

# **Operational Manual for RFI Machine**

**Name of Customer :-**

Serial Number:- 1

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## Safety First :



### 1. Burn Hazards

- A. All the safety precautions should be taken before handling the RFI Injection Machine.
- B. Normally Melting shop environment is at high temp because of molten metal and the consequent high temperature of the unit, proper protective clothing must be worn during operation and maintenance of the unit. Such precautionary clothing should prevent or minimize potential burn hazards.

## **2. Electrical safety :**

- A. RFI Machine's electrical specification is 3 phase, 430 V, 50 Hz, total power 8 KW max. The system must always be electrically grounded. Lock the control panel while in operation, this could prevent an electric shock.
- B. Power must be shut off and locked out at the control panel to ensure complete electrical deactivation while servicing the equipment.

## **3. Gas safety :**

Normally Argon and Nitrogen gases are used for purging while Treatment.

These gases are inert, colorless, odorless and tasteless gases.

Be careful, while opening & closing the Gas bottles/ Line pressure.

Also purging at high LPM may cause splashes of liquid metal so purge the carefully.

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## **Section 1 Safety**

### **1.1 Notes**

- 1.1.1 Authorized operator should read and understand all instructions and warnings in this manual prior to operation. Improper operation of this equipment could result into personnel injury, damage to equipment, or both.
  - 1.1.2 This unit is only used for clean the metal and any application not intended for its use will result into personal injury or damage to equipment.
  - 1.1.3 Ensure that this equipment and its piping are dry prior to operation to avoid any accident.
  - 1.1.4 The unauthorized person should not open the control panel or operate the equipment. And the unauthorized person also shouldn't touch the elements inside of control panel to avoid the electric shock.
  - 1.1.5 Always wear the proper protective clothing and equipment when operating this machine.
  - 1.1.6 Never disconnect the safety switch or safety valve. The safety switch is designed to avoid personnel injury or equipment damage.
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- 1.1.7 Inspect the equipment for damage or worn parts prior to operation. Ensure that equipment is at safe condition before operation.
- 1.1.8 The gas supply to meet specification should be connected to the machine prior to operation. And gas should be flow until the Graphite shaft & Rotor is removed out from the metal.
- 1.1.9 After gas supply is connected, a steam of gas would blow out to prevent the metal from entering into Graphite shaft and clogging. Inspect the gas in Manual operation mode when gas supply is connected. If there is no gas coming out, inspect the gas lines and resolve this problem before operation.
- 1.1.10 Make sure that the outlet of Graphite shaft & Rotor is not blocked during operation.

## **1.2 Burn and hazards**

- 1.2.1 Due to high temperature of molten metal and the hot condition when operates this machine, proper protective clothing and equipment must be worn during operation and maintenance to avoid the potential burn hazards.
- 1.2.2 Any operation resulting into the metal splash should be avoided.
- 1.2.3 Any tooling or facility inserted into metal should be preheated to dry prior to use.
- 1.2.4 Some area of the equipment is very hot and don't touch it.
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### **1.3 Gas safety**

Argon and Nitrogen are colorless and odorless. If leakage of them occurs, potential hazardous condition with low oxygen or without oxygen could form in low pit areas.

Any situation with high content of inert gas or with low content oxygen would result into personal injury.

### **1.4 Electric safety**

1.4.1 The machine must be grounded to prevent electric shock or operation error.

1.4.2 It is forbidden to replace the breaker existed in machine with ones of specification.

1.4.3 Lock the control panel while machine is operating to prevent electric shock.

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## **Section 2 Equipment Description**

### **2.1 RFI Machine description**

This machine is of introducing the flux into metal as far below surface as possible to disperse flux throughout the metal.

This Machine consists of Battery operated pallet truck with Trolley, control panel, a flux tank, Up & down Electric cylinder, Main Gas + Flux purging Hosing, Graphite shaft & Rotor etc.

RFI machine is easy to Push / Pull inside the Melt shop from one station to another because of Battery pallet truck.

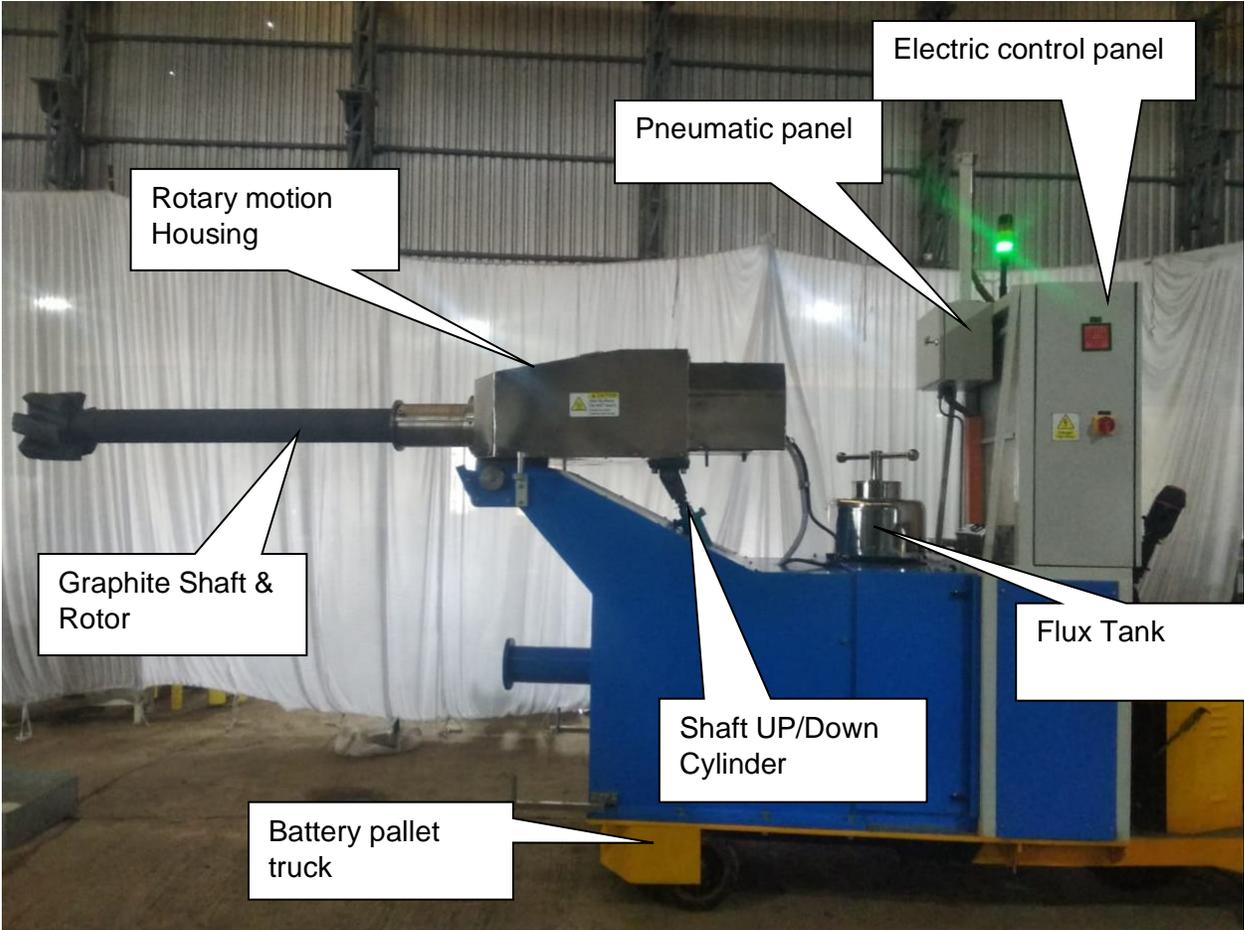
The flux is inject from the flux tank alongwith the carrier gas into the metal through a Graphite shaft & Rotor. And dispersion of the flux is accomplished by Rotor's rotation inside in the melt.

### **2.2 Features**

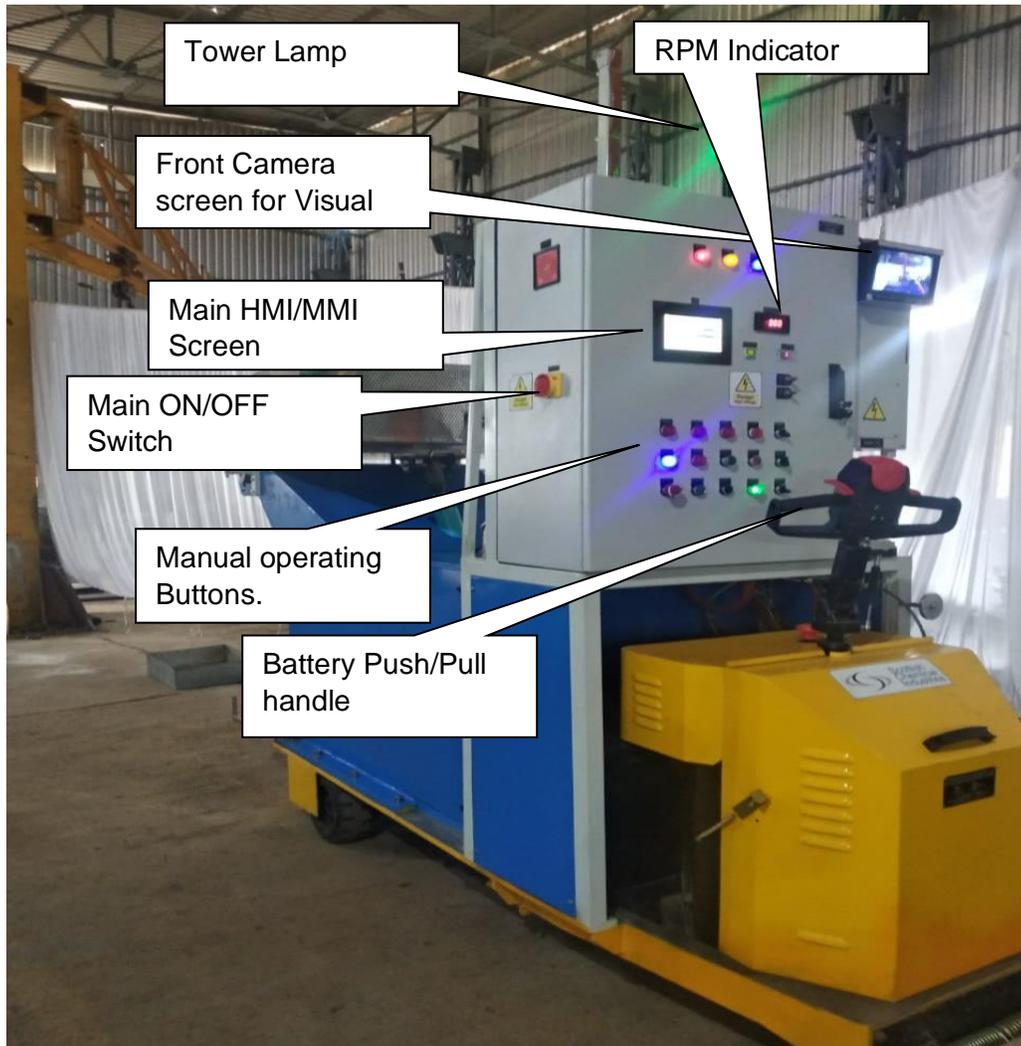
- Fluxing Low gas flow: 70 to 100 & High Gas flow - 150-200L/ min, adjusted manually by Flow control valve.
  - Input Gas supply 4 to 6 bar ( kg/cm<sup>2</sup>)
  - Flux injection speed: 0.5, 1.0, 1.5, 2.0Kg/ min
  - Flux tank capacity : 50 kgs
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**2.3 Equipment components**

**Side View -**



- Rear View -



#### **2.4 RFI Machine Graphite parts dimensions -**

Flux is injected through Graphite Shaft & Rotor.

Well design of these parts drawings can be modified as per the Melting Furnaces dimensions. Graphite Rotor's designed in such a way that Flux can purges at bottom of the melting furnace & properly mixed into the liquid metal.

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## **2.5 Gas supply requirements**

Gas supply: Argon or Nitrogen :

Gas supply flow :  $\geq 220$  L/min;

Gas supply pressure : 4 to 6 Bar.

Purity :  $\geq 99.996\%$ ;

Water content :  $< 3$ ppm(dew point is less than  $-92^{\circ}\text{F}$  or  $-69^{\circ}\text{C}$ );

Oxygen content :  $< 5$ ppm.

## **2.6 Power supply requirements**

Power supply : 3 Phase , 440 V, 50Hz;

Total power : 8KW

It must be grounded for earthing.

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## **Section3 Equipment Installation**

### **3.1 Connecting Graphite shaft & Rotor**

3.1.1 Connect first Graphite Shaft with the help of Overhead Crane / Assembly provided with the machine. Turn the Graphite shaft to tighten into the Machine adaptor. Tight until it stop.

Then take the Rotor & Tight up into the shaft's thread until its get full.



### 3.2 Gas supply connection

3.2.1 Connect N2 / AR2 line pressure gas hose pipe with the help of Quick lock coupling / Open the Gas bottle of N2 / AR2 and adjust pressure of gas supply to 4 to 6 Bar.



### 3.3 Power supply connection

Connect the main supply cable to the Power supply of 3 phase.

Give the earthing connection also.

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## **Section 4 Parameter Setting**

### **4.1 Parameters setting value**

<b>NO</b>	<b>Parameter</b>	<b>Setting</b>	<b>Remarks</b>
<b>1</b>	<b>Input gas supply pressure</b>	<b>4 to 6 Bar</b>	
<b>2</b>	<b>Fluxing gas pressure</b>	<b>4 to 6 Bar</b>	
<b>3</b>	<b>Gas pressure alarm</b>	<b>≤ 3 Bar</b>	<b>Set before delivery</b>
<b>4</b>	<b>Fluxing Low gas flow</b>	<b>70 to 100 L/min</b>	
<b>5</b>	<b>Fluxing High Gas flow</b>	<b>150 to 200 L/min</b>	
<b>6</b>	<b>Fluxing speed</b>	<b>0.5, 1.0, 1.5, 2.0 Kg/min</b>	
<b>7</b>	<b>Pre-purge</b>	<b>20sec</b>	<b>Can be set as per requirement.</b>
<b>8</b>	<b>Purge time</b>	<b>0~ 999sec</b>	<b>Set according requirement</b>
<b>9</b>	<b>Post-purge time</b>	<b>0~ 60sec</b>	<b>Set according requirement</b>

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## 4.2 Parameter setting description

### 4.2.1 Gas pressure adjustment

- The pressure requirement of gas supply for the unit is 4 to 6 Bar.
- Adjust the “pressure regulator” from Line pressure / from cylinder mounted regulator to reading of 4 to 6 Bar. If the injection is not smoothly, you can increase pressure.
- Adjustment of pressure regulator: Adjusting screw head of regulator, rotate it clockwise or counter clockwise till the reading on the pressure indicator meet the use requirement.

### 4.2.2 Gas pressure alarm adjustment

- Its needs to be done for Digital Pressure switch which is at Main Control.

### 4.2.3 Fluxing gas flow adjustment

- The fluxing gas flow can set as per the requirement, as far as the flux should be injected smoothly with the final flow rate adjustment.
- Low and High Gas flow valve mounted on Main control panel.

### 4.2.4 Flux speed adjustment

- Flux speed have 4 levels: 0.5,1.0,1.5,2.0 kg/min
  - Choose the proper feeding rate according to requirement through HMI/ MMI screen.
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#### 4.2.5 Flux time adjustment

- Pre purge time setting 20 to 30 Sec: adjust the time setting as 30 sec in the HMI control. Once setting, it cannot be reset.
  - Flux injection time: adjust the time setting on the HMI panel; adjust the flux injection time according to requirement.
  - Post Purge time setting 30 to 60 sec: adjust at the time setting through HMI/MMI screen.
  - Timer Setting :-
    - 1) Click on the Menu.
    - 2) Go to the setting.
    - 3) It will prompted for Password then Put 12345 as password.
    - 4) Go to Timer setting then choose the timer.
    - 5) Click on the time.
    - 6) Type the Time and press Enter. Again go to the Menu.
  - Cycle over time setting: after the unit cycle is over, alarm appears; after the cycle time is over, the alarm is disappeared.
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## **Section 5 Equipment Operation**

### **5.1 Preparation before operation**

**5.1.1 Preheat Graphite shaft & Rotor** : The Graphite shaft & Rotor inserted into the metal should be kept in dry; otherwise it would result into the accident or personal injury. The Graphite parts should be preheated before inserting into metal.

### **5.1.2 Flux charging :**

Open the Flux tank by rotating the Handle in Anticlockwise direction, take out the cover outside. Feed the required flux. Put the cover on the Flux tank & tight it by rotating in Clockwise direction.

### **5.1.3 Setting of gas supply and gas pipe :**

A sufficient & constant inert gas supply is needed when machine is in operated. The flow of gas supply should not be more than 250L/min and the interruption of gas supply should be avoided during operation. Input pressure of gas supply should be set for 4 to 6 Bar and the Digital Pressure switch regulate it at 4 to 6 Bar. In operation, this pressure would drop a little.

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## **5.2 Operation procedure for Pre melt purging.**

**Move the Battery pallet truck towards the empty Melting furnace to Check the Graphite Shaft & Rotor limits into it before main melt operation.**

**Move down the Graphite shaft & Rotor into the Melting furnace by manually with the help of Cylinder's Rev / Forwd selector switch.**

**Make sure that the Rotor should not touch to the bottom of the melting furnace. It should be above 200 mm from the melting furnace bottom level.**

**Adjust the Battery trolley positions accordingly. Set the stopper to the Melting furnace to avoid any damages. i.e. make the Poka Yoke system for successful operation in the liquid melt before.**

5.2.1 Fit the Line gas pressure hose / Open gas cylinder / Release the pressure from it through Regulator.

5.2.2 Turn on the "power switch". Check that no fault is observed & Machine at Home conditions on HMI screen light.

5.2.3 Choose the flux speed: 0.5,1.0,1.5,2.0 kg/min through HMI / MMI screen.

5.2.4 Feed the flux injection time and post-purge time.

5.2.5 Press Auto start button.

5.2.6 Graphite shaft Rotation start at low RPM & its comes down to 45 degree approx.

Check that the Low LPM gas should be come out from Rotor.

Check the Flow at 70 to 90 LPM.

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5.2.7 Then Rotor speed increase to High RPM & Flux start coming out from the Rotor until the Flux feeding time set into the parameters.

5.2.8 The unit operation procedure: pre purge → Flux injection → Alarm then post purge → cycle over.

5.2.9 Before the post purge time is coming, the “cycle over” light is on. But the Rotor will be into the for shaft hole cleaning purpose. After completing the operation, Graphite shaft & Rotor comes to its Home position & total cycle is over.

5.2.10 If the auto running cycle is not over, press the “Reset” button for 3 to 5 sec, the Shaft turn back the initial status,

**Note: Make sure the flux cannot be stored in the flux tank, otherwise it will be get blockage. The flux must be purge completely after every operation.**

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## **5.2 Operation procedure for Actual melt flux purging.**

**Move the Battery Pallet truck trolley near to the Melting furnace with the help of Camera screen & stop at the Stopper / Poka Yoke system.**

**Preheat the Graphite parts for 30 min before inserted into the liquid metal**

**( It will be for initial / first cycle. After Graphite parts can be preheat below 30 min also but it is always recommended to well preheat them )**

**Make sure that the Graphite parts heated properly. Rotate the Graphite parts manually inside the melting furnace for proper preheating then stop it manually.**

**Open all the Heat insulating covers towards the Melting Furnace to avoid the metal splashes towards the RFI machine.**



a) Fit the Line gas pressure hose / Open gas cylinder / Release the pressure from it through Regulator.

b) Turn on the “power switch”. Check that no fault is observed & Machine at Home conditions on HMI screen light.

c) Choose the flux speed: 0.5,1.0,1.5,2.0 kg/min through HMI / MMI screen.

d) Feed the flux injection time and post-purge time.

e) Press Auto start button.

f) Graphite shaft Rotation start at low RPM & its comes down to 45 degree approx.

Check that the Low LPM gas should be come out from Rotor.

Check the Flow at 70 to 90 LPM.

g) Then Rotor speed increase to High RPM & Flux start coming out from the Rotor until the Flux feeding time set into the parameters.

h) The unit operation procedure: pre purge →Flux injection →Alarm then  
post purge →cycle over.

i) Before the post purge time is coming, the “cycle over” light is on. But the Rotor will be into the for shaft hole cleaning purpose. After completing the operation, Graphite shaft & Rotor comes to its Home position & total cycle is over.

j) After shaft & Rotor come out from the liquid metal, Close all the Heat Insulating covers & take the trolley reverse / away from the Melting Furnace.

Check that the Rotor / Shaft hole is not blocked. Clean it with the help of Steel rod.

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### **5.3 Alarm instruction**

While alarm occurs, the unit cannot be started until troubleshooting was fixed. The unit cannot be maintained with a long time alarm, buzzer and alarm light running for a long time will infect the electric parts working life.

#### **5.3.1 Alarm for gas pressure insufficient**

- The gas pressure connected unit is less than 3 Bar will make the unit alarm.
- Flux injection cannot be started while alarm occurs.
- If alarm occurs after starting flux injection, the buzzer will be loud, and injection will be stop automatically & press the Reset button 3 to 5 sec machine comes to Home position.

#### **5.3.2 Alarm for gas flow insufficient**

- While injecting flux, if gas flow is less than presetting alarm valve, the alarm occurs.
  - The buzzer alarm occurs, injection will stop automatically.
  - & press the Reset button 3 to 5 sec machine comes to Home position.
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### **5.3.3 Alarm for Flux insufficient / Low flux**

- If the Low Flux alarm occurs, check if there sufficient flux inside the Flux Tank.
- Flux sensor should be ON during operation.

### **5.3.4 Alarm for Machine not Home position -**

- Check that the Green light on HMI / MMI screen should be in GREEN & no Fault observed.
  - If the Rotor at down position / Machine is in Manual mode.
  - Put the machine in Auto mode then press Reset button for 3 to 5 sec. Machine will comes to it home position.
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## **Section 6 Troubleshooting and Maintaining**

### **6.1 Troubleshooting**

#### **6.1.1 No power and no screen displaying**

Check whether power switch / Control ON is turned on or not; check whether Emergency stop is pushed in or not. If not, turn it clockwise and pull out; check whether circuit breaker in control panel is open or not. If it is open, close it.

#### **6.1.2 Flux not injecting**

**Examine the following -**

- 1) leaks around the top cover of tank.
  - 2) Pneumatic pipelines/ Back pressure build up in Flux tank on Gauge/ safety valve.
  - 3) check whether the flux hose is folded.
  - 4) Inspect whether flux feeding gear motor is rotated or not. Flux Assembly shaft is Rotate or not during operation.
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### 6.1.3 Alarming for insufficient gas supply pressure

Check whether pressure setting is correct and pressure of gas supply is sufficient or not. If gas supply pressure is sufficient and setting is correct, the alarming setting at pressure switch inside control panel maybe is changed. It is usually set for 3 Bar by manufacturer. Adjust it to 3 Bar through Digital pressure switch.

Check whether flux piping is clogged and hose is folded.

### 6.3 Discharging flux manually

- If RFI is out of service and require discharge flux manually, procedure as follow:
- The method: Open cover at the side of Conical Flux tank of flux discharge tube. In do so, most of flux can be discharged out of flux tank. Pick all the Flux into proper bag. Rest of the Flux will be into the transparent hose pipe in between Flux tank & Fluxing assembly. Pull the pipe upper side & take out the Flux form it.



## 6.4 Maintaining

- The authorized operator should read and understand the safety instruction and the equipment should only be operated by the authorized operator.
- The operator should read and understand the manual prior to operation to avoid any incorrect operation.
- Control panel should be sealed tightly and should be maintained cleanly.
- Do not leave the flux at flux tank for more than 8 hours; otherwise it would clog the equipment. The flux should be injected completely every cycle.

### A. Daily check :

- ✧ Clean the equipment surface.
  - ✧ Check the flux hose condition. If it is damaged, replace it.
  - ✧ After the completion of operation, the flux remaining at wall of flux tank and flux piping should be clean up.
  - ✧ Battery charging point should be fixed at one points & Charger kept into that area.
  - ✧ Check that the Batter is charged sufficiently of the pallet truck.  
If not charge it
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## **B. Weekly check :**

- ✧ Inspect leakage around the top opening of tank. Replace the gasket if leakage is found.
- ✧ Check whether the parts of FIM are loose or damaged.
- ✧ Inspect drive shaft of flux feeder. If there is leakage, replace the sealing ring and bearing.
- ✧ Open the gas control panel and clean the dust inside. If there are parts damaged or loose, replace it or fit it again.

## **C. Monthly check :**

- ✧ Open electric control panel to see whether electric element is damaged or loose. If it is loose, fix it again or contact with us.
  - ✧ Wipe off the dust remaining at wall of control panel and inside with clean rag.
  - ✧ Dismantle ball valve and safety valve to clean the build-up flux inside. And
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check condition of ball valve.

- ✧ Feel the grease into all the greasing points.
- ✧ Check the UP/ Down movement Electric cylinder positions and movements.
- ✧ Check the sufficient water content into the Battery.

D. Separate manual will be provided for Battery operated pallet truck in hard copy.

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