 3-12
3.9 - Crusher motor ............................................................ 3-12
3.10 - General assembly and disassembly information .................... 3-12
3.11 - General maintenance information .................................... 3-13
3.12 - Minimum recommended spare parts list ............................. 3-13
3.13 - Special tools .............................................................. 3-13
3.14 - Protecting the crusher against rust corrosion ...................... 3-14
### 3.1 Installation

See paragraph 2.5. "Main dimensions" for general dimensions of the crusher.

#### Weight of main components

<table>
<thead>
<tr>
<th>Weight</th>
<th>NP1007</th>
<th>NP1110</th>
<th>NP1210</th>
<th>NP1213</th>
<th>NP1313</th>
<th>NP1315</th>
<th>NP1415</th>
<th>NP1520</th>
<th>NP1620</th>
<th>NP2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete crusher (without option)</td>
<td>7240 kg</td>
<td>9250 kg</td>
<td>12800 kg</td>
<td>17800 kg</td>
<td>18100 kg</td>
<td>21850 kg</td>
<td>21500 kg</td>
<td>21500 kg</td>
<td>27100 kg</td>
<td>40000 kg</td>
</tr>
<tr>
<td>Feed box</td>
<td>1300 kg</td>
<td>1600 kg</td>
<td>1660 kg</td>
<td>1864 kg</td>
<td>1864 kg</td>
<td>2288 kg</td>
<td>10400 kg</td>
<td>15000 kg</td>
<td>15000 kg</td>
<td>32840 kg</td>
</tr>
<tr>
<td>Rotor assembly with hammers and pulley</td>
<td>2250 kg</td>
<td>3065 kg</td>
<td>3722 kg</td>
<td>4850 kg</td>
<td>6340 kg</td>
<td>6670 kg</td>
<td>5685 kg</td>
<td>10400 kg</td>
<td>15000 kg</td>
<td>32840 kg</td>
</tr>
<tr>
<td>Hammer</td>
<td>145 kg</td>
<td>215 kg</td>
<td>215 kg</td>
<td>335 kg</td>
<td>335 kg</td>
<td>454 kg</td>
<td>454 kg</td>
<td>745 kg</td>
<td>745 kg</td>
<td>895 kg</td>
</tr>
<tr>
<td>Hammer lifting tool</td>
<td>20 kg</td>
<td>30 kg</td>
<td>30 kg</td>
<td>60 kg</td>
<td>60 kg</td>
<td>70 kg</td>
<td>70 kg</td>
<td>90 kg</td>
<td>90 kg</td>
<td>150 kg</td>
</tr>
<tr>
<td>Standard-cutter pulley (*)</td>
<td>110 kg</td>
<td>190 kg</td>
<td>190 kg</td>
<td>485 kg</td>
<td>485 kg</td>
<td>485 kg</td>
<td>485 kg</td>
<td>266 kg</td>
<td>90 kg</td>
<td>2230 kg</td>
</tr>
<tr>
<td>Lifting/beam and hold option</td>
<td>170 kg</td>
<td>320 kg</td>
<td>320 kg</td>
<td>320 kg</td>
<td>320 kg</td>
<td>430 kg</td>
<td>40 kg</td>
<td>610 kg</td>
<td>745 kg</td>
<td>1440 kg</td>
</tr>
<tr>
<td>Hotel capacity (option)</td>
<td>250 kg</td>
<td>500 kg</td>
<td>500 kg</td>
<td>500 kg</td>
<td>500 kg</td>
<td>500 kg</td>
<td>500 kg</td>
<td>1000 kg</td>
<td>1000 kg</td>
<td>1250 kg</td>
</tr>
</tbody>
</table>

(*) Standard-cutter pulley is in some cases replaced by a pulley having a different diameter.

#### Load by sealing bolt

<table>
<thead>
<tr>
<th>Load by sealing bolt</th>
<th>NP1007</th>
<th>NP1110</th>
<th>NP1213</th>
<th>NP1313</th>
<th>NP1315</th>
<th>NP1415</th>
<th>NP1520</th>
<th>NP1620</th>
<th>NP2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal and vertical dynamic load</td>
<td>14 kN</td>
<td>18 kN</td>
<td>25 kN</td>
<td>35 kN</td>
<td>32 kN</td>
<td>32 kN</td>
<td>40 kN</td>
<td>60 kN</td>
<td>90 kN</td>
</tr>
<tr>
<td>Vertical static load</td>
<td>1.7 kN</td>
<td>2.2 kN</td>
<td>2.4 kN</td>
<td>3.3 kN</td>
<td>3.3 kN</td>
<td>3.8 kN</td>
<td>4.5 kN</td>
<td>4.5 kN</td>
<td>4 kN</td>
</tr>
</tbody>
</table>

| Table 3-1 Weights information |
| Table 3-2 Load by sealing bolt |
3.2 Foundations

The frame must bear on a flat, horizontal surface.

Leave sufficient clearance over the crusher to enable removal of the feed box and to open the access doors used when replacing breaker plate liners.

Sufficient clearance must be left around the breaker plate liners to enable the hammer to be removed from the front of the main feed hopper to the screen. Also, sufficient space must be provided around the feed hopper to allow for the replacement of the feed hopper and auxiliary equipment. Any space must be sufficient to allow for the discharge of the product chutes, belt conveyors, etc.

Sealing:

Should the machine be installed on a concrete base, it will be secured by anchor bolts. These bolts transmit their tractive force to the sealing concrete by grouting.

The sealing grout transmits the force received from the bolts to the concrete. This force is transmitted from one concrete to the other one by their boundary layer.

If a foundation shim is required, this is merely an assembling device for locking the bolts and the part to be grouted. This grouting is complete, i.e., the concrete has set.

The grouting must be completed prior to commissioning. Note that the resistance of a new created anchor bolt is only one tenth of the resistance after grouting.

The foundation shim has no part in foundation resistance, only the grouting concrete ensures bolt anchorage.

Practical consequences:

Before pouring the grouting concrete, you should ensure that the holes are free of all foreign matter, waste, shatters, rags and debris of all kinds. The one in charge of installation is responsible for carrying out this inspection.

The CM 66 French regulations even recommend shot blasting the faces of the holes, prior to grouting, to improve the link between the concrete.

Finally, products which are quick setting and non-shrink should preferably be used such as:

- CLAVEX (Lafarge cements)
- SELTEX (concrete technical treatments)

Wait until the grouting has set (15 days for ordinary cement mortar, 1 or 2 days for special products) before commissioning the installation.

3.3 Service platform

The crushing unit must be fitted with a service platform to make maintenance easy and safe. If the service platform is not ordered or supplied with the crusher it must be built and installed by the operator. The service platform should be at least 600 mm wide, solid and safe to use. Service stairways or ladders must also be tough and safe. The platform, stairways and ladders must have handrails to protect personnel from falls.

3.4 Lifting the crusher

Crusher component weights must be considered when preparing the study for the foundations and the hoisting equipment. A heavy crane, a tyre-mounted or truck-mounted mobile crane, a chain hoist or any other suitable equipment must be used to lift and handle the heavy components of the crusher when installing the machine or replacing wear parts.
Refer to Table 3-1 for the weights of the main crusher components.

Only use suitable approved equipment and braided metal cables of the correct weight-bearing capacity. When raising the complete crusher unit, attach the braided metal cables as shown in Figure 3-1.

**ATTENTION**

Never stand or work under a suspended load.

Figure 3-1 Lifting the crusher
3.5 Safety device for frame opening (slave systems to be executed by the installer)

3.5.1 In case of mechanical setting with or without optional hydraulic assistance

Two proximity sensors are fitted to the split of the frame near the pivoting bolts. When activated, they detect if the frame is open or closed. For safe crusher operation, the crusher motor and the hydraulic power pack motor.

**ATTENTION**

When the sensors show that the frame is closed, crusher motor and hydraulic power pack operation are authorised to enable the first screen to be launched. If an attempt is made to open the frame while the crusher is working, the slave system instantaneously shuts down the power pack and stops the crusher motor. The rotation sensor will only authorise power pack re-start once the rotation rate is zero.

The sensors will only authorise the crusher to start once the frame is closed.

Foresee a reset button to restart after the defect occurred.

During installation, take care to protect the electric cable connected to the proximity sensors from falling materials.

**Proximity sensor specifications:**

- **Type:** TELEMECANIQUE XS1
- **Model:** M30MA239C
- **Voltage:** 24V to 240V, dc and ac.

3.5.2 In case of hydraulic setting

Crusher and hydraulic power pack motors are slaved to proximity sensors which detect if the frame is open or closed.

**Operating principles:**

**ATTENTION**

When activated, the proximity sensors on the split of the frame near the pivoting bolts detect that the frame is closed, enable crusher start-up and inhibit hydraulic power pack start-up to prevent accidental opening of the frame and use of adjustment functions.

The rotation sensor will only authorise power pack re-start once the rotation rate is zero.

The crusher can only be started after authorisation via the contact switches (i.e. when the frame is closed).

The system must be reinitialised if it cuts in to prevent an incident.

During installation, take care to protect the electric cable connected to the proximity sensors from falling materials.

**Proximity sensor specifications:**

- **Type:** TELEMECANIQUE XS1
- **Model:** M30MA239C
- **Voltage:** 24V to 240V, dc and ac.

3.6 Crusher feeder

Installers must provide feed plates with chain or rubber curtains to prevent ejection of materials and trap dust.

The crusher will only work at maximum efficiency if a sufficient quantity of feed is supplied in a constant way and at the correct width for the crushing cavity. Normally, material is fed to an impact crusher by means of a vibrating feeder or an apron feeder. A belt conveyor can be used for secondary applications where material is of reduced size, providing that a stone box system is used to ensure regular distribution of the material in the crushing cavity.
Feeder equipment must be installed in such a way as to ensure that the materials are fed directly towards the crushing cavity and not onto the side liners of the form.

The feeder, hopper and chutes must be designed, built and installed in such a way as to protect personnel from injuries by accidental expulsion of flying rocks from the cruscher cavity, hopper or chutes.

Feeder system layout and installation must permit easy access to the cruscher for maintenance purposes.

If feed material contains a high proportion of fines, the feed arrangement must be fitted with a screen or a scalper to remove dust from the cruscher feed to increase crushing performance and reduce wear on hammers and liners.

ATTENTION

Never feed metallic or uncrushable parts into the cruscher as they could damage it by jam at overload.

The feed system must always be shut down before the cruscher. Interlocking the feeder to the cruscher is the ideal way to shut down the crusching station.

3.7 Discharge of crushed product

Installers must provide metal chutes and reception plates to channel the materials, prevent ejection of materials and trap dust.

Usually crushed product is removed by a conveyor belt. The removal system must be designed to simplify cruscher maintenance.

Crushed product must be removed continuously; discharge area design must prevent product from building up under the cruscher. If product piles up, hammers will wear rapidly, production rates will decrease and the cruscher could stall due to overload. Check that the removal equipment is dimensioned correctly so as not to restrict the product discharge. We recommend oversizing of removal system width and capacity by 2 to 3 times nominal cruscher output.

If a chute is used at the discharge, the slope must be greater than 45 degrees and even more if material is very sticky.

Discharge chute must be designed with a stone box to enable a dead bed of material; as they leave the cruscher, falling material hits the dead bed which absorbs most of the impacts before it drops onto the conveyor belt system. This design will extend conveyor belt service life.

3.8 Drive

3.8.1 Type of drive

The standard recommendation for driving the cruscher is through a V-belt drive. The V-belt drive is particularly desirable because of, first its feature which prevents cruscher shock loads from being transferred to the cruscher motor and, secondly, its ability to carry surge loads without a resultant loss in cruscher speed.

The narrowest belts are designed for compactness of drive, drive economy and reduced overturning load. Banded belts are single belts united with a common cover to prevent belt whip or turnover. Banded belts fit all standard pulleys, however, banded belts should be limited to only 2 or 4 individual belts banded together.

Power may be furnished by either an electric motor or diesel engine.
Initial installation of V-belt drive

1. Clean all oil, grease or rust from the pulley grooves.
2. Make certain that the pulleys are correctly aligned and that the shafts are parallel.
3. Never force belts on to pulleys. Always shorten the center distance until belts can be slipped on easily. To determine the minimum allowances for shortening or lengthening the center distance between pulleys, see Table 3-3.

After calculating a center distance from a standard pitch length make provision that the centers can be moved closer together by the amount shown in the following table to facilitate installing the belts without deterioration. Also, the centers should be adjustable over the calculated distance by an amount as shown in last column of the Table 3-3 because of manufacturing tolerance and possible stretch and wear of belts.

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pulley</td>
</tr>
<tr>
<td>2</td>
<td>Shorter center distance for V-belt installation</td>
</tr>
<tr>
<td>3</td>
<td>Motor pulley</td>
</tr>
<tr>
<td>4</td>
<td>Longer center distance for V-belt take-up</td>
</tr>
<tr>
<td>5</td>
<td>Center distance</td>
</tr>
</tbody>
</table>
### Table 3-3 V-belt installation and take-up allowances

<table>
<thead>
<tr>
<th>Belt length (nm inches)</th>
<th>BV</th>
<th>BV (banded belts)</th>
<th>SPC</th>
<th>Minimum allowance above centers for stretch and wear</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 (79) thru 2749 (108)</td>
<td>40 (1 1/2)</td>
<td>85 (3 3/8)</td>
<td>35 (1 3/8)</td>
<td>40 (1 1/2)</td>
</tr>
<tr>
<td>2750 (108) thru 3499 (138)</td>
<td>40 (1 1/2)</td>
<td>85 (3 3/8)</td>
<td>35 (1 3/8)</td>
<td>45 (1 3/4)</td>
</tr>
<tr>
<td>3500 (138) thru 4499 (177)</td>
<td>40 (1 1/2)</td>
<td>85 (3 3/8)</td>
<td>35 (1 3/8)</td>
<td>55 (2 1/8)</td>
</tr>
<tr>
<td>4500 (177) thru 5499 (216)</td>
<td>45 (1 3/4)</td>
<td>90 (3 1/2)</td>
<td>35 (1 3/8)</td>
<td>65 (2 1/2)</td>
</tr>
<tr>
<td>5500 (216) thru 6499 (256)</td>
<td>45 (1 3/4)</td>
<td>90 (3 1/2)</td>
<td>40 (1 1/2)</td>
<td>85 (3 3/8)</td>
</tr>
<tr>
<td>6500 (256) thru 7999 (315)</td>
<td>45 (1 3/4)</td>
<td>90 (3 1/2)</td>
<td>40 (1 1/2)</td>
<td>95 (3 1/2)</td>
</tr>
<tr>
<td>8000 (315) thru 9999 (394)</td>
<td>50</td>
<td>100</td>
<td>45 (1 3/4)</td>
<td>110 (4 3/8)</td>
</tr>
<tr>
<td>over 10000 (394)</td>
<td>50</td>
<td>100</td>
<td>45 (1 3/4)</td>
<td>145 (5 1/2)</td>
</tr>
</tbody>
</table>

(*) In each group the range is to, but not including the second length.

4. Always use a matched set of belts and use new belts of the same manufacture. Never mix worn and new belts.

5. Place belts on pulleys and run the drive for a few minutes. Then tension the drive until only a slight bow or sag appears on the slack side of the belts when the drive is running. An example of tight side and slack side is shown in Figure 3-4. The slack side depends on motor position and rotation direction.
3.8.2 Tensioning the V-belt drive

Tensioning the drive is a term used when force is applied to the V-belt by some method to provide the wedging action between the V-belt and the pulley. This wedging action provides the ability for a V-belt to transmit power from the motor pulley to the crusher pulley.

Various methods of tensioning V-belts have been established. Two simplified methods will be described in the following paragraphs: Tension-deflection and percent (%) of elongation. Either of these two methods will provide satisfactory belt tension. Each has certain advantages for a given type of belt.

3.8.3 Tension-deflection

1. Place a straight edge across the top of both pulleys. See Figure 3-5.
2. Measure the span length.
3. Using a spring scale at right angles to the center of the span length, apply a force to the scale great enough to deflect one of the belts the equivalent of 0.016 times millimeters of span length (0.016 times inches of span length).
4. The force should approximate the forces shown in Table 3-4 for a properly tensioned drive.
Example

V-belts 8 V = V-belts SP°C

Span length (center distance) = 1575 mm (62")
Deflection force (from table) = 15.22 kg (34-50 lbs.)

Deflection = 1575 mm (62") x 0.016 = 25 mm (1")

Therefore, on a new installation with a standard 8V section belt and a span length of 1575mm (62"), the belt should deflect 25 mm (1") with a spring force of 15.22 Kg (34-50 lbs.) for a properly tensioned drive.

5. At the end of 2-4 hours of operation, the drive should be retensioned to approximately the maximum force.
6. After 24-48 hours, it is well to check the drive to see if the force on the belts is between the minimum and maximum force shown in table. Retension if necessary. Either excessively low or high tension will affect the life and operation of a V-belt.

IMPORTANT!
When properly tensioned a narrow V-belt may not feel as tight as one might expect from the tension they can't. Therefore, it is advisable to use a spring scale to check belt tension on these belts.
### Table 3-4: Flexion forces

<table>
<thead>
<tr>
<th>Belt section</th>
<th>Standard belt</th>
<th>Ended belt*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum tension Kg (in l.b.s.)</td>
<td>Maximum tension Kg (in l.b.s.)</td>
</tr>
<tr>
<td>8V</td>
<td>15.4 (34)</td>
<td>22.7 (50)</td>
</tr>
<tr>
<td>SPC</td>
<td>10.4 (23)</td>
<td>15.4 (34)</td>
</tr>
</tbody>
</table>

(*) Multiply these values by number of belts in band.

### 3.8.4 Elongation method

This particular method of tensioning V-belt drives was developed primarily for tensioning banded belts.

1. Remove the slack from the belts.

2. Next, wrap a 15 meter (50 foot) steel tape around the outside circumference of the belt and measure to the nearest millimeter (1/16”). Record this length. See Figure 3-6.

3. Multiply this recorded length by a percent of elongation factor which is shown in Table 3-3 and add this amount to the initial measurement.

4. Elongate the belt to this new reading.

![Figure 3-6: Percent of elongation method](image)

---

3-10 NP SERIES IMPACT CRUSHERS
Example

V-belt section = Standard 8V belt
Initial tape reading = 3 meter, 48 mm (120")
Elongation factor (from table) = 0.009 (multiplier) which is 0.9% (percent)
New length reading = 3 meter, 48 mm (120") initial reading × 0.009 elongation factor
= 3 meter, 48 mm (120") + 27 mm (1-1/16") or 3 meter, 75 mm (127-1/16")

<table>
<thead>
<tr>
<th>Belt Section</th>
<th>Factor</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8V</td>
<td>0.009</td>
<td>0.9</td>
</tr>
</tbody>
</table>

(*) Standard or banded belts

Table 3-5 Elongation Factors

Therefore, on an installation with an 8V belt and an outside circumference measurement of 3 meter, 48 mm (120"), the motor pulley should be moved away from the crusher pulley until the steel tape reads 3 meter, 75 mm (127-1/16") for a properly tensioned drive.

5. Periodic belt tension checks must be made and if retensioning becomes necessary, the tensioning process just described should be repeated.

It must be pointed out that the TENSION-DEFLECTION METHOD is the preferred method of tensioning V-belts.

Usually the first sign that indicates retensioning is necessary is belt slippage. This slippage will show up in loss of power and speed at the crusher pulley and in a high rate of belt and pulley groove wear. These conditions are usually accompanied by belt "squeal" and also a reating up of belts and pulleys. These conditions are readily apparent and can be detected by simply looking, listening, and feeling.

V-Belt precaution

Some of the do's and don'ts in connection with proper V-belt drive operation are as follows:

1. Do - Check belt tension frequently during the first few days of run-in operation. When the belts have had time to become seated in the pulley groove, retension the belts. New belts have a certain amount of initial stretch and will require additional tensioning.

2. Don't - Over-tighten belts as too much tension shortens both belt and bearing life. Maintain uniform tension. Idler belts should appear tight; in motion, they have a slight sag on the slack side.

3. Do - Keep drives well ventilated as heat buildup over 60°C (140°F) causes belt life to become shortened. The sides of the belt guard must be designed to allow for adequate circulation of air. Either perforated plate or expanded metal is ideal for this type of application.

4. Don't - Allow any oil or grease to come in contact with the belts as excessive oil causes the rubber to swell and the belts to fail prematurely.

5. Do - Make V-belt drive general inspections on a periodic basis. The following points must be checked at each inspection.
   a. Loss of crusher speed - check tension.
   b. Unequal stretch - check each belt.
   c. Excessive elongation - check for overload.
   d. Belt softening or swelling - check for oil or grease.
   e. Belt hardening and cracking - check for excessive heat.
3.8 Drive safety guard

The drive guard protects the operator and the drive from accidental rock falls.

As the motor position is specific to each crusher installation, the guard is often designed and produced specifically for each crushing station.

**DANGER**

For the safety of the personnel the drive guard must be in position when the crusher is operating.

3.9 Crusher motor

The electrical driving motor is to be a squirrel cage induction or slip ring motor, continuous rated, with normal starting torque (approximately 125 percent) and normal breakdown torque (approximately 200 percent) with ± 10 percent acceptable voltage variance.

Abrasive resistant insulation and stator thermostats (an internal protective device) are suggested. The motor can either be open drip-proof or totally enclosed fan cooled.

To maintain continuous service of the recommended operating horsepower level, an electric motor with 1.15 service factor is required. If a service factor of 1.0 is used, the horsepower rating appearing on the motor's nameplate should be approximately 15 percent higher than the recommended operating horsepower. However, the crusher power draw is to be kept to the nominal horsepower.

If a V-belt drive is used, care should be taken when ordering the motor that the motor bearings are adequately sized for the overhung pulley weight and belt pull. The motor must also have 360° radial belt pull capacity. Motor shaft diameter must be able to withstand peak torque and simultaneous bending due to belt pull and pulley weight. The shaft should be of sufficient length to accommodate the entire length of the motor pulley centering or hub as well as provide clearance between the motor housing and the rim of the pulley.

With the V-belt drive, slide rails under the motor are required to provide allowance for V-belt take-up due to belt stretch and fix belt installation.

If a direct drive is used, care should be taken when ordering the motor that the motor shaft extension and bearings are adequately sized for a direct drive application. The motor shaft diameter must be able to withstand peak torque.

All horsepower ratings referred on Table 2.1 are based on electric horsepower. Therefore, when using a diesel engine as the driving unit, the engine manufacturer must be contacted in order to find out what diesel horsepower is equivalent to the electric horsepower at the given speed for the application.

3.10 General assembly and disassembly Information

Metso Minerals crushers are shipped either as a complete unit or in sub-assemblies, depending on crusher size. For domestic shipment, the smaller size crushers are usually shipped as a complete unit, ready to be set on the foundation.

In some instances these smaller machines will be dismantled into sub-assemblies for export shipment or for domestic shipment where shipping or handling restrictions so demand. The larger size crushers are, in most instances, dismantled for shipment.

See section 9 "Servicing" for the installation of the drive shaft line.

Before installing any of these crusher parts, check that the protective coating applied to all machined surfaces for shipment has been removed and that all parts are clean and free from grit and dirt, especially oil passages and pipes.

All machined surfaces and threads that may have possibly been damaged in shipment must be restored to the proper condition before assembly. After cleaning, lightly oil all bearing surfaces.
3.11 General maintenance information

When performing any maintenance work on the crusher, the following general precautions should be observed:

1. When removing parts with machined or bearing surfaces which may rust, they should be well oiled or covered with a rust preventive, if they are to be kept out of the crusher for any length of time.

2. Use additional caution when handling any parts which have bearing surfaces or a machined surface that has close tolerances.

3. When disassembling any parts with bearing or machined surfaces, protect these surfaces from coming in contact with the ground by using wooden blocking.

4. Bearings should be handled with extreme care. Excessive ramming or pounding on this soft material may cause warping or springing of such parts.

5. Clean thorough and oil all machined parts before installing them in the crusher. Do not replace a bearing surface without coating it with oil.

6. When assembling two mating parts that require either a press or sliding fit, coat the contacting surfaces with a light coating of oil. This will act as a lubricant and prevent rusting in place.

ATTENTION

During a welding operation on the crusher, the welding current must never pass through the rotor bearings which might then be damaged.

3.12 Minimum recommended spare parts list

The following is a list of the minimum spare parts which should be on hand at all times to insure a minimum of down time.

- Hammers.
- Breaker plate liners and bolts.
- Lateral frame liners and bolts.
- Lateral hammer stops and bolts.
- Drive belts.

It is to be understood that this list contains only the minimum compliment of spare parts and if the crusher installation is either in a remote location or consists of several crushers, this list should be expanded. Therefore, consult the factory for a suggested list of spare parts for your particular operation.

Before storing any spare parts, check that the protective coating applied before shipment is still intact.

3.13 Special tools

The only tools supplied with the crusher are those which are not easy to find commercially. These include:

- Flat spanners.
- Hex wrenches for hammer locking wedges.
- Hammer lifting system.
- Rotor locking pin.
- Hydraulic hose.
- Tooling for hydraulic assistance (option).
- Tooling for third breaker plate equipment (option).

NP SERIES IMPACT CRUSHERS 3-15
3.14 Protecting the crusher against rust corrosion

Corrosion is a natural phenomenon and all equipment must be protected.

Corrosion can:
- Cause shut-downs.
- Increase maintenance costs.
- Reduce equipment service life.
- Generate risks.

Factors accelerating corrosion are:
- Ambient humidity.
- Dirt.
- Temperature, rain and wind.

To protect your crusher from rust corrosion during seasonal shutdown, or for foreign shipment or for outdoor storage (winter or summer), the following protective measures are recommended:

1. At least once each month while the crusher is in storage or during the seasonal shutdown the crusher should be operated for approximately 5 minutes to make sure the bearings remain properly greased. If the crusher is in storage and cannot be operated, the crusher pulley must be rotated 3 or 4 times by hand to make sure the bearings are properly greased. Add grease to the bearing at this time, if necessary.

The above procedure is necessary as moisture condensation will cause corrosion where the bearing rollers contact the inner and outer rings. This corrosion will destroy the highly finished surfaces of the rollers and rings at this point.

When the crusher is started and operating under load, bearings not properly cared for will soon become rough, causing premature bearing failure.

2. The crusher hydraulic mechanism used for opening the upper rear frame is to be filled with a lubricating oil which has a rust-preventive blend designed for the protection of internal parts of enclosed assemblies such as engines, compressors, pumps, gear sets and hydraulic assemblies.

Five U.S. gallons is sufficient to coat a crusher. The viscosity of the oil should be 150 to 300 SSU at 100°F.

Fill the hydraulic pump with rust preventive oil. Make sure the oil is compatible with neoprene, polyester, bronze, nickel, chrome, seal and iron.

The hydraulic system must be operated to assure that the pump and hydraulic cylinders have been thoroughly coated with the rust preventive.

After the hydraulic assembly has been completely filled with the special rust preventive oil drain system before placing it in storage. The remaining film is all that is required for adequate rust protection.

In most applications, the residual rust-preventive film left by these products need not be flushed away or otherwise removed when the crusher is put into normal service.

---

**DANGER**

Do not use this oil to operate the crusher, it is designed only for rust prevention.

If the above recommendations are followed, a crusher stored outdoors should have 6 to 12 months of rust protection.
Section 4

OPERATION

4.1 - Rotation direction and speed ........................................ 4-1
4.2 - Safety device for frame opening ....................................... 4-1
4.3 - Crusher adjustment ...................................................... 4-1
  4.3.1 - Adjusting the 1st breaker plate ................................. 4-2
  4.3.2 - Adjusting the 2nd breaker plate ............................... 4-3
4.4 - Running in .................................................................. 4-7
4.5 - Unjamming ................................................................... 4-8
4.6 - Before starting .............................................................. 4-8
4.7 - Starting the crusher ....................................................... 4-9
4.8 - Operation ................................................................. 4-9
  4.8.1 - Feed ................................................................... 4-9
  4.8.2 - Settings ................................................................. 4-10
  4.8.3 - Inspection ............................................................... 4-10
  4.8.4 - Reduction of dust emission ........................................ 4-10
4.9 - Shut down ................................................................. 4-11
4.1 Rotation direction and speed
The crusher motor must rotate in the direction shown in Figure 4-1.

![Figure 4-1 Motor rotation direction](image)

A correct rotation speed will give an efficient crushing. Keep running with the speed determined for crusher installation and in case of speed change please consult Metso minerals technical department. Never exceed the maximum rotation speed, indicated on Table 2-1.

4.2 Safety device for frame opening

**ATTENTION**

Before starting the Crusher, check that the safety system is fitted and operating; see paragraph 3.5 “Safety device for frame opening (raise systems to be executed by the installer)” for installation and operation.

Protect sensor and electrical cable from accidental stone falls when the crusher is operating.

4.3 Crusher adjustment
The space between the breaker plates and the hammers only permits carburized products to exit from the crusher. Materials with higher dimension remain in the crushing cavity until the correct size is obtained and then they are discharged. The crushing cavity is limited by two adjustable breaker plates which control crushed product size.

The closer the breaker plates to the hammers, the smaller the product size.

The further the breaker plates from the hammers, the higher the output of the crusher - and the bigger the product size.

The setting is the distance between the top of the hammer and the breaker plate when the hammer is facing the last liner. The measurement of the setting is obtained through the side access doors with the frame closed.
DANGER

Check that the crushe rotor has fully stopped before adjusting the setting or before opening the inspection doors and measuring the setting.

Always lockout controls of the power supply to the crushe rotor before entering the crushing cavity or checking settings, supply operators with personal padlocks and one key. Be absolutely certain that the electric motor or engine cannot be started under any circumstances.

4.3.1 Adjusting the 1st breaker plate

1. Unscrew the protection tube on the two breaker plate setting rod.
2. Remove the lock plate.
3. Rotate the setting nut to move the breaker plate, the rods and the spring washers to obtain the required setting. Screw the nut to increase the setting, unscrew the nut to reduce the setting.
4. If there are two breaker plate rods (NP 1520 SR), position the setting nuts to ensure that the breaker plate bears on both setting rods simultaneously.
5. Fit again the locking plate and the protection tubes.

Figure 4-2 1st breaker plate setting assembly

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Setting nut</td>
</tr>
<tr>
<td>2</td>
<td>Locking plate</td>
</tr>
<tr>
<td>3</td>
<td>Frame</td>
</tr>
<tr>
<td>4</td>
<td>Setting rod</td>
</tr>
<tr>
<td>5</td>
<td>Protection tube</td>
</tr>
<tr>
<td>6</td>
<td>Grease nipple</td>
</tr>
<tr>
<td>7</td>
<td>Spring washers</td>
</tr>
</tbody>
</table>

4-2 NP SERIES IMPACT CRUSHERS
4.3.2 Adjusting the 2nd breaker plate

1. Remove the lock yoke from the setting nut.

2. Adjust the nuts to obtain the setting required. Setting is achieved without acting on the return springs.
   Screw the nut to increase the setting, unscrew the nut to reduce the setting.
   IF THERE ARE TWO BREAKER PLATE RODS (NP 1520 SR), POSITION THE SETTING NUTS TO ENSURE THAT THE BREAKER PLATE BEARS ON BOTH SETTING RODS SIMULTANEOUSLY.

3. Refit the setting nut lock yoke.
Figure 4-3 2nd breaker plate setting assembly for NF1520, 1315, 1213, 1110 and 1007

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Setting rod</td>
<td>5</td>
<td>Return spring</td>
</tr>
<tr>
<td>2</td>
<td>Frame</td>
<td>6</td>
<td>Grease nipple</td>
</tr>
<tr>
<td>3</td>
<td>Setting nut</td>
<td>7</td>
<td>Locking fork</td>
</tr>
<tr>
<td>4</td>
<td>Return spring beam</td>
<td>8</td>
<td>See Table 4-1</td>
</tr>
</tbody>
</table>
Figure 4-4 2nd breaker plate setting assembly for NP2023, 1620, 1415, 1313 and 1210

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Locking fork</td>
</tr>
<tr>
<td>2</td>
<td>Grease nipple</td>
</tr>
<tr>
<td>3</td>
<td>Return spring</td>
</tr>
<tr>
<td>4</td>
<td>Return spring beam</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Setting nut</td>
</tr>
<tr>
<td>6</td>
<td>Frame</td>
</tr>
<tr>
<td>7</td>
<td>Setting rod</td>
</tr>
<tr>
<td>8</td>
<td>See Table 4-1</td>
</tr>
</tbody>
</table>
The length of the return springs must be as shown in Table 4-1.

<table>
<thead>
<tr>
<th>NP1007</th>
<th>NP1110</th>
<th>NP1210</th>
<th>NP1213</th>
<th>NP1313</th>
<th>NP1315</th>
<th>NP1415</th>
<th>NP1520</th>
<th>NP1620</th>
<th>NP2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return spring length</td>
<td>340 mm</td>
<td>340 mm</td>
<td>420 mm</td>
<td>430 mm</td>
<td>510 mm</td>
<td>420 mm</td>
<td>510 mm</td>
<td>510 mm</td>
<td>440 mm</td>
</tr>
<tr>
<td>13.4 in.</td>
<td>13.4 in.</td>
<td>16.5 in.</td>
<td>16.5 in.</td>
<td>20 in.</td>
<td>16.5 in.</td>
<td>20 in.</td>
<td>17.3 in.</td>
<td>20 in.</td>
<td>17.3 in.</td>
</tr>
</tbody>
</table>

Table 4-1 Return spring length

During operation, a small movement of approximately 1 to 2 mm (0.04 to 0.1 in.) of the return spring beam is acceptable. Excessively frequent or large movements are generated by a setting too tight or an output too high; this kind of movement means the crusher is working over the limits for the considered application. Nevertheless, return springs can be compressed by an additional 40 mm (1.6 in.).

The minimum operation setting depends on the size, the nature of the feed material, and the capacity through the machine. Table 4-2 indicates minimum second breaker plate settings for each size of machine. The minimum setting is related to the application and should be defined on site. This value is always obtained before excessive movement of the second breaker plate return springs beam occurs.

<table>
<thead>
<tr>
<th>Minimum</th>
<th>NP1907</th>
<th>NP1110</th>
<th>NP1210</th>
<th>NP1213</th>
<th>NP1313</th>
<th>NP1315</th>
<th>NP1415</th>
<th>NP1520</th>
<th>NP1620</th>
<th>NP2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary application</td>
<td>40 mm</td>
<td>40 mm</td>
<td>50 mm</td>
<td>50 mm</td>
<td>60 mm</td>
<td>50 mm</td>
<td>50 mm</td>
<td>60 mm</td>
<td>60 mm</td>
<td>60 mm</td>
</tr>
<tr>
<td>1.5 in.</td>
<td>1.5 in.</td>
<td>2 in.</td>
<td>2 in.</td>
<td>2.5 in.</td>
<td>2 in.</td>
<td>2.5 in.</td>
<td>2 in.</td>
<td>2.5 in.</td>
<td>2 in.</td>
<td>2.5 in.</td>
</tr>
<tr>
<td>Secondary application</td>
<td>25 mm</td>
<td>25 mm</td>
<td>30 mm</td>
<td>30 mm</td>
<td>30 mm</td>
<td>30 mm</td>
<td>30 mm</td>
<td>30 mm</td>
<td>30 mm</td>
<td>30 mm</td>
</tr>
<tr>
<td>1 in.</td>
<td>1 in.</td>
<td>1.2 in.</td>
<td>1.2 in.</td>
<td>1.2 in.</td>
<td>1.2 in.</td>
<td>1.2 in.</td>
<td>1.2 in.</td>
<td>1.2 in.</td>
<td>1.2 in.</td>
<td>1.2 in.</td>
</tr>
</tbody>
</table>

Table 4-2 Indicative minimum second breaker plate setting

Adjustment of the second breaker plate defines the size of the product discharged from the crushe: Knowing the setting of the second breaker plate S2 and the largest dimension D of the feed block, the setting for the first breaker plate S1 can be calculated using the following formula:

\[ S1 = \frac{(D+S2) 	imes 4}{20} \text{ mm (1 in.)} \]

Another formula giving similar results can be applied:

\[ S1 = \sqrt{D \times S2 / 0.75} \]

When commissioning the crusher, check that all components operate correctly and add approximately 20 mm (0.75 in.) to the settings determined for the application. Make the definitive adjustment one hour later.

4-6 NP SERIES IMPACT CRUSHERS
Example 1: primary application
- Feed: 60/600 mm (2.5/25 in.)
- Product size required after crushing: 0/60 mm (0/2.5 in.)
- 2nd breaker plate setting: 60 mm (2.5 in.)
- 2nd breaker plate setting for the first hour of operation: 80 mm (3.25 in.)
- 1st breaker plate setting: 600 * 60 / 0.75 = 220 mm (25 * 2.5 / 0.75 = 8.75 in.)
- 1st breaker plate setting for the first hour of operation: 240 mm (9.25 in.)

Example 2: secondary application
- Feed: 30/200 mm (1.25/8 in.)
- Product size required after crushing: 0/20 mm (0/0.75 in.) in closed circuit
- Minimum indicative setting for the 2nd breaker plate: 30 mm (1.25 in.)* (see table 4-2)
- 2nd breaker plate setting for the first hour of operation: 50 mm (2 in.)
- 1st breaker plate setting: (200+30) / 4 + 20 = 80 mm ((8+1.25) / 4 + 0.75 = 3 in.)
- 1st breaker plate setting for the first hour of operation: 100 mm (3.75 in.)

For crushers equipped with hydraulic assistance, see section 10 "Optional equipments".

4.4 Running in
Although the crusher was tested run at the factory, it is advisable after initial start-up or starting after installation of new bearings, to permit the crusher to run without a load or at reduced load for several hours. This will permit a general running-in of the crusher and an assurance that all parts are functioning properly. For crusher adjustment during the first working hours, see paragraph 4.3 "Crusher adjustment".

Before starting a new crusher, pump 60 to 90 g (two or three ounces) of fresh grease into each bearing.

Then let the machine idle for 30 to 60 minutes, adding grease at 10 minute intervals, until signs of grease appear at the bearing grease seals. It is also advisable to check the bearing temperature more closely during this time. The crusher should be given special attention during its first two weeks of operation. Before the crusher is started each day during this period, check all bolts for tightness. Give special attention to the hammer wedge locking device bolts, liner bolts, bearing housing bolts and the cap screws on the pulley locking ring.
4.5 Unjamming
The return spring system is designed to protect the machine from overloads and uncrushable parts. The breaker plates open and return to their initial work position automatically.

DANGER
If the crusher stops under load, never attempt to restart it before emptying the crushing cavity completely. Any attempt to restart the crusher with the cavity full could cause serious damage.

The main reasons for a crusher to stop under load are:
- the crusher motor or engine has stopped because of a power cut or a lack of fuel.
- the feed capacity to the crusher is too high.
- drive belts are slipping.
- the extraction conveyor has stopped and product is building up under the crusher and blocking the rotor.

4.6 Before starting

DANGER
Start the crusher only when all safety and protection systems are fitted and in operation.

Before starting the crusher:
- The frame opening safety device must be fitted and in operation. See paragraph 3.5 "Safety device for frame opening (slave systems to be executed by the installer)".
- The drive guard and the shaft guard must be fitted.
- Inspect the crusher to check that the crushing cavity is empty, that no tools or mechanical obstructions remain on the crusher, that all fixtions are fully tightened, that there are no visible leaks from the hydraulic circuits and that there are no other reasons why the crusher should not be started.
- Check that the rotor locking pin has been removed.
- If it is the first start-up or the first start-up after major reconditioning, follow the instructions in the paragraph 4.4 "Running on" above.
- Check that the crusher has been fully lubricated; refer to section 5 "Lubrication".
- Check that the breaker plates have been set to obtain the product size required. Refer to the paragraph 4.3 "Crusher adjustment".
- Turn the rotor by hand to check that it rotates freely and that it is not touching the breaker plate liners.
- Check that with the frame open, the inspection and access doors are closed and locked or bolted.
4.7 Starting the crusher

For the crusher station, the following start up sequence must be respected: start the product discharge conveyor, start the crusher and, once at nominal speed, start the feed system.

The start-up of the crusher corresponds to the start-up of the electric motor or the engine done according to the manufacturer instructions. To start the crusher, proceed as follows:

1. Confirm that all the checks and inspections detailed in chapter 4.6 "Before starting" have been made and that any necessary corrective action has been taken.
2. Start the electric motor or diesel engine.
3. Check the rotor rotation direction.
4. Check the crusher rotor speed. The nominal speed must be within the range indicated in Table 2-1.
5. After start-up, listen to the crusher to make sure that there are no abnormal noises. The crusher must operate smoothly with very few vibrations. When all components are operating correctly, feed a small quantity of material into the crusher and gradually increase the feeding rate until the crusher is operating at full load.
6. Check bearing shaft temperature frequently and grease immediately if any unusual temperature rise is observed. During operation, bearings will feel warm to the touch but it should always be possible to support this heat for a few seconds. The normal operating temperature of the bearings is 60° - 65°C (140° - 149°F).
7. If the operating temperature reaches 75° - 85°C (170° - 185°F), it is essential to determine the reason why the bearing is over-heating. Make sure that the bearing is lubricated as specified in section 5 "Lubrication".
8. During operation, continue to listen for unusual noises and check for signs of trouble. Keep accurate operating and maintenance records. Record any unusual operating conditions and all maintenance performed. Make sure that the next operator is aware of any abnormal operating conditions.
9. Stop the crusher anytime operating conditions are dangerous to personnel or damage to the crusher is possible.

ATTENTION

Prevent metal uncrushable parts and explosive material from entering the crushing cavity. Make sure that the feed conveyor to the crusher has a metal detector and it is working properly.

4.8 Operation

4.8.1 Feed

Provide to the crusher a feed as regular as possible with no blocks larger than the crusher opening and a capacity corresponding to the rated power of the motor or engine. Feeding larger blocks than the crusher opening can lead to jams at the crusher opening or in the crusher cavity; crushing station efficiency will be then reduced due to production stoppages.

REFERENCE

It is also important to set the feed system so that the feed produces into the crushing cavity little by little. This ensures that products are better fragmented and increases crusher capacity. It too much material is fed into the crushing cavity, blocks tend to be scraped and not hummed; this type of operation increases wear on the hammers and reduces output.

As far as possible, feed material should be dry and free of clay or earth. To prevent breaker plate clogging, alternate the feed of clean materials with materials containing earth or clay.
REFERENCE

Distribute the feed across the whole width of the crusher. This will improve crushing and distribute wear on hammers and liners evenly across the whole width of the crushing cavity.

When crushing demolition materials, concrete or asphalt it is essential to prepare them correctly before feeding them into the crusher.

ATTENTION

- Sort to remove rubble and uncrushable parts.
- Use a hydraulic hammer or hydraulic shears to break up big blocks.
- Cut return to limit length to 1 metre. Too long returns can wind around the rotor and cause serious damage.

Never stand in front of the crusher feed opening when it is operating. Even though the feed chute is equipped with chain and rubber curtains, large blocks entering the feed box push the curtains to the side and occasionally small flying rock can be thrown out of the crushing cavity at high speed.

DANGER

The speed of materials occasionally ejected from the crushing cavity is high enough to seriously injure anyone located in the immediate vicinity of the feed opening.

4.8.2 Settings

Settings may have to be changed to match the material processed on site. During operation, a small movement of approximately 1 to 2 mm (0.04 to 0.1 in.) of the return spring beam is acceptable. Excessively frequent or large movements are generated by a setting too tight or an output too high; this kind of movement means the crusher is working over the limits for the considered application. Refer to paragraph 4.3 "Crusher adjustment".

4.8.3 Inspection

Inspect the crushing cavity regularly. The more abrasive the material, the more frequent inspection must be. In the case of non-abrasive material, one inspection per week is a minimum.

Cover the following points:

ATTENTION

- Check the wear on the hammers, breaker plate and frame liners and change them if necessary; see section 6 "Replacing wear parts".
- Check the condition of the rotor, particularly, the rotor protection build-up zones in front of the hammers and the condition of the setting rods behind the breaker plates. See section 8 "Servicing".

These inspections are done when the frame is open. For details about opening the frame and the use of the hydraulic pump, refer to section 6 "Replacing wear parts".

Once terminated, check the settings again with the frame closed via the lateral access doors; see paragraph 4.3 "Crusher adjustment".

For maintenance intervals, refer to section 7 "Scheduled maintenance".

4.8.4 Reduction of dust emission

Some crushing applications cause sometimes high dust emission. Spraying water onto the feed or into the crushing cavity can significantly reduce dust. Dust from product can be reduced by placing a 5 metre (200 in.) long housing over the exit conveyor.

The crusher front frame beam is fitted with a hole open on the crusher cavity and a connector for a water hose located on the side of the frame. Use 5 to 10 litres (1.3 to 2.6 US gal) of water per minute depending on the size of the crusher, application conditions and material characteristics.
4.9 Shut down

Shut the crusher down in the reverse order to the sequence used at start up. This means: shut down the feed system, shut down the crusher and finally, shut down the product discharge conveyor.

Before shutting down the crusher, wait until all materials inside the crushing cavity have been discharged.

---

**DANGER**

⚠️ Because of the inertia of the rotor assembly, the rotor continues to turn after the crusher motor has been switched off.
Section 5

LUBRICATION

5.1 - Rotor assembly bearings
5.1.1 - Greasing
5.1.2 - Grease specifications
5.1.3 - Bearing temperature

5.2 - Hydraulic circuits
5.2.1 - Description
5.2.2 - Oil specifications

5.3 - Other lubrication points
LUBRICANTS MEETING THE SPECIFICATIONS OF THIS SECTION ARE ESSENTIAL FOR THE PROTECTION AND CORRECT OPERATION OF CRUSHER COMPONENTS. THEY ARE AVAILABLE FROM ALL MAJOR OIL COMPANIES. UNSUITABLE LUBRICANTS CAN DAMAGE CRUSHER COMPONENTS AND THEIR USE WILL VOID CRUSHER WARRANTY.

5.1 Rotor assembly bearings

5.1.1 Greasing

Lubrication of spherical roller bearings is accomplished by a manual type grease gun through the grease nipples. A nipple is fitted on each bearing. See Figure 5-1.

![Figure 5-1-bearing lubrication](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grease nipple</td>
</tr>
<tr>
<td>2</td>
<td>Bearing</td>
</tr>
</tbody>
</table>

Add grease immediately after the crusher has been shut down and when the bearings are still warm.

Before greasing the bearings, thoroughly clean around each nipple before removing the nipple cap.

IN NORMAL OPERATING CONDITIONS, GREASE BEARINGS EVERY 100 HOURS OR EVERY TWO WEEKS OF OPERATION. PUMP INTO THE BEARING THE QUANTITY OF GREASE SHOWN IN Table 5-1.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>NP1007</th>
<th>NP1118</th>
<th>NP1210</th>
<th>NP1213</th>
<th>NP1313</th>
<th>NP1315</th>
<th>NP1415</th>
<th>NP1520</th>
<th>NP1620</th>
<th>NP2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 g</td>
<td>2.5 oz</td>
<td>2.5 oz</td>
<td>3.5 oz</td>
<td>4 oz</td>
<td>3 oz</td>
<td>3 oz</td>
<td>4 oz</td>
<td>5 oz</td>
<td>9 oz</td>
<td>14 oz</td>
</tr>
<tr>
<td>70 g</td>
<td>2.5 oz</td>
<td>3.5 oz</td>
<td>3 oz</td>
<td>3 oz</td>
<td>4 oz</td>
<td>3 oz</td>
<td>4 oz</td>
<td>5 oz</td>
<td>9 oz</td>
<td>14 oz</td>
</tr>
<tr>
<td>100 g</td>
<td>3.5 oz</td>
<td>3 oz</td>
<td>3 oz</td>
<td>4 oz</td>
<td>3 oz</td>
<td>4 oz</td>
<td>5 oz</td>
<td>9 oz</td>
<td>14 oz</td>
<td></td>
</tr>
<tr>
<td>90 g</td>
<td>3 oz</td>
<td>3 oz</td>
<td>4 oz</td>
<td>3 oz</td>
<td>4 oz</td>
<td>5 oz</td>
<td>9 oz</td>
<td>14 oz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120 g</td>
<td>4 oz</td>
<td>3 oz</td>
<td>4 oz</td>
<td>3 oz</td>
<td>4 oz</td>
<td>5 oz</td>
<td>9 oz</td>
<td>14 oz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 g</td>
<td>3 oz</td>
<td>4 oz</td>
<td>5 oz</td>
<td>9 oz</td>
<td>14 oz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>150 g</td>
<td>5 oz</td>
<td>9 oz</td>
<td>14 oz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>150 g</td>
<td>5 oz</td>
<td>9 oz</td>
<td>14 oz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>260 g</td>
<td>9 oz</td>
<td>14 oz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>410 g</td>
<td>14 oz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5-1 Grease quantity per bearing

NP SERIES IMPACT CRUSHERS 5-1
During operation, there is always a very slight working of the grease out through the bearings and the grease seals. Movement of grease out of the bearing and the adhering of grease outside the seal protect the bearing and seal from foreign particles.

DO NOT REMOVE THIS GREASE FROM THE SEALS AS IT HELPS TO PROTECT THE BEARINGS FROM FOREIGN BODIES PARTICLES.

5.1.2 Grease specifications

Use a class 2 NGLI multi-purpose lithium base grease having extreme pressure (E.P.) characteristics with oxidation, rust and corrosion inhibitors.

ALL GREASES EQUIVALENT TO A TYPE XM2 GREASE (ISO STANDARD 3498) ARE SUITABLE.

Never use a molybdenum base grease.

5.1.3 Bearing temperature

Check bearing shaft temperature frequently and grease immediately if any unusual temperature rise is observed. During operation, bearings will feel warm to the touch but it should always be possible to suppon the heat for a few seconds. The normal operating temperature of the bearings is 60°-65°C (140°-149°F). If the operating temperature reaches 75°-85°C (167°-185°F), it is essential to determine the reason why the bearing is overheating. Make sure that the bearing is lubricated as specified in the «Lubrication» section.

5.2 Hydraulic circuits

5.2.1 Description

The hydraulic assembly comprises a hydraulic power unit, two single-acting cylinders fitted on the crusker frame and hoses with push-pull connections.

The hydraulic assembly is used to open the frame and then to replace wear parts.

Fill the tank of the power unit with hydraulic oil as specified below.

5.2.2 Oil specifications

Use a paraffin base industrial oil of a viscosity as defined below. It must have a high film strength with high adhesiveness to metal surfaces and stable physical and chemical properties. Moreover, the oil used must have a high viscosity index, good water separation resist foaming, provide high protection from corrosion, resist oxidation and contain anti-wear additives.

THE LUBRICANT MUST HAVE A VISCOSITY OF:

- 20 TO 46 CST AT 40°C (104°F)
- 6 CST OR HIGHER AT 100°C (212°F)

THE OIL MUST HAVE A VISCOSITY INDEX OF 140 OR HIGHER.

ALL OILS EQUIVALENT TO A TYPE HM2 (ISO STANDARD 3498) ARE SUITABLE.

Approximately 40 litres (10.6 US gal.) are required to fill the power unit tank, the cylinders and the hoses.
5.3 Other lubrication points

To ease breaker plate adjustments grease the setting rods periodically, for example when greasing the bearings. See Figure 5-2.

Figure 5-2 Setting rods lubrication

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grease nipple</td>
</tr>
</tbody>
</table>
Section 6

REPLACING WEAR PARTS

6.1 - Hydraulic frame opening assembly .............................................. 6-1
  6.1.1 - Hydraulic power unit .................................................. 6-2
  6.1.2 - Hydraulic power unit (NP2023) ........................................ 6-4
  6.1.3 - Frame opening cylinders .............................................. 6-5
  6.1.4 - Hydraulic assistance jacks .......................................... 6-6

6.2 - Opening and closing the frame ............................................. 6-6
  6.2.1 - Closing the frame ...................................................... 6-6

6.3 - Hammer changes ............................................................ 6-6
  6.3.1 - Replacing hammers ..................................................... 6-8
  6.3.2 - Vertical dismantling or fitting of the hammers ................... 6-8
  6.3.3 - Lateral dismantling or fitting of the hammers ............... 6-10
  6.3.4 - Reversing hammers .................................................... 6-10

6.4 - Changing breaker plate liners ........................................... 6-10

6.5 - Changing frame liners ..................................................... 6-11
Open the frame to replace wear parts.

6.1 Hydraulic frame opening assembly

The hydraulic assembly for frame opening is supplied with the crusher. It comprises a hydraulic power unit, hoses with push-pull and two cylinders fitted with safety valves mounted on the crusher frame. See Figure 6-1.

![Figure 6-1: Crusher with hydraulic assembly](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>locking fork</td>
</tr>
<tr>
<td>2</td>
<td>pivoting bulk for frame locking</td>
</tr>
<tr>
<td>3</td>
<td>safety arm stop</td>
</tr>
<tr>
<td>4</td>
<td>frame opening cylinder</td>
</tr>
<tr>
<td>5</td>
<td>hydraulic power unit</td>
</tr>
<tr>
<td>6</td>
<td>Hose</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Safety valve(s)</td>
</tr>
<tr>
<td>8</td>
<td>Cylinder rot spindle</td>
</tr>
<tr>
<td>9</td>
<td>Safety arm</td>
</tr>
<tr>
<td>10</td>
<td>Incle for safety con</td>
</tr>
<tr>
<td>11</td>
<td>Maintenance hoist boom</td>
</tr>
<tr>
<td>12</td>
<td>Electric hoist</td>
</tr>
</tbody>
</table>

NP SERIES IMPACT CRUSHERS 6-1
6.1.1 Hydraulic power unit

See Figure 6-2.

Figure 6-2 Hydraulic power unit

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Off button</td>
</tr>
<tr>
<td>2</td>
<td>Oil level</td>
</tr>
<tr>
<td>3</td>
<td>Drain plug</td>
</tr>
<tr>
<td>4</td>
<td>Relief valve adjustment</td>
</tr>
<tr>
<td>5</td>
<td>3 Phases 1.5 kW (2HP) multi-voltage motor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Output connection</td>
</tr>
<tr>
<td>7</td>
<td>Control panel</td>
</tr>
<tr>
<td>8</td>
<td>Oil return knob</td>
</tr>
<tr>
<td>9</td>
<td>Filler cap</td>
</tr>
</tbody>
</table>
1. The tank must be filled with oil complying with the specifications given in the section 5 "Lubrication". Tank capacity is 20 litres (5.3 US gal.).

2. The multi-voltage electric motor has a rated power of 1.5 kW (2 HP). Connect the motor to the 3-phase electric supply. Check the service plate attached to the motor.

3. The thermal cut-out and electric devices must be supplied and installed by the customer and comply with current local and national standards.

4. Check that the motor rotates in the correct direction.

5. After connecting the hydraulic hoses to the pump and the cylinders, extend and retract the cylinders several times. When the cylinders have been retracted and are still, check the oil level in the tank.

6. Fill up with oil if necessary.

7. WHEN MAKING HOSE CONNECTIONS IT IS IMPORTANT TO PREVENT FOREIGN PARTICLES FROM ENTERING THE HYDRAULIC CIRCUIT. CLEAN THE PUSH-PULL CONNECTIONS BEFORE CONNECTING HOSES.
6.1.2 Hydraulic power unit (NP2023)

See Figure 6-3.

Figure 6-3 Hydraulic power unit (NP2022)

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Oil button</td>
</tr>
<tr>
<td>2</td>
<td>Oil level</td>
</tr>
<tr>
<td>3</td>
<td>Drain plug</td>
</tr>
<tr>
<td>4</td>
<td>Relief valve adjustment</td>
</tr>
<tr>
<td>5</td>
<td>3 Phases 4 KW (5.5 HP) multi-voltage motor</td>
</tr>
<tr>
<td>6</td>
<td>Output connection</td>
</tr>
<tr>
<td>7</td>
<td>Control panel</td>
</tr>
<tr>
<td>8</td>
<td>Oil return orifice</td>
</tr>
<tr>
<td>9</td>
<td>Filter cap</td>
</tr>
</tbody>
</table>

6-4 NP SERIES IMPACT CRUSHERS
1. The tank must be filled with oil complying with the specifications given in the section 5 "Lubrication". Tank capacity is 40 litres (10.6 US gal.).
2. The multi-voltage electric motor has a rated power of 4 kW (5.3 HP). Connect the motor to the 3-phase electric supply. Check the service plate attached to the motor.
3. The thermal cut-out and electric devices must be supplied and installed by the customer and comply with current local and national standards.
4. Check that the motor rotates in the correct direction.
5. After connecting the hydraulic hoses to the pump and the cylinders, extend and retract the cylinders several times. When the cylinders have been retracted and are still, check the oil level in the tank.
6. Fill up with oil if necessary.
7. WHEN MAKING HOSE CONNECTIONS IT IS IMPORTANT TO PREVENT FOREIGN PARTICLES FROM ENTERING THE HYDRAULIC CIRCUIT. CLEAN THE PUSH-PULL CONNECTIONS BEFORE CONNECTING HOSES.
6.1.3 Frame opening cylinders
The single-acting cylinders are fitted with safety valves to prevent the frame from closing rapidly in case of hose or connection rupture.

ATTENTION
Safety valves are safety devices to protect operators, take care never to damage them and ensure that they are serviceable at any time.

6.1.4 Hydraulic assistance jacks
On option, the first and second breaker plates can be fitted with hydraulic jacks to assist when adjusting; see the section 10 "Optional equipment".

6.2 Opening and closing the frame

DANGER
Make sure that the crushe rotor has stopped completely before opening the frame.

1. Raise the locking fork of the pivoting frame locking bolts.
   Unscrew the pivoting bolts and swing them to the open position.
2. Connect the hydraulic hoses and close the pump oil return knob to send oil to the cylinders.
3. Run the pump by pressing the ON button on the control panel until the cylinders are fully extended.
4. Check that the safety arms are correctly positioned on the cylinder rod spindles. Slowly open the oil return knob to enable the frame to bear on the safety arms.

OPEN THE OIL RETURN KNOB GRADUALLY OR THE SAFETY VALVES WILL PREVENT THE FRAME FROM CLOSING.

TO RELEASE THE SAFETY VALVE:
- CLOSE THE OIL RETURN KNOB.
- SWITCH THE PUMP ON A WHILE.
- THEN OPEN THE OIL RETURN KNOB TO CLOSE THE FRAME.

DANGER
Once the frame opened, check that the safety arms are correctly engaged on the cylinder rod spindle.

5.2.1 Closing the frame
1. Thoroughly clean the contact surfaces on both sections of the frame.
2. Close the oil return knob.
3. Run the pump using the slot of the safety arm is released from the cylinder rod spindle.
4. Raise the safety arms by pivoting them around their upper axis until they are in contact with the stop.
5. Gradually open the oil return knob to close the frame. Re-position the safety arms.
6. Correctly screw in the pivoting bolts and swing down the bolt head locking forks.

6.3 Hammer changes
Hammers are reversible. When one face is used, the hammer can be turned round to use the other face.
The wear limit is shown in Figure 6-4 and in Table 6-1.
### Figure 6-4 Hammer wear limit

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Safety pin hole</td>
</tr>
<tr>
<td>2</td>
<td>Welding protections</td>
</tr>
<tr>
<td>3</td>
<td>Worn out section</td>
</tr>
<tr>
<td>4</td>
<td>Hammer</td>
</tr>
<tr>
<td>5</td>
<td>Rotor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimension D in figure 6-3</th>
<th>NP1007</th>
<th>NP1110</th>
<th>NP1212</th>
<th>NP1213</th>
<th>NP1313</th>
<th>NP1315</th>
<th>NP1415</th>
<th>NP1520</th>
<th>NP1620</th>
<th>NP2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 mm 2 in.</td>
<td>55 mm 2.2 in.</td>
<td>55 mm 2.2 in.</td>
<td>60 mm 2.4 in.</td>
<td>60 mm 2.4 in.</td>
<td>70 mm 2.8 in.</td>
<td>70 mm 2.8 in.</td>
<td>70 mm 2.8 in.</td>
<td>80 mm 3.2 in.</td>
<td>50 mm 2 in.</td>
<td></td>
</tr>
</tbody>
</table>

Table 6-1 Height limit for changing hammers

**REFERENCE**

To protect the rotor from wear, do not exceed the maximum wear dimension shown for hammers in Table 6-1.
6.3.1 Replacing hammers

1. Open the frame and check that the safety arms are correctly locked.

**DANGER**
Always look out controls of the power supply to the crusher motor before entering the crushing cavity or checking settings, supply operators with personal padlocks and one key. Be absolutely certain that the electric motor or engine cannot be started under any circumstances.

2. Install the safety pin supplied with the tooling through the holes of the frame and the rotor rib see Figure 6-1 and Figure 6-5. This safety pin immobilises the rotor with a hammer in top position.

**DANGER**
Never work on the rotor without locking it with the safety pin. Rotor rotation might cause injury to the operator.

3. Use the lifting tool.
A beam and an electric hoist are supplied as an option on the machine. If you do not have this equipment, use a hoist of the right capacity for lifting the load (i.e., the weight of the hammer plus the lifting tool).

4. Clean under hammers and wedges if necessary.

5. Lower the lifting tool into position over the hammer and screw the four bolts of the lifting tool.

6.3.2 Vertical dismantling or fitting of the hammers

6. Put pins through the upper wedges to hold them in top position. Clean the threads on the lower wedge clamping bolts. Unscrew the bolts and remove the lower wedges by hammering them if necessary.

7. TO AVOID ANY SUDDEN MOVEMENT OF THE HAMMER, MAKE SURE THAT THE LIFTING CABLE IS KEPT TIGHT.
Remove the wedge pins and lower the upper wedges down to their housing.

8. Move the hammer out of its rotor groove and lift it.

9. Clean thoroughly bearing surfaces or the rotor, the hammer and the wedges.

**ATTENTION**
If the wedge locking nuts are not locked any more because of nylon ring damage, replace the locking nuts imperatively.

10. WHEN HAMMERS ARE REPLACED, IT IS IMPORTANT THAT BALANCE IS KEPT. FIT IN OPPOSITION AT 180 DEGREES THE HAMMERS WHICH WEIGHTS ARE CLOSEST. THE WEIGHT IS NORMALLY INDICATED ON THE HAMMERS. IN CASE OF DOUBT ON WEIGHTS OF THE TWO OPPOSITE HAMMERS, WEIGHT THEM TO ENSURE THEY HAVE APPROXIMATELY THE SAME WEIGHT.

Position the upper wedges in their housing. Put the new hammer in its groove. Put pins through the upper wedges to hold them in top position. Fit lower wedges and the locking bolts.
11. Screw the locking bolts of the end wedge device; the hammer must be locked on the backing beam of the rotor.

For the NP 1097, 1110 and 1210 lock the wedge bolts at a torque of 20 daNm (145 Lbs/ft).

For the NP 1213, 1315 and 1415 lock the wedge bolts at a torque of 50 daNm (220 Lbs/ft).

For the NP 1520 and 1620 lock the wedge bolts at a torque of 45 daNm (330 Lbs/ft).
12. Proceed the same way for the three other hammers beginning by the one on the opposite side; the new hammer being heavier, it will take the bottom position after the rotation of the rotor.

13. Remove rotor safety locking pin, turn by hand the rotor and make sure the hammers are correctly fitted in their housing.

14. Close the frame and adjust the breaker plate settings (i.e. distance between hammer and breaker plate liner checked through lateral viewing doors).

15. Run the crusher under-load for at least one hour in order the parts settle down.

**ATTENTION**

Tighten again the wedge locking bolts as per torque given here above.

Check every 50 working hours the locking of the wedge bolts.

6.3.3 Lateral dismantling or fitting of the hammers

This operation requires on the opposite side of the drive a clearance at least equal to the length of the hammer. Such operation can not be done on crushers equipped with two pulleys.

Proceed the same way as for hammer vertical dismantling or fitting except for following operations:

6. Remove the lateral stop on the opposite side of the drive.
7. Unscrew the wedge bolts.
8. Hammer the lower wedges to get the upper wedge down.
9. Create a clearance of about 3 mm (1/8") between the hammer and the upper wedge.
10. Slide the hammer out of its housing.
11. Slide in the new hammer and fix again the lateral stop.

6.3.4 Reversing hammers

1. **ONCE THE HAMMER IS LIFTED OUT OF ITS HOUSING, PUT IT ON THE ROTOR OR ON THE GROUND TO PREVENT ANY ACCIDENTAL SWINGOVER DURING OPERATION.**
2. Unscrew the 2 upper bolts from the lifting tool; the hammer is still in liaison with the lifting tool by the 2 lower bolts.
3. Lift the hammer slowly, It will pivot around the lower bolts and the worn face of the hammer will swing to the bottom position.
4. Turn the lifting tool and the hammer using the rotating shackle on the lifting tool to present the correct bearing face to be applied on the rotor backing beam.

6.4 Changing breaker plate liners

1. Open the frame and check that the safety arms are locked.

**DANGER**

Always lockout controls of the power supply to the crusher motor before entering the crushing cavity or checking settings. Supply operators with personal padlocks and one key, i.e., absolutely certain that the motor, motor or engine cannot be started under any circumstances.

2. Put the rotor safety pin.

**DANGER**

Never work on the rotor without locking it with the safety pin. Rotor rotation might cause injury to the operator.

3. Open the access doors.

Release the lock nuts of the liners to be changed.

If breaker plates are fitted with manganese liners, a steel plate provided with a hole can be welded to the liner in order to be used as a lifting point.
If breaker plates are equipped with chrome iron liners, replace one bolt by a longer one or by a threaded rod, then do the same operation for the other bolt. 

A will enable to get clearance seen the breaker plate and the liner and then to use a sling or rope to lift it. Reverse the procedure to fit a liner. 

Tighten the locking nuts until the spring washers are fully flattened.

Tighten periodically if necessary.

6.5 Changing frame liners

DANGER

Adopt some safety precautions as when changing breaker plate liners, paragraph 6.4 "Changing breaker plate liners".

Linens are easy to change as they are tapped and fitted to the frame by spring washers and locking bolts. Tighten the locking bolt until the spring washers are fully flattened.
Figure 6-6 Changing frame liners

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bolt</td>
</tr>
<tr>
<td>2</td>
<td>Spring washer</td>
</tr>
<tr>
<td>3</td>
<td>Frame liners</td>
</tr>
<tr>
<td>4</td>
<td>Spring washers</td>
</tr>
<tr>
<td>5</td>
<td>Locking nut</td>
</tr>
<tr>
<td>6</td>
<td>Bimetal plate liner</td>
</tr>
<tr>
<td>7</td>
<td>Bolt</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Screen liner (cast iron)</td>
</tr>
<tr>
<td>9</td>
<td>Shim</td>
</tr>
<tr>
<td>10</td>
<td>Washers</td>
</tr>
<tr>
<td>11</td>
<td>Hexagonal bolt</td>
</tr>
<tr>
<td>12</td>
<td>Elastic washer</td>
</tr>
</tbody>
</table>

6-12 NP SERIES IMPACT CRUSHERS
Section 7

SCHEDULED MAINTENANCE
Table 7-1 indicates the main maintenance operations and the recommended servicing frequency. The maintenance frequency depends essentially on crushing application conditions and on abrasivity of processed material. Maintenance will be scheduled according to application needs observed during first running months.

<table>
<thead>
<tr>
<th>Maintenance operation</th>
<th>Every day</th>
<th>Every 40 to 50 H</th>
<th>Every 80 to 100 H</th>
<th>Every 160 to 200 H</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Check locking of frame and access doors</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Remove accumulations of material from the frame</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Check belts tension</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Check condition of adjustment systems</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Check that frame opening sensor works correctly</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Lubricate the bearings</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Check condition of feed box curtains and dust protection (option)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Lubricate the settings</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Check eventual bearing noise</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Check condition of hydraulic power unit</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Check condition of frame opening cylinders and setting adjustment hydraulic assistance jacks (option)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wear parts</th>
<th>Every day</th>
<th>Every 40 to 50 H</th>
<th>Every 80 to 100 H</th>
<th>Every 160 to 200 H</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Check tightness of breaker plate liners</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Check tightness of frame liners</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Check locking of hammers</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Tighten hammer locking wedges</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Check condition of wear parts for abrasive materials and recycling applications</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Check condition of wear parts for average abrasive materials</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Check condition of wear parts for non-abrasive materials</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7-1 Periodical maintenance

NP SERIES IMPACT CRUSHERS 7-1
Section 6
SERVICING

8.1 - Bearing replacement ........................................ 8-1
8.2 - Breaker plate replacement ................................. 8-4
8.3 - Build-up on the rotor ...................................... 8-4
8.1 Bearing replacement

This operation, when needed, requires to be done in a work shop or in other clean and dust-free location.

Dismantling:

- Dismantle the locking ring of the drive pulley. The locking ring will normally loose itself by unscrewing the opposite bolts. Proceed as follows:
  
a. Progressively unscrew the opposite bolts.
  
b. Hit slightly on the bolt heads for loosening the rear conical ring of the locking ring.
  
c. If the front conical ring is locked, screw bolts in the holes and pull on their; heads for loosening the locking ring.
  
- Remove the pulley.
  
- On the other side, remove the shaft guard.
  
- Unscrew the fixation bolts of the bearing housing on the frame.
  
- Put shims under the shaft.
  
- Remove the two screws of the labyrinth seal nut.
  
- Remove the locking nut, the labyrinth seal nut and the bearing housing cover.
  
- Remove the bearing adapter sleeve (by means of a standard or hydraulic nut).
  
- Remove the bearing housing assembly.
  
- Slide out the bearing, replace it.
Assembling:
- Fit bearing housing, adapter sleeve, bearing housing cover, labyrinth seal nut, and locking nut.

Distribute play equally between the bearing and dust guards on the mobile bearing blocks.
SECTION 8 - SERVICING

Table 8-1 Bearing clearance

<table>
<thead>
<tr>
<th>Bearing clearances</th>
<th>NP1007</th>
<th>NP1110</th>
<th>NP1210</th>
<th>NP1213</th>
<th>NP1313</th>
<th>NP1315</th>
<th>NP1415</th>
<th>NP1520</th>
<th>NP1620</th>
<th>NP2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radial clearance</td>
<td>0.16 to 0.19 mm</td>
<td>0.14 to 0.16 mm</td>
<td>0.18 to 0.20 mm</td>
<td>0.18 to 0.20 mm</td>
<td>0.18 to 0.20 mm</td>
<td>0.18 to 0.20 mm</td>
<td>0.22 to 0.24 mm</td>
<td>0.22 to 0.24 mm</td>
<td>0.30 to 0.34 mm</td>
<td>0.40 to 0.52 mm</td>
</tr>
<tr>
<td>before assembly</td>
<td>0.0003 to 0.0007 in</td>
<td>0.0003 to 0.0007 in</td>
<td>0.0007 to 0.001 mm</td>
<td>0.0007 to 0.001 mm</td>
<td>0.0007 to 0.001 mm</td>
<td>0.0007 to 0.001 mm</td>
<td>0.0006 to 0.001 mm</td>
<td>0.0006 to 0.001 mm</td>
<td>0.00114 to 0.0014 in</td>
<td>0.00114 to 0.0014 in</td>
</tr>
<tr>
<td>Radial clearance</td>
<td>0.085 to 0.09 mm</td>
<td>0.065 to 0.08 mm</td>
<td>0.075 to 0.085 mm</td>
<td>0.075 to 0.085 mm</td>
<td>0.075 to 0.09 mm</td>
<td>0.075 to 0.09 mm</td>
<td>0.09 to 0.10 mm</td>
<td>0.09 to 0.10 mm</td>
<td>0.12 to 0.13 mm</td>
<td>0.17 to 0.23 mm</td>
</tr>
<tr>
<td>reduction</td>
<td>0.0025 to 0.0035 in</td>
<td>0.0025 to 0.0035 in</td>
<td>0.0025 to 0.0035 in</td>
<td>0.0029 to 0.0039 in</td>
<td>0.0032 to 0.0043 in</td>
<td>0.0032 to 0.0043 in</td>
<td>0.0035 to 0.0045 in</td>
<td>0.0035 to 0.0045 in</td>
<td>0.0047 to 0.0067 in</td>
<td>0.0067 to 0.0081 in</td>
</tr>
<tr>
<td>Resulting</td>
<td>0.08 mm to 0.09 mm</td>
<td>0.08 mm to 0.09 mm</td>
<td>0.09 mm to 0.09 mm</td>
<td>0.09 mm to 0.10 mm</td>
<td>0.1 mm to 0.11 mm</td>
<td>0.1 mm to 0.11 mm</td>
<td>0.1 mm to 0.11 mm</td>
<td>0.1 mm to 0.11 mm</td>
<td>0.1 mm to 0.11 mm</td>
<td>0.1 mm to 0.11 mm</td>
</tr>
<tr>
<td>clearance after</td>
<td>0.0032 in to 0.0035 in</td>
<td>0.0032 in to 0.0035 in</td>
<td>0.0035 in to 0.0035 in</td>
<td>0.0035 in to 0.0035 in</td>
<td>0.0035 in to 0.0035 in</td>
<td>0.0039 in to 0.0039 in</td>
<td>0.0035 in to 0.0035 in</td>
<td>0.0035 in to 0.0035 in</td>
<td>0.0035 in to 0.0035 in</td>
<td>0.0035 in to 0.0035 in</td>
</tr>
<tr>
<td>assembly</td>
<td>94</td>
<td>94</td>
<td>94</td>
<td>100</td>
<td>912</td>
<td>134</td>
<td>182</td>
<td>182</td>
<td>230</td>
<td>570</td>
</tr>
</tbody>
</table>

Bearing block
tightening torque
(in daN)

- Fit the locking ring of the pulley:
  - Apply a light coating of oil on the internal parts of the locking ring.
  - Do not use oil with molybdenum disulfide additive or extreme pressure oil or grease.
  - Do not put oil on the external surface which will be into contact with the pulley.
  - Lightly tighten the bolts. Position the pulley hub.
  - Progressively tighten the bolts by means of a torque wrench.

Check all bolts are tightened at the right torque. Tightening operation is accomplished when the correct torque is reached for all bolts.

Grease the bearings see section 5 "Lubrication".

Table 8-1 Bearing clearance

<table>
<thead>
<tr>
<th>Tightening torque must be as follows:</th>
<th>&quot;TAS&quot; type</th>
<th>Other type</th>
</tr>
</thead>
<tbody>
<tr>
<td>NP1007</td>
<td>Key</td>
<td></td>
</tr>
<tr>
<td>NP1110</td>
<td>Key</td>
<td></td>
</tr>
<tr>
<td>NP1210</td>
<td>Key</td>
<td></td>
</tr>
<tr>
<td>NP1213</td>
<td>145 Nm (107.5 Lb-ft)</td>
<td>110 Nm (81.5 Lb-ft)</td>
</tr>
<tr>
<td>NP1313</td>
<td>145 Nm</td>
<td>110 Nm (81.5 Lb-ft)</td>
</tr>
<tr>
<td>NP1315</td>
<td>145 Nm (107.5 Lb-ft)</td>
<td>110 Nm (81.5 Lb-ft)</td>
</tr>
<tr>
<td>NP1415</td>
<td>145 Nm (107.5 Lb-ft)</td>
<td>110 Nm (81.5 Lb-ft)</td>
</tr>
<tr>
<td>NP1520</td>
<td>190 Nm (141 Lb-ft)</td>
<td>190 Nm (141 Lb-ft)</td>
</tr>
<tr>
<td>NP1620</td>
<td>355 Nm (263 Lb-ft)</td>
<td>266 Nm (197 Lb-ft)</td>
</tr>
<tr>
<td>NP2023</td>
<td>690 Nm (511 Lb-ft)</td>
<td>499 Nm (369 Lb-ft)</td>
</tr>
</tbody>
</table>

NP SERIES IMPACT CRUSHERS B-3
8.2 Breaker plate replacement

If a breaker plate is damaged by excessive wear (i.e. liners changed too late) or deformed by uncrushable parts, it may be necessary to replace it.

The easiest way is to disconnect the cylinders by removing the cylinder rod spindle pins on the rear frame, to remove the shaft connecting the 2 frames and then to remove the rear frame.

The operation is simplified by turning the rear frame round after having removed the setting screws through the access doors.

8.3 Build-up on the rotor

In front of the hammers, rotor ribs are protected by hard surface weldings.

If necessary use a weld rod that will deposit a hardness layer of 550 to 650 BRINELL (TYPE SAFER R600 or equivalent).
Section 9

TROUBLE SHOOTING
<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame does not open.</td>
<td>Check opening bolts are opened. Check hydraulic connections, pump and pressure sensor working condition.</td>
<td>Open the locking bolts. Repair or change faulty parts.</td>
</tr>
<tr>
<td>Frame does not close down.</td>
<td>Safety valves on frame cylinders stopped the oil flow.</td>
<td>Use the pump to pump pressure in the cylinders, then open very slowly the oil return adjustment knob.</td>
</tr>
<tr>
<td>Crusher does not start, jammed rotor.</td>
<td>Breakers plates are touching the rotor. Rocks are jamming the rotor. Electrical connections.</td>
<td>Adjust and check breaker plates setting. Clean up the chamber to run the rotor freely. Check electrical cabling and interlocking. Check V-belt condition and drive.</td>
</tr>
<tr>
<td>Unusual vibrations.</td>
<td>Failing motor.</td>
<td>Motor to be controlled.</td>
</tr>
<tr>
<td></td>
<td>V-belt drive.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wrong rotation speed. Too much weight difference on hammers.</td>
<td>Check the speed. Place hammers having similar weight into opposite housing.</td>
</tr>
<tr>
<td></td>
<td>Hammer wrongly positioned in the hocking.</td>
<td>Check and rectify if necessary.</td>
</tr>
<tr>
<td>Noisy bearing.</td>
<td>Lack of grease.</td>
<td>Lubricate according to instruction manual recommendations.</td>
</tr>
<tr>
<td>Rotor does not rotate by hand.</td>
<td>Bearing seized up.</td>
<td>Check bearing condition.</td>
</tr>
<tr>
<td>Stalled motor, crusher under load.</td>
<td>Power consumption too high. Products get out of the feed chute.</td>
<td>Decrease feed capacity or open crusher setting. Check and reverse rotation direction. Repair the curtains.</td>
</tr>
<tr>
<td>Dust emission.</td>
<td>Wrong rotation direction of the rotor. Faulty chain and rubber curtains. Very dry products. Bad dust encapsulation at the discharge opening.</td>
<td>Place water spray at the feed and at the discharge openings. Repair or improve it.</td>
</tr>
<tr>
<td>Problem</td>
<td>Cause</td>
<td>Remedy</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Improper movement of the breaker plates.</td>
<td>Springs compression is not correct.</td>
<td>Check; see section 4 &quot;Operation&quot;.</td>
</tr>
<tr>
<td></td>
<td>Too high capacity.</td>
<td>Reduce feed capacity.</td>
</tr>
<tr>
<td></td>
<td>Too tight setting regarding feed size.</td>
<td>Increase machine settings; see section 4 &quot;Operation&quot; for setting calculation.</td>
</tr>
<tr>
<td>Difficult breaker plate adjustment.</td>
<td>Threaded rod and protection tubes are dirty. Products frame parted between breaker plate and frame side linias.</td>
<td>Clean thoroughly rod and tubes, then put grease. Clean up the packed products, then adjust the breaker plate.</td>
</tr>
<tr>
<td>Uneven wear of hammers.</td>
<td>Feed segregation.</td>
<td>Check feed flow and spread it evenly on the width of feed opening.</td>
</tr>
<tr>
<td>Wear of rotor.</td>
<td>Hammers changed too late.</td>
<td>Hammers must be changed before their wear limit; see section &quot;replacing wear parts&quot;</td>
</tr>
<tr>
<td>Bolts of hammer lateral stops are loosening.</td>
<td>Bolts are not locked.</td>
<td>Use screwlock adhesive. Fit disc washers and tighten the bolts; check them periodically.</td>
</tr>
<tr>
<td>Damaging of hammer back ing beam surface.</td>
<td>Entrance between hammer and housing hammers bear not on the backing beam.</td>
<td>Lock the wedges bolts.</td>
</tr>
<tr>
<td>Hammer breakage when using chrome iron hammers.</td>
<td>Too violent shocks for chrome iron. Metallic parts passing through the machine. Feed size too large.</td>
<td>Check metal detector. Feeds machine with appropriate feed size.</td>
</tr>
<tr>
<td>Breaker plate wear.</td>
<td>The liners are too much worn.</td>
<td>Replace liners and bolts in time.</td>
</tr>
<tr>
<td>Loose breaker plate / frame lines.</td>
<td>Locking bolts are not properly tightened.</td>
<td>Clean thoroughly bearing surfaces of liners and breaker plate / frame, then tighten up the bolts.</td>
</tr>
<tr>
<td>Frame wear.</td>
<td>Excessive liner wear.</td>
<td>Check regularly the inside of the machine and replace liners in time.</td>
</tr>
</tbody>
</table>
Section 10

OPTIONAL EQUIPEMENTS

10.1 - Hydraulic assistance for first breaker plate clearing or adjusting of both breaker plates .................................................. 10-1
10.2 - Hydraulic adjustment system (Not for NP2023, 1620, 1415, 1313 and 1210) ................................................................. 10-2
10.3 - Third breaker plate (Not for NP1007, 1110, 1210 and 1313) ........... 10-3
10.4 - Electric hoist ............................................................... 10-4
10.1 Hydraulic assistance for first breaker plate clearing or adjusting of both breaker plates

![Diagram of hydraulic assistance](image)

Figure 10-1 Hydraulic assistance

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Setting rods beam</td>
</tr>
<tr>
<td>2</td>
<td>Hydraulic jack</td>
</tr>
<tr>
<td>3</td>
<td>Hydraulic jack</td>
</tr>
<tr>
<td>4</td>
<td>Safety shim</td>
</tr>
</tbody>
</table>
The breaker plate can be lifted temporarily with two jacks to increase the passage volume or assist with manual adjustment. The hydraulic jack rod must not bear on the frame after the operation.

First breaker plate clearing:
- Connect hydraulic pump
- Lift up the setting rods beam thanks to the hydraulic jack.
- Open the return oil knob on the pump to empty the single acting jack and to get the rod into the setting rod beam and the breaker plate will get in their initial position.

Adjustment of the 1st and 2nd breaker plates:
- Connect hydraulic pump.
- Unscrew the locking nuts of the setting rods beam to about 50 mm (1.97 in) to free the setting nuts or more if the breaker plate needs a large adjustment.
- Raise the setting rods beam using the jack.
- Insert safety wedges between the frame and the beam.
- Adjust the setting by acting on the setting nuts.
- Check the required setting by the inspection door.
- After having done the adjustment, take away the safety shim and release jack oil pressure to get the initial position of the setting rods beam.

10.2 Hydraulic adjustment system
(Not for NP2023, 1620, 1415, 1313 and 1210)

![Diagram](image)

Figure 10-2 Hydraulic adjustment system

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Air bleed</td>
</tr>
<tr>
<td>2</td>
<td>Index lock screw</td>
</tr>
<tr>
<td>3</td>
<td>Index</td>
</tr>
</tbody>
</table>

10-2 NP SERIES IMPACT CRUSHERS
Operating principal:
- A double-acting jack fitted with non-return valves shifts the breaker plate directly.
- Jacks are powered by an hydraulic powerpack fitted with manual controls.
- Jacks are fitted with an index which displays and marks their position to enable checks that they have not lost pressure during use.
- A screw locks the index in position for use in difficult cases or when adjustments are rare.
- Jacks are fitted with 2 bleeds (4 per chamber) to eliminate air from the circuit. Air could cause the piston to vibrate in the cylinder which would reduce the service life of internal seals.
- When operating, jacks must behave like rigid components. The complete support beam and jack assembly can be pulled back in the event of an overload or grizzlies.

Settings

**WARNING:** Always check that the crusher is OFF before making settings.

- The hydraulic powerpack must be slaved to the crusher motor and it must be impossible to start the powerpack within 12 minutes of crusher motor shut down to ensure that the rotor is longer rotating.
- Open an access trap to inspect and measure settings R and r.
- Start the hydraulic powerpack.
- If necessary, loosen the index lock bolt.
- Slowly manipulate the lever in the appropriate breaker plate compartment until the required setting is attained.
- Turn the powerpack off.

**PRECAUTIONS:**
- If necessary, retighten the index screw.
- Mark the index points to enable rapid checks that jacks have not lost their settings.

10.3 Third breaker plate (Not for NP1007, 1110, 1210 and 1313)

Refer to Figure 10-3.

The 3rd breaker plate is fitted in the front frame.

It helps to better control the top of the graduation curve and to get a finer product.

The third breaker plate is composed by: an articulated frame item 1, with a setting device item 2, spring, two replaceable support plates item 4 fitted with liners item 5.

In case of crushing overload, springs allow the setting rod beam.

For safety reasons, the rear access to the crusher must be locked when operating.
**Third breaker settings:**
The breaker plates is adjusted when rotor is stopped; operation and setting are controlled through lateral access door on lower frame.

Take out the locking fork item 8 and adjust the setting tube of breaker plate rod; untighten to reduce clearance between hammer and breaker plate liner, tighten to increase the setting.

---

**ATTENTION**
Setting of second breaker plate must be less than clearance at the top of the third breaker plate, actually about half the clearance; if this is not applied, the top of the support plates might be worn out quickly despite hard welding deposit.

---

**ATTENTION**
Turn the rotor by hand to check setting for each hammer. Recommended minimum setting is 40mm (1.5 in.).

**REFERENCE**
Note: a tight setting increases power absorption and wear of liners and hammers as well.
Breaker plate liners replacement:

- Use the lifting tool item 9 supplied with the 3rd breaker plate.
- Remove fixation bolts item 10 which can also be used to lock the lifting tool on the liners backing plate item 4.
- Lift and take out of the breaker plate item 1 the two assemblies backing plate equipped with the liners.
- Replace the liners on the backing plate and the fixations with new bolts item 11 and spring washers item 12.
- Put back on the breaker plate the liner assembly. Lock the fixation bolts item 10.
- Adjust the setting of the 3rd breaker plate. Turn the rotor by hand to check the setting for each hammer.
- It is recommended to have two other backing plate pre-equipped with liners for getting quick liners replacement.

Withdrawal from rotor action (NP1520, 1315 and 1415):

To stop crushing on the third breaker plate, the complete assembly can be withdrawn from rotor action as follows:

- Open the breaker plate at the maximum.
- Dismantle lateral stop liners item 7.
- Pull back the breaker plate using a hoist.
- Fit lateral stop liners specially designed to keep the breaker plate withdrawn.

Withdrawal from rotor action (NP1620 and 1415):

To stop crushing on the third breaker plate, the complete assembly can be withdrawn from rotor action as follows:

⚠️ DANGER

Wedge the breaker plate against the rear of the lower frame to prevent it to go backwards suddenly.

- Unscrew the two articulation bolts item 6.
- Take out the wedging; the breaker plate rotates on its top articulations and pushes back the setting rod.
- Dismantle lateral stop liners item 7.
- Pull back the breaker plate using a hoist.
- Fit lateral stop liners specially designed to keep the breaker plate withdrawn.

Putting back to working position:

When positioning the breaker plate into working position, proceed in opposite order of withdrawal operation.

⚠️ DANGER

Before dismantling lateral stop liners, secure the breaker plate to prevent any movement of the assembly toward the rotor.

NP SERIES IMPACT CRUSHERS 105
10.4 Electric hoist

The electric hoist is used mainly when lifting the hammers.

The lifting boom is slid in the tube mounted on the side of the frame. It can pivot freely.

The hoist trolley is fitted on the lifting boom. Then the stops of the trolley must be fixed on the boom.

The electric motor of the hoist must be connected to the electrical supply by an electrician and taking care of the motor tension.

<table>
<thead>
<tr>
<th>NP10007</th>
<th>NP1110</th>
<th>NP1210</th>
<th>NP1313</th>
<th>NP1314</th>
<th>NP1415</th>
<th>NP1520</th>
<th>NP1620</th>
<th>NP2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Force daN</td>
<td>250</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>1250</td>
</tr>
</tbody>
</table>

Table 10-1 Electric hoist

**CAUTION**

The customer must perform the commissioning of the lifting machinery in accordance with the legislation of the country involved.

10-6 NP SERIES IMPACT CRUSHERS
11.1 - Hydraulic circuit .................................................. 11-1
11.2 - Commissioning .................................................... 11-1
11.3 - Maintenance ....................................................... 11-3
11.1 Hydraulic circuit

Refer to Figure 11-1 and Figure 11-2 to identify the components of the hydraulic power unit.

11.2 Commissionning

Filling the tank:
ALL OILS EQUIVALENT TO A TYPE HM 32 (ISO STANDARD 3498) ARE SUITABLE.
Before opening the drum, clean thoroughly the taps and check the oil is not mixed with water which must be filtered.
A funnel equipped with a filter must be used to fill the tank. Do not use wool rag for cleaning operations.

Starting:
The following operations must be done during the starting phase:
- Visual checking of the device, the connections and the corresponding lockings.
- Electrical connections checking.
- Minimal pressure adjustment of all pressure relief valves.
- Checking of rotation direction of the pump motor (direction indicated by the arrow) by a short action on the start button.
- Pump motor start-up.
- Purging the air out of the hoses and cylinders in making the components working twice or three times.
- The following indicates there is no more air in the circuit:
  * No foam in the tank.
  * No abnormal noise in the circuit.
  * Smooth movement of the cylinder rods.
- Oil level checking and if necessary refilling.
- Visual control to find any possible leak and locking of the connections.

Relief valve adjustment:
The pressure relief valve have to be setting to the pressure of 210 bar (3045 PSI).
### Figure 11-2 Hydraulic circuit

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Drain cap</td>
</tr>
<tr>
<td>2</td>
<td>Oil level with thermometer</td>
</tr>
<tr>
<td>3</td>
<td>3-Phase 1.5 KW multi-voltage motor</td>
</tr>
<tr>
<td>9</td>
<td>Rack sliver valve</td>
</tr>
<tr>
<td>12</td>
<td>Oil return adjustment knob</td>
</tr>
<tr>
<td>13</td>
<td>Pressure relief valve</td>
</tr>
<tr>
<td>14</td>
<td>Pump</td>
</tr>
<tr>
<td>15</td>
<td>Filling and breaker tap</td>
</tr>
<tr>
<td>16</td>
<td>Tank</td>
</tr>
<tr>
<td>17</td>
<td>Filter</td>
</tr>
<tr>
<td>18</td>
<td>Hose connection outlet</td>
</tr>
</tbody>
</table>

11-2 NP SERIES IMPACT CRUSHERS
Figure 11-3 Hydraulic power unit for NP2023
Figure 11-4 Hydraulic circuit for NP2023

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Squirrel cage motor</td>
</tr>
<tr>
<td>2</td>
<td>Lütern</td>
</tr>
<tr>
<td>3</td>
<td>Pump coupling</td>
</tr>
<tr>
<td>4</td>
<td>Pump</td>
</tr>
<tr>
<td>5</td>
<td>Oil level indicator</td>
</tr>
<tr>
<td>6</td>
<td>Cap</td>
</tr>
<tr>
<td>7</td>
<td>Return filter</td>
</tr>
<tr>
<td>8</td>
<td>Distributor</td>
</tr>
<tr>
<td>9</td>
<td>Coupling element</td>
</tr>
<tr>
<td>10</td>
<td>Pressure gauge</td>
</tr>
</tbody>
</table>
11.3 Maintenance

* After 10 running hours, check:
  - Correct seating of all components.
  - Adjustment of valves.
  - Oil level.

* At least twice a year, a visual checking must be done to the following points:
  - Leaks, breakages, fixations, hoses and connections, corrosion and wear.

* In any case, it is recommended to do the following:
  - Tank and oil:
    - Check weekly oil level and seal of the tank.
    - Check monthly oil temperature and alteration.
    - First oil change after 100 running hours; the other oil changes every 500 hours.
  - Valves:
    - Adjust the valves first time after 100 running hours then yearly.

NOTE: Maintenance frequencies are given as an indication and they depend on working conditions of the circuit.
Section 12

HYDRAULIC POWERPACK FOR HYDRAULIC SETTING OPTION

12.1 - Hydraulic circuit and designations .......................... 12-1
12.2 - Start up ......................................................... 12-2
12.3 - Maintenance .................................................... 12-4
12.1 Hydraulic circuit and designations

Figure 12-1 Hydraulic circuit
### Filling the oil tank:

Before filling the oil tank make sure that the equipment and the tank are absolutely clean. Clean up if necessary. Never use woolen wipers.

**Oil specifications (See 9.5.2 “Hydraulic circuit”):**

- Make sure that the cans used for filling are clean.
- Never remove the metal oil tank cap filter. Fill to maximum level.
- After filling, carefully tighten the filter cap.
- We recommend marking the reference of the oil use on the oil tank.

### Start up:

All Metso minerals equipment is thoroughly factory-tested before delivery to validate engineering design, correct operation of the complete unit and to detect any visible leaks. Upon request, equipment can be supplied ready-adjusted and, if required, with a lead security seal. After reception, customers should carry out the following inspections:

- Visual inspection of the unit to check for compliance, damage during shipment, cleanliness, etc...
- Open all taps and valves on unit suction lines (if any). It is strictly prohibited to touch these taps and valves when the unit is operating as damage would occur to the pump within a few minutes. We recommend removing the control levels to prevent mishandling.
- As a general rule, all Metso minerals pressure devices are adjustable and accessible. All (except the sequence valves) can be re-set.
- Connect up the receivers in compliance with normal practice.
- Connect up all utilities.
- All power-packs must be protected by thermal circuit breakers which we can supply to order (please specify voltage).
- Star-triangle connection for power ratings over 15 CV (15 HP).
- Test that the motor junction box connection.

**Motor junction box connection:**

- 220 V. TRI.
- 380 V. TRI.

- Check the rotation direction of the motor with short ON/OFF tests. The correct rotation direction is shown by an arrow. Invert 2 phases to change direction if the motor does not rotate in the right direction.
- S tart and idle the unit for several minutes.
- Bleed the circuit either through the bleed holes or via the connectors near the receivers.

The circuit has been fully purged when receiver movements become regular with no foam in the tank and no abnormal noises.
- Run a separate test on each receiver if possible without load: several strokes should be made to obtain maximum bleed.
- Set up the unit for normal operating pressure.

- After purging and filling the whole circuit, check the oil level in the tank and top up if necessary.
- If it becomes necessary, re-purge the circuit once the unit has attained its normal operating temperature.
- Check for leaks.
- Before delivery, all units are tested for leaks. However, vibrations during shipment and from the plant may cause leaks in connections after a few hours operation. Re-tighten as necessary.

**Practical tips for installation:**

- Take care to prepare and execute all connections correctly.
- Never use tapered connections in cast iron chambers.
- Only use suitable connectors.
- Make sure that all connections are easily accessible for maintenance.
- During assembly take care not to mechanically stress connections.
- Do not stretch or pinch hose connections (minimum hose curve = 10 x hose diameter).
- Hoses must not rub on any part of the unit during normal movements.
12.3 Maintenance

Scrupulous compliance with maintenance instructions will ensure optimum unit performance.

- Oil temperature must never exceed 60°C (140°F). If overheating occurs, you must find out why. Oil deteriorates twice as quickly in the 60°C to 100°C (140°F to 212°F) range.
- Check hydraulic oil deterioration regularly.

In the maintenance shop it is easy to:

- Take a sample of a few cc of fluid from the tank immediately after shutting down the unit.
- To detect the presence of water, pour oil into a transparent container; after a little while any water will fall to the bottom. Maximum admissible water content: 0.5%.
- To check the amount of carbon in the oil, filter a drop in absorbent paper. If the oil is dirty the centre of the stain will be black.
- For high capacity units run laboratory tests.
- Our after-sales service will be happy to test oil we have supplied.
- During scheduled maintenance, treat drawers removed from the distributors with an anti-oxidant product.
- If serious damage occurs to the unit and a moving part has to be replaced, the circuit must be flushed and rinsed.