



Document No.	NLM-URT-21 /007
Rev. No.	3
Department/Section:	NLM
Title:	USER REQUIREMENT SPECIFICATIONS FOR SLAG-CRUSHER FOR SMELTER PROJECT

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**Revisions**

This document has been revised according to the following schedule:

Revision	Date Approved	Nature of Revision	Prepared by
00	22/11/2021	First Issue	MKM RAMOTLOU
01	01/02/ 2023	The exclusion crusher enclosure/ contamination in URS	MKM RAMOTLOU
02	See title page	Additioan of Distribution list and Authorization. Updating section 2.0 purpose	SR MNGOMA
03	02/04/2025	“Slag-crusher” replaced with “slag-crusher”. Capacity of the crusher chenged from 3-6TPH to 1TPD. Drum lifting equipment belt replaced with a drum lifting device.	SR MNGOMA

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## USER REQUIREMENT SPECIFICATIONS FOR SLAG-CRUSHER FOR SMELTER PROJECT

### 1.0 INTRODUCTION

The slag-crusher is required to reduce waste size of the cooled solid waste slag(s) of the low level nuclear waste, to smaller size particles, and then drum it so that it can comply with the acceptance criteria of the waste storage facility.

The user requirements specification (URS) will form part of the tender bid documents during procurement stage. The crusher is required to have an enclosure, which will keep all the dust and contamination during the crushing process within the enclosure. The dust control extraction system will be venting dust at a maximum velocity of 4 m/s. The crusher enclosure and dust control extraction system does not form part of this URS, however it will have a separate URS.

### 2.0 PURPOSE

The purpose of this user requirement specification is to provide details of the requirements for the design, manufacture and supply of a fully functional Slag-crusher, along with all its accessories (see section 9.0). This equipment is required for crushing radioactive nuclear waste solid slag to 60mm particle size.

### 3.0 SCOPE

The scope of supply is as follows:

- Supply a slag-crusher design and auxiliaries (specified in Section 9),
- Review the slag-crusher design, and auxiliaries.
- Develop a quality control plan for slag-crusher and auxiliaries.
- Procure materials for a slag-crusher and auxiliaries.
- Fabricate, manufacture and assembly the slag-crusher and auxiliaries
- Perform Non-destructive examination on applicable components of the slag-crusher and auxiliaries
- Perform factory acceptance test (FAT) for the slag-crusher and auxiliaries
- Deliver the slag-crusher to the Necsa site
- Install the crusher
- Perform a Site Acceptance Test (SAT) for the slag-crusher and auxiliaries.
- Pre-commission for the slag-crusher and auxiliaries
- Commissioning the slag-crusher and auxiliaries.
- Sign-off all installation and commissioning documents.
- Train the operators on how to operate the Slag-crusher.
- Supply an operating manual for the slag-crusher and auxiliaries.
- Supply a maintenance manual for the slag-crusher and auxiliaries.

Maintenance procedure, commissioning procedure, operating procedure , critical spares list i.e. assembly drawings; electrical drawing; instrumentation drawings; control systems drawings (hard copies) form part of this scope of work for the supply of the slag-crusher, and shall be supplied with the slag-crusher.

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The above mentioned requirements in this document should satisfy and meet all the client's (Necsa) requirements including the slag-crusher ISO quality standard(s).

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### 4.0 STANDARDS

- Slag-crusher shall be built in accordance with the latest ISO 9001 standard.
- Adhere to Occupational Health and Safety Act 85, of 1993
- **BS EN 13383-1: 2013 - Air-cooled blast-furnace slag armour stone.**
- The slag-crusher and related items must be designed to sound engineering and scientific practices and appropriate technical standards to ensure intended function and performance.
- Safety, human factors, maintenance, operating and other interfaces shall be considered while designing the Slag-crusher.

### 5.0 REFERENCES

- EN 932-3, Tests for general properties of aggregates – Part 3: Procedure and terminology for simplified petrographic description
- EN 1097-1:2011, Tests for mechanical and physical properties of aggregates – Part 1: Determination of the resistance to wear (micro-Deval)
- EN 1367-2:2009, Tests for thermal and weathering properties of aggregates – Part 2: Magnesium sulfate test
- EN 1744-1:2009+A1:2012, Tests for chemical properties of aggregates – Part 1: Chemical analysis
- EN 1744-3, Tests for chemical properties of aggregates – Part 3: Preparation of eluates by leaching of aggregates
- EN 1926:2006, Natural stone test methods – Determination of uniaxial compressive strength
- EN 13383-2:2013, Armour stone – Part 2: Test methods EN 16236, Evaluation of conformity of aggregates – Initial Type Testing and Factory Production Control

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### 6.0 GENERAL REQUIREMENTS

#### 6.1 SAFETY PRINCIPLES

##### 6.1.1 Safety hazard pertaining to equipment

All safety symbols shall be posted on the equipment and contained in the manuals. All safety symbols, labels, and instructions must be visible at all times.

- Safety instructions and safety labels attached to the equipment shall be complete and legible.
- Safety instructions and safety labels shall be kept visible.
- Any illegible or missing safety instructions and safety labels shall be replaceable before operating the equipment.

##### 6.1.2 Symbols for prohibited actions

Prohibited actions used on equipment shall be indicated by a red circle with a red diagonal line across the circle. The following action shall be indicated as prohibited on the crusher where applicable.

- No climbing
- No smoking
- Do not touch
- No open flames
- Limited or restricted access
- Do not use hands for testing hydraulic leaks, and.
- All other non-stated but applicable prohibited actions
- All required PPE shall be displayed

##### 6.1.3 Blockage and malfunction

In the event of material blockage, any malfunction or operational difficulty, it should be made possible to stop equipment and lockout immediately (i.e. emergency stop). Rectify problem immediately, and carry on with the crushing activities.

### 7.0 OPERATION OF THE SLAG-CRUSHER

#### 7.1.1 Minimum safety requirements

All required personal protective equipment requirements, instructions and signs shall be posted and be clearly visible on the crusher as follows:

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- Operating the slag-crusher generates dust. Breathing or inhaling silica dust particles will cause death or serious injury.
- .
- All necessary precautions shall be taken to reduce the risk of breathing dust or particles.
- Working on or in close proximity to the crusher whilst it is operational could cause serious injury or death.
- All safety guards shall be installed and in correct working order before operating the crusher. Failure to do so could cause serious injury or death.
- The crusher shall not be started for any operational activity until the operators have read and fully understood the operating manual, including the safety section of the manual.
- This crusher shall be electrically isolated prior to cleaning.

### 7.2 METHODS AND MODES OF OPERATION

- The crusher start-up shall have an automatic mode which should normally be used. The manual crusher start up mode may be used if desired but components of the machine shall be started and stopped in the correct sequence.
- The machine controls shall only allow the correct sequence by highlighting the next step when available.
- The crusher shall comprise of an interlock such that no operator can start it with material while loaded on it.
- All material shall be cleared first before starting the crusher.

### 7.3 REMOVAL OF SAFETY DEVICES , GUARDS, AND DECALS

- Prior to operation, all safety devices, control devices, decals and guards, temporarily removed for set-up, maintenance or repair purposes shall be refitted and checked immediately upon completion of the maintenance or repair work.
- To avoid serious personal injury or death, the crusher shall never be operated without the the equipment safety devices, decal or guards removed or unsecured.

## 8.0 TROUBLE SHOOTING

### 8.1 FAULT CODES

- Fault shall be reported on the display screen, when the system detects a fault.
- Each fault shall be identified by a fault number.
- A fault description shall be shown on the display screen.



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### 9.0 SPECIFICATIONS

#### 9.1 CRUSHER

- The slag-crusher shall be supplied with an inclined drum lifting equipment belt system, a feed chute and other accessories fully mounted on one skid, and supplied as one unit.
- Capacity of the slag-crusher: 1 ton per day (tpd)
- The crusher power to be determine accordance to the slag hardness.
- The crusher motor voltage shall be 3 phase, 380 Volts.
- Compact crusher shall crush slag to 60mm or smaller particle size
- Hardness of the slag is 156.8 Vickers hardness
- The maximum feed size of the crusher shall have a throat opening of 200\*350mm, with ribbed liners.
- The main feed drum lifting equipment shall be fitted with feeding launders
- The slag-crusher shall be fitted with dust control and extraction hood.
- The slag-crusher shall be supplied with a crusher support structure
- The slag-crusher bottom discharge seal (Iris valve) shall seal 160 L and 210 L drum containers to receive the crushed slag. The dimensions for the 160L drum container are 630mm diameter and 630mm height. The dimensions for the 210 L drum are 750 mm diameter and 1100 mm height.
- The slag-crusher shall have a maximum feed size of 150mm\*150mm.
- The clearance between the concrete work and the base plate shall be pressure pack with non-shrink grout.
- The flooring around the slag-crusher shall be checkered plate 6,5mm material thickness, suitable for a safe working area around the crusher, and there will be enough room to create a suitable safe work area for maintenance on the crusher.
- Mentis design hand railing will be secured with bolts around the perimeter of the upper flooring to create a safe working environment.
- Access ladder shall be bolted to the frame work and built to slag-crusher design code.
- The designer shall specify all slag-crusher components including quantity, and materials of construction.

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### 9.2 DRUM LIFTING DEVICE:

- The drum lifting device shall have a lifting frame which will have two 12mm base plate one on each upright, as well as two connector plates, and a structural bracing
- The outer steel work shall be made from a combination of 120x60 and 152x76 taper flange channel, as well as additional flame cut parts.
- The bin holder shall be designed to suit a standard 160L and a 210 L drum, where it will be clamped and held steadily in place.
- The drum lifting device shall be able to lift, tilt and off-load drums with 1650 kg in mass.
- The lifting part of this drum lifter shall be done by two double acting hydraulic cylinders, both driven from a single but efficient power packs.
- The power pack shall be kept outside the slag crusher room of operation for access and for annual service.
- Controls shall be two simple forward and reverse, non-latch switch wire inside a separate electrical control panel to suit the application.
- All Cleaves shafts, pivoting shafts and pinions shall have grease nipples for lubrication purposes.
- The lifting frame shall be anchored to the ground in the same way as the frame work for the slag crusher, to keep correct heights as per the intended design.
- All slides and travels as well as tipping mechanism shall be made specifically to make the tipping process as smooth, and as dust free as possible.

### 9.3 MAIN INLET AND DISCHARGE HOPPER

- Main inlet hopper shall be fabricated in such a way as to minimize dust from the tipping drum, when it is being emptied.
- The inlet hopper shall allow for direct dust extraction at the main inlet hopper.
- The discharge hopper shall be made flexible to allow the inlet for receiving drums.
- A wheeled trolley shall be specifically fabricated and supplied for travel in a straight line, to prevent the trolley from falling over when turning. The trolley's main purposed will be to move material in and out the crusher room.
- The pallet drum trolley (with brakes) shall be designed to handle up to 1650kg in mass.
- The pallet drum trolley shall receive crushed material at a height of 1,5m

## 10.0 CERTIFICATE

- Certificate of conformity shall be supplied by the supplier
- Mechanical completion certificate shall be supplied by the supplier on completion of site installation, electrical connection and crusher energizing, pre-commissioning and commissioning of the crusher.

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### 11.0 PLANT LAYOUT

The crusher shall be installed inside Area 26 building, in the smelter furnaces hall area.

