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GOVERNMENT OF INDIA (भारत सरकार)
MINISTRY OF RAILWAYS (रेल मंत्रालय)
(RAILWAY BOARD) (रेलवे बोर्ड)

No.2021/Track-III/TK/15 **New Delhi, dated 27.05.2024.**

The Principal Executive Director(Infra-I)
RDSO
Lucknow.

The Director General
IRICEN
Pune

Sub: 2nd Edition of Indian Railway Small Track Machine Manual (IRSTMM-2005).

Ref : Board's letter No.2008/Track-III/TK/8 Vol.IV dated14-06-2019

Please find enclosed herewith the 2nd Edition of Indian Railway Small Track Machine Manual (IRSTMM-2005) containing comprehensive guidelines on Procurement, Operation, Maintenance and Repair of Small Track Machines, duly approved by Member Infrastructure, Railway Board for further necessary action.

The manual has concurrence by Finance, traffic, and establishment Directorate of Ministry of Railways.

DA: as above

Vijay
27/5/2024

(VIJAY SINGH)
Ex. Director, Track (M& MC)
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PREFACE TO FIRST EDITION

Mechanised maintenance of track on Indian Railways was introduced during the early sixties. Modern track can't be maintained and laid manually and thus use of machines has become a basic necessity. Track Machines on Indian Railways have been categorised as Small Track Machines & Large Track Machines. Manual covering large track machines was first published in March 2000. For working of small track machines, instructions have been issued by Railway Board &Zonal Railways from time to time. For documentation of these instructions at one place it was felt necessary to publish a small track machine manual. To achieve this objective Railway Board, vide letter no. 90/Track-III/TK/9/vol-III dated 07-5-2003 appointed a committee consisting of CE/TP/C.Rly., CE/PL/W.Rly., Dean/IRICEN/Pune & ED/TMM/RDSO.

The following officers participated in the Committee from time to time: -

(i) Shri S.N. Agrawal, CE / TP /C. Rly,
(ii) ShriSanjeev Mittal, CE / PL / W. Rly,
(iii) ShriAjitPandit, Dean/IRICEN/Pune
(iv) ShriSurendra Kumar, ED /TMM/ RDSO.
(v) Shri Vijay Sharma, ED/TMM/RDSO
(vi) ShriAdesh Sharma, CE / TM / C. Rly
(vii) Shri Hitesh Khanna, CE / TM / N. Rly.

While preparing the manual, efforts have been made to cover the following aspects of small track machines working:

1. Description and use of small track machines.
2. Guidelines for using, handling, transporting and storing of machines, safely and efficiently.
3. Maintenance schedules and type of maintenance in each schedule.
4. Requirement of manpower.
5. Requirement of consumables.
6. Type of power pack to be used.

The committee held its first meeting on 4th and 5th Nov. 2003 at RDSO/Lucknow. Subject matter of various chapters of the manual was discussed by the committee during subsequent meetings. Draft of the manual was finalised in the last meeting of the Committee held on 7th& 8th July, 2004 at Mumbai CST. The prevailing instructions in regard to working of small track machines over different railways, instructions issued by Railway Board, provision in IRPWM, Indian Railways General rules and other relevant codes and manuals and circulars issued by RDSO had also been kept in view while writing this manual.

While every effort has been made to cover all aspects of small track machine working, it is not possible to make any manual absolutely complete. Chief Engineerofzonal railways may issue such supplementary instructions as necessary to suit local conditions on the railways. Such instructions, however, should not contravene any of the provisions in this manual and other codes/manual.

The committee was rendered valuable assistance & contributions by ShriPradeep Singh, Narender Kumar (both Directors, RDSO) during deliberation and preparation of this manual.

Though every care has been taken in preparing this manual, any error or omission may be brought to the notice of the Railway Board. Suggestions for further improvement in this manual are welcome. The same may be addressed to ED/Track Machine, RDSO or ED/TK (Machine), Railway Board.

New Delhi
July 2005

(N.Aravindan)
Addl.Member/Civil Engg.
Railway Board, New Delhi

PREFACE TO SECOND EDITION

Indian Railways has decided to switch over to complete mechanisation by 2024. Small Track Machines have an increasingly important role to play in this regard. Various instructions have been issued in connection with Small Track Machines (STMs) in the past. Instructions also exist in terms of IRSTM Manual. Six correction slipstothis manualhave been issued so far.

Railway Board constituted a committee, consisting of following officers, for revision of Small Track Machine Manual – 2005 based on change in technological improvements and also change in policy environment under "Make in India" concept, vide letter No. 2004/Track-III/TK/13 Vol. II dated 07.08.17.

1.	Director/ IRICEN, Pune	Chairman
2.	EDTM/RDSO	Coordinator
3.	Sri Anil Choudhary, Sr. Professor/IRICEN	Member
4.	Chief Track Engineer/WCR	Member
5.	Chief Engineer/TMC/CR	Member

Subsequently Railway Board vide letter No. 2021/Track-III/TK/15 dated 02.11.21 revised the nomination of committee as under:

1.	Shri R. K. Jha, ADG/ IRICEN	Chairman
2.	Shri S. K. Singh, EDTM/RDSO	Coordinator
3.	Sri Anil Choudhary, Sr. Professor/IRICEN	Member
4.	Shri Ajay Gupta, Chief Track Engineer/WCR	Member
5.	Shri D. Anjaneyulu Reddy,CE/TM/SCR	Member

In revised nomination it was advised that the committee may also study the possibility of setting up of only one centralised Small Track Machines Depot (ZCSTMD) as against one in each division as recommended by RDSO in its Report No. TM-227 'Guidelines on Procurement, Operation, Maintenance and Repair of Small Track Machines'.

The First meeting of the committee was held atIRICEN on 06.09.22 and 07.09.22 and subsequent meetings were held online on 25.10.22 and 15.11.22. The Final meeting of the committee was held at IRICEN on 30.11.22 to 01.12.2022. The committee took consideration of all six correction slips issued so far and directive on Comprehensive Guidelines on Procurement, Operation, Maintenance and Repair of Small Track Machines issued vide RDSO Report No. TM-227 before finalisation of this edition.

Chapters on obsolete machines like Hydraulic Rail Joint Straighter, Rail Creep Adjuster, Concrete Sleeper Breaker with Angle Grinder, Concrete Sleeper Drilling Machine, Jib Crane attachable to BFR/BRH for Handling Concrete Sleeper, Attachment for Rail Dolly for PRC Sleeper, Powered Rail Hauling System, Portable Ballast Cleaner (semi-mechanized) & Portable Shoulder Ballast Compactor have been omitted and chapters on machines which are not covered in earlier edition like Track Based Lubricators, Compressed Air Petrol Preheating Machine, Gang /Worksite Remote Control Hooter, Magnetic Base type Rail Thermometer & Continuous Rail Thermometer have been added in this edition.

While every effort has been made to cover all aspects of small track machine working, Chief Engineer of zonal railways may issue such supplementary instructions as necessary to suit local conditions on the railways. Such instructions, however, should not contravene any of the provisions in this manual and other codes/manual. It is also pertinent to mention that there is no requirement of additional manpower exclusively for Operation & Maintenance of small track machines.

The committee was rendered valuable assistance & contributions by Shri Nihal Singh, Director/RDSO,Shri D.S. Prajapati, SSE/STM/RDSO, Shri Manish Kumar, SSRE/STM/RDSO, Shri Lalan Deo Modi, SSE/STM/BZA, Shri CH. Akhil Teja, JE/STM/BZA and Shri Milind Jadhav, Sr. Instructor/Comp-2/IRICENduring deliberation and preparation of this manual.

Though every care has been taken in preparing this manual, any error or omission may be brought to the notice of the Railway Board. Suggestions for further improvement in this manual are welcome. The same may be addressed to ED/Track Machine, RDSO or ED/TK (M & MC), Railway Board.

New Delhi
May, 2024

(Brijesh Kumar Gupta)
Addl.Member/Civil Engg.
Railway Board, New Delhi

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7.	*Portable D.C Welding Generator Suitable for reconditioning of CMS X-ings& tongue rails and Fillet welding using DC.	01 per SSE/In-charge.
8.	Electronic/Mechanical Toe Load Measuring Device	1 per JE/SSE (Sectional)
9.	Hydraulic Track Jack (non-infringing 15 tonne capacity)	6 per JE/SSE(Sectional)
10.	Hydraulic Rail Tensor (Non-infringing type) 70t capacity	2 per JE/SSE(Sectional)
11.	Light Weight Rail (Mono) cum Road Trolley	2 Per Gang
12.	Self-Propelled Light Weight Trolley	1 per ADEN
13.	Powered Material Trolley	1 per SSE(In-charge)
14.	Box type Gauge cum Level (BG) along with Spirit Level	1 Per Gang
15.	Chamfering Kit- Manual/ Chamfering Machine- Battery operated	1 Per Gang
16.	Magnetic Base type Rail Thermometer	1 Per Gang
17.	Continuous Rail Thermometer	2 per SSE (In-charge)
18.	Gang / Worksite Remote Control Hooter	2 Per Gang
19.	Portable track lifting & slewing device (TRALIS)	See note No.3 below
20.	Off track Tampers	See note No.3 below
21.	Track Based Lubricator (Electronic/Hydraulic)	As per requirement depending on the curves available in that section.

NOTE-

1. *Additional Portable DC Welding Generators may be procured on a need basis with approval of CTE.*
2. *Adequate number of spare machines (at least 30% of the divisional requirement) may be kept at Divisional Depot to be used in emergencies/unit exchange for repair of STMs.*
3. *Off track hand heldtampers (Power pack or engine mounted) & Portable track lifting & slewing device (TRALIS) may be procured with the approval of CTEfor those sections where MMU is implemented as per para 604 (2)© of IRPWM. However, these may also be procured for other sections with the approval of CTE.Further contractual agencies appointed for track maintenance should invariably use these machines for packing, lifting and alignment corrections of track.*
4. *In the list only minimum requirement is specified and all machines are not part of the list. The additional requirement of other small track machines, wherever required, shall be worked out based on the requirement of individual division/ Zonal Railway. Such spare machines should be frequently used so that they remain in good condition. Additional spare machines may be kept at Divisional Depot, to be decided by division based on actual needs to be used in emergencies.*

5. **In extreme exigencies, also suitable for running of rail profile weld grinder & lighting arrangements using AC.*

105 Requirement of Manpower: The manpower required will be for operation and maintenance of Small Track Machines.

(1) For Operation of Machines: The indicative manpower requirement for operation of different machines is given in the manual against each machine. However, the actual requirement will depend on the nature of track maintenance operations to be carried out, grouping of machines and local conditions as all the machines will not be required to work every day in each section. The requirement of manpower will be different for various sections depending on work involved. Leave reserves have not been included in the requirement of manpower indicated in the manual. The actual requirement for the individual section shall be worked out by the division.

(2) For maintenance of Machines: Each SSE/P.way/In-charge will be assisted by 2 Technicians (Ex-cadre selected from the willing available Track maintainers), preferably ITI/Diploma/Graduate. SSE/P.way/In-Charge will propose the qualified technicians for their nomination by ADEN.

106 Inspection: Frequency for inspection of STMs shall beas laid down in Table 1A (para 103)&Table 1B (Para 106, 106 (4(1)), 109)of IRPWM 2020. Sr.DEN/DENs/AENs shall pay special attention to repairs, maintenance and effective use of Small Track Machine during their regular inspection of Section Engineer's offices and stores. They shall also scrutinize the Small Track Machines Register. Sr.DEN/DENs shall monitor the availability, use and performance of each type of machine under the control of each ADEN/DEN and the report shall be submitted to HQ office regarding their performance in their monthly PCDOs. The problematic aspects of Small Track Machines as brought out in PCDOs by the division shall be inspected by an officer nominated by Zonal HQ and report about problems and suggested solutions shall be endorsed to Sr.DEN/Co-ord. and CE/TM, who shall endeavour to communicate the solutions to the users.

Items to be checked by Open Line officials for some of the important machinesare listed below for guidance.

(1) Abrasive Rail Cutter

a. Cutting parameters like cross cutting within tolerances, time of cutting, number of cuts per disc and fuel consumption per cut etc.

b. Condition of Lube Oil and its level.

c. Maintenance registers like log book and history book.

d. Quality as per specifications of the cutting Disc as per RDSO standards.

e. Check whether maintenance is done as per prescribed schedules including IOH, POH.

(2) Rail Drilling Machine

a. Drilling parameters like eccentricity of drilled hole, oblong dia of hole, drilling time, various sizes of the drill bits to be used for different types of fish plated joints, such as gap less joint etc.

b. Availability of template for correctly maintaining the pitch and edge distance.

c. Condition of Lube oil and its level.

d. Check whether maintenance is done as per prescribed schedules including IOH, POH.

e. Scrutiny of registers like Log book and History book.

(3) Compressed Air Petrol Preheating System

a. Air pressure generated in the machine is adequate.

b. Petrol Consumption per weld.

c. Condition of Lube oil and its level.

d. Check whether maintenance is done as per prescribed schedules including IOH, POH.

e. Scrutiny of registers like Log book and History book.

(4) Weld Trimmer

a. Availability of 52/60 kg shearing blades and their condition.

b. Quality of finish of the weld.

c. Adequacy of Shearing force developed by the cylinders.

d. Condition of Hydraulic Oil and Lube oil and their level.

e. Check whether maintenance is done as per prescribed schedules including IOH, POH.

f. Scrutiny of registers like Log book and History book.

(5) Rail Profile Grinder

a. Quality of the smoothed surface on the finished weld.

b. Check whether maintenance is done as per prescribed schedules including IOH, POH.

c. Scrutiny of registers like Log book and History book.

(6) Generators

a. Condition and level of Lube oil.

b. Measure current and voltage with multi-meter (whether steady or fluctuating)

c. Check whether maintenance is done as per prescribed schedules including IOH, POH.

d. Scrutiny of registers like Log book and History book.

(7) Hydraulic Track Jack

a. Check for any leakages in the track jack.

b. Condition of Hydraulic Oil.

c. Check whether maintenance is done as per prescribed schedules including IOH, POH.

d. Scrutiny of registers like Log book and History book.

(8) Hydraulic Rail Tensor

a. Check for any leakages in Hose pipes.

b. Condition of Hydraulic Oil.

c. Check whether maintenance is done as per prescribed schedules including IOH, POH.

d. Scrutiny of registers like Log book and History book.

(9) Toe Load Measuring Device

a. Calibration of the Machine

b. Tension in the spring.

c. Display settings (for electronic Toe load Machine).

(10) Light Weight Rail (Mono) cum Road Trolley

a. The trolley shall be visually checked for proper assembly, soundness of fittings, proper welding etc.

b. The movement of the trolley shall be even and trouble-free.

c. Movement of the trolley under loaded condition shall be checked on Point and crossing and level crossing also.

(11) Self-Propelled Light Weight Trolley& Powered material Trolley

a. The trolley shall be visually checked for proper assembly, soundness of fittings, proper welding etc.

b. The movement of the trolley shall be even and trouble-free.

c. Movement of the trolley under loaded condition shall be checked on Point and crossing and level crossing also.

d. Check whether maintenance is done as per prescribed schedules including IOH, POH.

e. Scrutiny of registers like Log book and History book.

(12) Box type Gauge cum Level (BG) along with Spirit Level

a. It shall be checked for straightness of the housing frame, and proper fitting of different parts like end caps, rail seats, handle, eye-piece (reading window) etc.

b. The surfaces of the housing frame shall be free from any burrs or scale and shall be smooth.

(13) Chamfering Kit- Manual/ Chamfering Machine- Battery operated

a. The equipment shall be able to achieve proper chamfering of the edges of the bolt holes.

(14) Magnetic Base type Rail Thermometer

a. The thermometer shall be visually examined for proper shape, soundness in appearance, and free from any defect that can be detected visually.

(15) Continuous Rail Thermometer

a. The device shall be examined for its proper shape, soundness in appearance and free from any defects, which can be detected visually.

b. All the internal components shall be visually verified for its make, proper shape, positioning etc. by opening the data logger unit.

(16) Gang / Worksite Remote Control Hooter

a. Device shall be examined for external finish, dimensions andworkmanship.

b. The hooter shall be operated continuously for 5 minutes without interruption.

(17) Portable track lifting & slewing device (TRALIS)

a. TRALIS shall be examined for any defects such as blow holes in the body or cracks at welded joints and coupling etc.

(18) Off track Tampers

a. The equipment shall be visually checked for its components, orientation of handle, power off/on switch, tool insertion sleeve, electrical cable connections etc.

(19) Track based Lubricator (Electronic/Hydraulic)

a. The equipment shall be visually checked for its components etc.

b. Quantity of grease in the tank shall be checked.

c. Spreading of grease through applicator shall be checked.

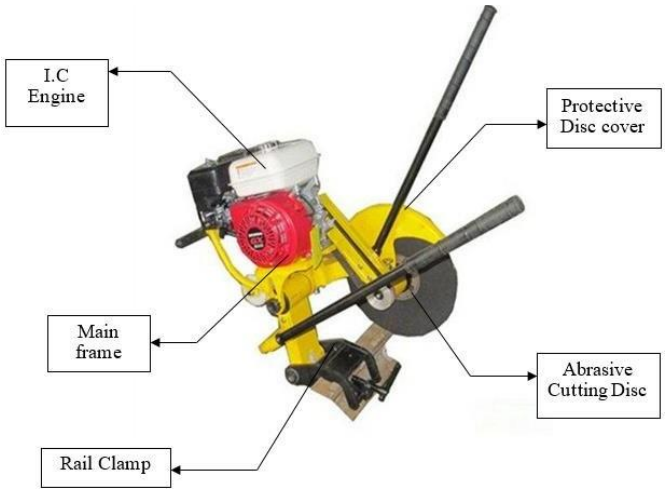
107 Duties of Assistant Divisional Engineer/Open line:

The Assistant Divisional Engineer In-charge of Sub Division is generally responsible for the inspection, maintenance of small track machines in the sub-Division for accuracy,

Chapter-2
Part-A
Abrasive Rail Cutter (ARC)

201 Use:

Abrasive Rail Cutter is used for quick cutting of all types of rail sections including wear resistant, head hardened rails. Photo of sample Abrasive Rail Cutter is given below:



Abrasive Rail Cutter

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

202Description:

Important Assemblies of ARC machines are:

(1) Rail Clamp: The rail clamp shall be made of tough, durable and lightweight material having sufficient mechanical strength. The rivet/bolts used in the clamp shall be of high tensile category. It is fixed on the Rail head while doing cutting operations. It should not be loosen/misaligned during cutting operation.

(2) Arm: The arm is made of durable, light weight material. This arm helps to connect the rail clamp and engine mounting frame. It facilitates the Abrasive rail cutter to move only in vertical axis (2 degrees of freedom, to move in vertical motion and rotation about the rail length) there by allowing to cut the rail perpendicularly.

(3) Engine mounting Frame: The engine mounting frame is made of durable, light weight material. It is used to fix the prime mover on it.

(4) Power Source: The engine/electric/hydraulic motor shall be of reputed make and shall provide sufficient power to cut the rail within the specified time and tolerance.

(5) Guard for abrasive rail cutting wheel: The guard of the cutting wheel shall be made of good quality non-combustible light weight material to prevent the sparks and iron chips emitted during cutting operation. There shall be sufficient space between the new wheel and guard periphery. The maximum angular exposure of the abrasive wheel periphery and sides for safety guards shall not exceed 180^0.

203 Functional Requirements:

(1) The abrasive rail cutter shall be capable of cutting all types of flat bottom rails being used in Indian Railways and of any metallurgy.

(2) The abrasive rail cutter shall be capable of cutting rail at any distance from rail end.

(3) The abrasive rail cutter shall have a strong and rigid clamping arrangement which shall fix the machine on rail near the cutting location. The clamping arrangement shall have a suitable location pointer to mark the cutting point on the rail. The fixing and removing mechanism shall be easy and quick in nature. The abrasive rail cutter while attached with clamp during cutting operation shall not be loosen/misaligned. The abrasive rail cutter shall be so attached with the clamp that it can swing vertically.

(4) The abrasive rail cutter shall be capable of working continuously during the severe Indian atmospheric and climatic conditions.

(5) The machine shall function normally in a tilted position during cutting. In an integrated engine driven cutter there shall not be any operational trouble in a tilted position.

(6) The abrasive rail cutter shall be so designed that there shall be minimum or no vibration during cutting operation to avoid possibility of misalignment and breakage of the abrasive cutting wheel.

204 Technical Requirement

1.	Prime mover	The engine/electric/hydraulic motor shall be of reputed make and shall provide sufficient power to cut the rail within the specified time and tolerance.
2.	Fuel Tank Capacity (Engine Driven)	Sufficient to run for minimum 4 cuts for 1175HT rails/ 5 cuts for 60 kg 90 UTS

		rail/7 cuts in 52 kg 90 UTS rail
3.	Overall weight	Maximum 32 kg.
4.	Squareness of cuts	± 0.5 mm for vertical and lateral direction.

Cutting time

Sl.No	Rail Type	Recommended time in minutes
1.	1175 HT rails	6
2.	60 Kg/m, 90 UTS	5
3.	60 Kg/m, 72 UTS	4
4.	52 Kg/m, 90 UTS & other rails	4
5.	52 Kg/m, 72 UTS & other rails	2

205 Guidelines for using, handling, transporting and storing of Machines

(1) Proper utilisation of machine:

Instructions contained in the manual supplied with the machine shall be followed for operation including operational safety measures, repair/maintenance, overhauling, trouble-shooting etc. In addition to the operational instructions contained in the manual given by the supplier, following instructions shall be observed before commencement of actual cutting:

- **a.** Inspect wheel for cracks or other damages.
- **b.** Test disc by striking lightly with a piece of wood. If the disc does not make a full ringing sound, it is damaged.
- **c.** Check the contact surfaces of the cutter disc and ensure that flanges are flat and free of foreign material.
- **d.** The disc shall be within its expiry date of use.

(2) Precautions in operation:

- **a.** The operator shall be fully conversant with use of the machine. The operator shall not be tired, under stress or under influence of any drug or alcoholic drink.
- **b.** The operator shall read and understand the safety precautions mentioned in the operation's manual and shall strictly follow the instructions.
- **c.** The operator shall wear safety clothing, shoes and goggles before starting the machine.
- **d.** No inflammable article shall be in vicinity of the cutting location. During cutting of rails in track circuit area care should be taken to avoid signal cable from burning.

(3) Safety instructions:

- **a.** Ensure the proper tightening of all nut and bolts of the abrasive rail cutter before operation
- **b.** Always make sure that the cutting disc is properly inserted & fixed in the

machine

c. Clamping device must be clamped and tightened in proper position

d. No extra force should be exerted on the machine handle during operation.

e. Always make sure that there should be sufficient Mobil oil in the engine.

f. Do not touch the muffler.

g. Control the surrounding area before operation- The safety distance around the abrasive rail cutter for personnel not operating the machine should be at least 15 meters.

h. There should be no one in the line of rotating cutting disc on both sides of the machine.

i. During transportation, always remove the cutting disc from the cutter.

j. When cutting the rail off line, the machine should put on the rail steadily to prevent the rail from overturn or hurting some body after cutting it off.

(4) Handling:

The Abrasive Rail Cutter shall be handled carefully to avoid any physical damages. It shall not rest on the cutting wheel during idle period, which can cause breakage of the cutting wheel.

(5) Transportation

The machine shall not be transported while the cutting disc is mounted on it. In an engine driven cutter, the fuel tank shall be empty while transporting from one place to another place. There shall not be rough handling during transporting. The machine may be transported on push trolley/material trolley.

(6) Storage:

The machine shall be stored in a box/carton at a dry place.

206 Maintenance Schedule:

(1) The important component of the machine is tabulated below.

List of Spare parts used in frame of ARC machine			
Sl. No	**Description of Spare Parts**	**Unit**	**Quantity**
1.	Main Frame	No	1
2.	Main Frame Arm	No	1
3.	Rail Clamp	Set	1
4.	Shaft	No	1
5.	Bearing (6906, 6005)(6905, 6205)	No	Each 02
6.	Shaft Key	No	1
7.	Engine Pulley	No	1
8.	Frame Pulley	No	1

9.	V belts	No	2

NOTE: *for detailed description of spare parts of the engine, refer Appendix-I*

(2) The maintenance (Schedule I to IV)should be done as per schedule discussed in chapter-I. The maintenance activities to be performed in different schedule are given below:

Sl. No	Items	Daily Maintenance (Schedule-I)		Quarterly Maintenance (Schedule-II)		Half yearly Maintenance (Schedule-III)		Yearly Maintenance (Schedule-IV) (IOH)	
		Check/ clean	Change	Check/ clean	Change	Check/ clean	Change	Check/ Clean	Change
1.	Air filter	✓					✓		✓
2.	Tension of the drive belt.	✓					✓(*)		✓(*)
3.	Condition of the cutting wheel	✓							
4.	Re-coil Starter spring and starter chord	✓							
5.	All nuts and bolts	✓							
6.	Air filterpaper	✓		✓(2)			✓(2)		✓(2)
7.	Tension of governor spring and throttle spring	✓							✓(*)
8.	Condition of handles.	✓							✓

9.	Frame joints	✓							
10.	Spark plug			✓		✓			✓
11	Cooling fans on the flywheel					✓		✓	
12.	Fuel tank filters								✓
13.	Grease in Frame bearings						✓		✓
14.	Engine Oil	✓	✓(1)				✓		✓
15.	Pulleys	✓		✓		✓	✓(*)	✓	✓(*)
16.	Valves					✓			✓(3)
17.	Carburettor			✓		✓		✓	✓(*)
18.	Piston					✓		✓	
19.	Head of the chamber					✓		✓	

Note: *(*) check and change the items only if necessary.*

1. *Change engine oil after first20 hrs of engine working, in case of both new engine and overhauled engine.*
2. *Inspection/Maintenance to be carried out more frequently in dusty conditions.*
3. *Adjust the spacing in the valves to manufacturers standards, preferably toInlet: 0.15 ± 0.02 mm , Outlet: 0.20 ± 0.02 mm*

(3) POH of engine & Frame(Schedule V):

a. POH Frequency:

POH of the ARC is done for every **300 cuts or 2 years**, whichever is earlier.

b. Methods of POH of engine & Frame:

Sl. No.	Type of overhauling	Procedure& Benefits
1.	POH of Engine by	This method is used to overcome the problem of

	Re-boring method	oversize dia developed, by adjusting the bore of the machine to the standard dia designed as per manufacturer's standards. This re-boring work is highly dependent on the condition of the engine chamber and skill of the technicians (who does the re-boring work). This puts us in a situation in which we are not 100% confident on the desired outcome from the overhauled machine. As re-boring work is uneconomical &no reliable, it is highly recommended not to adopt overhauling using re-boring work. *However POH can be done only **once** in such cases.*
2.	POH of Engine by Replacement with new barrel assembly	This method is used to overcome the problem of oversize dia developed by restoring the bore of the machine to the standard dia by replacing with a new barrel assembly as per manufacturer's standards. Replacing with new barrel assembly (Chamber) results in developing the characteristics of a new engine and does not require any skill of technicians as in re-boring work. As this method of overhauling is highly reliable and economical, it is recommended to prefer this method of overhauling. An engine can be normally overhauled **3-4 times** by this method.
3.	POH of engine by Engine replacement	When an engine is found damaged or not feasible/ economical to be overhauled by any one of the above two methods, it is recommended to replace the old engine with new one.
4.	POH of Frame	POH of the cutting frame is to be done on Condition basis

c. Must change items during POH of engine & Frame

Must change item of Engine during POH				**Sl.No**	**Must change item of POH in Frame**
Sl.No	**By Barrel assembly method**	**Sl.No**	**By Re-Bore method**		
1.	Barrel assembly	1.	Piston	1.	Frame Pulley
2.	Piston	2.	Piston Ring	2.	Engine Pulley
3.	Piston Ring	3.	Connecting Rod	3.	Shaft Bearings
4.	Connecting Rod	4.	Valves	4.	Reconditioning ofShaft.
5.	Valves	5.	Piston locks	5.	V-Belts
6.	Piston locks	6.	Connecting Pins		
7.	Connecting Pins	7.	Lifter Valves		

8.	Lifter Valves	8.	Bearings		
9.	Bearings	9.	Cranks oil seals		
10.	Cranks oil seals	10.	Stem oil seals		
11.	Stem oil seals	11.	Lube oil		
12.	Lube oil				

d. Testing procedure of STM after POH:

Abrasive Rail Cutter Shall be tested on test track for Cutting time and tolerances mentioned in para 204of chapter 2.(Details of the track on which it is to be tested are given in Sl. No: 7 of table -1 in chapter 21)

207 Troubleshooting:

Sl.No.	Problem	Probable - cause	Remedy
1.	Engine does not start	i) Engine starting switch is off. ii) Fuel in the tank is not enough. iii) Carbon deposition in spark plug. iv) Improper spark during ignition. v) Fuel not reaching the carburettor.	i) Put it in 'ON' position. ii) Fill the tank with fuel. iii) Clean the spark plug. iv) Check spark plug gap. It shall be 0.5 mm. Adjust the gap. Change the spark plug if damaged. v) Check and repair fuel oil lines.
2.	Cutting is slow	i) Improper surface speed of cutting wheel. ii) Driving belt loose.	i) Check the engine r.p.m. which shall match the required r.p.m. of the wheel. ii) Tighten the belt.
3.	Rotation of cutting disc stops during cutting while engine runs continuously	i) Driving belt is run out. ii) Defective alignment.	i) Stop the engine. Replace/ tighten the driving belt. ii) Stop the engine and re-align the machine properly.

4.	Cross Cutting	i) Damaged/broken bearings. ii) Clamp shaft is loose iii) Improper disc setting. iv) Improper thickness of the disc. v) Bent shaft. vi) Improper disc plates.	i) Change the bearings. ii) Tighten the clamp shaft. iii) Adjust the disc properly. iv) Use proper thickness approved by RDSO. v) Change the Shaft. vi) Adjust the disc plates properly.

Note:

Engine:*Low RPM, Not able to take Load, Long Duration for a cut and white Smoke from the Engine muffler is indication that POH of Engine is required.*

Frame:*Cross cutting, play in the joints of the frames, improper fixture of the rail clamp, seizure of the disc shafts is an indication that POH is required for the Frame.*

208Requirement of manpower

Two persons are required– One skilled person to operate the machine and one unskilled person to carry it.

209Requirement of consumables

(1) Abrasive disc

(2) Petrol

Part-B
Rail Cutting Wheel (Abrasive Disc)

210 Use:

The Rail Cutting Wheel (Abrasive Disc) is a disc used with abrasive rail cutting machine for cutting rails for various permanent way maintenance works of Indian Railways.

211 Description:

The Rail Cutting Wheel (Abrasive Disc)is a thin circular cutting disc made of abrasive sand and bonding material.

Rail Cutting Wheel (Abrasive Disc)

(This Photo is only for guidance and the material can differ. However, it should meet the functional requirements as described below)

212Functional Requirements:

(1) The materials shall be such that, the disc periphery does not break/chipped off during cutting operation. The disc shall be capable of cutting of rails of any section up to 65 kg/m and of any metallurgy up to 1175 HT rail.
(2) The bore and diameter of the abrasive disc shall make it compatible to use with RDSO/Railway Board approved abrasive rail cutter.
(3) The abrasive disc during cutting operation shall not lose its abrasive particles rapidly so that it can retain its discard diameter upto the specified number of cuts.
(4) The disc materials shall be such that, there shall be no fumes/smokes emitted during the cutting operation. The physical stability to retain the disc flat in new condition and during cutting operation shall be sufficient.

213 Technical Requirements:

1.	Diameter	400 + 5 mm - 3 mm
2.	Thickness	4.0 + 0.25 mm
3.	Bore	22.23 + 0.5 mm - 0 mm
4.	Nominal size	400 x 4 x 22.23 mm (approx.)
5.	Operating speed	≤ 4800 r.p.m. (approx.)
6.	Performance	Minimum 7 Nos. of cuts on 52 kg 90 UTS rail, 6 Nos. of cuts on 60 kg 90 UTS rail and 3 Nos. of cuts on 1175HT rail at discard diameter of 260 mm.

7.	Rail cutting wheels shall carry legible and indelible markings indicating:	i) Name, initials and trade mark. ii) Expiry date or shelf life. iii) Manufacturing lot number and year of manufacturing.

214Guidelines for using, handling, transportation and storing of abrasive disc:

(1) Proper utilisation of Abrasive Disc

Instructions contained in the manual supplied with the item shall be followed for operation including operational safety measures etc. In addition to the operational instructions contained in the manual given by the supplier, following instructions shall be observed before commencement of operation:

a. The cutting wheel shall be fixed to the spindle of the machine after ensuring that diameter of the spindle perfectly matches the bore of the cutting wheel.
b. The operating speed as prescribed by the manufacturer of the cutting wheel shall be ensured.
c. Cutting operation shall be done as per the operating instructions furnished by the manufacturer of both the machine and wheel.
d. The cutting wheel shall only be used on an abrasive cutting machine originally equipped with 400 mm guards.
e. Supplier's manual shall be referred to for safe operation.

(2) Precautions in Operation:

Instructions regarding safety precautions for operation, mentioned in the operation and maintenance manual issued by the manufacturer of the cutting wheel shall be followed.

(3) Handling:

The abrasive cutting wheels shall be handled carefully to prevent breakage. The disc shall not be under any impact loading/hitting which can cause breakage.

(4) Transportation:

For transportation, the cutting wheel shall be packed suitably in packets/carton. Being light in weight, the cutting wheels may be transported on bi-cycle/push trolley/material trolley.

(5) Storage:

The rail cutting wheels shall be stored in polythene bags within carton/packing box with silica gel inside the bags to protect from moisture.

(6) Maintenance Instructions:

Supplier's booklet shall be referred to for maintenance of the disc. The cutting wheel shall be kept clean and dry when not in use.

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Chapter- 3
Rail Drilling Machine (RDM)

301 Use :

Rail Drilling Machinesare used for drilling holes in rail webs of all types of rails.Purpose of the Rail drilling machine is to produce holes of different sizes wherever required to facilitate Fish plates, Bond wires etc. The machine should be easily movable and capable to make holes in all types of Rails.The machine should comprise of an integrated driving engine with drilling unit coupled together rigidly in a compact unit.

302Types of Rail Drilling Machine

There are following types of rail drilling machines depending on their drive.

(1) Electric Driven Rail Drilling Machine

The Electric Driven Rail Drilling Machine runs on electricity. The machine needs an electric power supply either 230 volts. This rail drill machines are equipped with a power electric DC motor with brushes. The Electric Driven Rail Drilling Machines are ideal machines to use on railway workshops/major yards where power supply is easily available. When using an Electric Driven Rail Drilling Machine in a remote location it can also be connected to generators.

(2) Engine driven Rail Drilling Machine:

There are two types of engine operated RDMwhich are described below

a. Light weight Rail Drilling Machine (LWRDM)

This machine is equipped with a light weight petrol engine. The max weight of the machine is 22 kg. This machine is very handy in drilling holes in remote locations.

Light weight Rail Drilling Machine

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

b. Regular Rail Drilling Machine (RRDM):

The Petrol start& kerosene driven Rail Drilling Machine is most commonly known as Regular Rail Drilling Machine. This machine is equipped with engine generally of 3 HP. These Rail Drilling Machines are ideal machines when drilling in a remote location where there is no availability of electricity.

As the availability of kerosene is getting scarce, these petrol start, kerosene driven engines shall be replaced with petrol engines of the same capacity in a phased manner.

Rail Drilling Machine

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

(3) Battery operated Rail Drilling Machine (BORDM):

The Battery Driven Rail Drilling Machine runs on electricity supplied from a Li-ion battery. These rail drill machines are equipped with power electric DC motors with brushes. This is an ideal machine to make holes in rail tracks at a remote location. The machines can do limited holes as the power of the machine depends on the capacity of the battery.

Following machines are covered below:

- **a.** Engine driven RDM
- **b.** Battery operated RDM (Cordless)

Part-A

Engine operated RDM

303Description:

The machine consists of a driving engine with a drilling unit coupled together rigidly. Fixing arrangements with rail i.e., clamping unit is also provided to ensure a straight and correct position of drilling the holes.

The following are the important assemblies in RDM:

(1) **Engine**: The prime mover is a strong single cylinder air-cooled petrol start kerosene run engine having fuel tank capacity of 3.7 liters capable of developing 3.5 HP (HONDA GK200) when running at 3600 rpm under NTP conditions.

(2) **Gear box:** Suitable gear box is provided on each machine which automatically reduces the 3600rpm to only 90rpm (approx.) which are nominal for drilling machine. The gear box consists a Worm shaft and Worm wheel which are used to reduce the speed. The both are fixed in the gear box with bearings firmly for smooth running.

(3) **Drilling Unit:** A hollow spindle is attached at the output of gear box to hold the drill bit of variable size up to 35 mm. A chain sprocket system is fitted on machine axially in such a way to guide the drill bit towards the rail by providing a linear motion to the spindle. It can drill up to 35 mm drill within 3 to 4 minutes. Specification of the Drill bit is as per I.S:5103-1969 and shall last for 100 fish bolt holes in 60Kg/90 UTS Rails.

(4) **Trolley frame:** A light weight Mono rail cum road trolley is used to transfer the machine from one place to another place.

(5) **Water bucket:** A small water tank is kept to spray the water on the rotating drilling bit to reduce the heat generated during drilling the holes and to protect the drill bit.

304Functional Requirements

(1) It should be able to drill hole up to 35 mm dia. hole in the rail web of any type and section of rail from 60 R to 60 kg/m having UTS of 70 to 90 kg/mm2.
(2) It should be able to drill a hole within the prescribed time.
(3) Drill spindle rotation should be within the prescribed RPM.
(4) It should have clamps provided such that handling by men is easy.
(5) It should be able to drill hole as close as 40 mm from rail ends.
(6) Clamp should ensure a straight hole centrally to both axes.

305Technical Requirements

Sl. No	Description	Requirement	
		Light weight RDM	RRDM
1.	Overall weight	Max 22 kg	65 Kg (approx.)(without fuel)
2.	Drilling time	Sufficient to drill holes in the rail section upto 60 kg having UTS upto 90 within 1 minute and 2 minutes for 1175HT rails.	03 to 04 minutes in 60 kg 90 UTS rails, 06 to 07 minutes for 1175HT rails.
3.	Fixing time	Fixing time shouldnot take more than 2-1 minute for fixing to prepare thehole & 1 minute for removing the fixture.	2 minutes (Max.)

4.	Prime Mover (Engine)	Petrol start & run 2 HP.	Petrol start, kerosene/petrol run 3 HP engineat 3000 to 4000 rpm
5.	Fuel tank capacity	700 ml (approx.)	2.0 Litres (approx.)
6.	Fuel consumption	Each litre of fuel should drill a minimum of 10 holes in the rail section upto 60 kg 90 UTS & capacity of tank should be enough to cater fuel for drilling at least forty holes in rail section upto 60 kg 90 UTS and 1175HT rails	Minimum 10 Nos. of holes in 60 Kg/90 UTS rails & 06 Nos. of holes in 1175 HT rails with2litre of fuel
7.	Drill spindle rotation	40-290 rpm	60 to 90 rpm
8.	Tolerance for diameter and Position of the hole.	$\pm$0.5mm	$\pm$0.7 mm
9.	Drill bit	16mm-40mm	16mm-40mm

306Guide-lines for using, handling, transporting and storing of machines:

(1) Proper utilization of the machine:

Instructions contained in the manual supplied with the machine shall be followed for operation including operational safety measures, repair/ maintenance, overhauling, trouble-shooting etc. However following instructions shall be observed in general:

a. Check engine oil level: To check oil level, take out level gauge, clean it with clean cloth, refit it and again take it out. On the level gauge see whether the oil mark matches with the level mark on the scale .If not, add engine oil and again check with level gauge. Repeat the procedure till it shows the correct level.

b. Gearbox grease: always ensure that the gear box is adequate with grease. Recoup whenever necessary. Check any grease is leaking from the oil seals of the shafts.

c. Fill water in the water tank.

d. Check drill bit: On the shank of the drill bit, size of the drill bit is given. Select the size of drill bit to suit the requirement. Use taper shank drill bit only.

e. Fixing Drill Bit: For fixing and taking out the drill bit, the manufacturer's manual shall be strictly followed.

f. Fix template of proper size in the machine as per rail section.
g. Clamp the machine to the rail section by operating a handle provided with a clamping device.
h. Start engine on petrol and shift to kerosene for running in kerosene run engines.
i. Slowly give feed to the drill bit for drilling by rotation of the drive sprocket.
j. Open the knob of the water tank.
k. After drilling of hole, remove the drill bit from the drilled hole by rotation of the drive sprocket in anti-clockwise direction.
l. For kerosene run engines, before switching off, turn the fuel knob from kerosene to petrol so that at the time of switching off, the engine is running on petrol.
m. De-clamp the fixtures and fix it as above for next drilling.
n. After the drilling work is over, clean the machine with a clean dry cloth.
o. If the work is not to be continued, take out petrol, kerosene oil and water.

The drill bit shall be taken out from the socket.

(2) Precautions in operation:

Following precautions shall be taken during operation of the drilling machine:

a. The operator shall be fully conversant about the operation of the machine and shall know the safety precautions mentioned in the operating and maintenance manual issued by the manufacturer/supplier.
b. Excessive feed shall not be given at a time.

(3) Handling:

The rail drilling machine shall be handled carefully to avoid any physical damage. The machine shall be kept vertical during shifting and shall not be moved on uneven surfaces to avoid falling. During drilling operation, it shall be evenly placed.

(4) Transportation:

a. The machine is fitted with a mono-rail wheel arrangement and a handle of convenient height, to enable it to be pushed over one rail by one person to take it to the work site. Nylon wheels are also provided at the bottom to move it on cess/plain surfaces.

b. Powered material trolleys, dip lorry and inspection trolleys with detachable trailers can be used for transportation on track. The machine can also be carried by a road vehicle.

(5) Storage:

The rail drilling machine shall be stored in a covered and dry place.

307Maintenance Schedule (RRDM):

(1) The important component of themachine is tabulated below.

List of Spare parts used in frame of RRDM machine			
Sl. No	**Description of Spare Parts**	**Unit**	**Quantity**
1.	Gear box	No	01
2.	Worm wheel	No	01
3.	Worm shaft	Set	01
4.	Bearings 6008,6206	No	Each 01
5.	Bearing (6205)	No	02
6.	Shaft Key	No	01
7.	Socket for drilling bit	No	01
8.	Chain sprocket	No	01
9.	Chain	No	01
10.	Direction thread shaft	No	01
11.	Guiding shaft	No	02
12.	Rail Clamp	No	01
13.	Engine pulley	No	01
14.	Frame pulley	No	01
15.	V belts	No	01

NOTE:

(i) For details description of Spare parts used in frame of LWRDM, details provided by OEM can be referred.

(ii) For detailed description of spare parts of the engine, refer Appendix-I.

(2) The maintenance (Schedule I to IV)should be done as per schedule discussed in chapter-1. The maintenance activities to be performed in different schedule is given below:

Sl.No	**Items**	**Daily Maintenance (Schedule-I)**		**Quarterly Maintenance (Schedule-II)**		**Half yearly Maintenance (Schedule-III)**		**Yearly Maintenance (Schedule-IV)**	
		Check/ clean	**Change**	**Check / clean**	**Change**	**Check / clean**	**Change**	**Check / clean**	**Change**
1.	Air filter	✓					✓		✓
2.	Tension of the drive belt.	✓					✓(*)		✓(*)

3.	Condition of the Drill bit	✓							
4.	Re-coil Starter spring and starter chord	✓							
5.	All nuts and bolts	✓							
6.	Air filter sponge	✓		✓(2)			✓(2)		✓(2)
7.	Tension of governor spring and throttle spring	✓							✓(*)
8.	Condition of frame handles.	✓							✓
9.	Frame joints	✓							
10.	Spark plug			✓		✓			✓
11.	Cooling fans on the flywheel					✓		✓	
12.	Fuel tank filters								✓
13.	Grease in gear box						✓		✓
14.	Engine Oil	✓	✓(1)				✓		✓
15.	Pulleys	✓		✓		✓	✓(*)	✓	✓(*)
16.	Valves					✓			✓(3)
17.	Carburettor			✓		✓		✓	✓(*)
18.	Piston					✓		✓	

19.	Head of the chamber					✓		✓	

Note: *(*) check and change the items only if necessary.*

1. *Change engine oil afterfirst20 hrs of engine working, in case of both new engine and overhauled engine.*
2. *Inspection/Maintenance to be carried out more frequently in dusty conditions.*
3. *Adjust the spacing in the valves to manufacturers standards, preferably to Inlet: 0.15 ± 0.02 mm, Outlet : 0.20 ± 0.02 mm*

(3) POH of engine & Frame(Schedule-V):

a. POH frequency:

POH of the engine is to be done for every 3000 holes or 2 years or 200 engine working hours

*(**Note:** In RRDM, re-boring & barrel assembly replacement methods of overhauling are on condition basis and are not mandatory to follow the below methods for every POH.)*

b. Method of POH:

Sl. No.	Type of overhauling	Procedure& Benefits
1.	POH with Re-boring method	This method is used to overcome the problem of oversize dia developed, by adjusting the bore of the machine to the standard dia designed as per manufacturer's standards. This re-boring work is highly dependent on the condition of the engine chamber and skill of the technicians (who does the re-boring work). *However POH can be done only **Twice** in such cases.*
2.	POH with Replacement with new barrel assembly	This method is used to overcome the problem of oversize dia developed by restoring the bore of the machine to the standard dia by replacing with a new barrel assembly as per manufacturer's standards. Replacing with new barrel assembly (Chamber) results in developing the characteristics of a new engine and does not require any skill of technicians as in re-

		boring work. An engine can be normally overhauled **3-4 times** by this method.
3.	POH with Engine replacement	When an engine is found damaged or not feasible/ economical to be overhauled by any one of the above two methods, it is recommended to replace the old engine with new one.
4.	POH of Frame	POH of the Drilling frame is to be done on Condition basis

c. Must change items during POH:

Must change item of Engine during POH				**Sl.No.**	**Must change items of Frame during POH**
Sl.No.	**By Barrel assemblymethod**	**Sl.No.**	**By Re-Bore method**		
1.	Barrel assembly	1.	Piston	1.	Grease
2.	Piston	2.	Piston Ring	2.	V belts
3.	Piston Ring	3.	Connecting Rod		
4.	Connecting Rod	4.	Valves		
5.	Valves	5.	Piston locks		
6.	Piston locks	6.	Connecting Pins		
7.	Connecting Pins	7.	Lifter Valves		
8.	Lifter Valves	8.	Bearings		
9.	Bearings	9.	Cranks oil seals		
10.	Cranks oil seals	10.	Engine packing kit		
11.	Engine packing kit	11.	Lube oil		
12.	Lube oil				

d. Items to be changed on condition basis in the Frame during POH

Sl. No	**Item**
1.	Bearings
2.	Pulley
3.	Worm gear
4.	Worm shaft
5.	Socket
6.	Gear box oil seals

e. Testing of STM after POH:

Rail Drilling Machine Shall be tested on test track for Drilling time and tolerances mentioned in para 305 of chapter 3.(Details of the track on which it is to be tested are given in Sl. No: 7 of table -1 in chapter 21).

308Troubleshooting:

Sl.No.	Problem	Probable Cause	Remedy
1.	Engine does not start	i) Engine starting switch is off. ii) Fuel in the Tank is not enough. iii) Fuel is not reaching the carburetor. iv) Improper spark during ignition. This may also happen when the engine has stopped	

Part-B

Battery Operated Rail Drilling Machine (BORDM)

311Use:

Battery Operated Rail Drilling Machine' is used fordrilling holes in all section of rails using core drill bit.

Battery Operated Rail Drilling Machine

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

312Description:

Themachine should comprise of anintegrated battery with drilling unit coupled together rigidlyto form a compactunit. This machine is mounted on the rail by using a clamping arrangement and is used to drill holes in different kinds of rails. This machine uses core drill bit for drilling operation.Important assemblies of BORDM machines are:

(1) **Rail Clamp**: The rail clamp shall be made of tough, durable and light weightmaterial having sufficient mechanical strength. The rivet/bolts used in theclamp shall be of high tensile category.

(2) **Power Source**: The Machine shall be powered by suitable battery with good records of service with sufficient power to drill holes in all types of rail.

313Functional Requirements:

(1) It should be able to drill straight (centrally to both axes) hole upto 38 mm dia. Inthe rail web of any type and section of rail from 60 R to 60 kg/m having UTS of70 to 90kg/mm2 with suitable clamp, as close as 46 mm from rail ends withtolerance for diameter & position of hole within + 0.5 mm.

(2) Machine should be supplied with mono rail cum nylon wheel to enable machine tocarry/transport on mono rail/plain surface or any other suitable arrangement for easy transportation.

314Technical Requirements:

Sl.No	Description	Requirements
1.	Weight of the complete unit including all attachments/ Battery for drilling holes (excluding transportation arrangement)	26 kg. max.
2.	Capacity of power source and drilling time	Sufficient to drill hole in 60kg90UTS rail section within 1 minute and 2 minutes for 1175HT rail.
3.	fixing time of rail clamp and theMachine	Fixing arrangement should be firmand easy and should not take morethan 2 minutes for fixing tocommence drilling operation
4.	No. of drillings with full charged battery	35 nos. with ϕ 28 mm or 32mm for 60 kg 90UTS rail section 20 for 1175HT rail.

315 Guide-lines for using, handling, transporting and storing of machines:

(1) Proper utilization of the machine:

Instructions contained in the manual supplied with the machine shall be followed for operation including operational safety measures, repair/ maintenance, overhauling, trouble-shooting etc. However following instructions shall be observed in general:

a. Install the hollow drill bit on the spindle before turning on the power supply.
b. Select the locating block matched with the type of rail to be drilled then install it onthe front plate and fasten.
c. Put the water tank at the same side of the machine and insert the water pipe into the waterinlet.
d. Lift the clamping arm to loosen the clamp and put the fixture on the rail. Press the adjustinglever until the fixture chuck the rail firmly (clip the two tips of clamp lower part to the railweb), while the fixture is open, the machine can be moved away from the track freely, makesure that the center of the rail hole to be drilled is in alignment with the drill center, (drillholes with locating ruler). Make sure that the front plate is perpendicular to the rail bottom,the positioning block is in close contact with the rail palate and the upper arc surface of therail bottom, and then press the clamping arm, the drilling operation can be carried out afterthe clamping unit is installed firmly.
e. Press down the water valve and push it forward to open. Then switch on the motor.If there is nothing wrong, drive the feeding handle to do the rail drilling

operation. Thecooling liquid will flow out automatically to cool the bit once the bit touches the rail.

f. While drilling, operate properly with feeding evenly to avoid feeding too much, and slowdown the feeding rate at the end of completing the hole drilling.

g. After drilling operation, drive the feeding handle to allow the drill bit return and switch offthe motor. Then push back the water valve to stop filling coolant and remove the water tank.Lift the clamping handle to loosen the fixture, and move the machine to the next drilling spot.

(2) Precautions in operation:

Following precautions shall be taken during operation of the drilling machine:

a. The operators have to be trained technically, qualified with work permit.

b. The operators have to read the manual and know the structure, features and applyingmethod of the machine as well as the safety operation notice.

c. Before working, check and make sure that the machine is in good working condition. Checkif the insulating condition is good enough. If anything wrong, deal with the problem at once.

d. Operate and maintain the machine according to the requirement mentioned in themanual, and follow the safety operation notice strictly.

e. While drilling, make feeding evenly. Towards the end of completing the hole drilling slowdown the feeding rate.

f. If the drill is blocked, return it and feed again slowly.

g. If the machine is out of order while working, move it away from the track clearance and dotrouble shooting. While adjusting, maintaining the machine or replacing any part, stop the motor.Maintain the machine according to the requirement to keep it in good working condition.Never employ the out of Order-machine in the rail drilling operation.

h. While operation, prohibit cleaning up the scrap iron with hand.

i. Don’t use the machine if raining.

j. Prohibit employing the power cable to haul the equipment.

(3) Handling:

The Battery Operated Rail Drilling Machine shall be handled carefully to avoid any physical damage. The machine shall not be moved on uneven surfaces to avoid falling. During drilling operation, it shall be evenly placed.

(4) Transportation:

The equipment is portable and can be carried by one man. It can be transported by a monorail trolley and by any road vehicle.

(5) Storage:

The Battery Operated Rail Drilling Machine shall be stored in a covered and dry place.

316 Maintenance :

(1) Recondition the worn out drill bit in time to keep the bit sharp.
(2) Keep the machine from drenching. Don't use it in wet situation or place with any flammable objectsnearby.
(3) Shut off power supply before replacing part or maintaining the machine.
(4) The battery should be charged with the charger in time to avoid battery failure.
(5) After operating, clean up the machine (keep the air duct of the drill clean and uncloggedwithout any scrap iron or other foreign matter). Oil the guiding rod regularly and lubricate the feedscrew periodically to keep the equipment always in good working condition.
(6) If don't use the equipment for a long time, store it in dry-ventilated room without corrosive air or fume.

317 Troubleshooting

Sl.No.	Problem	Probable Cause	Remedy
1.	The motor can't start	Battery under current	Replace battery or charge
2.	Dill bit broken while drilling clamped firmly	i) Applying force too much ii) Worn out drill bit iii) The fixture is not	i) Applying force evenly to avoid impact. ii) Replace bit. iii) Adjust the fixture and secure it.
3.	Hole size beyond expectation	i) Worn out drill bit ii) Poor chucking iii) Locating block worn out	i) Change new drill bit ii) Secure bit iii) Locating block

318 Requirement of manpower:

Two persons (one skilled & one unskilled).

319Requirement of Consumables

Battery (need based after expiry of life cycle period as mentioned by the manufacturer).

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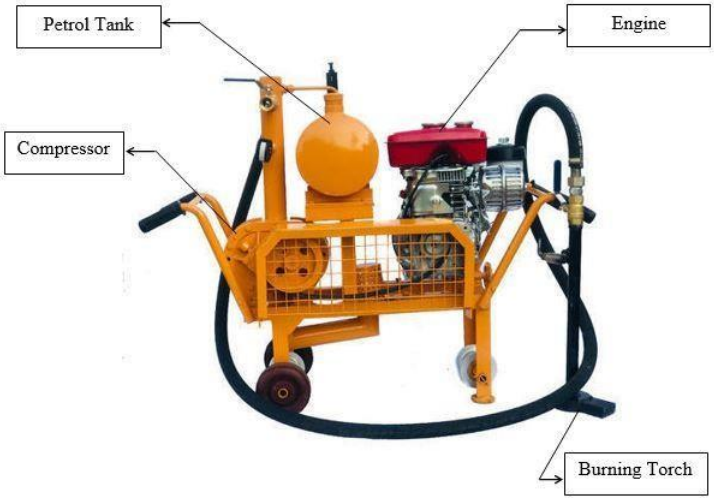
Chapter-4
Compressed Air Petrol Preheating Machine (CAP)

401Use:

Conventional preheating system that used a petrol tank and drum vaporizer need longer preheating time i.e.12 minutes for 60 kg and 10minutes for52 Kg rails which requires longer block periods and width of the heat affected zones is wider and the preheating process is also not uniform due to manual operation. To eliminate all these deficiencies fully mechanized compressed air petrol preheating machines which allow the preheating of the rails ends uniformly and reduces the preheating time.



Compressed Air Petrol Preheating Machine

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

402Description

The fully mechanized Compressed air petrol machine is able to preheat the rail ends uniformly and reduce the preheating time to 4.5 minutes for 60 Kg and 4 minutes for 52 kg rails and the width of the heat affected zone is also narrowed.

Important assemblies of CAP machines are:

(1) Engine: The prime mover generally is a strong single cylinder air cooled petrol start kerosene engine having fuel tank capacity of 3.3 litres of kerosene and 0.35 litresof petrol capable of developing 3 HP (HONDA GK-200) when running at 3600 rpm under NTP conditions.

(2) Petrol Tank:10litres capacity petrol tank made out of heavy gauge MS sheet fitted with safety release valve is provided which is sufficient for heating minimum 10 Joints.

(3) Compressor: Robust Heavy duty compressor (Roots Blower) with all safety features having air discharge capacity of 70m^3/Hr and maximum air pressure of 0.5 bar has been provide.

(4) Pressure gauge: Pressure gauge gives the pneumatic pressure and shall be of glycerine filled type for preventing fluctuation of needle.

403Functional Requirements

(1) It should be able to preheat the rail of any type and section of rail from 60 R to 60 kg/m having UTS of 70 to 90 kg/mm2.
(2) It should be able to produce a continuous pressure without interruption.
(3) Weight of the complete unit including all attachments like wheels and air compressor motor but without fuel should be within 80 kg.
(4) It should be able to generate preheating temperature for AT welding with in the stipulated time.
(5) It should be able to work with 60 kg and 52 kg portions.
(6) Fixing arrangement should be easy and firm and should not take more than 1minutes for fixing.
(7) Arrangement for knowing the pressure developed in the air compressor tank shall be made.

404Technical Requirements

Sl.No	Description	Requirements
1.	Preheating Time	4 to 5.5 minutes
2.	Temperature range	temperature in the range of 650°C-850°C
3.	Pressure to be developed	0.2-0.3 kg/cm^2
4.	Compressor Petrol tank capacity	10 Litres.
5.	Petrol tank capacity	Able to perform preheating of 10 joints on full tank capacity of fuel.
6.	Prime Mover capacity	Petrol start, kerosene/petrol run 3 HP engine at 3000 to 4000 rpm or Petrol driven engine of 3HP engine at 3000-4000 rpm

405Guide-lines for using, handling, transporting and storing of machines:

(1) Proper utilization of machine:

Instructions contained in the manual supplied with the machine shall be followed for operation including operational safety measures, repair/ maintenance, overhauling, trouble-shooting etc. However following instructions shall be observed in general:

a. Check engine oil level: To check oil level, take out level gauge, clean it with clean cloth, refit it and again take it out. On the level gauge see whether the oil mark matches with the level mark on the scale .If not, add engine oil and again check with level gauge. Repeat the procedure till it shows the correct level.
b. Gearbox oil: always ensure that the gear box is adequate with gear oil. Recoup whenever necessary. Check any oil is leaking from the oil seals of the shafts.
c. Fill petrol in the air compressor petrol tank.
d. Place the blow torch gently in the 3 piece mould and clamp it to the rail.
e. Make sure that any of the hosepipes are not in twisted condition.
f. Start engine on petrol and shift to kerosene for running in kerosene run engines.
g. Open the valve of the petrol tank gently.
h. Light the torch and adjust the pressure of the machine as per the required standards.
i. After completion of preheating, close the petrol tank valve and de-clamp the blowtorch from the rail.
j. For kerosene run engines, before switching off, turn the fuel knob from kerosene to petrol so that at the time of switching off, the engine is running on petrol.
k. After the preheating work is over, clean the machine with a clean dry cloth.
l. If the work is not to be continued, take out petrol, kerosene oil.

(2) Precautions in operation:

Following precautions shall be taken during operation of the drilling machine:

a. The operator shall be fully conversant about the operation of the machine and shall know the safety precautions mentioned in the operating and maintenance manual issued by the manufacturer/supplier.
b. Correct pressure shall be maintained every time while operating the STM.

(3) Handling:

The Compressed Air Petrol preheating machine shall be handled carefully to avoid any physical damage. The machine shall be kept vertical during shifting and shall not be moved on uneven surfaces to avoid falling. During preheating operation, it shall be evenly placed and at sufficient distance from the weld area.

(4) Transportation:

a. The machine is fitted with a mono-rail wheel arrangement and a handle of convenient height, to enable it to be pushed over one rail by one person to take it to the work site. Nylon wheels are also provided at the bottom to move it on cess/plain surfaces.

b. Powered material trolleys, dip lorry and inspection trolleys with detachable trailers can be used for transportation on track. The machine can also be carried by a road vehicle.

(5) Storage:

The Compressed Air petrol preheating machine shall be stored in a covered and dry place.

406 Maintenance Schedule:

1. The important component of the machine is tabulated below.

List of Spares required for the frame of CAP			
Sl.No	**Item**	**Unit**	**Quantity**
1.	Air compressor tank	Nos.	1
2.	Air compressor tower	Nos.	1
3.	Roots air compressor	Nos.	1
4.	Oil seals for air compressor	Nos.	1
5.	Air hose pipe	Nos.	1
6.	Petrol hose pipe	Nos.	1
7.	Blow torch	Nos.	1
8.	Pressure gauge	Nos.	1
9.	On/off switch for hose pipe	Nos.	2
10.	On/off switch for petrol pipe	Nos.	1
11	Engine Pulley	Nos.	1
12	Air compressor Motor pulley	Nos.	1
13	V belts	Nos.	2

NOTE: *for detailed description of spare parts of the engine, refer Annexure- I.*

2. The maintenance(Schedule I to IV)should be done as per schedule discussed in chapter-I. The maintenance activities to be performed in different schedule are given below.

Sl. No	**Items**	**Daily Maintenance (Schedule-I)**		**Quarterly Maintenance (Schedule-II)**		**Half yearly Maintenance (Schedule-III)**		**Yearly Maintenance (Schedule-IV)**	
		Check/ clean	**Change**	**Check / clean**	**Change**	**Check / clean**	**Change**	**Check / clean**	**Change**

1.	Air filter	✓					✓		✓
2.	Tension of								

	kit				
12.	Lube oil				

d. Items to be changed on condition basis

Sl.No.	Frame
1.	Bearings in air compressor motor
2.	Hose pipe Valves

e. Testing of STM after POH:

Compressed Air Petrol preheating machinesshall be tested for development of 650^0C -850^0Ctemperature.

407Trouble Shooting:

Sl.No.	Problem	Probable cause	Remedy
1.	Engine does not start	i) Engine starting switch is off. ii) Fuel in the tank is not enough. iii) Carbon deposition in spark plug iv) Improper spark during ignition. v) Fuel not reaching carburettor.	i) Put it in 'ON' position. ii) Fill the tank with fuel. iii) Clean the spark plug. iv) Check spark plug gap. It shall be 0.5 mm. Adjust gap. Change the spark plug if damaged. v) Check and repair fuel oil line.
2.	Blower not functioning	i) Petrol valve in closed condition ii) Hose pipe in twisted condition iii) Obstruction in Air line	i) Open the petrol valve ii) Make hose pipe in stretched position. iii) Obstruction to be cleared.
3.	Gear oil Leaking into roots air chamber and Pumping to the blow torch.	Oil seals of the Gear box might be Damaged.	Replace the oil seals or the chamber.
4.	Not able to achieve	i) Petrol valve is not working properly.	i) Check and replace the petrol valve.

	required temperature	ii) Hose pipe in twisted condition. iii) Obstruction in Air line.	ii) Make hose pipe in stretched position. iii) Obstruction to be cleared.

Note:

Engine: *Low RPM, Not able to develop sufficient pressure, White Smoke from the Engine muffler is an indication that POH of Engine is required.*

Frame: *Improper noise in the air compressor, seepage of gear oil to the air petrol tank is an indication that POH of frame is required.*

408Requirement of manpower:

Two persons- one skilled and one unskilled.

409Requirement of consumables:

(1) Kerosene/Petrol
(2) Blow torch

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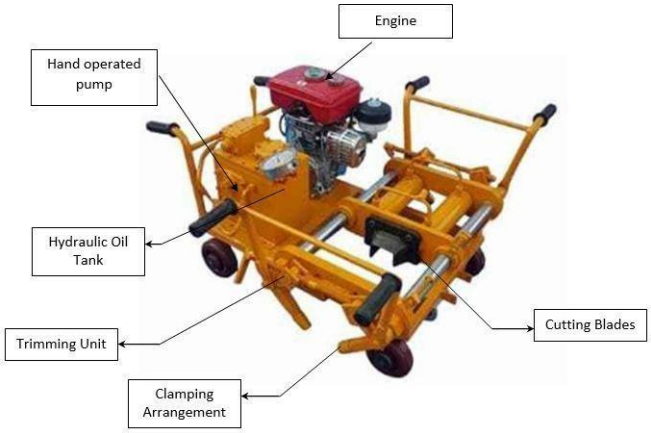
Chapter -5
Weld Trimmer (Power Pack Version) for AT Welding

501Use:

This machine is used for trimming extra weld metal from rail (top and sides) of AT welded rail joint after the welding operation.



Weld Trimmer (Power Pack Version) for AT Welding

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

502Description

The machine works with petrol/kerosene engine coupled with a hydraulic oil tank. The hydraulic pump in the hydraulic oil tank moves the actuators to provide necessary shearing force. This machine is mainly used for trimming of excess metal using after AT welding operation of joint rails.

Important assemblies of the Double action weld trimmer are given below

(1) Engine:

The prime mover is a strong cylinder air cooled petrol start kerosene run engine having fuel tank capacity of 3.7 litres capable of developing 3 HP (HONDA GK-200) when running at 3600 rpm under NTP conditions.

(2) Motorised Pump:

A small motorised pump is provided having the capacity of 600 bar fitted with directional control valves. A small powerful hand pump is also provided for emergency operations. The pump is immersed in the Hydraulic tank and coupled with the engine with the help of a coupler.

(3) Double action trimming Unit:

Two hydraulic cylinders capacity of 9 tons each are coupled together by mechanical means and trimming blades made out of special hardened steel to give better and long lasting performance are fitted. Handles are also provided for easy handling.

Trimming Blade

(4) Clamping Arrangement:
A fabricated clamping system is also provided on the trimming unit to automatically grip the rail in such a way to operate smoothly.

After welding the rail joint by Alumino-Thermit the extra weld metal over rail head (top & sides) used to be chipped off manually with the use of a chisel and hammer which was still in red hot condition. This manual operation had many disadvantages like hot metal flying, deformity in trimming and it requires long blocks. To eliminate these shortcomings and faster operation Double action Weld trimmer is used to trim the Welded joint within less time.

The equipment is characterised by two shear blades travelling towards each other by a hydraulic force provided by two double acting cylinders and four two way direction control valve connected with a hydraulic pump through hoses.

Hydraulic pump may be hand operated pump or motor driven with diesel/petrol engine commonly known as power pack.

503Functional Requirements

(1) The machine shall be capable of removing excess weld metal of Alumino-Thermit weld joint (commonly known as A.T.Weld) uniformly from top and sides of rail head without giving any jerk/shock to the weld while worked either by hand pump or motor driven hydraulic pump fitted with diesel/petrol engine.
(2) The machine shall be robust and rugged in construction and design to withstand the various operating and handling forces.
(3) The construction of the machine shall be such that parts can be easily and quickly replaced in case of break down while carrying out work at site.
(4) The design and construction of machine shall be such that the operator is able to watch the trimming process continuously.
(5) It shall be easy to use, operate and maintain.
(6) It shall be portable in nature.
(7) The machine shall be as light weight as possible.

(8) The operation and transportation of machine shall be capable by maximum 2 persons in an efficient manner.

(9) The machine shall be capable of performing on different rail sections by changing the shear blades and fitting appropriate shear blades without any modification /addition/alteration to the machine. Each machine shall be fitted with one set of shear blades of desired rail section (to be specified by the purchaser).

(10) Clamping force, shearing force and shear blades shall be centred on the rail head giving/ensuring in line push.

(11) Four way direction control valve shall be capable of reversing the direction of the movement of shear blades through the power provided by hydraulic pump.

(12) The hydraulic stroke and internal clearances of weld trimmer shall be such that sand mould can be accommodated inside unless agreed otherwise between manufacturer/supplier and Railway Board/RDSO/purchaser.

(13) Motorised hydraulic pump shall have an in-built manually operated hand pump/ device for retrieving the shear blades in case of failure of power pack.

(14) All exposed surface shall be painted with yellow paint of standard quality to protect it from rusting and other weathering effects.

504Technical Requirements:

Sl.No	**Description**	**Requirement**
1.	Prime mover	Petrol start kerosene/petrol run engine of minimum rating 3 HP
2.	Hydraulic stroke	120-150 mm
3.	Minimum shearing force	18 tonnes
4.	Totalweight (motor driven) (manual driven)	 175 Kg(Max.) 100 Kg (Max.)
5.	Life of shear blade	Trimming of minimum 100 joints
6.	The machine is also provided with emergency hand pump device which can be used in case of failure of power pack for retrieving the trimming unit.	
7.	Tolerance before grinding (with respect to standard dimensions of rail section)Top of rail head Side width of rail head	 + 0.5 mm to + 1.5 mm + 1.00 mm to + 2.0 mm
8.	Time:- Trimmer with hand operated pump: For 52kg 72 UTS & 52kg 90 UTS: For 60kg 72 UTS & 60kg 90 UTS: For 1175HT rails With motor driven pump:	 2 min 3 min 4 min All sections – 1 min

505Guidelines for using, handling, transportation and storage of machine:

(1) ProperUtilisation of Machines:

Following steps shall be observed:

a. Pre-start check –

i) Check engine oil and hydraulic oil level. Top up if necessary.
ii) Check for loose bolts, nuts, screws etc. Tighten if necessary.
iii) Visually check all pipes/hoses for damage. Replace if damaged.
iv) Ensure correct hydraulic oil grade as recommended by the supplier.
v) Check fuel and fill up if necessary.
vi) Connect the hose pipe to the power pack.
vii) Start the engine. Run at rated speed. Check for leakage at joints.
viii) Check and clean the cutting head of the shear blade after each cut.

b. Operation :

i) Operate Direction Control valve in forward direction till the rams of the trimming unit are fully extended.
ii) Ensure that the gap between cutting heads is 0.5 to 1.0 mm in fully extended position.
iii) Retract the cutting heads by changing the oil flow.
iv) Place the machine on the rail, with the welding mould in between the two cutting heads. Waiting period is generally 3 to 4 minutes for 25 mm gap and 8 to 12 minutes for 75 mm gap after pouring hot metal. Operate the direction control valve to move cutting heads to inward direction for trimming excess metal. With reversal of direction control valve, cutting heads move outward. Trimming time is approximately half a minute to one minute for different rail sections.

(2) Precautions in operation:

Following instructions shall be followed:

a. DO's

i) Clean the cutting tool edge of shear blades after every cut.
ii) Always ensure that the gap between two cutting heads is 0.5 to 1.0 mm when fully extended.
iii) While changing the cutting heads, remove the cutting heads when the ram is fully contracted.
iv) Leave all rams retracted when the weld trimmer is not in use.

b. DON'Ts

i) Never open any hydraulic parts except during troubleshooting.
ii) Never use the machine on cold welds.
iii) Never operate a power pack unless the hose connection with the machine is fixed properly.
iv) Never run the engine beyond rated speed.
v) Do not operate the control valve during withdrawal from the weld joint until the cutting heads are closed.

(3) Handling :

The weld trimmer shall be handled carefully to avoid any physical damage. While not in use, the cylinder's pistons shall be kept in retracted position.

(4) Transportation:

The machine has been provided with a mono-rail double flange wheel arrangement at the bottom with a handle to enable it to be pushed over the single rail to take it to the work site. Nylon wheels are also attached at either end of double flanged wheels to enable the machine to be moved on cess/plain surface. The machine can also be handled/transported with help of a lightweight monorail trolley by keeping the two units i.e., trimmer and power pack separately.

(5) Storage:

The machine shall be kept at a dry and covered place.

506Maintenance Schedule:

(1) The important component of the machine is tabulated below.

List of Spare parts used in frame of WT machine			
Sl.No	**Description of Spare Parts**	**Unit**	**Quantity**
1.	Main Frame for Power pack and hydraulic Pump reservoir.	No	01
2.	Frame for cutting the welding	No	01
3.	Rail holding Legs	No	04
4.	Threading rods	No	02
5.	Rollers for Rail holding legs	No	04
6.	Shearing Blades	No	02
7.	Thread rod handles	No	02
8.	Hydraulic Cylinders	Set	02
9.	Hydraulic Pipes $3/8^{th}$ inch 10000 psi	Set	01
10.	$3/8^{th}$ male T joint	Set	01
11.	Polyhedral plunger pump	No	01
12.	Direction Control Valve	No	01
13.	Gear Coupling	No	01
14.	Pressure gauge	No	01

NOTE: *for detailed description of spare parts of the engine, referAppendix-I.*

For detailed description of spare parts of the hydraulics, referAppendix-II

(2) The maintenance (Schedule-I and IV)should be done as per schedule discussed in chapter-I. The maintenance activities to be performed in different schedule is given below:

Sl. No.	Items	Daily Maintenance (Schedule-I)		Quarterly Maintenance (Schedule-II)		Half yearly Maintenance (Schedule-III)		Yearly Maintenance (Schedule-IV)	
		Check/ Clean	Change	Check/ Clean	Change	Check/ Clean	Change	Check/ Clean	Change
1.	Air filter	✓					✓		✓
2.	Re-coil Starter spring and starter chord	✓							
3.	Condition of the Shear Blades	✓					✓*(#)*		✓*(#)*
4.	Air filter sponge/ paper	✓		✓			✓*(2)*		✓*(2)*
5.	All nuts and bolts	✓							
6.	Tension of governor spring and throttle spring	✓							✓*(*)*
7.	Spark plug			✓		✓			✓
8.	Cooling fans on the flywheel					✓		✓	
9.	Fuel tank filters	✓				✓			✓
10.	Engine Oil	✓	✓*(1)*				✓		✓

11.	Carburetor			✓		✓		✓	✓*(*)*
12.	Piston					✓		✓	
13.	Head of the chamber					✓		✓	
14.	Valves					✓		✓*(3)*	✓*(*)*
15.	Gear Coupling	✓							✓*(*)*
16.	Hydraulic Pipes	✓							✓*(*)*
17.	Leg Rollers	✓							✓*(*)*
18.	Oil Seals								✓*(*)*
19.	Condition of frame handles.	✓							
20.	Frame Legs	✓							
21.	Hydraulic Oil in the reservoir	✓					✓		✓
22.	Hydraulic Pump							✓	

Note: *(*) check and change the items only if necessary.*

(#) refer welding manual for changing the shear blades.

1. *Change engine oil after first20 hrs of engine working, in case of both new engine and overhauled engine.*
2. *Inspection/Maintenance to be carried out more frequently in dusty conditions.*
3. *Adjust the spacing in the valves to manufacturer's standards, preferably toInlet: 0.15 ± 0.02 mm Outlet: 0.20 ± 0.02 mm.*

(3) POH of engine& Frame(Schedule-V):

a. POH Frequency:

POH of the WT is done for every **2 years or 500 joints**whichever is earlier.

*(**Note:** In WT re-boring & barrel assembly replacement methods of overhauling are on condition basis and are not mandatory to follow the below methods for every POH.)*

b. Methods of POH of engine& Frame

Sl. No.	Type of overhauling	Procedure& Benefits
1.	POH with Re-boring method	This method is used to overcome the problem of oversize dia developed, by adjusting the bore of the machine to the standard dia designed as per manufacturer's standards. This re-boring work is highly dependent on the condition of the engine chamber and skill of the technicians (who does the re-boring work). *POH can be done only **twice** in such cases.*
2.	POH with Replacement with new barrel assembly	This method is used to overcome the problem of oversize dia developed by restoring the bore of the machine to the standard dia by replacing with a new barrel assembly as per manufacturer's standards. Replacing with new barrel assembly (Chamber) results in developing the characteristics of a new engine and does not require any skill of technicians as in re-boring work. An engine can be normally overhauled **3-4 times** by this method.
3.	POH with Engine replacement	When an engine is found damaged or not feasible/ economical to be overhauled by any one of the above two methods, it is recommended to replace the old engine with new one.
4.	POH of Frame	POH of the Trimming frame is to be done on Condition basis. Usage of frame can be continued subjecting to following good maintenance practices.

c. Must change items during POH of engines

Must change item of Engine POH method by	**Must change item in**

				POHof Frame	
Sl.No.	**Barrel Assembly**	**Sl.No.**	**Re-Bore work**	**Sl.No.**	**Items**
1.	Barrel assembly	1.	Piston	1.	Oil Seals
2.	Piston	2.	Piston Ring	2.	Hydraulic Oil
3.	Piston Ring	3.	Connecting Rod	3.	O-rings
4.	Connecting Rod	4.	Valves		
5.	Valves	5.	Piston locks		
6.	Piston locks	6.	Connecting Pins		
7.	Connecting Pins	7.	Lifter Valves		
8.	Lifter Valves	8.	Bearings		
9.	Bearings	9.	Cranks oil seals		
10.	Cranks oil seals	10.	Engine packing kit		
11.	Engine packing kit	11.	Lube oil		
12.	Lube oil				

d. Items to be changed based on Condition Basis

Sl. No.	Item
1.	Hydraulic hose pipes
2.	Hydraulic pump
3.	Hydraulic connectors

e. Testing of STMs after POH: Weld Trimmer shall be tested on test track by checking the pressure between shear blades developed during trimming operation as per para 504 of chapter 5. (Details of the track on which it is to be tested are given in Sl. No: 7 of table -1 in chapter 21)

507Troubleshooting

(1) for Power Pack

Sl.No.	Trouble	Probable causes	Remedy
1.	Pump delivering insufficient or no oil	i) Clogged strainer or suction pipe line. ii) Air leak in suction line iii) Low level of oil in the reservoir. iv) Oil viscosity is too high or too low.	i) Clean strainer or suction pipe line. Remove foreign matter. ii) Check for leaks and repair. iii) Add oil and check the level in the reservoir. iv) Use oil as per recommendation.

2.	Pump making unstable or no pressure	i) Pump not delivering oil for any of the above reasons. ii) Relief valve not working properly.	i) Apply the above remedies. ii) Consult the manufacturer.
3.	Pump making noise.	i) Partially clogged suction line or suction strainer. ii) Air leak at pump's suction piping joints or from shaft packing of pump. iii) Air in pump. iv) Pump bolts loose. v) Resonance noise in the system vi) Air bubbles or too much foam in suction oil. vii) Too high viscosity of oil.	i) Clean and remove foreign matter. ii) Pour oil on suspected joints while listening for change in sound. If sound stops, tighten the joints. iii) Eliminate all air through the air breather. iv) Tighten the bolts. v) Consult the manufacturer. vi) Check and ensure that return lines are below oil level and well separated from suction line inside the tank. vii) Use recommended oil
4.	Internal leakage around pump	i) Shaft seal worn. ii) The top cover seal was damaged.	i) Consult manufacturer ii) Consult manufacturer
5.	Breakage of parts for pumps.	i) Solid matter being wedged in the pump. ii) Excessive tightness of head screw.	i) Replace pump ii) Replace pump
6.	Insufficient pressure in system	i) Leakage of oil within circuit. ii) Oil leakage in pump due to defective seals.	i) Detect and rectify. ii) Replace seals.
7.	Excessive heating of oil in system	i) Clogged lines ii) Large pump deliveries not unloaded properly	i) If lines are clogged, replace. ii) If partially clogged for any reason, remove obstruction.

8.	Power pack not functioning.	i) Due to engine failure of engine or any other part failure.	i) Operate a hand pump to retrieve the trimming heads. Remove the trimmer. For further operation, rectify the defective part. Consult the manufacturer.

(2) For Weld Trimmer Frame:

Sl.No.	Problem	Probable Cause	Remedy
1.	Slow movement of ram	i) Hydraulic oil leakage around piston	i) Check and overhaul cylinder, replace defective parts
		ii) Less delivery pump	ii) Check pump.
		iii) Direction control valve not shifting fully.	iii) Check direction control valve.
2.	Insufficient trimming force	i) Hydraulic oil leakage around piston	i) Check and overhaul cylinder, replace defective parts
		ii) Pump not delivering hydraulic oil	ii) Check the pump and arrange necessary repairs.
		iii) Defective direction valve	iii) Replace direction valve

Note:

Engine (Power pack):*Low RPM, Not able to take Load, Not able to develop enough cutting Force, Not able to cut the weld, White Smoke from the Engine muffler in an indication that POH is required for Engine.*

Weld Trimmer Frame:*Oil leaking from the cylinder, not able to cut the weld, bent frame is an indication that POH is required for the frame.*

508Requirement of manpower :

2person required (One skilled and one unskilled).

509Requirement of Consumables:

(1) Petrol
(2) Kerosene
(3) Shear blades

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Chapter-6
Rail Profile Weld Grinder (RPWG)

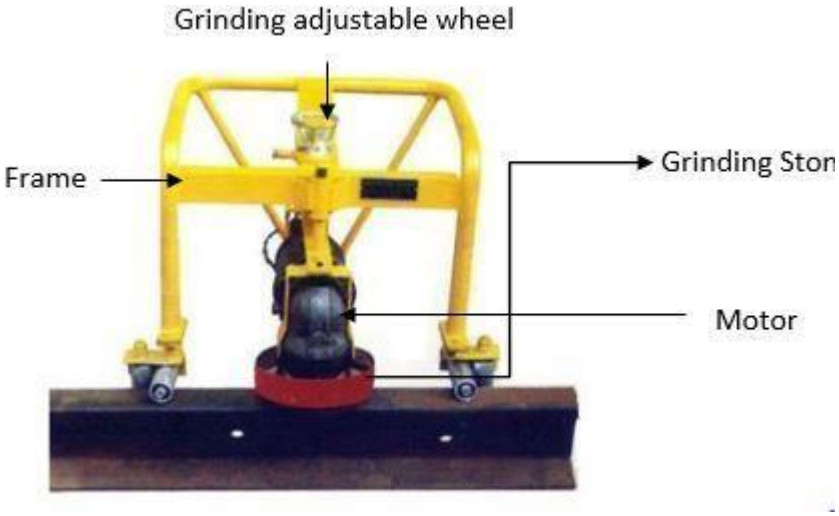
601Use:

The Rail Profile Weld Grinder is used for grinding of A.T. welded joints after weld trimming operation is complete.

602Description:

The Rail Profile Weld Grinder consists of a grinding unit coupled with an engine/electric motor and fitted to a lightweight frame. This machine is used for grinding off the leftover metal from rail joints after A.T. welding to provide the correct profile on the top and both sides of the rail head. For convenience, the term "Rail Profile Weld Grinder" will be referred to as 'grinding machine'. The grinding unit can be removed up or down by a feed screw fitted to the frame. The frame is having two sets of rollers right angle to each other attached at its both legs for to and fro movement of the grinder during grinding operation.

The Rail Profile WeldGrinder requires an external power supply either Electric power supply of 220 volts AC or Portable A.C. Generator with capacity of 2.8/3.0 kVA. In extreme exigencies the auxiliary A. C. power supply of Portable D.C. Welding generator can also be utilized.



Rail Profile Weld Grinder

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below)

Important Assemblies of Profile Grinding machine:

(1) Frame: The frame of the grinding machine shall be made of lightweight, strong tubular/suitable section of ferrous/non-ferrous alloy/suitable material having sufficient mechanical strength.

(2) Sliding Roller: The sliding rollers shall be made of strong, durable material like mild steel/alloy steel/nonferrous alloy or other suitable material to meet the required mechanical strength and workability

(3) Safety Guard: The grinding wheel safety guard shall be made of hard drawn steel /other suitable material to withstand the impact of iron sparks during grinding operation. The dimensions of the safety guard may be referred from IS: 1991 (Part 4).

(4) Grinding Stone: The grinding stone shall be of cup shape and made of Aluminium oxide grain/equivalent material of resinite bond which is normally available in market.

(5) Grinding Machine: It has a motor electrically driven which supplies the motion power to the grinding wheel.

603Functional Requirements:

(1) The grinding machine shall be compatible and portable with power source such as petrol or diesel engine generator, power supply etc.

(2) The machine shall use cup shape grinding stone of Aluminium oxide grain made out of resinite bond. Grain size 14/16 grinding hardness zero (NIW). The grinding stone shall be of a type which normally available in market. Dia, thickness and complete nomenclature of grinding stone to be specified by the manufacturer/supplier of the machine.

(3) The machine shall be capable of grinding head and both sides in about 15 minutes for 60 to 90 UTS rails to the following tolerances when used with grinding stone.

a. 0.5 mm on top of the rail head, gauge and non-gauge faces with 1 meter straight edge.
b. 0.2 mm on top of the rail head with 10 cm straight edge and
c. 0.3 mm on gauge and non-gauge faces of rail head with 10 cm straight edge.

604Technical Requirements:

Sl.No	Description	Requirement
1.	Power pack	Generator or A.C. supply
2.	Weight including power pack	80 Kg (Maximum),
3.	Grinding tolerance	i) 0.5 mm on top of rail head, gauge and non-gauge faces with 1 metre straight edge ii) 0.2 mm on top of rail head with 10 cm straight edge iii) 0.3 mm on gauge and non-gauge faces of rail head with 10 cm straight edge,
4.	Capacity and make	Greater than 2200 watts & sturdy motor body for rugged use.
5.	Life of grinding stone	50 joints.
6.	Grinding time	15 minutes (max.) for 60 to 90 UTS 20 minutes (max.) for 1175HT rail.
7.	The machine shall be electrically insulated as per IS: 1271-1985 (Re-affirmed-2001).	

605Guidelines for using, handling, transportation and storage of machines:

(1) Proper utilisation of machine:

Following procedure shall be observed:

- **a.** Check the level of the engine oil and refill if required. For AC power, check and ensure correct electrical connections.
- **b.** Check fuel level in the fuel tank. Top up if necessary.
- **c.** Check the grinding wheel. It should be tightly fixed on the shaft.
- **d.** The condition of the insulated covering shall be checked by the user before every use.
- **e.** Ensure firm footing of trolley on level ground.
- **f.** Start the engine/motor. The grinding wheel automatically starts rotating. The machine can be moved to and fro over the welded joint by means of two rollers attached to the machine.
- **g.** For grinding, the feed screw shall be slowly rotated clockwise.
- **h.** After the grinding is complete, turn the handle of the feed screw anticlockwise till the grinding wheel has moved up from the rail.
- **i.** Stop the engine/motor and remove the machine from the top of the rail.

(2) Precautions in operation:

- **a.** Do not apply extra pressure on the grinding wheel.
- **b.** Use safety goggles while grinding.
- **c.** Stop the engine fuel supply/switch off the electric motor immediately after the grinding is completed.

d. Any part of the motor shall not be touched while the grinder is in operation.

(3) Handling :

The rail profile weld grinding machine shall be handled carefully to avoid any physical damage. The electric motor shall be kept off rains/water splashes.

(4) Transporting:

The rail profile weld grinder can be transported on material trolley/road vehicles.

(5) Storage:

The machine shall be stored at a covered and dry place.

606Maintenance Schedule:

(1) The important component of the machine is tabulated below.

List of Spare parts used in frame of RPWG Machine			
Sl. No	**Description of Spare Parts**	**Unit**	**Quantity**
1.	Main Frame	No	01
2.	Rollers	No	04
3.	Bearings 6302	No	08
4.	Adjustable Spring	No	01

(2) The maintenance(Schedule I to IV)should be done as per schedule discussed in chapter-1. The maintenance activities to be performed in different schedule is given below:

Sl. No	**Items**	**Daily Maintenance (Schedule-I)**		**Quarterly Maintenance (Schedule-II)**		**Half yearly Maintenance (Schedule-III)**		**Yearly Maintenance (Schedule-IV)**	
		Check/ clean	**Change**	**Check/ clean**	**Change**	**Check/ clean**	**Change**	**Check/ clean**	**Change**
1.	Bearings					✓		✓	✓
2.	Carbon Brushes	✓							✓
3.	Grease	✓					✓		✓
4.	Bevel gear assembly					✓*		✓*	

NOTE: ** check and change the items only if necessary.*

(3) POH of motor & Frame(Schedule V):

a. POH Frequency:

POH of the RPWG is done for every **500joints or 2 years** whichever is earlier.

b. Must change items during the POH of motor:

Sl.No.	Must change items during POH
1.	Carbon brushes
2.	Brush Holder Plates
3.	Brush Holders
4.	Grease
5.	Bearings 6203, 6205, 3204.

c. Items to be changed on condition basis

For Motor		For Frame	
Sl.No.	Items	Sl.No.	Items
1.	Armature	1.	Rollers
2.	Field Coil	2.	Bearings
3.	Motor frame	3.	Bearing shafts

d. Testing of STM after POH:

Rail Profile Weld Grinder Shall be tested on test track for rpmand sufficient grinding using AC power supply and A.C generator. (Details of the test track are given in Sl. No: 7 of table -1 in chapter 21).

607Troubleshooting :

Sl.No	Problem	Probable Cause	Remedy
1.	Machine did not Start	i) Armature insulation worn out or chipped off. ii) Damaged field coil. iii) Improper current/voltage from the power supply. iv) Carbonbrushes are not aligned with the commutator.	i) Change the armature. ii) Change the Field coil. iii) check the output voltage/ current from the power supply. iv) Arrange the carbon brushes correctly aligned with the commutator.
2.	Overheating of the machine	i) No grease in the chamber.	i) Replace the grease in the chamber.

		ii) Bearings might be damaged.	ii) Change the bearings.
3.	Excessive spark from the armature	i) Carbon brushes are not aligned with the commutator. ii) Brush holder springs are over tensioned.	i) Align the carbon brushes with the commutator. ii) Adjust the brush holder springs accordingly.
4.	Squeaking noise , play in the armature, excessive spark	i) Damaged bearings.	i) Replace the bearings.
5.	Worn out Bevel Gear Assembly	i) No grease in the chamber. ii) Alignment of the Gear wheel is not proper due to damaged bearing.	i) Provide grease in the chamber. ii) Change the bearing of the gear wheel.

Note:

Motor: *Smoke from motor, excessive spark from motor, improper working of the motor is an indication that POH of the motor is required.*

Frame: *No movement in the rollers, damage to the frame is an indication that POH of the frame is required.*

608 Requirement of manpower:

2personrequired (1 skilled + 1 unskilled).

609 Requirement ofConsumables:

Grinding stone (as per machine manufacturer's recommendation).

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Chapter –7
Generator

701General :

Generator is a machine bywhich mechanical energy is converted into electrical energy for use in external electrical power. They produce electricity based on the principle of electromagnetic induction. A Generator generally consists of an engine coupled with a dynamo/alternator, and is controlled with a control panel. The engine provides the mechanical energy to rotate the dynamo/alternator, this rotation of the dynamo/alternator develops variable magnetic field and induces emf(electro motive force) in the conductor. This induced emf is transferred to control panel with the help of conductors, capacitors and rectifiers.

Types of Generators

(1) PortableA. C. Generator

(2) PortableD.C. welding Generator

Technical Features required for a Generator used in Indian Railways

PortableA.C. Generator	Portable D.C. welding Generator
Portable A.C. generator of 2.8 kVA rated Petrol run.	Portable D.C. welding Generator (current usage 40-225 Amp petrol run) with Auxiliary A.C. Output (single Phase 4 kVA, 3-Phase 5 kVA)

Part-A
Portable A.C.Generator

702 Use:

Portable A.C.generators are used as power pack for rail profile grinding machine and for lighting purposes during night for working of track machines and accident restoration sites

Portable A.C. Generator

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

703 **Description:**AC generator works on the principle of Faraday's Law of Electromagnetic Induction (these are commonly referred to as alternators). The movement of a conductor in a uniform magnetic field changes the magnetic flux linked with the coil, thus inducing an emf. The parts of the AC generator consist of a rotor, stator, slip rings, brushes as its main components.

(1) Prime Mover:

The prime mover is the component that is used to drive the AC generator. The prime mover may be any type of rotating machine, such as a petrol engine.

(2) Rotor:

The rotor of an AC generator is the rotating component of the generator. The rotor is driven by the generator's prime mover, which may be a petrol/kerosene/diesel engine. Depending on the type of generator, this component may be the armature or the field. The rotor will be the armature if the voltage output is generated there; the rotor will be the field if the field excitation is applied there.

(3) Stator

The stator of an AC generator is the part that is stationary. Like the rotor, this component may be the armature or the field, depending on the type of generator. The stator will be the armature if the voltage output is generated there, the stator will be the field if the field excitation is applied there.

(4) Slip Rings

Slip rings are electrical connections that are used to transfer power to and from the rotor of an AC generator. The slip ring consists of a circular conducting material that is connected to the rotor windings and insulated from the shaft. Brushes ride on the slip ring as the rotor rotates. The electrical connection to the rotor is made by connections to the brushes.

704 **Functional requirements:**

(1) The generator shall be able to develop enough power to operate the Rail profile Grinder.

(2) It shall be able to be transported to the worksite with less man power.

(3) Provision for AC power supply shall be included with an overload protection switch.

(4) It shall be able to work in all weather conditions without interruption.

(5) Shall be able to work in all weather conditions.

705 **Technical requirements**

Sl.No	Description	Requirements
1.	Max Output (VA)	3000
2.	Rated output(VA) 230/50Hz	2800

3.	Fuel type	Petrol
4.	Fuel tank capacity	12lit
5.	Continuous operating hours @rated output	6 hrs
6.	Starting system	Manual and self-start.
7.	Dry weight	Max 65 kg
8.	Dimensions(LxWxH) mm	750x500x600

706 Guidelines for using, handling, transportation:

(1) Proper Utilization of the machine:

a. The generator shall be kept on dry and level ground.
b. The condition of the insulated covering shall be checked by the user before every use and by all inspecting officials.
c. Start the generator set.
d. To utilise auxiliary output (AC supply), connect the plug sockets (auxiliary output) in the generator with a device requiring AC supply at site such as grinder, cutting machine, lights etc.
e. After completion of work, the engine shall be stopped and the electrical cable connections from the generator set to other devices like grinder etc. shall be disconnected.

(2) Precautions in operation:

Following precautions shall be followed during operation of the generator:

a. The operator shall be conversant with the operation, maintenance and trouble-shooting of the machine. He shall also be aware of his personal safety.
b. The generator shall not be exposed to rains for which rain guard/ cover shall be used.
c. It shall be made sure that the insulation of the power cable is proper.
d. The operator shall wear gloves, apron and shoes during work.
e. Any part of the generator shall not be touched when the generator is ON.

(3) Handling and transportation:

The A.C generator shall be handled carefully to avoid damage. Care shall be taken to protect the control panel and output sockets from external damage during shifting.

(4) Transportation:

The machine has four nylon wheels fitted at the bottom frame. On cess / ground the machine can be pulled to the work site on its nylon wheels. For transportation on mono rail, two double flanged wheels are also provided. The machine can also be transported by a road vehicle or a rail vehicle.

707 Maintenance Schedule :

(1) The important component of the machine is tabulated below.

List of Spare parts used in alternator of the AC generator			
S. No.	**Description of Spare Parts**	**Unit**	**Quantity**
1.	Rotor	No	01
2.	Stator	No	01
3.	Capacitor	No	01
4.	diodes	No	01
5.	Control panel	set	01
6.	Output socket	No	01

NOTE: *for detailed description of spare parts of the engine, refer Appendix I.*

(2) The maintenance (Schedule I to IV) should be done as per schedule discussed in chapter-I. The maintenance activities to be performed in different schedule are given below:

Sl. No	**Items**	**Daily Maintenance (Schedule-I)**		**Quarterly Maintenance (Schedule-II)**		**Half yearly Maintenance (Schedule-III)**		**Yearly Maintenance (Schedule-IV)**	
		Check/ clean	**Change**	**Check/ clean**	**Change**	**Check/ clean**	**Change**	**Check/ clean**	**Change**
1.	Air filter						✓		✓
2.	Re-coil Starter spring and starter chord					✓			
3.	All nuts and bolts	✓							
4.	Air filterpaper			✓(2)			✓(2)		✓(2)
5.	Tension of governor spring and throttle spring								✓(*)
6.	Spark plug			✓		✓			✓

7.	Cooling fans on the flywheel							✓	
8.	Fuel tank filters								✓
9.	Engine Oil	✓	✓(1)		✓		✓		✓
10.	Valves					✓			✓(3)
11.	Carburettor			✓		✓		✓	✓(*)
12.	Piston					✓		✓	
13.	Head of the chamber					✓		✓	

Note: *(*) check and change the items only if necessary.*

(1) Change engine oil after first20 hrs of engine working, in case of both new engine and overhauled engine.

(2) Inspection/Maintenance to be carried out more frequently in dusty conditions.

(3) *Adjust the spacing in the valves to manufacturers standards, preferably to*Inlet: 0.15 ± 0.02 mm Outlet: 0.20 ± 0.02 mm

(3) POH of engines &Alternator(Schedule- V):

a. **POH Frequency:**

POH of the A.C generator is done for every **2 years**or**500 welding joints**whichever is earlier**.**

*(**Note:** In A.C generator, re-boring & barrel assembly replacement methods of overhauling are on condition basis and are not mandatory to follow the below methods for every POH.)*

b. **Methods of POH of engines & Alternator:**

Sl. No.	Type of overhauling	Procedure& Benefits
1.	POH of Engine by Re-boring method	This method is used to overcome the problem of oversize dia developed, by adjusting the bore of the machine to the standard dia designed as per manufacturer's standards. This re-boring work is highly dependent on the condition of the engine chamber and skill of the technicians (who does the re-boring work). This puts us in a situation in which we are not 100% confident on the desired outcome from the overhauled machine. As re-boring work is uneconomical & not reliable, it is highly recommended not to adopt overhauling using re-boring work. *However POH can be done only **once** in such cases.*

2.	POH of Engine by Replacement with new barrel assembly	This method is used to overcome the problem of oversize dia developed by restoring the bore of the machine to the standard dia by replacing with a new barrel assembly as per manufacturer's standards. Replacing with new barrel assembly (Chamber) results in developing the characteristics of a new engine and does not require any skill of technicians as in re-boring work. As this method of overhauling is highly reliable and economical, it is recommended to prefer this method of overhauling. An engine can be normally overhauled **3-4 times** by this method.
3.	POH of Alternator	POH of the alternator is done on condition basis.

c. **Must change items during POH of engine & Alternator**

Must change item of Engine POH method by				**Must change items during POH of alternator**	
Sl.No.	**Barrel assembly**	**Sl.No.**	**Re-Bore work**	**Sl.No.**	**Items**
1.	Barrel assembly	1.	Piston	1.	Capacitor
2.	Piston	2.	Piston Ring		
3.	Piston Ring	3.	Connecting Rod		
4.	Connecting Rod	4.	Valves		
5.	Valves	5.	Piston locks		
6.	Piston locks	6.	Connecting Pins		
7.	Connecting Pins	7.	Lifter Valves		
8.	Lifter Valves	8.	Bearings		
9.	Bearings	9.	Cranks oil seals		
10.	Cranks oil seals	10.	Stem oil seals		
11.	Stem oil seals	11.	Lube oil		
12.	Lube oil				

d. **Items to be changed on Condition basis during POH of Alternator:**

Sl.No.	**Items**
1.	Rotor
2.	Stator
3.	Diodes
4.	Control Panel

e. **Testing of STM after POH:**

A.C. Generator shall be tested by running a RPWG with grinding load for 15 minutes continuously. On test track (add timing).(Details of the test track are given in Sl. No: 7 of table -1 in chapter 21)

708 Troubleshooting:

S.N.	Problem	Probable – cause	Remedy
1.	Engine does not start	i) Engine starting switch is off. ii) Fuel in the tank is not enough. iii) Carbon deposition in spark plug. iv) Improper spark during ignition. v) Fuel not reaching the carburettor.	i) Put it in 'ON' position. ii) Fill the tank with fuel. iii) Clean the spark plug. iv) Check spark plug gap. It shall be 0.5 mm. Adjust the gap. Change the spark plug if damaged. v) Check and repair fuel oil lines.
2.	No power output	i) Short circuit in wiring ii) Defective capacitor iii) Defective Stator	i) Check the wiring inside the set for a short circuit between cables or to ground. ii) If the wiring is OK, short circuit the condenser to be sure that it is discharged. Disconnect all wires from condenser and using an ammeter check that the condenser is not short circuited. iii) If the condenser box is OK disconnect all leads from the stator except for those going to the condenser box and check the output from the alternator. If there is no output from the stator winding, replace the stator.

709 Requirement of manpower

2person required(one skilled + 1 unskilled)

710 Requirement of Consumables

Petrol/ Kerosene

Part-B
Portable D.C welding Generator

711 Use:

Portable D.C. Welding Generator is used for reconditioning of CMS crossings & Tongue rails and any fillet welding using direct current (DC). In extreme exigencies, also suitable for running of Rail Profile Grinder & Lighting arrangements using auxiliary A.C. output.

Portable D.C. welding Generator

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

712 Description:

The following are the important assemblies of the DC generator.

(1) Yoke: The outer frame of a dc machine is called as yoke. It is made up of cast iron or steel. It not only provides mechanical strength to the whole assembly but also carries the magnetic flux produced by the field winding.

(2) Poles and pole shoes: Poles are joined to the yoke with the help of bolts or welding. They carry field winding and pole shoes are fastened to them. Pole shoes serve two purposes;

a. They support field coils

b. Spread out the flux in air gaps uniformly.

(3) Field winding: They are usually made of copper. Field coils are formerly wound and placed on each pole and are connected in series. They are wound in such a way that, when energised they form alternate North and South poles.

(4) Armature core: Armature core is the rotor of a dc machine. It is cylindrical in shape with slots to carry armature winding. The armature is built up of thin laminated circular steel disks for reducing eddy current losses. It may be provided with air ducts for the axial air flow for cooling purposes. Armature is keyed to the shaft.

(5) Armature winding: It is usually a former wound copper coil which rests in armature slots. The armature conductors are insulated from each other and also from the

armature core. Armature winding can be wound by one of the two methods; lap winding or wave winding. Double layer lap or wave windings are generally used. A double layer winding means that each armature slot will carry two different coils.

(6) Commutator and brushes: Physical connection to the armature winding is made through a commutator-brush arrangement. The function of a commutator, in a dc generator, is to collect the current generated in armature conductors. Whereas, in case of a dc motor, the commutator helps in providing current to the armature conductors. A commutator consists of a set of copper segments which are insulated from each other. The number of segments is equal to the number of armature coils. Each segment is connected to an armature coil and the commutator is keyed to the shaft. Brushes are usually made from carbon or graphite. They rest on commutator segments and slide on the segments when the commutator rotates keeping the physical contact to collect or supply the current.

713 Functional Requirements

(1) Class of Insulation: 'F'.

(2) Polarity Change over Switch: Portable D.C. Welding Generator shall be fitted with a polarity change over switch to facilitate welding with reverse polarity unless otherwise agreed mutually by purchaser and supplier/manufacturer.

(3) Internal Combustion Engine for Driving Portable D.C. Welding Generator: The Portable D.C. Welding Generator shall be driven by a compatible internal combustion Petrol / Diesel.

(4) The Portable D.C. Welding Generator shall be in conformity with IS: 2635-1997 (Reaffirmed 2017) however, purchaser may accept the Portable D.C. Welding generator conforming to BS: 638 part 2:1979 at his discretion.

(5) Limits of temperatures and temperature rise shall be as per of IS 2635-1997 (Reaffirmed 2017).

(6) Ampere Meter: Portable D.C. Welding Generator shall be fitted with an ampere meter properly to indicate the welding current.

(7) Current Regulator: The Portable D.C. Welding Generator shall be fitted with a current regulating device to set the welding current as required by operator. The current regulating device shall be duly calibrated and marked with graduation to show amount of current draw.

(8) Cooling: Natural or forced air cooling shall be used.

(9) Enclosures: The enclosure shall be of type designation IP 42 of IS 4691-1985 (Reaffirmed 2004).

(10) Portable D.C. Welding Generator shall be adequately guarded by robust pipe frame and mounted on wheels for easy portability and should have additional mono wheel to enable movement on the rail track.

(11) There shall be an arrangement to protect the Portable D.C. Welding Generator from direct rain.

714 Technical Requirements

Sl.No.	Description	Requirements
1.	Engine	15 hp. Petrol run
2.	Range of welding current	40 to 225 amp
3.	Rated current	Maximum welding current shall not be less than 200 amps at 60% duty cycles (one duty cycle of 5 minutes comprises of 3 min. welding load followed by 2 min. no load operation).
4.	Current regulation	Current is regulated by regulating switch/device with graduation to show the magnitude of current range.
5.	Open circuit voltage	Max. 100 V
6.	Auxiliary output	Single phase: 4kVA and 3 phase 5 kVA.
7.	Weight	Max 150 kg(excluding transportation arrangement)
8.	The machine shall be electrically insulated as per IS: 1271-1985 (Re-affirmed2001).	

715 Guidelines for using, handling, transportation and storing of machines:

(1) Proper Utilization of the machine:

a. The generator shall be kept on dry and level ground. The operator shall wear gloves, apron and shoes during work.
b. The condition of the insulated covering shall be checked by the user before every use.
c. Select and set the current range in the generator as per the current requirement for welding depending on the application required.
d. Connect the power cable from generator to arc welding equipment.
e. Start the generator set.
f. To utilise auxiliary output (AC supply), connect the plug sockets (auxiliary output) in the generator with a device requiring AC supply at site such as grinder, cutting machine, lights etc.
g. After completion of work the engine shall be stopped and the electrical cable connections from the generator set to other devices like arc welding etc. shall be disconnected.

(2) Precautions in operation:

Following precautions shall be followed during operation of the welding generator:

a. The operator shall be conversant with the operation, maintenance and trouble-shooting of the machine. He shall also be aware of his personal safety.
b. Correct current range as per electrode sizes shall be set before starting the generator.

c. Proper grounding shall be ensured before starting the generator.
d. The welding generator shall not be exposed to rains for which rain guard/cover shall be used.
e. It shall be ensured that the insulation of the welding cable is proper.
f. The operator shall wear gloves, apron and shoes during work.
g. Any part of the alternator and distribution board shall not be touched while the generator is on.

(3) Handling:

D.C. Welding generators shall be handled carefully to avoid damage. Care shall be taken to protect the control panel and output sockets from external damage during shifting.

(4) Transportation :

The machine has four nylon wheels fitted at the bottom frame. On cess/ground the machine can be pulled to the work site on its nylon wheels. For transportation on monorail, two double flanged wheels are also provided. The machine can also be transported by a road vehicle or a rail vehicle.

(5) Storage :

The generator shall be kept in a dry and covered place.

716 Maintenance Schedule:

(1) The important component of the machine is tabulated below.

List of Spare parts used in frame of Generator			
Sl. No.	**Description of Spare Parts**	**Unit**	**Quantity**
1.	Rotor	No	01
2.	Stator	No	01
3.	Diodes	Set	01
4.	Rectifier circuit	Set	01
5.	Capacitor	No	01
6.	Control Panel	No	01

NOTE: *for detailed description of spare parts of the engine, refer Annexure-I.*

(2) The maintenance(Schedule I-IV) should be done as per schedule discussed in chapter-I. The maintenance activities to be performed in different schedule (I to IV) is given below:

Sl. No	Items	Daily Maintenance (Schedule-I)		Quarterly Maintenance (Schedule-II)		Half yearly Maintenance (Schedule-III)		Yearly Maintenance (Schedule-IV)	
		Check/ clean	Change	Check / clean	Change	Check / clean	Change	Check / clean	Change
1.	Air filter	✓					✓		✓
2.	Re-coil Starter spring and starter chord								✓
3.	All nuts and bolts	✓							
4.	Air filter paper			✓			✓(2)		✓(2)
5.	Tension of governor spring and throttle spring					✓(*)			✓(*)
6.	Spark plug					✓(*)			✓(*)
7.	Cooling fans on the flywheel					✓(*)			✓(*)
8.	Fuel tank filters			✓			✓		✓
9.	Engine Oil	✓(1)		✓			✓		✓
10.	Valves	✓					✓(3)		✓(3)
11.	Carburettor	✓					✓		✓(*)
12.	Piston	✓						✓	
13.	Head of the chamber	✓					✓		✓(*)

Note

(*) check and change the items only if necessary.

(1) Change engine oil afterfirst20hrs of engine working, in case of both new engine and overhauled engine.

(2) Inspection/Maintenance to be carried out more frequently in dusty conditions.

(3) *Adjust the spacing in the valves to manufacturers standards, preferably to* Inlet: 0.15 ± 0.02 mm (0.006 ± 0.001in) Outlet : 0.20 ± 0.02 mm (0.008 ± 0.001in)

(3) POH of engines & Frame(Schedule-V):

a. **POH Frequency:**

POH of the DC generator is done for every **2 years** or**500 welding joints** whichever is earlier.

*(**Note:** In D.C generator, re-boring & barrel assembly replacement methods of overhauling are on condition basis and are not mandatory to follow the below methods for every POH.)*

b. **Method of POH**

Sl. No.	Type of overhauling	Procedure & Benefits
1.	POH with Re-boring method	This method is used to overcome the problem of oversize dia developed, by adjusting the bore of the machine to the standard dia designed as per manufacturer's standards. This re-boring work is highly dependent on the condition of the engine chamber and skill of the technicians (who does the re-boring work). *POH can be done only **twice** in such cases.*
2.	POH with Replacement with new barrel assembly	This method is used to overcome the problem of oversize dia developed by restoring the bore of the machine to the standard dia by replacing with a new barrel assembly as per manufacturer's standards. Replacing with new barrel assembly (Chamber) results in developing the characteristics of a new engine and does not require any skill of technicians as in re-boring work. As this method of overhauling is highly reliable and economical, it is recommended to prefer this method of overhauling. An engine can be normally overhauled **3-4 times** by this method
3.	POH of Alternator	POH of the alternator is done on condition basis.

c. **Must change items during POH of engines & Frame**

Must change item of Engine POH method by				Must change items during POH of alternator	
Sl.No	**Barrel assembly**	**Sl.No**	**Re-Bore work**	**Sl.No**	**Items**
1.	Barrel assembly	1.	Piston	1.	Capacitor
2.	Piston	2.	Piston Ring		
3.	Piston Ring	3.	Connecting Rod		
4.	Connecting Rod	4.	Valves		
5.	Valves	5.	Piston locks		
6.	Piston locks	6.	Connecting Pins		
7.	Connecting Pins	7.	Lifter Valves		
8.	Lifter Valves	8.	Bearings		
9.	Bearings	9.	Cranks oil seals		
10.	Cranks oil seals	10.	Stem oil seals		
11.	Stem oil seals	11.	Lube oil		
12.	Lube oil				

d. **Items to be changed on Condition basis during POH of Alternator:**

Sl.No	Items
1.	Rotor
2.	Stator
3.	Diodes
4.	Control Panel

e. **Testing of STM after POH:**

D.C. Generator shall be tested by running a RPWG with grinding load 15 minutes continuously on auxiliary power supply on test track.(Details of the test track are given in Sl. No: 7 of table -1 in chapter 21)

717 Troubleshooting :

Sl.No.	PROBLEM	PROBABLE CAUSE	REMEDY
1.	No welding current but auxiliary output is OK	i) Defective diode bridge ii) Problem with welding current control (Printed Circuit Board) PCB	i) Check the diodes of the bridge ii) Check the diodes and (Silicon Control Relays) SCR's of the bridge. Check the transformer which supplies power to the welding control PCB.
2.	Welds poorly	i) Defective diode bridge	i) Check the open circuit welding voltage. If it is OK, the diode bridge is OK. If it is 1/3 or 2/3

			of the nominal value, check the diodes.
3.	No welding output and no auxiliary power output	i) Short circuit in wiring ii) Defective condenser iii) Defective stator iv) Short circuited Diode Bridge.	i) Check the wiring inside the set for a short circuit between cables or to ground. ii) If the wiring is OK, short circuit the condenser to be sure that it is discharged. Disconnect all wires from the condenser and using an ammeter check that the condenser is not short circuited. iii) If the condenser box is OK, disconnect all leads from the stator except for those going to the condenser box and check the output from the alternator. If there is no output from the welding winding and the auxiliary winding, replace the stator. iv) If there is output from all windings, reconnect the diode bridge and check if there is welding current. If not, the diode bridge is defective. If there is welding current connected the auxiliary power leads one at a time until there is no output. At this point, the short circuit is in that line.
4.	Engine does not start	i) Engine starting switch is off. ii) Fuel in the tank is not enough. iii) Carbon deposition in spark plug iv) Improper spark during ignition. v) Fuel not reaching the carburettor.	i) Put it in 'ON' position. ii) Fill the tank with fuel. iii) Clean the spark plug. iv) Check the spark plug gap. It shall be 0.5 mm. Adjust the gap. Change the spark plug if damaged. v) Check and repair fuel oil lines.

Note:

Engine: *WhiteSmoke from the Engine, Low Voltage Output, Low welding current is an indication that the POH of the engine is required.*

Frame: *No voltage output, No current from the alternator is an indication that POH of the alternator is required.*

718 Requirement of manpower:

2person required(1 skilled + 1 unskilled).

719 Requirement of Consumables:

(1) Petrol/diesel/kerosene.

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Chapter-8
Hydraulic Track Jack (non-infringing type)

801 **Use**:

The Hydraulic Track Jack (non–infringing type) is used for lifting of track in track maintenance/construction work.

802 **Description**:

The hydraulic track jack is a portable lifting device consisting of a hydraulic lifting ram integrated with a hydraulic hand pump. The jack has a release key and a pre-set safety release valve.

Hydraulic Track Jack

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below)

Important assemblies of Hydraulic Jack are:

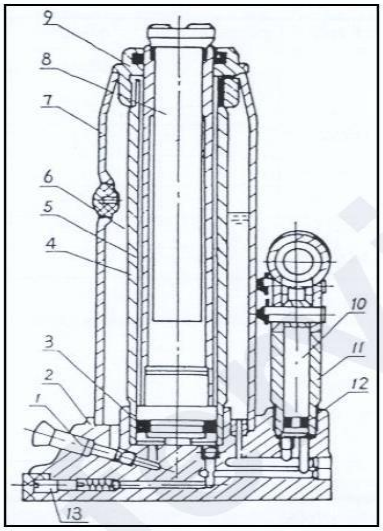

Figure 1 – Section view of the machine

1. VENT VALVE
2. BASE
3. O-RING (Cylinder)
4. HYDRAULIC CYLINDER
5. GUIDE TUBE
6. HYDRAULIC OIL
7. OIL TANK
8. PISTON ROD
9. UPPER CAP
10. PISTON PUMP
11. PUMP BODY
12. O-RING (Pump)
13. BALL-VALVE

The following are the important assemblies of the Hydraulic Track Jack.

(1) Vent Valve: vent valve is used to release the pressure developed in the Piston and releases the pressure gradually.

(2) Base: Base is used to support the whole assembly of the jack and provide good support during lifting operations.

(3) O-Ring (cylinder): O-ring is used to prevent fluid flow by providing leak proof sealing around the piston rod.

(4) Hydraulic cylinder: Hydraulic cylinder encases the Piston rod and allows the Flow of hydraulic Oil around the Guide tube.

(5) Guide Tube: Guide tube allows the Piston Rod to move vertically without any deviation.

(6) Hydraulic Oil: Hydraulic oil works as a pressure transferring medium in the Hydraulic jack and facilitates lifting operations.

(7) Oil Tank: This facilitates as the reservoir for Hydraulic oil and helps in supplying hydraulic oil whenever it is required.

(8) Piston Rod: This is the main component of which b provides the lifting operation in Hydraulic jack.

(9) Upper cap: Upper cap surrounds the piston to provide a seal for hydraulic oil and piston movement.

(10) Piston Pump: This is integrated in the jack, it helps to generate the necessary pressure required to lift the objects using Hydraulic jack.

(11) Pump Body: this helps to encase the pump fittings and hydraulic oil.

(12) O-Ring (Pump): O ring is used to seal the fluid & the pressure developed by the pump and allows the pump to transfer the pressure to the Piston rod.

(13) Ball Valve: Ball valve performs the function of a pump by sealing the generated pressure during the ram action.

803 Functional Requirements

(1) Hydraulic track jack should be lightweight, without handle and should have easy portability.

(2) The jack should have rigid, mono block construction of cylinder reservoir. It should be of single casting or fabrication for rough and rugged use in the field and to prevent leakage of hydraulic oil through joints and oil seals etc., during normal operation.

(3) The hydraulic jack should have a sufficiently large capacity pump such that in about 90/95 strokes.

(4) The ram shall be of one single diameter throughout its length for single stage lifting and of uniform diameters for multiple stages lifting for each part of the ram. It shall have a swivelling ram cap or saddle for better grip.

(5) Release valve should be so provided as can be closed by the clockwise movement of the handle at the time of operation. The anti-clockwise movement of the handle should enable the release valve to open there by lowering the jack ram. The position of the release valve shall be facing the operator.

(6) Release should be instantaneous and preferably obtained by a single twist of the handle.

(7) The hydraulic track jack should be fitted with a two-way overload safety release valve, which bypasses the pump, when the jack reaches its maximum or pre-set load, and instantaneously causes the jack to field safety, if a sudden overload occurs.

(8) The maximum capacity of the overload safety release valve should be 18.0 tonnes, but it should normally be possible to pre-set to a load of 11 tonnes for BG so that the release device will trip automatically under the wheel load of an approaching train. This should be used as a safety measure only for emergency tripping in situation of failure by manual release.

(9) The jack should be provided with a carrying handle/sling.

(10) The oil used for hydraulic jack shall be suitable good quality and easily available in the market.

(11) Oil seals (Nutring, O-Ring, Washer, etc.) should be of special high pressure brand of synthetic Neoprene/Nitrile rubber/Viton of Teflon material (superior brand to be provided) generally conforming to IS: 6838-1973 (Reaffirmed 2005).

804 Technical Requirements:

Sl.No	Items	10 tonnes Jack	15 tonnes Jack
1.	Capacity	10 tonnes	15 tonnes
2.	Closed height	166 + 3 mm	166 +3 mm
3.	Maximum hydraulic lift	80 + 3 mm	80 + 3 mm
4.	Weight (without handle)	10.5 + 0.5 Kg	13.5+ 0.5 Kg 13 kg max.
5.	Base Area	300 sq.cm. (approx.)	300 sq.cm. (approx.)
6.	Length of operating handle	750 mm (approx.)	750 mm (approx.)

805 Guidelines for using, handling, transporting and storing:

(1) Proper utilisation of Machine:

a. Check the hydraulic oil level in the pump reservoir.
b. Loosen the oil filler plug cum air vent to act as an air-vent, for the entrapped air in the oil pump.
c. At the location where the rail is to be lifted, remove some ballast and place the jack centrally underneath the rail foot.
d. Loosen the release key of the pump and pump a few times to flush out the trapped air (if any) from the pump unit.
e. Close the release key firmly.
f. Pump till the required lift is achieved.
g. When the jack is required to be lowered or removed from the track, unscrew the release key of the pump. The saddle of the jack below the rail foot gets slightly

lowered. The jack can be pulled out by hand and thereafter its ram can be manually pushed down.

(2) Precautions in operation:

Sl. No.	Do`s	Don'ts
1.	Air venting is an important precaution for the successful performance of any hydraulically operated device, equipment or system.	Under no circumstances, the equipment shall be used beyond rated capacity or rated maximum lift.
2.	All fasteners shall be properly tightened.	Do not forcibly hammer fit any component in the jack.
3.	The equipment shall be kept free from dust through regular cleaning.	After use, do not leave the equipment exposed to excessive heat in summers, dust and fumes.
4.	Check oil level each time before use.	Do not refill without a strainer.
5.	In the pump unit, the release valve shall be properly tightened during operation.	Do not use the jack if any leakage of oil is observed.
6.	The jack must be centrally loaded.	Do not apply extra force other than hand pressure to close the release valve.
7.	Use hydraulic oil of recommended grade.	Do not use fluffy clothes or cotton waste for cleaning cylinder ram, valve and oil tank.
8.	Use wooden/steel support under the jack where ground is soft or yielding.	Do not disturb the preset overload safety valve integrated with the pump.

(3) Handling:

The jack shall be handled with care to avoid damage. When not in use the ram shall be kept in a retracted position. The jack shall not be turned upside in down position, during transportation.

(4) Transportation:

As the machine is light in weight, one man can carry the machine on a bicycle or by monorail trolley over short distances. This can also be transported by material trolley/road vehicle.

(5) Storage:

The following shall be ensured for storing hydraulic track jacks:-

a. The ram shall be in the fully retracted position.
b. The pump plunger shall be in the retracted position.
c. The oil filler plug cum air vent shall be in a closed position.
d. The jack shall always be stored in an upright position.
e. The jack shall be free from dirt.
f. The jack shall be stored in a covered and dry place.

806 Maintenance schedule:

(1) Following maintenance (Schedule-I to IV)instructions shall be followed as routine maintenance practice before commencement of day's work.

Sl. No	Items	Daily Maintenance (Schedule-I)		Quarterly Maintenance (Schedule-II)		Half yearly Maintenance (Schedule-III)		Yearly Maintenance (Schedule-IV)	
		Check/ clean	Change	Check/ clean	Change	Check/ clean	Change	Check/ clean	Change
1.	Hydraulic Oil	✓					✓		
2.	Vent valve	✓							
3.	Pump body	✓							

Note: For details explanation about hydraulics refer Appendix-II
Any other procedure given in the manufacturer's manual shall also be followed.

(2) Periodic Overhauling ,POH(Schedule V):

a. Basis and Frequency of Periodic Overhauling

Frequency of POH is 2 years and is subjected to working of the STM.

b. Must change items during POH

i) Hydraulic oil
ii) Oil seals.
iii) O-rings

c. Testing of STM after POH:

Hydraulic Track Jackshall be tested by lifting the test track.(Details of the test track are given in Sl. No: 7 of table -1 in chapter 21).

807 Troubleshooting:

Sl. No.	TROUBLE	PROBABLE CAUSE	REMEDY
1.	Jack not closing completely	Air under ram	Open release valve and pump rapidly several times. Close release valve. If still not successful, open oil filler plug cum air vent.
2.	Pump handle stroke only partly effective	Air in pump chamber	Open release valve and pump rapidly several times. Close release valve.
3.	Handle rises without effort.	i) Sticky suction (intake) valve ii) Leaky suction (intake) valve	i) Remove pump and clean valve unit. ii) Remove the pump. Clean valve unit and reseat valve.
4.	Handle snaps back	Sticky delivery (discharge) valve	Open release valve. Pump rapidly for several times. Close release valve.
5.	Jack doesn't rise to full height.	i) Lack of oil ii) Sticky Suction (intake) valve.	i) Refill oil & check for leaks. ii) Remove pump and clean valve unit.
6.	Jack rises and falls during each stroke	Leaky delivery (discharge) valve.	Tighten pump or replace steel ball in the valve or replace Brass seat and Copper washer if found worn out or damaged.

7.	Jack doesn't rise	i) Release valve open (oil passing back into reservoir). Delivery (discharge) valve open (oil passing back into pump chamber) Suction (intake) valve open. (Oil passing back into the reservoir). ii) Sticky suction (intake) valve. iii) Lack of oil. Air under Ram. iv) Leaky release valve or safety valve tampered with high pressure leaks (at pump or release valve).	i) Close the respective valve firmly ii) Remove pump and clean valve unit. iii) Refill oil. Check for leaks. Bleed air out by opening the release valve. iv) Pump rapidly a few times and close the release valve. Clean valve unit and reseat valve. Re-adjust the safety valve to rated load carefully.
8.	Jack doesn't hold up the load.	i) Leaky release valve. ii) Defective ram seals	i) Reset valve. ii) Replace ram seals.
9.	Jack doesn't get released.	Valve damaged/or Bent rams.	Remove and replace defective parts.

Note:

Not able to generate enough lifting force, oil leakage from the cylinder is an indication that the jack requires POH.

808 Requirement of manpower:

One (skilled)person.

809 Requirement of Consumables:

Nil.

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Chapter-9

Hydraulic Rail Tensor (Non-infringing Type)

901Use:

Rail tensor is used to create either pulling or pushing action of rails. It is a device used for rail distressing operation in Continuous welded rail (CWR), repair of rail breakages etc. It avoids any tendency for the rail to be evenly stressed throughout its length.Obstruction less/non-infringing type hydraulic rail tensor is used for rail distressing, rail welding and other repair works of rail failures. The hydraulic rail tensor shall be obstruction less type, hydraulically operated with a hand pump connected to cylinder assemblies through flexible rubber hose pipe.

- 2 hydraulic cylinders (**1**)
- 2 clamping assemblers (**2**)
- 2 tie rods (**3**)

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

902Description

Important assemblies of the Hydraulic Rail Tensor are;

(1) Hydraulic cylinders: Double-acting, these make it possible to exert on the rail either traction or a compression. They are equipped with quick screw couplings and drain screws. Pressure limiters are calibrated in the factory, mounted on the unit to limit the thrust and traction forces.

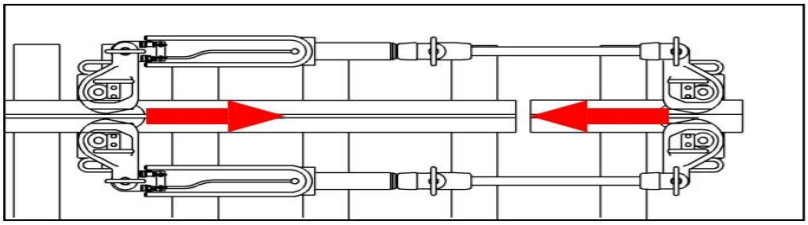
(2) Clamping Assemblies: This consists of 3 removable parts which comprises a stirrup and 2 jaws. The stirrup holds the rail from the bottom and the jaws are used to clamp the web of the rail. This assembly holds the rail firmly while traction and compression operations are being carried out.

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

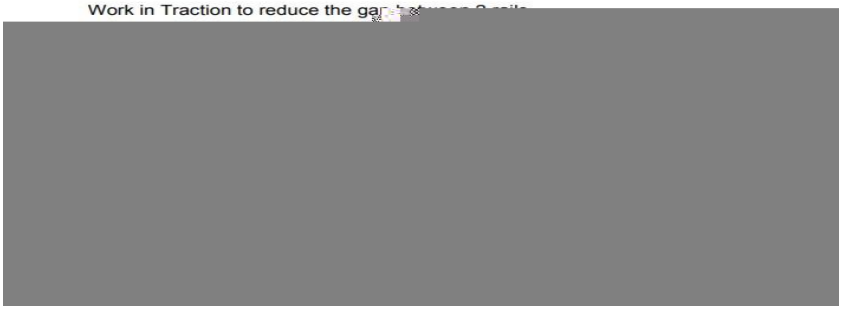
(3) Tie rods: For working in traction, these are connecting components that transmit the traction force from the cylinder rods to the other clamping assembly. The number of tie rods are not limited, it is possible to frame a piece of rail introduced into an LWR and to carry out connecting welds in the same interception of traffic on a straight portion.

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

Working method



Work in Traction to reduce the ga



903Functional Requirements

(1) Design of the hydraulic rail tensor shall be rugged and robust to withstand the various operating and handling forces.

(2) The construction of the machine shall be such that parts can be easily and quickly replaced in case of break-down while carrying out works at site.

(3) It shall be easy to use, operate and maintain.

(4) It shall be obstruction less in nature i.e. no part of tensor shall project above rail head while in operation.

(5) It shall be able to operate efficiently in all environmental conditions as expected in India.

(6) Hydraulic cylinders of rail tensor shall be double acting cylinders i.e. the jacks shall be able to exert force when ram is coming out and also when it is going in.

904Technical Requirements

Sl.No.	Description	Requirement
1.	Maximum total weight including hand pump	375 Kg.
2.	Maximum weight of any individual part	115 Kg
3.	Maximum pulling force	70 t
4.	Maximum pushing force	30 t
5.	Hydraulic ram stroke	300 mm (minimum)
6.	Rail section to be handled (to pull up to 150 mm)	90 R/52 Kg/60 Kg.

905Guidelines for using, handling, transportation and storage:

(1) Proper utilization of the machine:

Following procedure shall be followed during use of the tensor in the field.

a. The rail extension required for distressing of LWR track at the prevailing temperature is determined first. Accordingly, the gripping heads of the machine shall be placed at rail webs on either side of the rail joint to be welded.

b. The gripping heads are connected with the hydraulic rams through lever arms and connecting rods.

c. The hydraulic rams are connected with the pumping unit through hydraulic hoses. Before operating the pump, the lever arms are pulled manually for engaging the gripping blocks on the rail web firmly.

d. While operating the hydraulic pump manually it is ensured that the rams' move equally. In case an unequal extension of the two rams is observed, the same shall be rectified after referring to the supplier's instruction manual.

e. The hand pump is operated unless the required gap is achieved at the rail joint.

f. After completion of the AT welding and allowing for its cooling, the rail tensor is dismantled carefully from the track and its components kept safely.

g. Traffic block is required for installation and operation of the rail tensor on a track open to traffic.

(2) Precautions in operation:

Following precautions shall be taken during operation of the tensor:

a. The operator shall be fully conversant about the operation of the tensor.
b. The pump shall not be run if oil is deficient.
c. The pumping operation shall be started only after ensuring proper fitting of the yoke, lever, connecting rods and cylinders.
d. The system shall not be used beyond its rated capacity and the ram shall not be extended beyond its specified stroke.

(3) Handling:

The rail tensor shall be handled carefully to avoid any physical damage. During dismantling, cylinders shall not be lifted without detaching the connecting rods first.

(4) Transportation:

For transportation, the equipment shall be dismantled. The hydraulic rams shall be handled carefully to avoid any damage to the piston surface, oil seals and oil inlet and outlet adapters. The equipment in dismantled condition can be transported to worksite by powered material trolley, road vehicle or RCRV.

(5) Storage:

The following precautions are to be taken while storing the hydraulic rail tensor when not in use:

a. The rams of the cylinders shall be in fully retracted position.
b. Pump plungers shall be in a fully closed position.
c. Oil filter plug cum air vents shall be accurately closed.
d. Cylinders shall be placed in horizontal position.
e. The entire unit shall be free from dirt.
f. The unit shall be stored in a box in a covered place.

906Maintenance Schedule:

(1) Following maintenance(Schedule I-IV)instructions shall be followed as routine maintenance practice before commencement of day's work.

Sl. No	Items	Daily Maintenance (Schedule-I)		Quarterly Maintenance (Schedule-II)		Half yearly Maintenance (Schedule-III)		Yearly Maintenance (Schedule-IV)	
		Check/ clean	Change	Check/ clean	Change	Check/ clean	Change	Check/ clean	Change
1.	Hydraulic Oil	✓(*)					✓		
2.	All fittings	✓							
3.	Hydraulic hose	✓							✓(*)

	pipes								

***Note:** *change only if necessary*
For details explanation of hydraulics, refer Appendix-II.

Any other procedure given in the manufacturer's manual shall also be followed.

(2) Periodic overhauling (POH) (Schedule-V):

a. Periodic Overhauling (POH): Basis and Frequency of Periodic Overhauling
Frequency of POH is **2 years** and is subjected to working of the STM

b. Must change items during POH.
i) Hydraulic oil
ii) O-rings.

c. Testing of STM after POH.
Hydraulic Rail Tensor shall be checked for proper working of the hydraulic cylinders.

In addition to the instructions contained in the operating and maintenance manual, supplied with the machine, following maintenance instructions shall be followed in general.

907Troubleshooting:

Sl.No.	Trouble	Probable Cause	Remedy
1.	Pump delivers no oil to actuators	i) Less hydraulic oil in the tank ii) Release screw is loose. iii) Pump plunger seal damaged. iv) Leakage through the loose connections etc.	i) Top up hydraulic oil level. ii) Tighten the release screw. iii) Damaged seals shall be replaced. iv) Leakage shall be prevented by tightening the hose connections / using thread seal tape in the connections.
2.	Cylinders provide insufficient pulling effort.	i) Setting of pressure release valve (safety valve) is faulty. ii) Pump delivers insufficient oil to the cylinder. iii) Leakage at the release valve. iv) Leakage at the hose connections/	i) Set the pressurerelease valve to correct pressure. ii) Rectify pump output. iii) Repair the release valve to stop leakage. iv) Using proper coupler/banzo& thread

		cylinder buckets (seals).	seal tape leakage shall be stopped. Replace cylinder buckets/seal if found damaged.

***Note**: Not able to generate enough pulling/pushing force, oil leakage from the cylinders is an indication that POH is required for the STM.*

908Requirement of manpower :

4 (1 skilled + 3 unskilled)person.

909Requirement of Consumables:

Nil.

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Chapter-10
Toe Load Measuring Device
Part-A
MechanicalToeLoad Measuring Device (MTLMD)

1001Use:

Mechanical Toe load Measuring Device is used to determine the toe load of elastic rail clips during service in the field.

1002Description:

The Toe load measuring device consists of a pre-calibrated helical spring having a steel pointer attached to a lever arrangement through a link hanger for gripping elastic rail clip. When the spring is compressed by turning a rotating handle at the top of the device, the toe of the clip gets pulled up and compression of the spring causes a pointer to indicate displacement on a graduated scale. The Toe load (in Kg) exerted by the spring on the toe of the clip is measured by multiplying the displacement of the pointer and the spring constant. The device is supported on three legs, two resting on the sleeper and one on the rail head.

Mechanical Toe load Measuring Device

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below)

The Important assemblies of the MTLMD are:

(1) Helical Spring: When the rotating handle is rotated, the spring develops a compression force on the tong to exert tension on the Elastic Rail Clip and the displacement is measured by the pointer connected to the spring.

(2) Tong: tongs are metal clamps used to hold the ERC to exert tensile force on the clip.

(3) Rotation handle: when this handle is rotated, the spring gets compressed and helps to measure the displacement.

1003Functional Requirements

(1) The springs shall be suitably heat treated to give the desired performance characteristics.

(2) The tong shall be suitably heat treated to withstand a repetitive load cycle of 1400 kg without any sign of deformation/breakage.

(3) The hardness of the link hanger and the rotation handle shall be in the range of 210-240 HB.

(4) Steel Link Grips shall be as per drawing.

(5) All surfaces of the device shall be painted with one coat of Zinc Chromate primer to IS: 104-1962 followed by one coat of Red Oxide/Zinc Chromate primer to IS: 2074-1962 and two coats of synthetic enamel to IS: 2932-1964 or other approved painting system. The finish surface of the equipment shall be of yellow colour and the helical spring of red colour. Rotating handle, legs, link hanger, tong, nuts & bolts shall be of navy blue or black colour and the packing box of black colour.

1004Technical requirements

Sl.No	Description	Requirement
1.	Weight (max.)	12 Kg
2.	Capacity of the spring to measure toe load	1400 Kg
3.	Material of the main spring	Siliconmanganese spring steel conforming to Grade 55 of IS: 3195 – 1992.

1005Guidelines for using, handling, transporting and storing of the Device:

(1) Proper utilisation of Device:

a. Place the device with one leg resting on the rail top and the other two legs resting on the sleeper surface.

b. Adjust horizontally the base plate by means of the nut of the levelling leg.

c. Turn the handle continuously till air gap is created between rail flange/top of liner and toe of clip. Introduce a filler gauge of 0.1 mm thickness in the air gap created between the toe of the clip and the rail flange / top surface of liner.

d. The handle is then turned anticlockwise so that the filler gauge comes under a normal pressure. Turn the handle again clockwise and simultaneously pull out the filler gauge. The filler gauge when moved, indicates the lifting of the toe of the clip.

e. At this stage note down the reading on the graduated scale multiplied by the spring constant gives the toe load exerted by clip on the rail foot.

(2) Precautions in operation:

Following precautions shall be observed during operation:

a. Operating staff should be skilled and knowledgeable about the machine.
b. There shall be no oily substance on the surface of tongs so as to prevent slippage during operation.
c. Steel grip shall be engaged firmly to the clip to avoid the slippage on the application of load.
d. Longer portion of the steel grip shall be away from the rail web.
e. Base plate shall be horizontal.
f. Link hanger shall be vertical to the toe of the clip.
g. Operator shall not lean over the device.

(3) Handling:

The toe load-measuring device shall be handled with care to avoid physical damage.

(4) Transportation:

The equipment is portable and can be carried by one man. It can be transported by a monorail trolley and by any road vehicle.

(5) Storage:

The device shall be stored in a packing box and kept in a covered and dry place.

1006Maintenance Schedule:

(1) The important component of the machine is tabulated below.

List of Spare parts used Toe Load measuring device			
Sl. No	**Description of Spare Parts**	**Unit**	**Quantity**
1.	Tong	No	02
2.	Steel link	No	02
3.	Link hanger	No	01
4.	Base plate	No	01
5.	Levelling leg	No	01
6.	M.S. washer	No	04
7.	Rotation Handle	No	01
8.	Legs	No	01
9.	Nut	No	04

(2) Following maintenance instructions shall be followed as routine maintenance practice.

a. Keep spare links/tongs ready for replacement.
b. Lubricate/grease the threads inside the hole of the rotating handle as per requirement.

c. In case the equipment is not used for more than a week, the inside of the spring box and the surface of the main spring shall be oiled before storing.
d. Before use in the field, the oil, dirt and dust from the inside of the spring box and surface of the main spring shall be thoroughly removed.
e. The device shall be calibrated in /at RDSO laboratory at the time of procurement and thereafter whenever results are doubtful.

1007Troubleshooting:

Instructions regarding troubleshooting contained in the operating and maintenance manual supplied with the device shall be followed.

1008Requirement of manpower: One (skilled)person.

1009Requirement of Consumables: Nil.

Part-B
Electronic Toe Load Measuring Device (ETLMD)

1010Use:

It is used to directly measure the toe load of elastic rail clips during service in the field.

1011Description:

Electronic Toe Load Measuring Device has a load cell of 2000 kg capacity and an LCD panel integrated with suitable electronic circuitry. This device has got a lever arrangement attached to it in order to grip the toe of the elastic rail clip. When the load cell is compressed by turning a rotating handle, the elastic rail clip gets pulled up.The force applied on the load cell is converted into load (in kg.) and displayed directly on LCD screen.

Electronic Toe Load Measuring Device

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below)

The Important assemblies of ETLMD are:

(1) Rotation handle: Rotating handle is used to exert compressive force on the Load cell.

(2) Load cell: Load cell converts the compression force developed by rotating the handle into load and is displayed in the LCD indicator.

(3) LCD indicator: LCD indicator is used to display the Load exerted on the ERC.

(4) Tong: Tong is used to clamp the ERC firmly.

(5) Gap Sensing Unit: At the point of lifting of toe, this device should activate the peak hold facility of load measurement and display unit and freeze the Toe load reading in display panel and record the same in its memory.

(6) Spirit Level: it helps to adjust the Machine in correct level.

1012Functional Requirements:

(1) Electronic Load Measuring and Display Unit shall be compact, rugged, shock, dust and waterproof, electrically shielded and capable of functioning reliably in the severe field conditions normally encountered in Indian Railway system including on electrified section.

(2) The load cell shall be compressive type of stainless steel/corrosive resistant material conforming to relevant IS Specification for stainless steel for manufacture of load cell.

(3) Load measuring and display unit should be battery operated. There should be a provision of easily available compact rechargeable battery pack of reputed make provided inside the unit. Suitable charger should be provided to charge the battery pack provided inside the unit.

(4) Gap sensing device of suitable design with feeler strip of 0.05/0.10 mm. thickness to sense the incipient lifting of the toe of clip should be provided with the device.

(5) Dimensions and other details of sprit levels shall conform to RDSO, Drawings No. TM/9909 (Alt-3) and TM/9909/1 (Alt-3)

(6) This module is used for transferring data from Display Unit to Personal Computer (PC) through USB/Pen drive/Bluetooth/mobile set.

(7) High stability real time clock with date is to be provided. Clock should function even after the battery is removed for a month however suitable arrangement to set this clock is also to be provided.

1013Technical Requirements:

Sl.No.	Description	Requirement
1.	Capacity of load cell	2000 kg
2.	Display Resolution	1 kg
3.	Display	8 to 16 character alphanumeric display
4.	Operating Rail temperature	(-) 50C to 700C
5.	Measurement Accuracy	(+) 0.5% of rated capacity of load cell

6.	Humidity Effect	Nil
7.	Zero (Sensitivity)	Fast return to zero

1014Guidelines for using, handling, transporting and storing of the Device:

(1) Proper utilisation of Device:

a. Put the measuring unit of the electronic toe load device to 'ON' position for a few minutes before measuring the toe load of an elastic rail clip.
b. Place the device on its three supporting legs with one resting on the top of the rail head and the other two resting on the sleeper.
c. Bring the base plate in horizontal position by means of the levelling leg provided for adjustment of the three legs.
d. Engage the tong to the elastic rail clip keeping a longer portion of the tong away from the rail web.
e. Turn the handle clockwise to compress the load cell and pull the hanger. The toe of the elastic rail clip will get pulled up.
f. Continue to turn the handle until the toe leaves contact with the liner/ rail foot. A Feeler gauge of gap sensing device having thickness of 0.05-0.1 mm is inserted below the toe of the clip. The handle is then turned anti clockwise so that the feeler gauge comes under normal pressure. Turn the handle clockwise again and simultaneously the gap-sensing device is pulled out gently. When the feeler gauge moves out, it indicates the incipient point of lifting of toe of the elastic rail clip and at the same time the sensing device automatically freezes the toe load reading on LCD. At this stage, the reading displayed on the LCD panel is the measured toe load of the elastic rail clip.

(2) Precautions in operation:

Following precautions shall be observed during working:

a. The operator shall be fully aware of the using, maintenance and troubleshooting of the device.
b. The device shall be properly placed on its three legs and the base plate shall be kept horizontal before measuring the toe load.
c. No extra effort shall be utilised on the gap sensing instrument during pulling out of the feeler gauge.
d. Feeler gauge shall be correctly inserted below the toe of the clip to avoid slippage.
e. The operator shall not lean over the device.
f. It shall be ensured that the longer portion of the steel grip shall be away from the rail web.
g. Link hanger shall be vertical to the toe of the clip.

(3) Handling:

The electronic toe load measuring device shall be handled carefully to avoid any/physical damage. The device when not in use shall be kept in the box provided with the machine.

(4) Transportation:

The equipment can be carried by one man.

(5) Storage:

The device shall be kept in a packing box and stored in a covered dry place.

1015Maintenance schedule:

Following maintenance instructions shall be followed in general in addition to the instructions contained in the operating and maintenance manual supplied with the device.

(1) Ensure that there is no oily substance on the surface of grips to prevent slippage during operation.

(2) Keep ready spare links/ grips for replacement.

(3) After daily work, the battery shall be recharged by an external battery charger (supplied with device).

(4) Rechargeable battery shall be recharged from time-to-time if device is not in use.

(5) Lubricate the thrust bearing and link hanger threads.

(6) Calibration of the Load measuring cell shall be done as and when required from track laboratory of TMM directorate, RDSO/Lucknow or any govt. approved NABL accredited laboratory.

1016 Troubleshooting:

Sl.No	Observation	Cause	Remedy
1.	Switch is ON but no display is there	i) Battery fully exhausted. ii) Battery is not properly fit. iii) Battery polarity is not correct.	i) Charge the battery. ii) Check the fitment. iii) Check the polarity.
2.	LED does not glow at the time of charging.	i) Charger is defective. ii) Jack of charger is not plugged properly. iii) AC output is defective.	i) Replace the Charger. ii) Check the jack, if found damaged then replace the cable. iii)
3.	Backup time is less even after sufficient charging time.	i) Battery life is over	i) Replace the battery
4.	If reading is not freezed even when filler guage of gap sensor is released at the time of measurement	i) Jack of gap sensor is not properly inserted. ii) Limit switch of gap-sensor is not working.	i) Check the jack. ii) Replace the gap sensor.

1017Requirement of manpower:

One (skilled)person.

1018Requirement of Consumables:

Nil.

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Chapter- 11
Light Weight Rail (Mono) cum Road Trolley

1101Use:

It is a manually driven trolley to carry small track machines and can be moved on a single rail or on ground.

1102Description:

Light Weight Rail (Mono)cum Road Trolley is light weight manually operated wheel trolley consisting of a fabricated rectangular frame. A set of two double flanged wheels for use on rails and four nylon wheels for use on ground /road are fitted to four separate axles in such a manner that the nylon wheels can be lifted up when not in use. The trolley is having a tubular pushing handle (detachable) to push/pull the trolley.

Light Weight Rail (Mono) cum Road Trolley
(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

Important assemblies of Light weight Rail (Mono) cum Road Trolley is:

(1) **Trolley Frame**: The trolley frame shall be made of tubular/other suitable section of lightweight aluminium alloy / mild or alloy steel or any other suitable material having sufficient mechanical strength.

(2) **Trolley platform**: The trolley platform shall be made of square mesh of mild steel flats having thickness 1.5 to 2.0 mm and approx. width 25 mm. Alternately suitable wire mesh may be used the mechanical strength of which shall be enough to serve the purpose of the trolley. The wire shall be hard drawn of mild steel grade-I.

(3) **Trolley Handle**: The handle of the trolley shall be T-shaped and shall be made of mild steel/suitable lightweight aluminium alloy tube. The handle shall have two rubber grips at the top ends.

(4) **Trolley wheels**: The trolley shall be fitted with four nylon wheels for moving on cess/ road and a pair of double flanged wheel made of mild steel. or suitable aluminium alloy/ steel having sufficient mechanical strength. The nylon shall be good quality having high impact strength.

1103Functional Requirements:

(1) The trolley shall have rugged & robust construction for serving the purpose for entire life of the trolley.

(2) The trolley shall be capable of moving on cess without tilting, with ease by pushing/pulling the handle on cess.

(3) The double flange wheels provided at central axles of the trolley shall be capable of negotiating the curved track, point and crossing and level crossing.

(4) Suitable arrangement shall be made so that the nylon wheels do not infringe to any portion of point and crossing, diamond crossing and level crossing while the trolley moves on rail.

(5) The handle shall be fitted in such a manner that the trolley can be pushed or pulled by the operator without leaning down.

(6) Mono rail wheel and Nylon wheel shall not interfere with the movement of each other.

(7) Nylon/rubber wheels shall be such that it can negotiate any rough terrain/ cess with minimum of wear and tear.

(8) Trolley shall be capable of travelling /moving with easy in loaded condition on all types of rail section and track structure.

1104Technical Requirement:

1.	Trolley size (L x B)	650 mm x 400 mm (approx.)
2.	Dimensions of mono rail wheel (double flanged)	i) Tread dia. –60 mm (min.)
		ii)Flange depth-12mm (min.)
		iii) Flange thickness-5mm (min.)
		iv) Width -85mm (min.) [excluding flange thickness]
3.	Dimensions of Nylon wheel	i) Wheel dia. – 150mm(approx.)
		ii) Wheel base-450mm (approx.)
4.	Dimension of handle	i) Length : 700 mm(approx.)
		ii) Width at top : 500 mm(approx.)
5.	Weight	20 kg (max.)
6.	Pay load	100kg (approx.)

1105Guidelines for using, handling, transportation and storing of trolley:

(1) Proper Utilization of machine:

Instructions contained in the manual supplied with the trolley shall be followed for operation including operational safety measures, repair/maintenance, overhauling, trouble-shooting etc. In addition to the operational instructions contained in the manual given by the supplier, following instructions shall be observed before commencement of operation:

a. For running on road- Bring the nylon wheels downward and lock in position by bolts and nuts. The trolley is ready for use and can be moved by pulling/ pushing its handle.
b. For running on rail– The nylon wheels are lifted and locked in position. The trolley is moved on a single rail on its double flange wheels. For movement of the mono – rail trolley on rails, the safety rules for a push trolley should be followed as given in the GR/SR for that particular zonal railway.
c. 1 to 3 persons are required for loading/unloading and movement of the trolley as necessary depending upon the load. On sighting any approaching rail vehicle like a train etc., the mono - rail trolley shall be quickly off-tracked for safety, in case of its movement on rails without traffic block.

(2) Precautions in operation:

Following precautions shall be observed during operation:

a. The trolley shall not be overloaded.
b. The operator shall remain cautious about any approaching train.
c. The trolley shall not be run on the nose of crossing.
d. The trolley shall be put on line only after assuring proper functioning of the double flanged wheels and nylon wheels.

(3) Handling:

During use, the trolley shall be handled carefully so that its nylon wheels/double flanged wheels don't infringe with rails.

(4) Transportation:

The trolley can be dismantled and put in a box and transported by rail or road. Over short distances it can be moved on its nylon wheels on the ground or on its double flanged wheels on rails.

(5) Storage:

The trolley shall be kept in a covered and dry place.

1106Maintenance:

Following maintenance instructions shall be followed:

a. Keep the trolley neat and clean.
b. Check the nuts-bolts and bushes. Tighten the nuts and bolts if required. Replace the bush if worn out or damaged.
c. Lubricate the brass bush of nylon wheels once a week.
d. Keep the trolley away from rain when not in use.

1107Troubleshooting:

Sl.No.	Trouble	Probable cause	Remedy
1.	Movement of Trolley either on rail or on cess	Wheel may be jam	Greasing of bearing/bush.

1108Requirement of manpower:

1 to 3 (1 person is required to move the trolley and 1-2 are required to load/unload the material carried)person.

1109Requirement of consumables:

Nil.

Chapter – 12
Self-Propelled Light Weight Trolley

1201 Use:

The Self-Propelled Lightweight Trolley is used by Railway officials for track inspection and to reach accident/work sites quickly.

1202Type of self-propelled Light weight trolley:

Two types of Self-Propelled Lightweight Trolley are there:

(1) Engine operated

(2) Battery operated

Battery operated light weight trolley should be preferred over engine operated. However, the detail of Self-Propelled Lightweight Trolley (engine operated) is described below.

1203Description:

The trolley comprises a light metallic tubular frame with two sets of axles powered by an I.C. engine mounted on the frame. The trolley has seating arrangement in front and rear.

Self-Propelled Lightweight Trolley

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

Important assemblies of Self-Propelled Light Weight Trolley are:

(1) **Diesel/petrol engine or a light weight generator set**:The petrol/diesel engine shall be of reputed make indigenously available and of proven performance in traction/automotive application. The Engine shall be of adequate power having

sufficient reserve power to work in conditions. The continuous rating of engine under standard I.S. conditions shall not be less than 2 HP. The engine shall be air cooled. A fuel tank of adequate capacity shall be provided for a run of 60 km.

(2) **Head light/front light and tail light:** Trolley shall have two Nos. head light/front light to work the trolley during night. The visibility during night in dry and clear weather shall not be less than 50 m approx. The manufacturer shall also provide suitable tail lights. Wattage and voltage of bulbs used in head lights and tail lights shall be such that these are commonly available in market (Head lights used in motorcycles may be found suitable).

(3) **Trolley frame**: The frame may consist of strong, light weight welded tubular aluminium alloy frame or any other light weight high strength material capable of giving required strength and rigidity.

(4) **Plastic moulded Chairs**: The trolley shall have two number chairs of plastic moulded sheet with height adjustable feature enabling officials to sit comfortably while doing track works.

(5) **Wheel**: The wheel dia. of the trolley shall be 250-280 mm to provide stability at maximum designed speed

(6) **Foot pedal or mechanical hand brake**: The trolley shall have proper and efficient braking system operated by foot pedal or mechanical hand brake. Trolley shall also have mechanical parking brakes.

1204Functional Requirements:

(1) The trolley shall be self-propelled powered by an air cooled diesel/petrol engine or a light weight generator set. Manufacturer may use governor or any other suitable device to restrict the speed to 20 kmph (max).

(2) Trolley shall have two Nos. head light/front light to work the trolley during night. The visibility during night in dry and clear weather shall not be less than 50 m approx. The manufacturer shall also provide suitable tail lights. Wattage and voltage of bulbs used in head lights and tail lights shall be such that these are commonly available in market.

(3) The trolley may consist of strong, light weight welded tubular aluminium alloy frame or any other light weight high strength material capable of giving required strength and rigidity.

(4) The trolley shall have two number chairs of plastic moulded sheet with height adjustable feature enabling officials to sit comfortably while doing track works.

(5) The wheel dia. of the trolley shall be 250-280 mm to provide stability at maximum designed speed.

(6) The trolley shall be capable of running in curves (upto and including 10 degree curves) and shall also be capable of negotiating points and crossings, diamond crossings and single/double slips.

(7) The wheels may be of cold pressed steel; drop forged steel, cast steel or light alloy wheels and shall have self-adjusting ball bearings.

(8) The wheels/trolley shall be insulated so that it does not activate switches and signals while moving in track circuited areas.

(9) The trolley shall have proper and efficient braking system operated by foot pedal or mechanical hand brake. Mechanical hand brakeshall also work as mechanical parking brakes.

(10) The trolley shall have proper suspension system to give good riding.

(11) The trolley shall have

a. Provision for showing a red flag by day and a red light by night, during thick, foggy or tempestuous weather.
b. Suitable detachable guards to remove stone pebbles and stone ballast from rail top.
c. A light weight detachable hood.
d. A moulded plastic tool kit of adequate size to keep detonators, search light, diary, stationary etc.

(12) The trolley should preferably have electric horn to give adequate audible warning.

(13) The trolley shall have necessary speed controlling device to increase or decrease the speed to run at desired speed.

1205Technical Requirement:

The trolley shall fulfill following technical requirements.

1.	Track Gauge (Nominal)	1676 mm
2.	Pay load capacity	400 kg (Max.)
3.	Seating capacity	2 + 2 Nos. persons (Min.)
4.	Self-weight	Max. 95 kg
5.	Speed	20 kmph (approx.)
6.	Gear system	2 speed gear box or hand operated clutch device to increase/ decrease the speed

1206Guide-lines for using, handling, transportation and storing of trolley:

(1) Proper Utilization of the trolley:

Instructions contained in the manual supplied with the machine shall be followed for operation including operational safety measures, repair/maintenance, overhauling, trouble-shooting etc. In addition to the operational instructions contained in the manual given by the supplier, following instructions shall be observed before commencement of operation:

a. Fill the fuel tank if required.
b. Check the brakes.

c. Start the engine by rope / self-starter and run the engine for five minutes for circulation of oil.
d. Engage the gear and drive the trolley.
e. For braking, bring the gear to neutral position and apply the brake.
f. For movement of the trolley on a running track, the GR / SR rules for that particular Zonal Railway shall be followed as applicable for a push trolley.

(2) Precautions in operation:

Following precautions shall be observed during operation:

a. The trolley shall not be over speeded.
b. Operating instructions for the trolley and engine, supplied with the trolley shall be strictly followed.
c. The trolley shall run under trolley protection rule as mentioned in GR/SR.
d. The operator shall be fully conversant about working, maintenance and troubleshooting of the trolley.
e. The trolley shall not be put on the track during foggy or bad weather when visibility is hampered.

(3) Handling:

The trolley shall be handled carefully to avoid any damage. During off-tracking the trolley shall be bodily lifted and not dragged.

(4) Transportation:

The trolley shall be dismantled and loaded in the brake-van / SLR of a train or in a road vehicle for transportation.

(5) Storage:

The trolley shall be kept in a covered garage under lock and key.

1207Maintenance:

In addition to the instructions for maintenance contained in the operating and maintenance manual supplied with the machine, following maintenance practices shall be followed in general:

(1) Daily (Schedule-I):

a. Check the fuel tank and top up if necessary.
b. Clean the engine, axles and outside surfaces of the gear box.
c. Check the tightness of the V-belt / chain.
d. Check the nut, pulley / sprocket and other rotating parts.

(2) Monthly (Schedule-II):

a. Control cable adjustment shall be done, if necessary.
b. Tightening of all nuts and bolts shall be done.
c. Oil changing of the engine shall be done as per engine maker's instruction.
d. Check bearing assembly and replace if found damaged.
e. Check the clutch and gear shifting system.

Servicing of the engine shall be done after 500 km for the first time, after 1000 km for the second time, after 2000 km for third time and thereafter at each 1000 km run or as specified by the engine manufacturer.

(3) POH of Engine & Frame:

a. POH Frequency:

POH of the trolley is done for every **2000 KM or 2 years** whichever is earlier.

b. Methods of POH of engine & Frame:

Sl. No.	Type of overhauling	Procedure& Benefits
1	POH of Engine by Re-boring method	This method is used to overcome the problem of oversize dia developed, by adjusting the bore of the engine to the standard dia designed as per manufacturer's standards. This re-boring work is highly dependent on the condition of the engine chamber and skill of the technicians (who does the re-boring work). This puts us in a situation in which we are not 100% confident on the desired outcome from the overhauled machine. As re-boring work is uneconomical & not reliable, it is highly recommended not to adopt overhauling using re-boring work. *However POH can be done only **once** in such cases.*
2	POH of Engine by Replacement with new barrel assembly	This method is used to overcome the problem of oversize dia developed by restoring the bore of the machine to the standard dia by replacing with a new barrel assembly as per manufacturer's standards. Replacing with new barrel assembly (Chamber) results in developing the characteristics of a new engine and does not require any skill of technicians as in re-boring work. As this method of overhauling is highly reliable and economical, it is recommended to prefer this method of overhauling. An engine can be normally overhauled **3-4 times** by this method.
3	POH of engine by Engine replacement	When an engine is found damaged or not feasible/ economical to be overhauled by any one of the above two methods, it is recommended to replace the old engine with new one.
4	POH of Frame	POH of the trolley frame is to be done on Condition basis.

c. Must change items during POH of engine & Frame may be done, if required.

Item of Engine during POH				**Sl.No**	**Item of POH in Frame**
Sl.No.	**By Barrel assembly**	**Sl.No**	**By Re-Bore method**		

	method				
1.	Barrel assembly	1.	Piston	1.	Frame Pulley.
2.	Piston	2.	Piston Ring	2.	Engine Pulley.
3.	Piston Ring	3.	Connecting Rod	3.	Shaft Bearings.
4.	Connecting Rod	4.	Valves	4.	Reconditioning of Shaft.
5.	Valves	5.	Piston locks	5.	V-Belts.
6.	Piston locks	6.	Connecting Pins		
7.	Connecting Pins	7.	Lifter Valves		
8.	Lifter Valves	8.	Bearings		
9.	Bearings	9.	Cranks oil seals		
10.	Cranks oil seals	10.	Stem oil seals		
11.	Stem oil seals	11.	Lube oil		
12.	Lube oil				

1208Troubleshooting:

S.N.	Trouble	Probable cause	Remedy
1.	Engine fails to start	i) No fuel in the Tank. ii) Cylinder head loose or worn cylinder & piston iii) Improper gap in spark plug	i) Fill the tank with fuel. ii) Tighten all nuts and use Oversize piston & rings, after re-boring if necessary. iii) Adjust spark plug or replace.
2.	Engine starts but runs irregularly and stops.	i) Faulty injector jet ii) Water in the fuel tank iii) Low idling speed	i) Clean the jets change if required. ii) Drain the tank and fill with clean fuel. iii) Increase the idling speed.
3.	Poor Acceleration	Engine overloaded	Check and reduce the load

1209Requirement of manpower:

Twopersonare required for lifting and lowering the trolley on/from the track. One trolley man with a valid competency certificate is needed to drive the trolley.

1210Requirement of consumables:

(1) Fuel (Petrol/Kerosene).

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Chapter –13
Powered Material Trolley

1301 Use:

Powered Material Trolley is used by P.Way staff for carrying small track machines and tools for day to day track maintenance works.

1302Description:

The powered material trolley consists of a platform, made of light steel / aluminium alloy structure and chequered plates, four wheels, seats, braking arrangement fitted on the wheels and an air cooled engine to run the trolley.

Powered Material Trolley

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

Important assemblies of Powered Material Trolley are**:**

(1) **Petrol/diesel engine or a light weight Generator Set**: The petrol/diesel engine shall be of reputed make, indigenously available and of proven performance in traction/automotive application. The engine shall be adequate power having sufficient reserve power to work. The continuous rating of engine under standard I.S. conditions shall not be less than 4 HP. The engine shall be air cooled. A fuel tank of adequate capacity shall be provided for a run of 100 km.

(2) **3-speed gear box**:The transmission system shall be mechanical/hydraulic transmission through 3-speed gear box, hand operated and driving front/rear axles by means of gears.

(3) **Seats:**The Material Trolley shall have a seat in the front to sit 1 + 2 Nos. persons. The seat may have a provisional arrangement for sitting 3 more persons at the back of front seat. The seat shall be either collapsible or detachable. The seat should have a collapsible/ folding type hood/shed.

(4) **Steel or aluminium chequered floor**: The platform may be of steel or aluminium chequered floor having an Overall dimension of 2.0 m x 2.5 m approx. and should have maximum space for loading. The height of platform above rail level should

beapprox. 30 cm. The trolley shall have through axles with self-adjusting ball bearings & steel wheels.

(5) Wheel: The wheel dia of trolley shall be large enough to provide stability at designed speed of 30 kmph (min.) and capable of negotiating diamond switches. The wheels may be of cold pressed steel/forged steel/cast steel or light alloy wheels having a min. dia. of 300 mm and wheel base min. 1500 mm. The profile of wheels shall confirm to IRS profile

(6) Pushing handles: Pushing handles (two Nos.) shall be provided to facilitate pushing the trolley manually in case of engine failure.

1303Functional Requirements:

(1) The Material Trolley shall be self-propelled, powered by an air cooled diesel/ petrol engine or a light weight Generator Set.

(2) The Material Trolley may be fabricated & constructed using light weight material like aluminium alloy.

(3) It shall have easy on and off tracking facility. Preferably by a central turn table. For easy loading & unloading into breakeven, it shall be dismantlable at least in 3 parts.

(4) The Material Trolley shall have a seat in the front to sit 1 + 2 Nos. persons. The seat may have a provisional arrangement for sitting 3 more persons at the back of front seat. The seat shall be either collapsible or detachable. The seat should have a collapsible/ folding type hood/shed.

(5) Two hooks for catching Gauge-Cum-Level shall be provided on the vertical posts of the hood/shed.

(6) The platform may be of steel or aluminium chequered floor having an approx. Overall dimension of 2.0 m x 2.5 m approx. and should have maximum space for loading. The height of platform above rail level should be approx. 30 cm. The trolley shall have through axles with self-adjusting ball bearings & steel wheels.

(7) The wheel dia of trolley shall be large enough to provide stability at designed speed and capable of negotiating diamond switches.

(8) The trolley shall be capable of running in curves (up to & including 10 degree curves) and shall also be capable of negotiating points & crossing, diamond crossings, single/double slips.

(9) The wheels may be of cold pressed steel/forged steel/cast steel or light alloy wheels having a min. dia. of 300 mm.

(10) The trolley shall have proper suspension system to give good riding quality in empty & fully loaded conditions at designed speed.

(11) The trolley shall have proper breaking system operated by foot pedal or mechanical hand break. Mechanical hand break shall also work as mechanical parking brakes.

(12) The trolley shall have the following accessories:

a. Horn: Horn should be loud enough.
b. Flag fixing arrangement shall be provided for fixing flags (RED) during day time.
c. Pushing handles (two Nos.) shall be provided to facilitate pushing the trolley manually in case of engine failure.

1304Technical Requirement:

The trolley shall fulfil following technical requirements:

1.	Track Gauge (Nominal)	1676 mm
2.	Pay load capacity	1000 kg. (Min.)
3.	Seating capacity	3+3 = 6 persons. (Min.)
4.	Self-weight	350 kg (max.)
5.	Speed	30 kmph (Min.)
6.	Gear system	3 speed, 10, 20 & 30 kmph.
7.	Reverse speed	5 kmph (min.)
8.	Wheel base	1500 mm (Min.)
9.	Lighting arrangement	Head and tail lamps shall be provided to both the front and rear side of the trolley.

1305Guidelines for using, handling, transportation and storing of Trolley:

(1) Proper utilization of the trolley:

Instructions contained in the manual supplied with the machine shall be followed for operation including operational safety measures, repair/maintenance, overhauling, trouble-shooting etc. In addition to the operational instructions contained in the manual given by the supplier, following instructions shall be observed before commencement of operation:

a. Fill the tank with petrol / diesel.
b. Put the trolley on track
c. Check the brake.
d. Start the engine and run the engine for 5 minutes for proper oil circulation.
e. Then put the gear in first and give acceleration when the trolley is in movement. Engage the gear, give acceleration for required speed.
f. Always use the clutch in shifting of gear.
g. For stop, bring the gear in neutral position and pull the brake lever.
h. When the trolley is stopped, switch off the key.

(2) Handling:

The trolley shall be handled carefully to avoid any physical damage. During off track of the trolley, it shall be lifted bodily and shall not be dragged.

(3) Transportation:

The trolley should be dismantled in pieces as recommended by the manufacturer and may be transported on loading it to the brake van / SLR of a train or by road-vehicle.

(4) Storage: When not in use, the trolley shall be kept in covered shade.

1306Maintenance Schedule:

Following maintenance practices shall be observed in general. For maintenance of the engine, instruction contained in the operating and maintenance manual supplied with the engine shall be followed:

(1) Daily (Schedule-I):

a. Check the fuel tank and fill fuel if necessary.
b. Clean the engine, axles and outside surfaces of the gearbox.
c. Check the tightening of the V-belt / chain.
d. Check the nuts and bolts, pulley / sprocket and other rotating parts.

(2) Monthly (Schedule-II):

a. Control cable adjustment
b. Check and adjust drive chain / V – belt
c. Tightening of all nuts and bolts
d. Oil changing of engine
e. Check bearing assembly
f. Check clutch and gear shifting.

Servicing of the engine shall be done after 500 km for the first time, after 1000 km for the second time, after 2000 km for third time and thereafter at each 1000 km run or as specified by the engine manufacturer.

(3) **POH of Engine & Frame:**

a. POH Frequency:

POH of the trolley is done for every **2000 KM or 2 years** whichever is earlier.

b. Methods of POH of engine & Frame:

Sl. No.	Type of overhauling	Procedure& Benefits
1.	POH of Engine by Re-boring method	This method is used to overcome the problem of oversize dia developed, by adjusting the bore of the engine to the standard dia designed as per manufacturer's standards. This re-boring work is highly dependent on the condition of the engine chamber and skill of the technicians (who does the re-boring work). This puts us in a situation in which we are not 100% confident on the desired outcome from the overhauled machine. As re-boring work is uneconomical & not reliable, it is highly recommended not to adopt overhauling using re-boring work.

		*However POH can be done only **once** in such cases.*
2.	POH of Engine by Replacement with new barrel assembly	This method is used to overcome the problem of oversize dia developed by restoring the bore of the machine to the standard dia by replacing with a new barrel assembly as per manufacturer's standards. Replacing with new barrel assembly (Chamber) results in developing the characteristics of a new engine and does not require any skill of technicians as in re-boring work. As this method of overhauling is highly reliable and economical, it is recommended to prefer this method of overhauling. An engine can be normally overhauled **3-4 times** by this method.
3.	POH of engine by Engine replacement	When an engine is found damaged or not feasible/ economical to be overhauled by any one of the above two methods, it is recommended to replace the old engine with new one.
4.	POH of Frame	POH of the trolley frame is to be done on Condition basis.

c. Must change items during POH of engine & Frame may be done, if required.

Item of Engine during POH				**Sl.No**	**Item of POH in Frame**
Sl.No	**By Barrel assembly method**	**Sl.No**	**By Re-Bore method**		
1.	Barrel assembly	1.	Piston	1.	Frame Pulley.
2.	Piston	2.	Piston Ring	2.	Engine Pulley.
3.	Piston Ring	3.	Connecting Rod	3.	Shaft Bearings.
4.	Connecting Rod	4.	Valves	4.	Reconditioning of Shaft.
5.	Valves	5.	Piston locks	5.	V-Belts.
6.	Piston locks	6.	Connecting Pins		
7.	Connecting Pins	7.	Lifter Valves		
8.	Lifter Valves	8.	Bearings		
9.	Bearings	9.	Cranks oil seals		
10.	Cranks oil seals	10.	Stem oil seals		
11.	Stem oil seals	11.	Lube oil		
12.	Lube oil				

1307Troubleshooting:

Sl.No.	Trouble	Probable cause	Remedy
1.	Engine fails to start	i) No fuel in the Tank.	i) Fill the tank with fuel.

		ii) Cylinder head loose iii) Improper gap in spark plug	ii) Tighten all nuts iii) Adjust spark plug or replace.
2.	Engine starts but runs irregularly and stops.	i) Faulty injector jet ii) Water in the fuel tank iii) Low idling speed	i) Clean the jets; change jet if required. ii) Drain the tank and fill with clean fuel. iii) Increase the idling speed.
3.	Poor Acceleration	Engine overloaded	Check and reduce the load.

1308Requirement of manpower:

08 person (including at least one trolley man / supervisor).

1309Requirement of consumables:

Fuel & lubricant of recommended grade.

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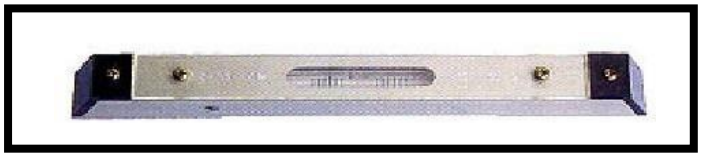
Chapter-14
Box Type Gauge cum Level (BG) with Spirit Level

1401Use:

The Box Type Gauge- Cum - Level is an instrument used to measure the track gauge in mm with an accuracy of 1 mm. This instrument simultaneously measures the cross level of the rails in mm with an accuracy of 1 mm.

Box Type Gauge cum Level (BG)



Spirit Level

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

1402Description:

The gauge- cum- level is an instrument which is to be used to measure the gauge as well as the cross level of Railway track simultaneously. Each gauge-cum-level comprises two main items i.e. the 'gauge' and a spirit level.

Important assemblies of Box Type Gauge cum Level (BG) are**:**

(1) Main Housing: This shall be a rectangular tubing of aluminium alloy and the size of the rectangular extruded Aluminium alloy shall be 50.8 mm x 25.4 mm x 2 mm (approx.)

(2) Handle: The instrument shall be provided with a suitable handle for carrying purpose. The handle including the handle rod and handle fixture shall be made of Aluminium.

(3) End Caps & Eye Piece: The end caps of the main housing and the eye piece including its fixing bracket shall be made of black nylon-6. The projecting glass cover shall have a clear vision and shall be of superior quality.

(4) Sliding Assembly: The connecting rod shall be made of mild steel (Grade A) as per IS: 2062-1992 whereas the Compression spring shall be of Spring steel conforming to IS specification No. 727-1964 (Grade 2) The fixed block and sliding bracket shall be made of Aluminium as per IS 733-1983. The sliding scale shall be of Aluminium as per IS 733-1983 (Design: E1BM) and to be anodised.

(5) Rail Seating: Rail seating as well as gauge tips provided at the sliding end and at the fixed end shall be made of alloy steel of grade 40NiCr1Mo15 and shall be suitably hardened and tempered to achieve a hardness in the range of 40 HRC – 45 HRC.

(6) Screws, bolts & nuts: All the CSK screws, bolts & nuts shall be of good quality. For the sake of interchange ability of the components, threaded screw holes shall be made to suit precision fasteners.

1403Functional Requirements:

(1) The gauge- cum- level is an instrument which is to be used to measure the gauge as well as the cross level of Railway track simultaneously. Each gauge-cum-level comprises two main items i.e., the `gauge' and a spirit level.

(2) The main housing of the gauge shall be fitted with a suitable handle at the centre and two rail seating at the end. These rail seating shall be fitted to the housing body through electrically insulating material so as to make the gauge electrically insulated. The gauge shall be fitted with two gauge tips of which one shall be fixed and other shall be of sliding type. The hardness of rail seating and gauge tips shall be in the range of 40 HRC to 45 HRC.

(3) For measurement of cross level, the housing frame shall be provided with three ramps i.e, smaller ramp , horizontal platform and longer ramp . Cross level from 1 to 30 mm shall be measured by smaller ramp whereas cross level from 1 mm to 200 mm shall be measured by the longer ramp. Graduations shall be neatly etched/ embossed on the scales provided on the ramps.

(4) The sliding assembly shall be housed inside the main frame and shall comprise of one sliding gauge tip (round), a connecting rod with compression spring and one fixed block. The connecting rod shall be fitted with the sliding gauge tip (round) at one end and a movable gauge scale block at the other end through the fixed block which is screwed to the main frame. The sliding tip shall be so designed, that it can be reused after reversal of the same by 180° and shall be capable to measure gauge correctly in both positions. In between the fixed block and the sliding bracket compression spring shall be provided. The movable gauge scale block should carry the ` gauge - scale' at the top. The gauge -scale shall be graduated to measure gauge variation upto 20 mm slack to 10 mm tight. This scale should be clearly visible from outside through the glass of the eye piece. The glass shall be provided with an indicator at the centre which shall be the reference mark to correctly show the correct reading of the gauge on the sliding scale.

(5) The ends of the main housing frame shall be covered with black nylon end caps to protect from dust, dirt and water.

(6) The track gauge shall have elegant finish and shall be properly painted/ anodized /electroplated or finished with such process so as to make the instrument durable and long lasting.

(7) The Gauge-cum-level shall also be of such design and construction so that all moving parts and sub-assemblies are fully enclosed and are protected against ingress of dust & rain. The design shall also have such fastener, and fittings which may not fall off during transit and usage in field.

(8) All the scales shall be finely etched, embossed which should be non-fading and should not deteriorate with usage.

1404Technical Requirement:

(1) For Broad Gauge -

1.	Nominal Gauge	1676 mm
2.	Overall length	1840 ± 5 mm
3.	Measuring range for gauge	+ 20 mm to -10 mm
4.	Accuracy for gauge	+ 1 .0 mm
5.	Super elevation range	- 30 mm to + 200 mm
6.	Cross level precision	+ 1.0 mm

(2) Sprit Level

1.	Base length	200 mm ±1 mm
2.	Base width	20 mm + 0 - 1
3.	Height	25 + 1 mm
4.	Sensitivity	2 Min. 30 Sec per 2 mm arc division of the vial
5.	Least count of graduation	2 mm
6.	Weight (Without packing box)	150 gm (approx.)

1405Guidelines for using, handling, transporting and storing of equipment.

(1) Proper utilization of the equipment:

Instructions contained in the manual supplied with the machine shall be followed for operation including operational safety measures, repair/maintenance, overhauling, trouble-shooting etc. In addition to the operational instructions contained in the manual given by the supplier, following instructions shall be observed before commencement of operation:

a. Inspect the device for damages.
b. Inspect the device for any measurement reading errors.

(2) Precautions in operation:

a. The operator shall be fully conversant with use of the machine. The operator shall not be tired, under stress or under influence of any drug or alcoholic drink.
b. The operator shall read and understand the safety precaution mentioned in the operation's manual and shall strictly follow the instructions.
c. No load or pressure shall be applied on the gauge cum level.

(3) Handling:

The Box Type Gauge Cum Levelshall be handled carefully to avoid any physical damages. The instrument shall be provided with a suitable handle for carrying purpose.

(4) Transportation:

There shall not be rough handling during transporting. The machine may be transported on push trolley/material trolley.

(5) Storage:

The machine shall be stored in a box/carton at a dry place under lock and key.

1406Maintenance:

Instructions regarding maintenance, contained in the operating and maintenance manual supplied with the device shall be followed.

1407Troubleshooting:

If there is trouble in movement of Sliding Assembly then open the spring and replace if required

1408Requirement of manpower:

One skilled person is required to operate the machine.

1409Requirement of consumables:

Nil.

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Chapter-15
Chamfering Kit
Part A
Chamfering Kit- Manual

1501Use:

Chamfering Kit is used to chamfer rail holes to eliminate chances of developing crack at the sharp edge of drilled holes in rail.

1502Description:

Chamfering kit is a tool used for chamfering and work hardening the sharp edges of the periphery of a fish bolt hole. This device is used in a pair on both sides of the rail web on the drilled fish bolt hole to be chamfered.

Important parts/assemblies of Chamfering Kit are:

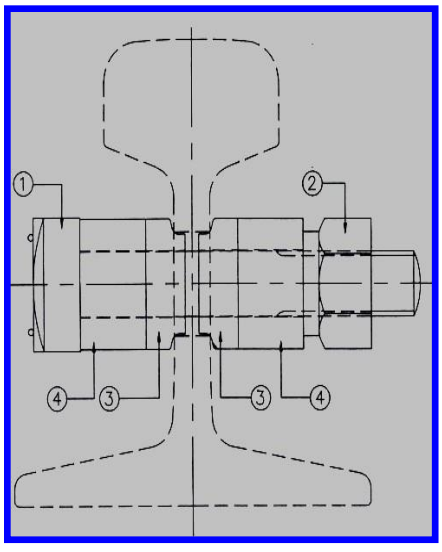
(1) High tensile Bolt:High tensile steel bolts of square head / hexagon head bolt of size M20 x 130.

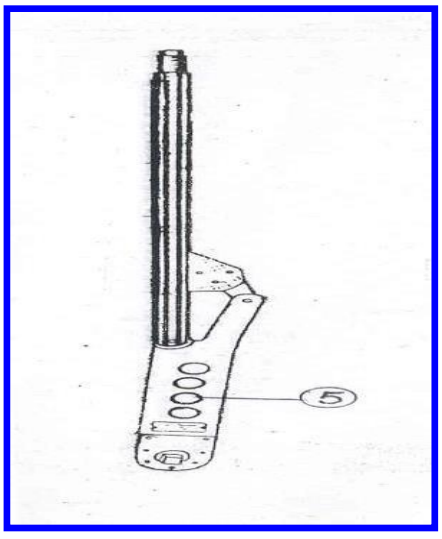
(2) High tensile Nut: The high tensile steel nut shall be of M 20.

(3) Chamfering Bit:Chamfering bit shall be of high speed tool steel and shall be of any one of the seven grades/ Chemical composition and Heat treatment as mentioned in the specification.

(4) Packing Piece:The packing pieces (sleeves) shall be of mild steel.

(5) Torque Wrench: T-400 torque wrench of length 1.25M.





1503Functional Requirement:

(1) The torque wrench shall be able to provide minimum torque of 52 Kg-m.
(2) The chamfering bits and packing pieces (sleeves) shall have good machine finished surface, free from any surface irregularities.
(3) The chamfering tool shall be able to remove minor projections of the edges of the hole as a result of drilling.

1504Technical Requirement:

The Chamfering kit shall fulfil following requirements:

1.	High tensile fish bolt 130 x 20 mm with nut (Bolt is conforming to IS: 1363 (Pt-1): 2019 and nut is conforming to IS: 1363 (Part-3):2018)	01 set
2.	Sets of 02 high speed steel chamfering bits.(For 32 mm dia holes) (Bit is conforming to IS:7291:1981)	01 set
3.	Sets of 02 high speed steel chamfering bits. (For 28 mm dia holes)	01 set
4.	19 mm square drive sockets size 32 mm	02 Nos.
5.	Sets of two packing pieces (sleeves)	01 set
6.	Torque-wrench with ratchet mechanism (Torque-wrench is conforming to IS 16906: 2018)	01 no.
7.	Square box wrench of nominal size 19 mm (if hexagonal head bolt is used).	01 no.

Chamfering kit is a tool used for chamfering and work hardening the sharp edges of the periphery of a fish bolt hole. This tool is used in a pair on both sides of the rail web on the drilled fish bolt hole to be chamfered.

1505Guidelines for using, handling, transportation and storing of equipment.

(1) Proper utilization of equipment:

Instructions contained in the manual supplied with the machine shall be followed for operation including operational safety measures, repair/maintenance, overhauling, trouble-shooting etc. In addition to the operational instructions contained in the manual given by the supplier, following instructions shall be observed before commencement of operation:

a. The hole, to be chamfered, is to be cleaned to remove iron-chips/burrs.
b. The bolt is to be fixed in the rail hole keeping one packing piece and one chamfering bit on one side of the hole and similar set on the other side of the hole. The nut is to be hand tightened first.

c. The torque-wrench is to be set at 52 kg-m torque (for 90 UTS rail) and to be fixed to the square drive socket, torque may be different for higher UTS rail.
d. The nut is to be tightened by the torque wrench, engaging the square drive socket to the nut.
e. Tightening is to be continued unless the torque wrench sounds a 'click', which indicates that the pre-set torque is achieved.
f. The nut is then loosened by the torque wrench by reversing its square drive and turning the nut in reverse direction.
g. The bolt, packing pieces and chamfering bits are removed from the hole.

(2) Precautions in operation:

Following precautions shall be observed during operation:

a. The operator shall be conversant with the use of this kit properly.
b. During tightening of the bolt, the operator shall not lean over the wrench.
c. Drive sockets shall be properly fitted to the nut before operating the torque wrench.
d. The tip of the chamfering bits shall properly match the hole.
e. Ensure correct dia. of hole before chamfering to avoid breakage of chamfering bit.

(3) Handling

The chamfering bits are very hard and shall not be subjected to impact or shock during handling to avoid breakage.

(4) Transportation:

Being light in weight, the chamfering kit can be transported by hand on bi-cycle/push trolley/material trolley.

(5) Storage:

The packing pieces and chamfering bits are to be kept assembled with the bolt. These shall be coated with a thin film of grease during storage. The chamfering kit shall be stored in a wooden carton and kept in a dry place.

1506Maintenance:

(1) The bolt shall be lubricated before every use.
(2) The packing pieces and chamfering bits are to be kept free of dust.
(3) A thin film of grease shall be applied on the packing pieces, chamfering bits and bolt when the kit is not in use.
(4) The torque wrench, when not in use, shall be kept set at its minimum range of setting.

(5) The torque wrench shall be periodically calibrated as per instructions of the manufacturer.

1507Troubleshooting:

(1) If the bolt fails, replace the same by the H.T. bolt as specified in RDSO specification.
(2) For any trouble with torque wrench, its manufacturer may be consulted.

1508Requirement of manpower:

One skilled and one unskilled personnel are required for operation.

1509Requirement of Consumables:

Nil.

Part B
Chamfering Machine (Battery Operated)

1510Use:

Chamfering Machine (Battery Operated) which is portable equipment used to chamfer holes in the rails.

1511Description:

This device is used to chamfer the fish plated bolt holes using drill bits fitted to battery operated drilling machine.

Importantparts/assemblies of Chamfering machine are:

(1) Rechargeable batteries: The machine works with the help of rechargeable batteries.
(2) Battery charger: It is used for charging the battery.
(3) Chamfering tools: With the help of its component, chamfer holes are made in the rail.

Chamfering Machine (Battery Operated)

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

1512Functional Requirement:

(1) The machine shall be lightweight, portable and handy so that one person can carry the same with ease.
(2) The operation of the machine shall be easy, safe and user-friendly.
(3) The vibration coming into the operator's hand shall be least and non-hazardous to operator's health.
(4) The design of the machine shall be such that it is compact in one piece and easily gripped by the operator's hand without any extra pressure or specified effort required to hold it during operation.
(5) The machine shall be capable to chamfer the hole in rails up to 1175 HT. The chamfering shall be uniform around the hole corner /edges.
(6) The machine shall be electrically shock-proof. The battery charger if designed "in-built', shall have easy fitment with the machine.
(7) The chamfering, when done by grinding or any other means, shall leave smooth surface. The grinding stone/tool shall have easy fitment.
(8) The chamfering tool shall be able to remove minor projections of the edges of the hole as a result of drilling.

1513Technical Requirement:

The Chamfering machine shall fulfil following requirements:

1.	Chamfering Time	For rails up to 1175 HT-20 Sec (Max.)
2.	Battery backup during operation	Minimum 150chamfering operations.
3.	Surface finish	Smooth and even
4.	Weight (with battery & one	Maximum 06kg

	chamfering tool)	
5.	Battery life	Minimum 3 years
6.	Stone/tool size	Suitable to chamfer holes of dia.28 mm to 32 mm.

1514Guidelines for using, handling, transportation and storing of machine.

(1) Proper utilization of the machine:

Instructions contained in the manual supplied with the machine shall be followed for operation including operational safety measures, repair/maintenance, overhauling, trouble-shooting etc. In addition to the operational instructions contained in the manual given by the supplier, following instructions shall be observed before commencement of operation:

a. The hole, to be chamfered, is to be cleaned to remove iron-chips/burrs.
b. Before using the machine, the battery should check the charge level. The battery should be fully charged.
c. The bolt is to be fixed in the rail hole keeping one packing piece and one chamfering bit on one side of the hole and similar set on the other side of the hole. The nut is to be hand tightened first.
d. The torque-wrench is to be set at 52 kg-m torque and to be fixed to the square drive socket.
e. The nut is to be tightened by the machine, engaging the square drive socket to the nut.
f. Tightening is to be continued 2-3 seconds only, which indicates that the pre-set torque is achieved.
g. The nut is then loosened by the machine by reversing its square drive and turning the nut in reverse direction.
h. The bolt, packing pieces and chamfering bits are removed from the hole.

(2) Precautions in operation:

Following precautions shall be observed during operation:

a. The operator shall be conversant with the use of this kit properly.
b. During tightening of the bolt, the operator shall not lean over the wrench.
c. Drive sockets shall be properly fitted to the nut before operating the machine.
d. The tip of the chamfering bits shall properly match the hole.
e. Ensure correct dia. of hole before chamfering to avoid breakage of chamfering bit.

(3) Handling

The chamfering bits are very hard and shall not be subjected to impact or shock during handling to avoid breakage.

(4) Transportation:

Being light in weight, the chamfering kit can be transported by hand on bi-cycle/push trolley/material trolley.

(5) Storage:

The packing pieces and chamfering bits are to be kept assembled with the bolt. These shall be coated with a thin film of grease during storage. The chamfering machine shall be stored in a suitable carrying caseand kept in a dry place.

1515Maintenance:

(1) The bolt shall be lubricated before every use.
(2) The packing pieces and chamfering bits are to be kept free of dust.
(3) A thin film of grease shall be applied on the packing pieces, chamfering bits and bolt when the kit is not in use.
(4) The machine, when not in use, shall be kept set at its minimum range of setting.
(5) Charge Battery regularly for long lasting battery life.
(6) The machine shall be periodically calibrated as per instructions of the manufacturer.

1516Troubleshooting:

For any trouble with machine, its manufacturer may be consulted.

1517Requirement of manpower:

One skilled and one unskilled person are required for operation.

1518Requirement of Consumables:

Battery (need based after expiry of life cycle period as mentioned by the manufacturer).

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Chapter- 16
Thermometer
Part: A
Magnetic Base type Rail Thermometer

1601Use:

It enables the user to take instantaneous readings of rail temperature using strong Magnetic sensor complete in case.

Magnetic Base type Rail Thermometer

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

1602Description:

This thermometer is provided with magnet for attaching it to the rail. The thermometer is attached on the shady side of the web. A steady recording of the rail temperature is reached within 6 minutes.

Important assemblies of Magnetic Base type Rail Thermometer are:

(1) Capillary tube: The capillary tube shall be made of any of the thermometric glasses as approved by National Physical Laboratory. The capillary shall be prismatic type with white/yellow enamel back.

(2) Thermometric liquid: Thermometric liquid shall be mercury of high purity.

(3) Magnetic Base: The base plate shall be made from brass sheet of 0.6 mm thick conforming to any of the three grades. The gripping clip for enclosing the bulb shall be made from copper strip of thickness 0.4 mm,

(4) Supporting Neck: The supporting neck and insert moulded rail contact shall be made of glass filled nylon of superior quality and shall be threaded to the casing as mentioned in the drawing.

(5) Top Cap: The top cap shall be made of glass filled nylon of superior quality or of aluminium. The cap shall be screwed into the inner sheath and shall have suitable locking arrangement for both open and close position of the casing by spring and stainless steel ball as shown in the drawing.

(6) Magnet: The magnet shall be of permanent high power rear earth type. The material shall be "Neodymium Ferrous Alloy" with hard zinc plating. The strength of the magnet shall be minimum 1800 gauss.

1603Functional Requirement:

(1) Appearance: Glass capillary shall be of clear transparent glass, free from occlusions, stain, stresses and other visual defects such as bubbles, knots, reflection failures and roughness of bore. A safety chamber shall be provided at the top end, in line with the capillary bore. The safety chamber shall be adequate for a rise of at least 20°C temperature above the specified higher range.

(2) The thermometer shall have magnetic base. The magnet shall be fitted at the periphery of the circular base plate. The base plate shall have good and direct contact with the rail top for rapid conduction of heat from rail to thermometer, when placed on the top of rail.

(3) The bulb of the thermometer shall be encased in a gripping clip which shall be fitted centrally with the base plate by soldering to provide sound metallic contact between the two. The gripping clip shall have a coaxial spring (fitted from outside) for proper contact with the thermometer bulb.

(4) The thermometer shall be enclosed in a metallic tube (inner sheath).The inner sheath shall be enclosed in an outer casing. Both the tubes i.e. inner sheath and the outer casing (rotary cover) shall have an opening lengthwise for viewing the thermometer scale from outside. . The casing shall have a suitable inbuilt lid to open and close the opening when required.

(5) The thermometer shall be designed to firmly stick to the rail top by magnetic action of the base of the thermometer when placed on the top of rail head and shall stand in vertical position. It shall be capable to measure the rail temperature correctly to the specified accuracy and tolerance within six minutes.

(6) The supporting neck shall be fitted tightly to the moulded insert rail contact (the base) by suitable arrangements such as by threading, using adhesive etc.

(7) The scale of the thermometer shall be engraved/etched or printed suitably on the stem.

1604Technical Requirement:

1.	Overall length	200 ± 5mm (including casing)
2.	Overall length of capillary tube	186 ± 2 mm
3.	Least Count	1.0^0C
4.	Temperature Range	- 5^0C to + 85^0C.
5.	Weight	Within 120 gms.
6.	Temperature Recording Time	Within six minutes

1605Guidelines for using and storing of equipment.

(1) Proper utilization of the equipment:

Instructions contained in the manual supplied with the machine shall be followed for operation including operational safety measures, trouble-shooting etc. In addition to the operational instructions contained in the manual given by the supplier, following instructions shall be observed before commencement of operation:

(2) Precautions in operation:

Following precautions shall be observed during operation:

a. The operator shall be conversant with the use of this device properly.
b. The device should be used only after seeing the movement of the train on the track.
c. The thermometer must have been compared with the standard thermometer before using it for the first time.
d. Thermometers shall be placed on rail top. The thermometer shall be kept on rail for six minutes and temperature shall be recorded.

(3) Storage:

The machine shall be stored in a box/carton at a dry place under lock and key.

1606Maintenance:

Instructions regarding maintenance, contained in the operating and maintenance manual supplied with the device shall be followed.

1607Troubleshooting:

If problem in erection of thermometer on rail top or thermometer is giving improper reading then clean the surface of the rail and magnetic base of thermometer.

1608Requirement of manpower:

One skilled person is required.

1609Requirement of Consumables:

Nil.

Part: B
Continuous Rail Thermometer

1610Use:

Continuous Rail Thermometer(CRT)is used for continuously displaying rail temperature, storing the data at pre-set interval and transferring this data to PC through USB port of PC, using Data Transfer Module.

Continuous Rail Thermometer

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

1611Description:

Continuous Rail Temperature Recorder is a versatile device specially designed for continuously displaying Rail Temperature, Storing Data at pre-set interval, and printing the same without the help of computer. The temperature sensing device is attached to the web of the rail through wire and the temperature record is stored in data logger. However, computer compatibility is provided in the device for storing data in CD, USB etc. The device is attached with an internal backup battery which enables the recorder to continuously record & display the data in case of power failure up to 72 hours. The enhanced flash RAM memory is designed to record the data up to 18months on hourly basis. The device comes with a separate data drive which facilitates the user to take the stored data to any remote computer without detaching or disturbing the recording process. A user-friendly browsing feature is also provided to check the pre-recorded data on the LCD Display itself, thus nullifying the need of always a necessary print out to analyse the data. Special Safety alarms on MAX/MIN Crossover &sensor Disconnection make this device fully secure.

Important assemblies of Continuous Rail Thermometer are:

(1) **Display Unit:**This unit shows the date, time, railway, division, station, and rail temperature.

(2) **Storage Unit:** This unit can be placed at nearby cabin to continuously monitor and store the rail temperature. The Device shall be capable of

continuous operation during the varying atmospheric and climatic conditions as follows:

a. Ambient temperature: 0 to 55 deg. C

b. Altitude: Sea level to 700 m

c. Maximum rail temperature: 85 deg. C

Non-volatile memory which shall be capable to store data up to 18 months on hourly basis. Data storing time shall be varied depending on the recording interval time.

(3) **LCD indicator:** There shall be provision to display all logged data output mentioned below on LCD display directly by scrolling.

a. Logged data for the given stipulated period.

b. Maximum and minimum temperature recorded per day for the given stipulated period in accordance with the time stamp.

c. Maximum and minimum temperature attained over the given stipulated period in accordance with the time and date stamp.

(4) **Data Transfer Module:** This module is used for transferring data from Data Logger to Personal Computer (PC) through USB Port of PC.

1612Functional Requirement:

(1) Continuous rail thermometer shall be compact, rugged, shock, dust and water proof, electrically shielded and capable of functioning reliably in field conditions normally encountered in Indian Railway system including on electrified section with High Tension overhead line.

(2) Non-volatile memory which shall be capable to store data on hourly basis. Data storing time shall be varied depending on the recording interval time.

(3) There shall be provision to display all logged data output mentioned below on LCD display directly by scrolling.

a. Logged data for the given stipulated period.

b. Maximum and minimum temperature recorded per day for the given stipulated period in accordance with the time stamp.

c. Maximum and minimum temperature attained over the given stipulated period in accordance with the time and date stamp.

(4) Data logger shall have an independent power source called AC Power Supply cum Battery Charger Module. The Module shall be competent to run on AC mains and charge SMF (Sealed Maintenance Free) or similar rechargeable battery simultaneously. The battery should have life period of minimum 36 months.

(5) While changing/ replacing the battery, there shall be no loss of stored data.

1613Technical Requirement:

1.	Weight	10 kg max.

2.	Resolution	0.1 (logging)
3.	Accuracy	$\pm$ 1.0^0 C
4.	Power Supply	220V $\pm$ 10%, 50Hz AC
5.	Battery backup	at least 72 hours
6.	Memory Type	Non-volatile, retained for upto 18 months on hourly basis
7.	Maximum rail temperature it can measure	85^0 C

1614Guidelines for using, handling, transporting and storing of machines.

(1) Proper utilization of the equipment:

Instructions contained in the manual supplied with the machine shall be followed for operation including operational safety measures, trouble-shooting etc. in addition to the operational instructions contained in the manual given by the supplier.

(2) Precautions in operation:

a. Ensure that all the connections are proper.
b. Check all the fuses before operation.
c. Kindly press Alarm Acknowledgement Key when the user sense the alarm indication as long duration usage of buzzer may damage it.

(3) Handling:

This device is of sophisticated nature, so it should be handling with utmost care.

(4) Transportation:

The machine can be transported manually by one person, if required.

(5) Storage:

The machine shall be stored in a box/carton at a dry place.

1615Maintenance:

Instructions regarding maintenance, contained in the operating and maintenance manual supplied with the device shall be followed. However replacement of the battery may be required after 36 months.

1616Troubleshooting:

Instructions regarding troubleshooting contained in the operating and maintenance manual supplied with the device shall be followed.

Sl.N	Trouble	Probable Cause	Remedy

o.			
1.	If power LED is in off state after applying power.	i) Power cable may be defective ii) Defect in AC to DC Adapter. iii) Fuse in CRT Unit may be blown out. iv) None of the above.	i) Check the power cable continuity. ii) Check voltage in DC socket. iii) Check fuse on CRT Base Unit, if blown, replace. iv) Contact Manufacturer for customer support.
2.	Insufficient battery backup time after complete charging of the batteries.	i) Usage of battery beyond its life.	i) Replace the battery.
3.	If CRT Base Unit is indicating communication error with sensor.	i) Sensor cable defective ii) Loose connection in sensor sockets. iii) None of the above	i) Check sensor cable continuity. ii) Remove the sensor socket and reconnect firmly to avoid loose connection. iii) Contact manufacturer customer support.
4.	Not detecting DTM (Data Transfer Module)	i) Loose connection in connecting DTM ii) None of the above	i) Remove the DTM and reconnect DTM. ii) Contact Manufacturer customer support.

1617 Requirement of manpower:

One skilled person can operate the machine whenever required.

1618Requirement of Consumables:

Nil

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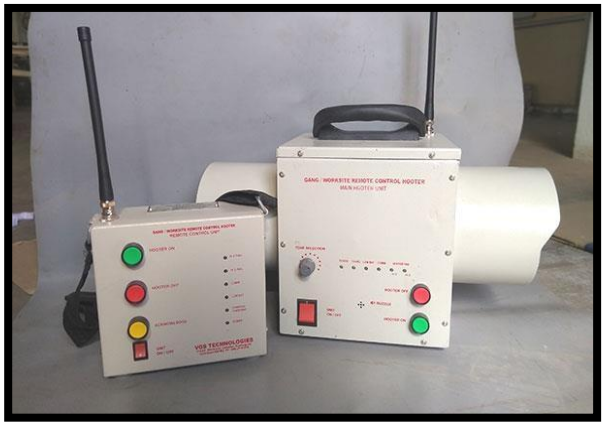
Chapter- 17
Gang/worksite Remote Control Hooter

1701Use:

Gang/Worksite Remote Control Hooter is used to warn the trackmen about a train approaching towards the worksite by transmitting hooting sound at site of work.



Gang/Worksite Remote Control Hooter

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

1702Description:

The equipment consists of two units, the hooting unit and remote-control unit. On the approaching of a train on the same line/adjacent line of track works, the lookout man standing at distance of 1200 M from worksite operates the hooting unit through remote control switch and the hooting unit at worksite emits hooting sound which warns the track men at the worksite. The system also works even if the switch and hooter are not in same line of collimation.

Important assemblies of Gang/worksite Remote Control Hooter are**:**

(1) **Remote Control Unit:**Remote control unit is used to operate Gang/Worksite Remote Control Hooter.

(2) Hooting Unit: The hooting unit shall have a powerful horn to blow in two different tones (one low and one high).The sound of the hooter shall be audible in all direction i.e. 360^0**.**

1703Functional Requirements:

(1) The hooter shall be operable by remote control unit from a distance of at least 1200 m. The system shall work even if the remote switch and hooter are not in same line of collimation.
(2) Lookout man standing at 1200 m from the working site shall operate the hooter by remote control unit in the event of an approaching train over the adjacent track/same track.
(3) The intensity of the sound shall be between 100-120 dB (A) from distance of 5 m from the hooter (when measured in still air in a closed room).
(4) The hooting system shall work normally even when any physical obstruction (like curvature of track in tunnels, cuttings, hills, vegetation etc.) occurs in between the remote-control unit and the hooting unit.
(5) Individual handheld/pocket gadget shall be provided as an optional feature to give visual (blinking LED) /audible (beeping)/vibration warning to workmen within 200-300 meters of the Hoot Unit. This optional feature can be utilized by Railways to give additional warning to workmen who are working in high noise/traffic environment.

1704Technical Requirement:

1.	Sound Intensity of hooter	100 – 120 dB (A)
2.	Sound Frequency	i) 370 $\pm$ 15 Hz (low tone) ii) 660 + 15 Hz (high tone)
3.	Power source	Suitable rechargeable battery
4.	Battery backup time	Min. 2 hrs hooting time & 2 days standby time
5.	Overall life of the battery	Min. 2 years
6.	Relative humidity	Up to 100%.
7.	Maximum weight of Hooting unit	7.5 kg
8.	Maximum weight of remote unit	3.0 kg

1705Guidelines for using, handling, transporting, and storing of equipment.

(1) Proper utilization of the equipment:

Instructions contained in the manual supplied with the machine shall be followed for operation including operational safety measures, repair/maintenance, overhauling, trouble-shooting etc. In addition to the operational instructions contained in the manual given by the supplier, following instructions shall be observed before commencement of operation:

a. Before starting the operation, power switches of both hooting unit and remote-control unit should be on.
b. The hooting unit is to be kept at worksite and the remote-control unit shall be with the lookout man away from the worksite.
c. Switch on both units Hooter Unit and Remote-Control Unit and confirm 'LOW' battery LED not glowing.
d. Wait for a minute and check communication 'LED' in the both units is blinking or not?
e. Press the SET button in the Hooter Unit or ON button in the Remote-Control Unit and check both Hooters are working or not.

(2) Precautions in operation:

a. Proper fixing of Antenna.
b. Indications will be observed regularly in order to check the status of battery before operating the system it may get failure of communication between the remote-control unit and the hooter unit in case Low battery occurs.
c. The system should be kept in charging mode after field operation is completed.
d. There should be an indication for detection of failure of link between the system and remote-control unit.
e. Before going away from the worksite, the lookout man carrying the remote switch should assure that both the hooting unit and the remote unit are functioning properly.
f. For operation of the equipment, after watching the incoming train, the authorized staff at far end shall press hooter 'ON' button on the remote-control unit and gets acknowledgement of hooter activation on his remote-control unit. The hooter placed at worksite will start and continues till the person at work site press the 'RESET' button or remote-control unit person press the hooter stop button in the unit.

(3) Handling:

The equipment shall be handled carefully to avoid any physical damage. Both the hooting unit and remote unit shall be switched off while not in use.

(4) Transportation:

As the equipment is light in weight, one man can carry the equipment himself (on shoulders) on a bicycle or by mono rail trolley over short distances. This can also be transported carefully by material trolley/road vehicle.

1706Maintenance:

For Maintenance of the equipment the instructions laid down in the manufacturer's operating and maintenance manual should be followed.

1707Trouble Shooting:

Sl.No	Observation	Cause	Remedy
1.	If Hooter does not work	i) Battery low ii) Out of covering range	i) Charge the battery ii) Bring in covering range
2.	No beep sound in hooting unit	i) Remote control not working ii) Remote control is out of covering range	i) Switch on the remote-control unit ii) Bring in covering range.
3.	Communication error	Communication LED glowing continually	Check the connectors in the both units tightened properly are not, check the modem ON/OFF switch is in which mode, and put the switch in ON mode.
4.	Problem in battery charging	i) Low battery indication ii) Battery-charging condition is doubtful	i) If any problem in low battery indication. Go through the schematic and verify and component is failed or battery failed. ii) Remove the lugs and check the voltage at the lugs (power card inserted condition). If voltage not coming first check the connection as per working diagram and check the charging PCB circuit.

1708Requirement of manpower:

Two semi-skilled persons are required to operate the machine.

1709Requirement of consumables:

Battery (need based after expiry of life cycle period as mentioned by the manufacturer).

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Chapter-18
Hydraulic Track Lifting cum Slewing Device (TRALIS)

1801Use:

Hydraulic Track Lifting cum Slewing Device (hereinafter called TRALIS) is a hydraulic device used for lifting and slewing of Railway track and turnouts for maintenance/ laying purpose.

1802Description:

TRALIS consists of a pair of lifting cum slewing units (each consisting of one vertical and one horizontal jack) operated by a single hydraulic hand pump connected with pairs of high pressure rubber hose pipes.

Hydraulic Track Lifting cum Slewing Device

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below)

Important assemblies/parts of Hydraulic Track Lifting cum Slewing Device are:

(1) **Saddle/Reaction Support plate**: The Saddle/Reaction Support plate shall be made of carbon steel. The top of saddle plate shall be insulated by providing suitable insulating material like resin-bonded fiber glass of minimum 3 mm thickness.

(2) **Hand pump**: The hand pump shall be steel. The connecting tube & nuts shall be made of good quality steel to withstand working pressure of minimum 800 bars. The pump shall have sufficiently rigid and effective base to avoid tilting of pump unit during operation.

(3) **Hydraulic Hoses**: Hydraulic hoses shall be double steel wire braided impregnated by rubber to withstand working pressure of 700 bars (minimum). The length of hydraulic hoses shall be such that TRALIS can be operated with ease from cess.
(4) **Vertical and horizontal jacks**: The operation of the vertical and horizontal jacks shall be smooth and vibration free under fully loaded condition. The vertical jack shall have safety release valve pre-set at working capacity.

1803Functional requirements:

(1) It is capable of lifting and slewing a plain track / turnout laid with wooden / CST-9/Steel Trough/PRC sleepers with 52 Kg/60 Kg rails. It can be operated by a single man by using its hydraulic hand pump connected with jacks through rubber hoses.
(2) It is capable of giving differential lift for adjustment of cross levels of track.
(3) The operation of the vertical and horizontal jacks shall be smooth and vibration free under fully loaded conditions.
(4) The length of rubber/hydraulic hoses is such that TRALIS can be operated with ease from cess.
(5) It is capable of working in track circuited and electrified areas.

1804Technical requirements:

1.	Reaction trough size	180 ± 5 mm x720 ± 5 mm
2.	Capacity	i) Vertical jack : 15 tons (Max.) ii) Horizontal jack: 7.5 tons (Max.)
3.	Hydraulic lift	i) Vertical jack : 120 mm ± 5.0 mm ii)Horizontal jack : 150 mm ±5.0 mm (left or right)
4.	Overall weight including oil & hoses	120 ± 05 kg
5.	Close Height (top of saddle to bottom of plate)	230± 02mm

1805Guidelines for using, handling, transportation and storing of Device:

(1) Proper Utilization of the device:

Instructions contained in the manual supplied with the Device shall be followed for operation including operational safety measures, repair/maintenance, overhauling, trouble-shooting etc. In addition to the operational instructions contained in the manual given by the supplier, following instructions shall be observed before commencement of operation:

a. Loosen/open the ballast at the ends of sleepers towards the direction of slew for 7 to 8 sleepers on both sides of the slewing point prior to the insertion of TRALIS.
b. Connect the Jack unit to the Pump Unit as per supplier's instruction manual if it is in dismantled condition.
c. Open the Oil Filler Plug cum-Air-Breather partially and close the Release Valve for vertical as well as horizontal operation.
d. Unlock the Directional Control Valve and set the Directional Control Lever for desired slewing (either to slew right or left).

(2) Precautions in operation:

Following precautions shall be observed during operation:

a. The operator shall be well conversant with operation, maintenance and troubleshooting of the equipment.
b. Both the horizontal and vertical jack shall never be loaded beyond rated capacity and the pistons shall not be extended beyond rated limit.
c. Eccentric loading shall not be allowed.
d. Factory pre-set overload safety valve shall not be disturbed.
e. Operate the Pump for lifting the Vertical Jack and stop pumping when the desired lift is achieved.
f. It is advisable to bring the Vertical Jacks at the centre of the reaction trough before they are placed below the rails for slewing. If the required slew is excessive the vertical Jack may be shifted to the extreme end before placing under the track.
g. If slewing for the other side is required, unlock the Directional Control Valve and shift the Valve Lever to the other position. Follow the operation procedure as directed above.
h. Pack the sleeper ends as required.
i. For lifting one rail of the track for correcting unevenness or super elevation, place both the loading units under the same rail at adjacent sleeper position and operate the vertical pump for lifting up to the desired level.

(3) Handling:

The equipment shall be handled carefully so that the surface of the trough plate and piston do not get damaged.

(4) Transportation:

The equipment can be transported by one man walking or on a bicycle or on a mono-rail trolley over short distances or carried by a road or a rail vehicle.

(5) Storage:

The equipment shall be stored in dry and covered place to protect it from rain and dust.

1806Maintenance:

(1) Daily (Schedule-I):

a. Check the hydraulic oil level in the reservoir. Top up if necessary.
b. Check all hoses for leakage. Replace if necessary.
c. Check for any leakages. Replace valves if necessary.
d. Clean the unit to keep it free from dust.

(2) Annual (Schedule-II):

a. It is advisable to open out the unit for servicing once a year or immediately after a period of heavy use. In case, the unit is to be disassembled for replacement of worn-out parts or any other reason, the instructions in Supplier's manual shall be followed.

1807Troubleshooting:

Sl.No	Trouble	Probable Cause	Remedy
1.	Pumping stroke is partially effective.	Air in the pump chamber.	Open release valve, operate the pump rapidly for several times. Close the release valve.
2.	Jack doesn't close completely.	Air under Ram.	Bleed air out. Open Release valve and pump rapidly several times.
3.	Handle rises without effort.	Sticky suction (intake) valve.	Remove pump and clean valve unit.
4.	i) Jack doesn't rise to full height.	i) Lack of oil. ii) Sticky suction (intake) valve.	i) Refill oil. Check for leaks. ii) Remove pump from jack base. Remove the valve unit with a matching screwdriver. Clean or replace ball valves. Retighten or repair.
5.	Jack rises and falls during each stroke	Leaky delivery (discharge) valve.	Tighten pump or replace steel ball in the valve or Brass seat and Copper washer.
6.	Jack doesn't hold up load.	Leaky release valve. Defective Ram seals.	Reseat valve. Remove ram and replace seals.

1808Requirement of manpower:

One skilled and one unskilled person.

1809Requirement of consumables:

Hydraulic oil (as recommended by the manufacturer).

Chapter- 19
Part-A
Track Based Lubricators (Electronic Type)

1901 Use:

Track Based Lubricators are used on railway tracks to lubricate the rails in curves or so as to reduce the friction coefficient between the gauge face of the rail and flange of the wheel. The lubricator is dispensed on to the rail which is then carried forward and spread by the wheel of the moving train.

The important provisions of this STM is described in this chapter. However, for further details RDSO IRST-48 may be referred.

Track Based Lubricator (Electronic Type)

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below)

1902Description:

The application system consists of a rail-mounted sensor, a control box, an AC to DC converter or solar-charged battery, a motor, a pump, a tank with a cover and a material distribution system of hoses and applicators attached to the rails. It consists of an electrically powered pumping system for delivering an adjustable quantity of lubricating material to the rails in a manner such that passing wheels, either all or nominated, would carry the designed amount of lubricant along the gauge face of rails.

Important assemblies:

(1) **Wheel sensor**: Wheel passage should be determined by a disturbance to the localized magnetic flux or such field established by the sensor. Disturbance of the magnetic flux or such field should induce a voltage signal indicating a passing wheel. Assembly to the rail should not require machining of the rail. The control circuit should be designed to accept voltage signals for speeds as low as 10 kmph and should be able to function properly up to speed of 200 kmph.

(2) **Power supply**: Application system should be designed to operate either with direct electrical connection to AC power source or independently using a solar panel and battery.

(3) **Electronic control circuit:** The control circuit should serve to coordinate all operational functions of applicators, meeting a wide variety of application needs and conditions.

(4) **Electric Motor:** The electric motor powering the pump should be directly coupled to the pump and designed to operate on minimum 12 volts DC. Electricmotor should incorporate a suitable arrangement to coordinate withthe speed requirements of the pump.

(5) **Pump:** The pump should be efficient and compact.It should require little and easy maintenance and also easy to prime. Pump should be capable of handling a wide range of viscosities, from the stiffest of lubricant to the most fluid one. Pump should be able to produce adequate minimum pressure required for pumping the desired quantity of lubricant from the lubricant chamber to track rail gauge face for various lifts/heights as per site conditions during passage of train and to perform all the functions of gauge face lubricator. Pump should be mounted in such a way that the pump's inlet port mates directly to tank's outlet near bottom of tank. Between the pump and material there should be a large mesh screen. The supplier will submit the detailed specifications of pump for technical scrutiny of the offer.

(6) **Lubricant Distribution System**: Shut off valve or any other suitable lubricant distribution system should be used to control the flow of lubricant to the applicators. Distribution system should be efficient, able to distribute the lubricant evenly. It should preferably have minimum moving parts. It should require minimum and easy maintenance.

(7) **Hose:**Hoses used with the application system should be connected via screw-type connections to the tank and manifold.

(8) Tank: Tank should be made of all welded steel construction and preferably should include a separate section from the material to hold the control box, power supply, and motor/pump etc. to improve protection against vandalism.

(9) Applicators: The application bars should clamp securely to the rail and beadjustable for different sizes of rails being used in India anddistribution configurations. It should have coverage of minimum 1 Km or 2 Km as the case may be with the recommended high qualityrail-road lubricant. Temperature range should be same as for hose.

(10) Lubricant: Its lubricity should be such that it should provide a friction value of 0.25 μ or below. The carry down effect should be a minimum 1.0/2.0 Km depending on the lubricator. Carry down effect is the distance from the location of lubricator, fixed in the track in the direction (s) of rail traffic up to which lubricant should be carried by the wheel flange effectively to reduce the rail wear and to fulfil all the performance requirements. The lubricant should be non-inflammable, non-toxic and non-health hazard. It should not have an adverse effect on rolling stock components and track components i.e. rails, sleepers, fastenings, ballast etc. Lubricants should be resistant to both water and high temperatures.

1903 Function: The applicator system should be an electrically powered pumping system for delivering an adjustable quantity of lubricating material to the rails in a manner such that passing wheels, either all or nominated would carry the designed amount of lubricant along the gauge face of rails.

1904 Guidelines for using, handling, transporting and storing of machines.

(1) Proper utilization of the machine:

The system operates as passing wheels enter the magnetic or such field of the rail-mounted sensor. The sensor transmits a signal back to the control box. After counting the number of signals from the sensor and when the pre-selected total is reached, the control box turns ON the pump for the pre-selected duration. The material is pumped through a main hose to a central distribution manifold where it splits into distribution hoses that connect to the multi-ported applicators, clamped to the rail i.e. the application of the lubricant to the rail is of non-squirting type. The product is then travel to the dispensing ports of each applicator to deliver controlled amounts of product onto the rails. The product is then picked-up by passing train wheels. The arrangement is such that the optimum product distribution takes place both along circumference of wheel flange as well as longitudinally along gauge face of rail.

(2) Precautions in operation:

a. On an IR network the electrified traction consists of an overhead electric system of either 25000 V AC or 1500 V DC with residual return current passing through one of the rails in the track. The voltage for track circuits for signalling purpose is

up to 12 volts and the corresponding current upto 1 ampere passes through the other rail. The lubricator system should be able to work in the above stated electric traction and signalling system and its induction effect.

b. The lubricator system should be such that it does not affect the signalling system.
c. Check for loose connection of components.
d. The machine is fixed to the building clearance to ensure safety.

(3) Handling:

This device is of sophisticated nature, so it should be handled with utmost care and it should be packed in a cardboard package.

(4) Transportation:

Always maintain the pump the right way up as indicated on the box. On receipt check that package has not been damaged.

(5) Storage:

The equipment shall be stored in a suitable packing box/carton in a covered and dry place.

1905 Maintenance schedule:

It is important to check all the tubing on the system to ensure that it is always tight and leak free.

(1) Daily/ weekly check :

a. Check the grease on top of the rail near the applicator if it is visible then it has to be removed.
b. Check if the grease is coming out of the applicator or not.
c. Check the working of the Wheel Sensor.
d. Check the working of Electronic Control Circuit, Power supply.

(2) Quarterly check :

a. Check the grease in the tank.
b. Check the electric motor.
c. Check when the motor is running Single lamp lights up or not.
d. Check the battery and solar panel, if used for power supply.

(3) Yearly check:

a. Replace the water/acid of Battery, if used for power supply.
b. Check the all hose and pipe condition.
c. Check grease distribution evenly or not.
d. Check the working of Electronic Control Circuit i.e. timer

(4) Bi-yearly check :

Overhaul the machine. (as per OEM instructions)

1906 Troubleshooting:

S. N.	Trouble	Probable Cause	Remedy
1.	Pump Motor does not operate	Power missing	Check the power lines; ensure that any fuse installed is still intact.
		Electric Controller does not function.	Replace electronics board
		Gear motor no longer works	Replace gear motor assembly
2.	Pump is operating but no lubricant reaches points	Tubing is disconnected	Check the condition of tubing in the system and ensure that it is correctly secured and not blocked for example, by hardened grease.
		Distributor valves are blocked	Clean or replace
3.	Lubricant does not reach lubrication points on each pump cycle or irregularly.	Distributor valves are incorrectly connected or sized	Check valves and system schematic.
		Incorrect pause/cycle settings	Ensure that the System designs and settings allow for at least a full cycle for all distributor valves in the system.
4.	No lubricator from pump	Reservoir is empty	Refill uncontaminated fresh grease.
		Air bubble in grease	Disconnecting the primary tubing from the

			pump operates a lubrication cycle. Check that clean, air free grease is coming from the pump and then reconnect the tubing.
		Incompatible lubricant	Some lubricants are not suitable for automatic pumping systems. Replace the grease
		Blocked pumping element	Dismantle the element and check contamination. Clean and reinstall or replace.
		Worn pump element	Replace pump element
		Pump element check worn	Replace pump element
5.	No output from distributor	Blocked plunger	Dismantle the plunger and check for contamination. Clean and reinstall or replace.
		Leakages in distributor	Check for leakages in plunger plug, O ring. Replace
6.	Improper lubricator from applicator	Leakages in applicator	Check for leakages in applicator
7.	The display is not lit in timer.	Incorrect power/voltage.	Check power and voltage. Ensure proper power supply to pump.
8.	The pump starts the lubrication cycle but then immediately stops	Defective or blocked pump motor	Allow the pump to cool. Retry lubrication cycle. If the problem persists it will be necessary to replace the pump motor assembly.

1907 Requirement of manpower:

Nil.

1908 Requirement of consumables:

Grease (as per specification).

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Part-B
Track Based Lubricators (Hydraulic Type)

1909 Use:

Track Based Lubricators are used on railway tracks to lubricate the rails so as to reduce the coefficient of friction between the rail surface and the wheel of the train. The lubricator is dispensed on to the rail which is then carried forward and spread by the wheel of the moving train.
The important provisions of this STM is described in this chapter. However, for further details RDSO IRST-48 may be referred.

Track Based lubricator (Hydraulic Type)

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below)

1910 Description:

The application system consists of an actuator, a pump, a tank with cover, and a material distribution system of hoses and applicators attached to the rails.The applicator system is a hydraulically powered pumping system for delivering an adjustable quantity of lubricating material to the rails in a manner such that passing wheels would carry the desired amount of lubricant along the gauge face of rails.

Important assemblies:

(1) Actuator: It should be easy to install and easy to remove for servicing. It should operate through a closed loop hydraulic system that delivers consistent pressure. While it should be a wheel actuated actuator, the conversion of train wheel energy into the impulses of hydraulic power must be independent of train wheel speed. It should be adjustable to compensate for train speed and wear on head of rails. Also it should be bi-directional.

(2) Pump: It should be an efficient, compact and hydraulically powered motor driving lubricant pump. lt should require little maintenance and be easy to prime. Pump should be capable of handling a wide range of viscosities, from the stiffest of lubricant to the most fluid. Pump should be able to produce adequate minimum pressure required for pumping

the desired quantity of lubricant from the lubricant chamber to track rail gauge face for various lifts/heights as per site conditions during passage of train and to perform all the functions of gauge face lubricator. Pump should be mounted in such a way that the pump's inlet port mates directly to tank's outlet near bottom of tank. Between the pump and material there should be a large mesh screen.

(3) Lubricant distribution system: Shut off valve or any other suitable lubricant distribution system should be used to control the flow of lubricant to the applicators. Distribution system should be efficient, able to distribute the lubricant evenly. It should preferably have minimum moving parts. It should require minimum and easy maintenance.

(4) Hose: Hoses used with the application system should be connected via screw-type connections to the tank and manifold.

(5) Tank: Tank should be made of all welded steel construction and preferablyshould include a separate section from the material to hold the controlbox, motor/pumps etc. The vendor has to provide satisfactory solutionto make complete unit theft/vandalism proof and safety againstdamage.to any part of the equipment. The steel tank containing thecomplete equipment including control panel etc. should be enclosedwith suitable fencing system having separate door with lock andkeyarrangements.

(6) Applicators: The application bars should clamp securely to the rail and be adjustable for different sizes of rails being used in India and distribution configurations. It should have coverage ofminimum 1 Km or 2 Km asthe case may be with the recommended highquality rail-road lubricant.Temperature range should be same as for hose.All bars should mount to rail in such a way so as to minimise thewastage of material from leakage aroundmounting.

The applicators should be multi-port (minimum 10 ports per applicator)configuration designed to deposit material uniformly along the length ofthe applicator.

(7) Lubricant:

Its lubricity should be such that it should provide a friction value of 0.25 μ or below. The carry down effect should be a minimum 1.0/2.0 Km depending on the lubricator. Carry down effect is the distance from the location of lubricator, fixed in the track in the direction (s) of rail traffic up to which lubricant should be carried by the wheel flange effectively to reduce the rail wear and to fulfil all the performance requirements. The lubricant should be non-inflammable, non-toxic and non-health hazard. It should not have an adverse effect on rolling stock components and track components i.e. rails, sleepers, fastenings, ballast etc. Lubricants should be resistant to both water and high temperatures.

1911 Function: The applicator system should be a hydraulically powered pumping system for delivering an adjustable quantity of lubricating material to the rails in a manner such that passing wheels, would carry the desired amount of lubricant along the gauge face of rails.

1912 Guidelines for using, handling, transporting and storing of machines.

(1) Proper utilization of the machine:

The application system must be a proven system and should be functional in all climatic conditions in India. The application system should consist of an actuator, a pump, a tank with cover, and a material distribution system of hoses and applicators attached to the rails. The whole system should be compatible with the lubricant.

(2) Precautions in operation:

a. On an IR network the electrified traction consists of an overhead electric system of either 25000 V AC or 1500 V DC with residual return current passing through one of the rails in the track. The voltage for track circuits for signalling purpose is up to 12 volts and the corresponding current upto 1 ampere passes through the other rail. The lubricator system should be able to work in the above stated electric traction and signalling system and its induction effect.
b. The lubricator system should be such that it does not affect the signalling system.
c. At the time of installation of the lubricator system, the lubricator system would not be older than 1year.
d. Check for loose connection of components.
e. The machine is fixed to the building clearance to ensure safety.

(3) Handling:

This device is of sophisticated nature, so it should be handled with utmost care and it should be packed in a cardboard package.

(4) Transportation:

Always maintain the pump the right way up as indicated on the box. On receipt check that package has not been damaged.

(5) Storage:

The equipment shall be stored in a suitable packing box/carton in a covered and dry place.

1913 Maintenance schedule:

On the first use of the pump after filling the reservoir, the air must be taken out from the system.It is important to check all the tubing on the system to ensure that it is always tight and leak free.

(1) Daily/ weekly check :

a. Check the grease on top of the rail near the applicator if it is visible then it has to be removed.
b. Check if the grease is coming out of the applicator or not.
c. Check for any leakage of grease from the hose and apply it to remove leakage if any.

(2) Quarterly check :

a. Check the grease in the tank.
b. Check the hydraulic oil in the tank.
c. Check the actuator.

(3) Yearly check:

a. Replace the hydraulic oil.
b. Check the all hose and pipe condition.
c. Check grease distribution evenly or not.

(4) Bi-yearly check :

Overhaul the machine. (As per OEMs instructions)

1914 Troubleshooting:

S. N.	Trouble	Probable Cause	Remedy
1.	Hydraulic Motor does not operate	Hydraulic actuator not working	Check the hydraulic lines
		Hydraulic pump not working	Replace NRV of hydraulic actuator
		Air lock in hydraulic actuator	Remove the hydraulic actuator Outlet and actuate the actuator, till the oil comes out.
2.	Pump is operating but no lubricant reaches points	Tubing is disconnected	Check the condition of tubing in the system and ensure that it is correctly secured and not blocked for example, by hardened grease.
		Distributor valves are blocked	Clean or replace
3.	Lubricant does not reach lubrication points on each pump cycle or irregularly.	Distributor valves are incorrectly connected or sized	Check valves and system schematic.
		Incorrect pause/cycle settings	Ensure that the System designs and settings allow for at least a full cycle for all distributor valves in the system.
4.	No lubricator from pump	Reservoir is empty	Refill uncontaminated fresh grease.
		Air bubble in grease	Disconnecting the primary tubing from the pump operates a lubrication cycle. Check that clean, air free grease is coming from the pump and then reconnect the

			tubing.
		Incompatible lubricant	Some lubricants are not suitable for automatic pumping systems. Replace the grease
		Blocked pumping element	Dismantle the element and check contamination. Clean and reinstall or replace
		Worn pump element	Replace pump element
		Pump element check worn	Replace pump element

1915 Requirement of manpower:

Nil

1916 Requirement of consumables:

(1) Hydraulic Oil.

(2)Grease.

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Chapter-20
Off Track Tamper

2001 Use:

The Off Track Tampers (OTT) are intended to be used as a regular means of packing for spot attention/picking up slacks in between two successive tamping with heavy on track tamping machine on concrete sleeper track on Indian Railways. It is useful to eliminate the triangular pits under the sleepers and improve the track safety. OTTs are either percussion type or vibrating type based on method of tamping. Based on mode of operation, they are of power pack version or engine mounted version or battery operated.

Off Track Tamper

(This Photo is only for guidance and the machine can differ. However, it should meet the functional requirements as described below).

2002 Technical Requirement

Sl.No.	Requirement	Description
1.	Drive	BLDC electric motor
2.	Output	2.0 kW
3.	Weight	from 22.5
4.	Diameter	Tamping tool 75 mm
5.	Battery power	2300 Wh.
6.	Operation	Vibration type

2003Guidelines for using, and precautions in operation of Machine.

(1) Proper utilization of the machine:

Instructions contained in the manual supplied with the tamper shall be followed for operation including operational safety measures, repair/maintenance, overhauling, trouble-shooting etc. In addition to the operational instructions contained in the manual given by the supplier, following instructions shall be observed before commencement of operation:

a. Inspect the entire tool before each use. Re-place damaged parts.
b. Check for fuel leaks and make sure all fasteners are in place and securely fastened.
c. Replace parts that are cracked, chipped or damaged in any way before using the tool.
d. Do not smoke or allow smoking near fuel or the tool or while using the tool.
e. When filling up fuel, stop engine and make sure engine is cool and choose the places where no flammables present and well ventilated.
f. Wipe up all fuel spills before starting engine.

(2) Precautions in operation:

a. Always wear heavy, long pants, boots and gloves. Do not wear loose clothing, jewellery, short pants and sandals or go barefoot. Secure hair so it is above shoulder length.
b. Do not operate the tool when you are tired, ill or under influence of alcohol, drugs or medication.
c. Never let a child or inexperienced person operate the machine.
d. Never start or run engine inside a closed room or building. Breathing exhaust fumes can kill.
e. Always wear a safety face shield or goggles.
f. Keep handles free of oil and fuel.
g. Hold the handles firmly with both hands and make sure to stand on the firm base or ground.
h. Do not touch spark plug, high voltage cord during operation as it may cause electric shock.
i. To avoid burn do not touch those places like engine, muffler, exhaust where get every hot during in use or even after stop engine until it gets cool for the time being.
j. When operation is prolonged, take a break from time to time so that you may avoid possible white finger disease which is caused by vibration.
k. For ear-protection against the sound emitted during operation of machine, suitable ear protector shall be supplied along with safety apron and leather gloves (four sets) by the manufacturer with each set.

(3) Handling:

The equipment shall be handled carefully to avoid any physical damage.

(4) Transportation:

A set of OTT can be transported in 2 Nos. of two wheelers fitted with hook by 2 persons (only drivers).

(5) Storage:

a. In case of engine mounted version: Empty the fuel tank before storing the tool. It is recommended that the fuel be emptied after each use at the end of the day. If fuel is left in the tank, ensure that fuel shall not leak.
b. Suitable precautions to be taken to ensure battery not get discharged in case of battery operated version.

2004Requirement of manpower:

Minimum 2 skilled persons per set are required to operate the machine.

2005Requirement of Consumables:

(1) Fuel in case of power pack & engine mounted version.
(2) Battery in case of battery operated version.

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Chapter-21
Man Power and Training

2101 General:

Manpower is the most precious and important resource for operation and maintenance of Small Track Machines. Skilled and trained manpower is required to man small track machines for their optimal utilization.

2102 Requirement of Manpower :

The scale of man power requirement for small track machine working and maintenance is fixed for following activities:

(1) Field operation (manpowerrequirement is specified in each chapter)
(2) Technicians for schedule attention including IOH, minor repairs and maintenance at SSE/P.way office.
(3) Repair and maintenance for POH/ major breakdowns atDCSTMD/ ZCSTMD.

Sl.No.	Depot	SSE/JE/STM	Technicians	Track maintainers/artisans/khalasis
1.	DCSTMDor (ZCSTMD)	1 or(3*)	2 or (6)	4 or (6)
2.	SSE/P.Way	-	2	-

Note: **3 SSE/JE/STM for working in ZCSTMD depot and in addition, 2 SSE/JE/STM for working in ZCSTMD/BZA training Institute.*

2103 Training:

Training in operation and maintenance shall be imparted to supervisors and technicians dealing with Small Track Machines.

(1) Training at Zonal Centralised Small Track Machines Depot(ZCSTMD)

Zonal Centralised Small Track Machines Depot (ZCSTMD) of South Central Railway at Vijayawada (BZA) shall be responsible for imparting training to all SSE/JE/STM and Technicians of DCSTMD of different divisions of Indian Railways. Following trainings shall be imparted:

- **a.** Induction
- **b.** Refresher
- **c.** Special Courses

ZCSTMD/BZA may also arrange courses for Technicians working under SSE/P.Way of Indian Railways from time to time.

The training should cover, understanding working of machines, their schedule maintenance (IOH & POH), attending minor repairs, trouble shooting and maintenance of Log book and History Books as per the training module given in table below.

(2) Training at Divisional Centralised Small Track Machines Depot(DCSTMD)

a. Divisional Centralized Small Track Machines Depot (DCSTMD) of every division shall be responsible for imparting training to all Technicians under SSE/P.Way of the division. This will include class room (25%) and On hand training (75%).

b. Initial/Induction training should be imparted immediately after their posting/selection as Technicians.

c. The technicians shall undergo refresher on job training once in 6 months on rotation basis while POH/ major repairs are carried out live at DCSTMD.This will ensure regular improvement of skill set required and understanding the technology involved in making STMs. This training will go in a long way in building confidence in the minds of techniciansfor day to day troubleshooting, attending to minor repairs and carrying out IOH of various STMs.

The training module to include various safety precautions while working on track, working instructions including Do's & Don'ts and various maintenance schedules along with common trouble shootings for frequently used machines, as given in table below.

The training frequency shall be as under:

Training Type	SSE/JE/STM	Technicians of DCSTMD	Technicians of SSE/P.way
Induction	After being posted as SSE/JE/STM for a period of 2 weeks at ZCSTMD/BZA.	After being posted as Technicians for a period of 3 weeks at ZCSTMD/BZA.	After being posted as Technicians for a period of 3 weeks at DCSTMD.
Refresher	Every 3 years for a period of 1 week at ZCSTMD/BZA.	Every 3years for a period of 1 week at ZCSTMD/BZA.	Every 6 months for a period of 1 week at DCSTMD.
Training for acceptance criteria of STMs at RDSO	SSE/JE/STM for a period of 3 days, As nominated by zonal railway.(RDSO will conduct special	-	-

	training programme every year.)		
Special Course	As required at ZCSTMD/BZA.	As required at ZCSTMD/BZA.	As required at DCSTMD/ZCSTMD/BZA.

(3) Training by OEM at DCSTMD or at manufacturer's premises:

a. During the procurement of STMs through vendors, initial training in operation and maintenance of machine shall be imparted in DCSTMD to operators and technicians. Vendors should impart another round of refresher training also for training of Operators after three months of supply subject to Tender Conditions.

b. The tender condition should be framed to include training in operation and maintenance of the supplied machine by the supplier/manufacturer.

c. Vendors shall also provide brochures containing directions, Do's & Don'ts about the machine and its working in Hindi and local language at the time of supply and during training.

2104 Training Modules:

(1) Items to be covered in SSE/JE/STM (Induction) course at ZCSTMD/BZAfor a period of 12working days(2-weeks):

Types of training	Items to be covered.
Class room training	i) Duties of SSE/JE/STM ii) Technicians & Maintenance Schedules iii) I.C. Engines iv) Abrasive Rail cutter (ARC) v) Rail Drilling Machine(RDM) vi) Compressed Air Petrol heating system(CAP) vii) Rail Profile Weld Grinder(RPWG) viii)Portable A.C. Generator ix) Portable D. C. welding Generator x) Weld Trimmer(WT) xi) Hydraulic/Mechanical Track Jack xii) Hydraulic rail tensor xiii) Toe Load measuring device xiv) All other STMs xv) Trouble shooting methods xvi) Essential spares, Lubricants & Consumables xvii)Maintenance of Log Book xviii) History books & Google Spread Sheet xix) All other STMs and any other new machine if

	introduced.
Field training	i) Visit to model room and identification of spare parts, ii) Illustration of I C Engine Parts, iii) Witnessing Dismantling/Assembling of Abrasive Rail Cutter, iv) Rail Drilling Machine, v) Compressed Air Petrol preheating machine, vi) Rail Profile Weld Grinder, vii) Portable A.C. Generator viii) D.C Generator, ix) Weld trimmer, x) Hydraulic Track Jack, xi) Hydraulic Rail Tensor xii) Toe load Measuring Device xiii) All other STMs and any other new machine if introduced.

(2) Items to be covered in Refresher programme for SSE/JE/STM at ZCSTMD/BZAfor a period of 6 working days (1 week):

Types of training	Items to be covered.
Class room training/ Field training	i) IC engines working & Illustration of Engine spares ii) Witnessing Dismantling/Assembling of a. Abrasive Rail Cutter b. Rail Drilling Machine, c. Compressed Air Petrol preheating machine d. Rail Profile Weld Grinder e. Portable A.C. Generator f. D.C Generator, g. Weld trimmer, h. Hydraulic Track Jack, i. Hydraulic Rail Tensor j. Toe load Measuring Device k. All other STMs and any other new machine if introduced.

(3) Items to be covered for the Technicians at ZCSTMD/BZA or DCSTMD. (Induction Course)for a period of 18 working days (03 week):

Types of training	Items to be covered
Class room training	i) Illustration of I C Engine Parts, ii) Abrasive Rail Cutter, iii) Rail Drilling Machine, iv) Compressed Air Petrol preheating machine, v) Rail Profile Weld Grinder, vi) Portable A.C. Generator vii) D.C Generator, viii) Weld trimmer, ix) Hydraulic Track Jack, x) Hydraulic Rail Tensor xi) Toe load Measuring Device xii) All other STMs and any other new machine if introduced. xiii) Essential Spares, Lubricants & Consumables xiv) Maintenance of Log Book, History books, safety precautions &monitoring of STM's working

	through Google Spread Sheet
Hands on training	i) Visit to model room and identification of spare parts, ii) Illustration of I C Engine Parts iii) Dismantling/Assembling of a. Abrasive Rail Cutter b. Rail Drilling Machine c. Compressed Air Petrol preheating machine d. Rail Profile Weld Grinder e. Portable A.C. Generator f. D.C Generator g. Weld trimmer h. Hydraulic Track Jack i. Hydraulic Rail Tensor j. Toe load Measuring Device k. All other STMs and any other new machine if introduced.

(4) Items to be covered in refresher programme for technicians of DCSTMD at ZCSTMD/BZAfor a period of 6 working days (1 week).

Class room/ hands on training
i) Dismantling/Assembling of a. Abrasive Rail Cutter b. Rail Drilling Machine c. Compressed Air Petrol preheating machine d. Rail Profile Weld Grinder e. Portable A.C. Generator f. D.C Generator g. Weld trimmer h. Hydraulic Track Jack i. Hydraulic Rail Tensor j. Toe load Measuring Device k. All other STMs and any other new machine if introduced. ii) Trouble shooting methods of different STMs iii) Essential Spares, Lubricants & Consumables iv) Maintenance of Log Book, History books, safety precautions.

(5) Training module of refresher programme for technicians of SSE/P.wayat DCSTMD.

This training is to enable the technicians of sections to fully familiarize the repairs and troubleshooting techniques of the STMs.It should be mandated that at least 3 different

STMs are fully dismantled and assembled by the technicians of the sections in DCSTMD premises.

Class room/ on hands training
Every technician should get involved while POH/ major repairs of minimum 3 types of STMs are carried out live at DCSTMD.This will ensure regular improvement of skill set required and understanding the technology involved in making STMs. This training will go in a long way in building confidence in the minds of techniciansfor day to day troubleshooting, attending to minor repairs and carrying out IOH of various STMs.

2105 Training of SSE/JE/STMby RDSOregarding Acceptance Criteria of new STMs:

SSE/JE/STM of Zonal/Divisional Depots should be nominated as consignee in each Zone/Division to receive the supply of STMs. These machines should be accepted only after due inspections as stipulated in the specification of machines. The consignees need to be technically upgraded regarding the existing Acceptance Criteria laid down in the specification. SSE/JE/STMs responsible to carry out these inspections before acceptance of these machines should be trained by TMM Directorate of RDSO for 3 days to technically equip them for carrying out prescribed Acceptance Tests. Railway shall nominate their SSE/JE/STM to RDSO in consultation with TM directorate of RDSO for period of 3 days. RDSO will conduct special training programme every year**.**

Chapter-22
Maintenance Infrastructure

2201 General:

Periodical maintenance including overhauling and timely repairs are essentially required for ensuring reliable and efficient working of small track machines. There should be a proper schedule of maintenance and necessary infrastructure should be created for carrying out the maintenance of small track machines.

2202 Maintenance Schedule for Small Track Machines:

Periodical maintenance and repairs of machines shall normally be carried as per Schedules I to V mentioned in para 113 of chapter-1. Schedule IV pertains to Intermediate Overhauling (IOH) which is to be carried out at HQ of SSE/P.Way/In-chargeand Schedule V pertains to Periodic Overhauling (POH) which is to be carried out atzonal centralized small track machine Depot/Divisional centralized Small Track Machine Depot as per prescribed frequency.

Note: List of Essential spares, Consumables and Lubricants used in STMs are given in Appendix-III for guidance.

2203 Types of Workshops:

For carrying out the repairs as well as periodical maintenance of Small track machines, two types of repairs and maintenance facilities/workshops shall be developed as below:

(1) Zonal Centralized Small track Machines Depot (ZCSTMD) or Divisional Centralised Small Track Machine Depot (DCSTMD).
(2) SSE/P.Way office compound.

2204 Zonal / Divisional centralized Small Track Machine Depot:

ZCSTMD/DCSTMD isto be developed to carry out major repairs, periodical overhauling of STMs and as a technical hub for training the open line staff dealing with STMs.

(1) Functions of ZCSTMD/DCSTMD:

a. POH of machines.
b. Overhauling of I.C. Engines, gearboxes, Hydraulic units, Compressors, Generators.

c. Development of expertise, standardization/ documentation/ dissemination of knowledge with respect to overhauling of assemblies.
d. Study and development of inter-changeability of components and sub-assemblies.
e. Study of failures, finding out remedial measures, troubleshooting, modification & refinement of maintenance practices.
f. Procurement of stores and equipment required for POH and gadgets required for testing of overhauled machines, sub-assemblies and components.
g. Inspection and testing of machines/assemblies received prior to and after POH.
h. Study of new machines and preparation of inventory list with complete series of machines
i. Development of indigenous substitutes and reliable competitive sources of supply.
j. Providing shop floor training regarding maintenance and operation of machines to technicians/Operators on demand.
k. Acting as knowledge centres for Small track machines.

(2) POH Execution at Zonal/Divisional Centralized Depots.

a. On arrival of the machine JE/SSE/STM should conduct a survey of machine for assessment of repairs and reconditioning works required.
b. Unit Exchange for POH: To minimize POH duration, activities of POH should be planned on the basis of unit exchange for various subassemblies like engines and other important assemblies/sub-assemblies.
c. DCSTMD/ZCSTMD shall adhere to the prescribed time schedules for completing the POH.

(3) Dispatch of Machine after POH

a. After out turn of machine from shed, all functional parameters shall be checked and then only the machines shall be dispatched.
b. DCSTMD/ZCSTMD should furnish the list of spares replaced during POH and released components shall be handed over to sections from where the machine is come from.
c. Feedback of machine and its performance after POH should be sent to DCSTMD/ZCSTMD.

2205 Maintenance in SSE/P.Way Office:

The trained technicians shall perform emergency /minor repairs and will cater for schedules I, II, III, and IV in the office Compound of SSE/P.way. The technicians shall be provided with a standard tool kit @ 1 set per SSE/P.way to carry out minor repairs and complete maintenance schedules. List of tools is given in Table-1

In addition, the trained technicians shall also be provided with durable bag for accommodating a standard tool kit, Measuring devices (volt meter,current meter, spark pluggap measuring gauge ,load meter etc,.). All the STM operators are to be provided with safety gadgets such as aprons, goggles, hand gloves etc.for their personal safety during operation of STM.The tool kit, sky bag, measuring devices and safety gadgets shall be procured and supplied by ZCSTMD/DCSTMD. The expenditure shall be chargeable to Revenue /Track Renewals/Construction estimates.

Standard Tool Kit

2206 Infrastructure Facilities:

Following facilities are necessary for maintenance of machines:

(1) Infrastructural Facilities for ZCSTMD/DCSTMD: Various infrastructure facilities like shed & structure, Plant & machinery (work benches/Inspection & measuring tools/ working tools) and other miscellaneous equipment required for ZCSTMD, DCSTMD are given in **Table-1.**

(2) Mobility: A Multi Utility Vehicle with each SSE/STM should be provided for transportation of machines. This vehicle will also be utilized for transportation of machines to nearby local market for repair and for procurement of spares.

Requirement of Facilities in various Depots
(Table-1)

Sl.No	Description of Item	For ZCSTMD	For DCSTMD	For SSE/P.Way Office
1.	**Stacking Shed& model room**: This shed is utilized for stacking the Incoming and outgoing Machines & model room. The shed should be provided with vacuum dewatered flooring and roof made of Galvanised Aluminium /Aluminium sheet with thermal insulation layer and natural drift exhaust system which will have 10-15% translucent sheets.	24 m X 10 m	-	-
2.	**POH & Repair Shed**: This shed is utilized for carrying out POH and Major Repairs. The shed should be provided with vacuum dewatered flooring and roof made of Galvanised Aluminium /Aluminium sheet with thermal insulation layer and natural drift exhaust system which will have 10-15% translucent sheets. For DCSTMD, this shed may be provided for stacking of incoming and outgoing machines.	24 m X 10 m	24m X 10 m	-
3.	**Shed for Stores, Spare parts**, **Administration**: One shed is provided for Keeping the spares, consumables and lubricants with proper storage/ racks arrangement and also provision for Administration Office. The shed should be provided with vacuum dewatered flooring and roof made of Galvanised Aluminium /Aluminium sheet with thermal insulation layer and natural drift exhaust system which will have 10-15% translucent sheets.	24 m X 10 m	15m X 10m	-
4.	**Rest house** Adequate facilities for resting, dining, kitchen and	For ZCSTMD: 20	15 bedded dormitory for Technicians.	-

	recreation should be provided	bedded dormitory for technicians. For ZCSTMD/BZA: 6 rooms for supervisors and 20 bedded dormitory for Technicians.		
5.	**Class room for training:**	One Class room for training of 20 trainees.	One Class room for training of 15 trainees.	-
6.	Boundary wall with barbed wire fencing enclosing the workshop having provision of CCTV cameras with watch men and lighting posts to cover entire workshop area.	Yes	Yes	-
7.	**Test track**: For testing of Abrasive Rail Cutter, Rail Drilling machine, Rail profile Grinder, Toe load measuring device etc.,	Minimum One rail length	Minimum Half rail length	-
Plant and Machinery				
1.	**Work benches**: Work benches for repair of machines	04Nos.	02Nos.	-
2.	**Ramp** Ramp of suitable height and capacity for Loading and Unloading of STMs from lorry/ MUV.	01 No.	01 No	-
3.	**Inspection and measuring Equipment**:			
	Vernier calliper	02Nos.	01 No.	01 No.
	Feeler Gauge	02Nos.	01 No.	01 No.
	Digital Multi meter	02Nos.	01 No.	01 No.
	Measuring jugs: 0.5 lit, 1 lit, 2 lit	02 each	01 each	01 each
	Tachometer(0-9999 rpm) contact less type	02Nos.	01 No.	-

	Micrometre	02Nos.	01 No.	-
	Bore gauges	02Nos.	01 No.	-
	Contact less thermometer	02Nos.	01 No.	-
	Barrel pumps	04Nos.	04Nos.	-
	Mileage testing bottles	04Nos.	02Nos.	-
4.	**Working Tools:**			
	Lathe (3 ft.)	01 No.	01 No.	-
	Radial Drilling Machine(1.5m height up to 32 mm Drill)	01 No.	01 No	-
	Tool grinder(Rotary Type 500 mm disc)	01 No.	01 No.	-
	Drill, reamers & tap set 4,6,8,10,12,14,16,20& 24 mm	01 set	01No.	-
	Hand Drill (230v operated)	01 No.	01 No.	-
	Battery Charger (12/24V)	01 No.	01 No.	-
	Bench vice	01 No.	01 No.	-
	Pullers (for removing bearings, bearing covers)	02 Sets each	02 Sets each	-
	Arc welding plant	01 No.	01 No.	-
	Air compressor Painting equipment	01 No	01 No.	-
	Gas cutting equipment	01 No.	01 No.	-
	High pressure jet cleaning machine	01 No	01 No	-
	Standby power supply Generator	01 set	01 set	-
	Hydraulic Press capacity of 20 tonne capacity	01 No.	01 No.	-
	Soldering unit	01 set	01 set	-
	Tool kit (with different sizes of wrenches, spanners, ratchet bit sockets, hammers, pliers, screw drivers, adjustable wrenches, monkey pliers, and Allen keys)	05 Sets	02No.	01 Set.
	Sky bag (for accommodating tool kit)	-	-	01Nos.
5.	**Miscellaneous**:			
	Computer with printer(with internet connection)	03 No.	01 No.	01 No.

	Industrial RO with water cooler of Suitable capacity	01 Set	01 No.	-
	Multi utility Vehicle(6 seater)	01 No.	01 No.	-
	Lorry 6 ton capacity	01 No	-	-
	Firefighting system	01 Set	01 set.	-
	Heavy Duty Industrial vacuum cleaner	01 No.	01 No.	-
	Release material handling hand trolley	02Nos.	01 No.	-
	Aprons, googles, mask and safety shoes.	04 sets	02 sets	One set for each operator.

Chapter -23
STORES AND CONTRACTS

2301 Store Depot:

Small track machines of different types and models equipped with mechanical, hydraulic and Electrical system have very large numbers of spare parts. A well attached organized store depot is necessary for smooth functioning of the Zonal/Divisional centralized small track machines depot (ZCSTMD/DCSTMD).

Store shall have to be under the charge of SSE/JE/STM. Store shall be for stocking of consumables, spares and unit assemblies.

2302 Inventory Control:

(1) Pricing of Items and Consumption: SSE/JE/STM shall maintain record of pricing of spares and consumables procured for different STMs and their normal annual consumptions.

(2) Estimated annual Requirements: The stock position, consumption trends and the estimated annual requirements should be reviewed periodically by ADEN/ZCSTMD/DCSTMD.

(3) Fast moving items:Fast moving itemsare those spares or consumables, which are required to be issued frequently. Any items requiring issue more than once in a week regularly in last six months period can be termed as fast moving.

List of fast moving spares should prepare as per following pro-forma.

Sl.No.	Date	Item required	Stock position in stores	Remarks

A monthly review of the consumption of fast moving items should be done at the ZCSTMD/DCSTMD. SSE/JE/STM should maintain a record in which he should enter the stock position of materials affecting day to day working.This record will help the SSE/JE/STM to pin point the items to be dealt on priority.

(4) Recoupment of stocks: The action for recoupment of any items should be intimated keeping in view the lead period so as to have one year requirement in stock. Whenever procurement action is initiated the following shall be ensured:

a. That the estimated annual requirement is worked out on past three years consumption. For the items for which last three years consumption is not available, manufacture's recommendations or data from other railway can be considered to arrive at the figure of average annual consumption.

b. For proprietary items, necessary proprietary article certificate duly signed by competent authority shall accompany the indents.

c. Wherever required, indents shall be accompanied by detailed specifications, drawings.

2303 Procurement of Consumables, Components and Spares

(1) Purchase Powers

The In-charges of Engineering Department, dealing with Small track machines shall procure spares, consumables and small tools to meet the requirements of STM, duly following MSOP.

(2) Imprest: Imprest available with STM officials may also be utilized for procurement of spares, consumables and small tools to meet specific requirements of STM.

- **a.** Cash Imprest of Rs. 5,00,000/- or more shall be provided with the officer in-charge of the Zonal Centralized Small Track Machine Depot (ZCSTMD) for POH/ major breakdown maintenance and purchase of essential stores, including spares, consumables, tools plants, and machinery.
- **b.** Cash Imprest of Rs. 2,00,000/- or more shall be provided with the officer in-charge of the Divisional Centralized Small Track Machine Depot (DCSTMD) for POH/ major breakdown maintenance and purchase of essential stores, including spares, consumables, tools plants, and machinery.
- **c.** A separate cash Imprest of Rs. 50,000/- or more shall be provided with the each ADEN (Open Line) who is the In-charge of fleet of Small Track Machines for operation/minor repairs/routine maintenance/overhauling(IOH) and purchase of essential consumables, including, tools &plant for day to day operation of machine. The objective is to ensure that safety related Small Track Machines should not be idle for small amounts.
- **d.** The cash Imprest available shall be reviewed on the Zonal Railways every three years.

2304 Sourcing of Components & Spares and their Procurement Procedure:

Zonal Railway shall decide the source of procurement from among the following:

(1) OEM or their Authorized Representative: Proprietary article certificate (PAC) duly signed by the competent authority shall accompany the indents. A rate contract may be entered when number of items from a single source is sufficiently large to simplify and expedite the procurement process. No quantity, however, is required to be indicated against each item. The procurement against rate contract may be done for a period of 2-3 years specifying annual financial ceiling.

(2) Original Item/Component Manufacturers of High Repute in the Industry: These item/unit component manufacturers are the ones having established reputation in the industries. These also include those from whom the OEM also sources the supply for their machines. Spares like bearings and unit components like engines are examples of such items/unit components.

2305 Sources for Procurement of Small Track machines :

The small track machines approved for useon Indian Railways can be procured as given below:

(1) STMs for which vendor list is maintainedby RDSO:The STMs should be procured only from the approved vendors given in vendor list.

Current vendor list of Small Track Machines is available on IREPS website. Link is https://ireps.gov.in/→ Quick links →Approval of Vendors→ Click vendor directory link→Select Approving Agency (RDSO), Department (Engineering) and Sub-Directorate (TMM) →Click proceed tab.

(2) STMs for which RDSO approved vendors are not maintained: The STMs should be procured on the basis of RDSO approved specification (and drawing wherever available) from open sources.The specifications are available at RDSO website.

2306 Procurement Procedure

Following procedure for procurement shall be followed:

(1) Centralized Procurement: Procurement of STMs should be done for bulk quantity at Divisional/Zonal level. A Centralized depot (DCSTMD wherever available) in each division should be earmarked for supply of Small Track Machines. Following broad guidelines should be followed:

a. The Small Track Machines shall be charged to proper sanctioned estimates under Demand No.16 or revenue budget (Demand No.4 – P.Way Works). Track renewal estimate and construction estimate should also have provisions for procurement of STMs as per their requirement.
b. Before procurement of any machine, it shall be ensured that similar machines/tools available on division are being effectively utilized.
c. Small track machines/tools shall be accepted only after the firm arranges one field demonstration cum training at railway premises.
d. It is desirable that a yearly review of STMs i.e. requirement as per yardstick and its availability for each SSE/P.way should be carried out at the divisional level by Sr.DEN/Co-ordin the month of April/May. Indents for shortfall/replacement of STMs, if any, should be prepared at Divisional level by SSE/JE/STM. Centralised Procurement of STMs is done at HQ/Divisional level.
e. Requirement of STMs as per yardstick for new construction projects being commissioned in that year should be got made available by concerned construction units or may be procured by open line chargeable to concerned construction projects.

(2) Consignee and Inspection: SSE/JE/STM of Divisional/Zonal Depots should be nominated to receive the supply of STMs for the entire division/Zone. These machines should be accepted only after due inspections as stipulated in the specification of machines. The cost of inspection and testing shall be borne by the manufacturer/supplier. SSE/JE/STMs responsible to carry out these inspections

before acceptance of these machines should be trained by TMM Directorate of RDSO as per the training module given in Para 2105 of Chapter 21.

(3) Reserve for Unit Replacement: All Zonal Railways should procure STMs as per the yardsticks laid down in para 104 of chapter -1. 30% extra to be kept as a reserve with SSE/P.way.

(4) Warranty: All Small Track Machines & tools shall be purchased under one year manufacturer's warranty.

(5) Information related to supplier: Purchase Order must include warranty period and vendor's contact number/email/website address in bold letters. Such details should also be maintained at Divisional Depot and a copy of P.O. along with Operation and Maintenance Manual should be given to field SSE/P.Way also while supplying the machine.

2307 RDSO vendor development policy for Small Track Machines:

The detailed guidelines covering all aspects of the vendor development, quality audit and delisting/up gradation etc. may be accessed on RDSO website.

2308 InductionofNew small Track Machines/ New vendors:

The induction of new machines or new vendors can be done by following the below given procedure:

(1) **STMs for which vendor list is maintainedby RDSO**:

New vendor for the same item can approach RDSO for induction as approved vendor following the procedure laid down by RDSO.

(2) **STMs for which RDSO approved vendors are not maintained:**

Normally the machine should be procured as per RDSO specification only. However in case any vendor with improved performance but slightly varying specification approached railways for these machines , Railway can procure these machines with the approval of CTE, by modifying the specification to that extent.

(3) New type of machines:

New type of machines for which RDSO has neither approved the vendor nor has issued the specification will fall in this category. Supplier of such machines can approach RDSO as well as Railways for conducting trial. RDSO following the procedure laid can consider these machines in inclusion in type (1) and type (2) mentioned above. Railways can use these machines for limited quantity with the approval of CTE. On satisfactory performance, a report to be sent to RDSO through CTE/CE/TM for consideration as regular item in type (1) or type (2). Till such time the formal inclusion of these items are done by RDSO, Railways may procure these machines on regular basis with the approval of PCE.

2309 Accountal of the Machines:

All the STMs shall be entered in a separate register called STM ledger by each SSE/P.Way/In-charge. However to uniquely identify a machine it is essential that each STM to be given a unique ID (UID) as mentioned below:

Unique ID No.(Example)	BZA/EE/01/04/03/STM/01

Division Code	SSE/P.Way	STM Sl.No. as per chapter-1, table no:1 of para 104.*	Total No.of Specific STM in the section	Sl.No of that specific STMs as per ledger	Ledger book Name	Page No
BZA	EE	01(Abrasive Rail Cutter)	04	03	STM	01

*Note: * machines not included in the table mentioned above, will have this number as 00.*

Additionally, each STM shall be maintained with a history book and a log book.

(1) History Book:

History book is a record kept for each STM duly noting all the details and cost of the repairs/ schedule maintenance works carried out for that STM. History book shall contain the following details:

- **a.** Name of the STM
- **b.** Make of the STM
- **c.** Procurement date
- **d.** Engine No/Serial No
- **e.** UID No of the STM
- **f.** Repairs carried out to the STM
- **g.** Cost of the repairs
- **h.** Cumulative cost of repairs.
- **i.** Schedule maintenance works carried out such as change of engine oil/hydraulic oil/ gear oil/ grease etc.

This history book helps to give an overall record of the maintenance activities carried out and the steps carried to maintain the health of the STM.This book is to be maintained by technicians of the section.

(2) Log Book:

Log book is a record kept for each STM duly noting all the details of the working hours of the STM along with the progress of work. Log book is to be maintained by operators of the STM under the guidance of technician of the section. Log book shall contain the following details.

- **a.** Name of the STM
- **b.** Make of the STM

c. Procurement date
d. Engine No
e. UID No of the STM
f. Working hours of the STM
g. Location of Working (chainage)
h. Cumulative working hours of the STM.

These books are to be strictly maintained for STMS by technicians and overseen by Sectional SSE/JE. History book & log books are to be sent along with the STM while carrying out the POH of STM at ZCSTMD/DCSTMD.

History book shall be updated with details of repair and cost of repairs pertaining to the POH of the STM, duly approved by the SSE/JE/STM of DCSTMD/ZCSTMD.

Pro-forma for history book and log book is given ***Annexure-I.***

2310 Condemnation of Small Track Machine:

The STMs shall be sent from field units to DCSTMD/ZCSTMD for condemnation.

Small Track Machines shall be condemned after completion of codal/useful life.

The following procedure shall be adopted:

(1) If the machine is in repairable condition, the same will be repaired for further usage.

(2) If found beyond economical repairs (economical may be treated as the price of the repair at depot for one POH shall not exceed 50% of the cost of newSTM), the serviceable/ useful parts will be removed for interchange/future usage for repairs of similar other machines and the balance portion of the machine shall be condemned as a unit and thereby send it to the concerned field unit.

(3) Also, if the machine is not fit for any purpose, then it will be proposed for condemnation irrespective of its codal life.

A certificate of condemnation shall be issued by In-ChargeSSE/ZCSTMD/DCSTMD duly notifying all the details/basis of condemnation in history book.

2311 Codal life of Small track machines:

Codal life of different type of machines shall be as below.

Sl.No	Small Track Machine	Codal life
1.	Abrasive Rail Cutter	4 Years
2.	Rail Drilling Machine	6 Years
3.	Weld Trimmer power pack version for A.T. welding	6 Years
4.	Rail Profile weld Grinder	6 Years
5.	Compressed Air Petrol Pre heating System	6 years
6.	Portable A.C generator	6 years

7.	Portable D.C welding generator	6 years
8.	Hydraulic Rail Tensor	8 years
9.	Hydraulic Track Jack/	8 years
10.	Mechanical Jack	4 years
11.	Toe load Measuring Device(MTLMD)/(ETLMD)	6 years
11.	Light weight Rail (Mono) cum road Trolley	8 years
12.	Self-Propelled Light Weight Trolley	6 years
13.	Powered Material Trolley	6 years
14.	Gauge cum level (BG & MG) with spirit level	3 years
15.	Chamfering kit (Manual)/ Chamfering machine (battery operated)	6 years
16.	Magnetic base Thermometer/ Continuous Rail thermometre	4 years
17.	Gang worksite remote control hooter	4 years
18.	Hydraulic Track lifting cum slewing Device (Tralis)	8 years
19.	Track Based Lubricators	5 years
20.	Off Track Tampers	8 years

Note: For machines/equipment not included in the list, CTE/CE/TM may decide the life based on type of machine but in no case it should be more than 8 years.

Annexure-I

Samples pro-formas:

i. Index page for History book & Log book:

Sl.No	Description	Details
1.	Name of the STM	
2.	Make of the STM	
3.	Manufacturing year	
4.	Cost of the machine	
5.	Supplier name	
6.	Supplied through depot/Direct	
7.	Purchase order No.	

ii. Sample Pro-forma-I of history book for minor/POH/major breakdown repairs:

Sl.No	Date of Break down	Date repaired	Nature/Type of repairs	Attended by	Spare parts replaced	Cost of repairs	Cum. Cost of repairs	Signature of Technician	Signature of SSE	Remarks
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										

iii. Sample pro-forma-II of history book for attending maintenance schedule.

Sl.No	Date of Attention	Type of Maintenance	Schedule-I (Daily)	Schedule-II (Quarterly)	Schedule-III (Half yearly)	Schedule-IV (IOH)	Signature of Technician	Signature of concerned SSE
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

iv. Sample pro-forma for Log book:

Date	Worked time		Total Time	Cum. Hrs	Signature of the Technician	Signature of the SSE/P.way.
	From	To				

Appendix-I

Engine (POWER PACK)

The main component of the most of the small Track machines is the prime mover which is popularly known as Engine. It is known fact that 95% of the problems of STMs pertain to engine failures only. Therefore, understanding about engine is most essential for understanding the working of Small Track Machines.

1. Types of Engines:

There are mainly two types of engines

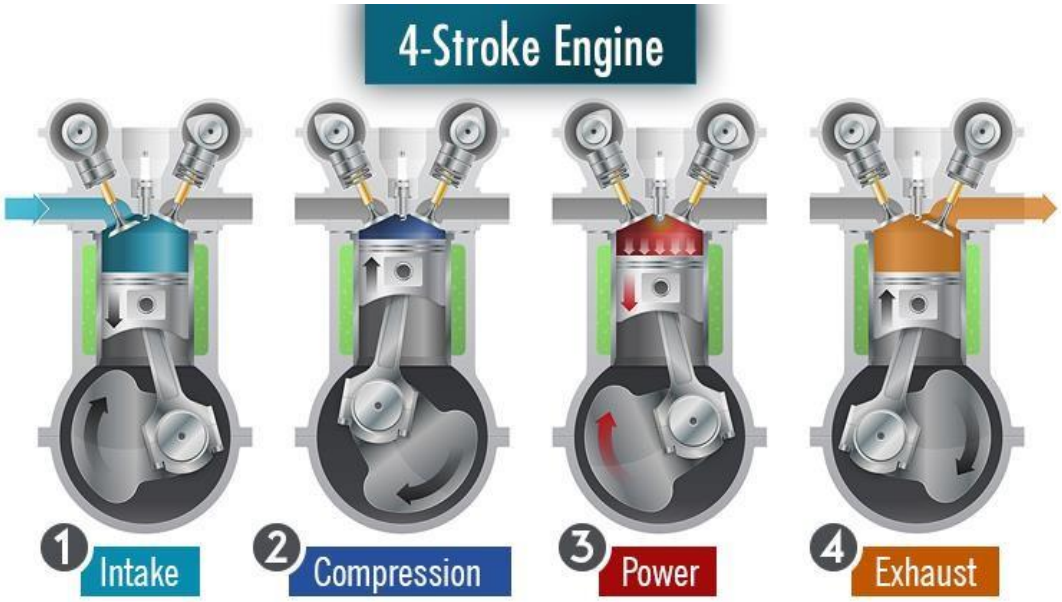
a. External combustion engines

b. Internal Combustion engines (I.C Engines)

These Engines can be further classified as:

- Spark ignition Engine
- Compression ignition Engine.

Small Track machines mostly use Four Stroke Engine with Spark Ignition (petrol). Some of the generators uses Four Stroke Engine with Compression ignition for which the user's manual can be referred.



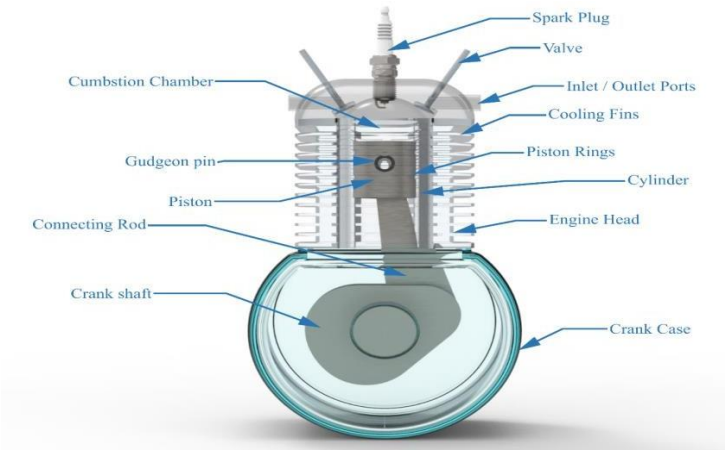
2. Working Principle of Four Stroke Spark Ignition I. C. Engine:

- A mixture of fuel with correct amount of air is exploded in an engine cylinder which is closed at one end. As a result of explosion, heat is released and this causes the pressure of the burning gases to increase. This pressure increase, forces a close-fitting piston to move down the cylinder. This movement of piston is transmitted to a crankshaft by a connecting rod so that the crankshaft turns a flywheel. To obtain continuous rotation of the crankshaft this explosion has to be repeated. Before this, the burnt gases have to be expelled from the cylinder. At the same time the fresh charge of fuel and air must be admitted and the piston must return back to its starting position. This sequence of events is known as working cycle.

- The sequence of events taking place inside the engine is as follows
  - Admission of air-fuel mixture inside the engine cylinder (suction)
  - Compression of the air fuel mixture inside the engine (compression)
  - Ignition of air-fuel mixture by an electric spark using a spark plug to produce thermal power inside the cylinder (power)
  - Removal of all the burnt gases from the cylinder to receive fresh charge (exhaust)

3.I.C. Engine Components:

The IC Engine components are shown the sketch given below:



1. Cylinder
2. Engine/Cylinder head
3. Piston
4. Piston Ring
5. Connecting Rod
6. Crank shaft
7. Inlet Valve
8. Exhaust Valve
9. Spark Plug
10. Gudgeon Pin
11. Cooling Fins
12. Crank Case

Fig: Engine Block

The detailed function of these components are as below:

Cylinder	i) It is a part of the engine which confines the expanding gases and forms the combustion space. ii) It provides space in which piston operates to suck the air or air-fuel mixture. iii) The piston compresses the charge and the gas is allowed to expand in the cylinder, transmitting power for useful work. iv) Cylinders are usually made of high-grade cast iron.
Cylinder Head	It is a detachable portion of an engine which covers the cylinder and includes the combustion chamber, spark plugs or injector and valves.
Cylinder liner or sleeve	i) It is a cylindrical lining either wet or dry type which is inserted in the cylinder block in which the piston slides. ii) Liners are classified as: (1) Dry liner and (2) Wet liner. iii) Dry liner makes metal to metal contact with the cylinder block casing. Wet liners come in contact with the cooling water,

	whereas dry liners do not come in contact with the cooling water.
Piston	i) It is a cylindrical part closed at one end which maintains a close sliding fit in the engine cylinder. ii) It is connected to the connecting rod by a piston pin. iii) The force of the expanding gases against the closed end of the piston, forces the piston down in the cylinder, this causes the connecting rod to rotate the crankshaft. iv) Pistons are usually made of Cast iron. Cast iron is chosen due to its high compressive strength, low coefficient of expansion, resistance to high temperature, ease of casting and low cost. v) Head (Crown) of piston: It is the top of the piston. vi) Skirt: It is that portion of the piston below the piston pin which is designed to absorb the side movements of the piston.
Piston Rings	i) It is a split expansion ring, placed in the groove of the piston. ii) They are usually made of cast iron or pressed steel alloy. The functions of the piston rings are as follows: a. It forms a gas tight combustion chamber for all positions of piston. b. It reduces contact area between cylinder wall and piston wall for preventing friction losses and excessive wear. c. It controls the cylinder lubrication. d. It transmits the heat away from the piston to the cylinder walls.
Piston Pin (gudgeon pin):	i) It is also called wrist pin or gudgeon pin. ii) Piston pin is used to join the connecting rod to the piston. iii) It provides a flexible or hinge like connection between the piston and the connecting rod. iv) It is usually made of case-hardened alloy steel.
Connecting rod	i) It is a special type of rod, one end of which is attached to the piston and the other end to the crankshaft. ii) It transmits the power of combustion to the crankshaft and makes it rotate continuously. iii) It is usually made of drop forged steel.
Crankshaft	i) It is the main shaft of an engine which converts the reciprocating motion of the piston into rotary motion of the flywheel. ii) Usually the crankshaft is made of drop forged steel or cast steel. iii) The space that supports the crankshaft in the cylinder block is called main journal, whereas the part to which connecting rod is attached is known as crank journal.
Fly Wheel	Fly wheel is made of cast iron. Its main functions are as follows: i) It stores energy during power stroke and returns back the same energy during the idle strokes, providing a uniform rotary motion by virtue of its inertia. ii) It may also carry a ring gear that meshes with the pinion of the

	starting motor. iii) The rear surface of the flywheel serves as one of the pressure surfaces for the clutch plate. iv) Engine timing marks are usually stamped on the flywheel, which helps in adjusting the timing of the engine. v) Sometimes the flywheel serves the purpose of a pulley for transmitting power
Crankcase	i) The crankcase is that part of the engine which supports and encloses the crankshaft and camshaft. ii) It provides a reservoir for the lubricating oil. iii) It also serves as a mounting unit for such accessories as the oil pump, oil filter, starting motor and ignition components.
Camshaft	i) It is a shaft which raises and lowers the inlet and exhaust valves at proper times. ii) Camshaft is driven by crankshaft by means of gears, chains or sprockets. iii) The speed of the camshaft is exactly half the speed of the crankshaft in four stroke engine. iv) Camshaft operates the ignition timing mechanism, lubricating oil pump and fuel pump. It is mounted in the crankcase, parallel to the crankshaft
Timing Gears	i) Timing gear is a combination of gears, one gear of which is mounted at one end of the camshaft and the other gear at the crankshaft. ii) Camshaft gear is bigger in size than that of the crankshaft gear and it has twice as many teeth as that of the crankshaft gear. iii) For this reason, this gear is commonly called half time gear. iv) Timing gear controls the timing of ignition, timing of opening and closing of valve as well as fuel injection timing.
Governor	The main function of the Governor in the IC Engines is to regulate the mean speed of the engine when there is a variation in the load. A tiny flywheel is used inside the engine to control the fluctuations of the speed during each cycle. It should not be confused with the governor function with the flywheel function.
Spark plug	The main function of spark plug is to conduct the high potential from the ignition system in to the combustion chamber. It provides the proper gap across which spark is produced by applying high voltage to ignite the combustion chamber.
Carburettor	It is a device (Use in Internal combustion engine) for mixing air with fuel in a system for the proper burn of fuel. Component of carburettor are as follows.

A simple carburettor is constructed of the following parts:

i) **Throttle Valve:** It is an important part of a Carburettor**.** It controls the mixture of charge (air fuel) supplied to the engine cylinder. The driver opens the throttle valve by pressing the accelerator.
ii) **Strainer:** It is a device that is used to filter the fuel before entering the float chamber.
iii) **Venturi:** Venturi is a gradually decreasing cross-sectional hollow tube. It helps to decrease the air pressure of the chamber. For which fuel comes out from the fuel pipe.
iv) **Metering system:** The metering system controls the flow of fuel into the nozzle. It is responsible to form a correct mixture of air-fuel.
v) **Idling system:** The idling system consists of passage directly from the float chamber to the venturi tube. It provides a rich mixture during idling and at low speed. It works during idling or when the throttle is open below 15%.
vi) **Float Chamber:** The float chamber serves as a storage tank of fuel for a continuous supply of fuel. It contains a float valve that maintains the level of fuel in the float chamber.
vii) **Mixing Chamber:** In the mixing chamber, the mixture of air + fuel is occurred and then supplied to the engine cylinder.
viii) **Choke Valve:** It is a valve that controls the mixture of air-fuel. The main function of this valve is to control the quantity of the air inside the mixing chamber.

4. Engines used in STMs:

Most of Small Track Machines (99%) are provided with Honda make engines. The engines used in different STM's are tabulated below:

Sl.No	Name of the STM	Engine used in the STM
1.	Abrasive Rail Cutting Machine	Honda GX-200 SD (Petrol run) Honda GX-200 QX (Petrol run) Honda GX-200 QTB (Petrol run) **Note**: GX 200 SD and GX 200 QX models are manufactured in Thailand. GX 200 QTB model is manufactured in India.
2.	Rail Drilling Machine	Honda GK-200 Q (petrol start and kerosene run). Honda GX-160 (Petrol run) **Note:**GK- G stands for Gasoline, which is petrol in India, K stands for Kerosene. Kerosene supply is getting reduced day by day, therefore GK -200 Q can be replaced by GX-160 without any modifications to the frame of Rail Drilling Machine.
3.	Weld Trimmer	Honda GK-200 Q (petrol start and kerosene run). Honda GX-160 (Petrol run) **Note:**GK- G stands for Gasoline, which is petrol in India, K stands for Kerosene. Kerosene supply is getting reduced day by day, therefore GK- 200 Q can be replaced by GX-160 with certain modifications to

		the mounting frame of Weld Trimmer.
4.	Compressed Air Petrol Pre heating System	Honda GK-200 Q (petrol start and kerosene run). Honda GX-160 (Petrol run) **Note:**GK- G stands for Gasoline, which is petrol in India, K stands for Kerosene. Kerosene supply is getting reduced day by day, therefore GK -200 Q can be replaced by GX-160 without any modifications to the frame of Compressed air petrol preheating machine.
5.	A.C Generator	Honda GX-160,(Petrol run) Honda GX-200, (Petrol run) Honda GK-300 (petrol start and kerosene run).
6.	D.C Generator	Honda GX-630 (Petrol run)
7.	Self-Propelled Light weight Trolley	Honda GX-160 (Petrol run)

5. Components of Honda GX200 Engine:

i) External component

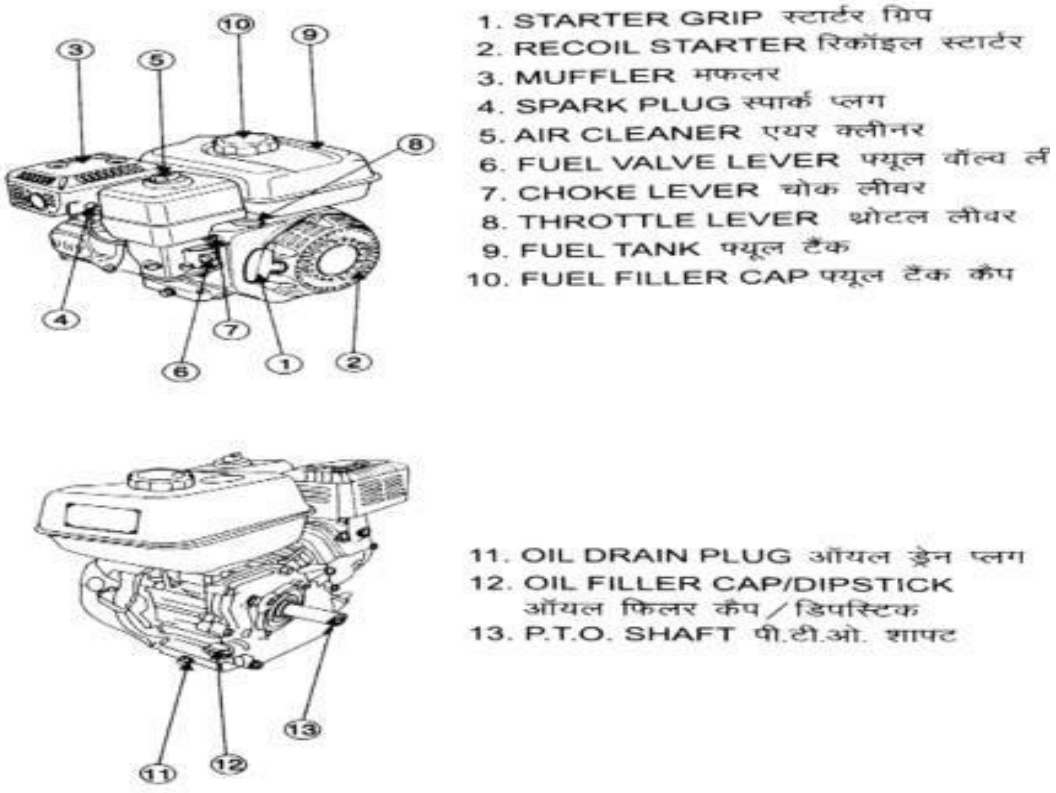


Fig: External Component of Engine

ii) Internal component of Engine:

Air Filter Cover

Air filter case

Air filter

Carburettor

Choke Lever

Valve Kit

Connecting Rod

Piston Kit

Crank Shaft

Cam Shaft

Engine Chamber

Engine Head

Exhaust Muffler

Recoil Starter

Ignition Coil

Rocker Arm Kits

Gasket Set

Fan Housing

Cooling Fan

Fly Wheel

Bearing with Oil Seals

Throttle Control

Fuel Tank

Governor Gear

iii) Maintenance Schedule of Honda GX 200/ Engine

Spares are common for all the three models except engine oil alert sensor.
The maintenance schedule of major components is tabulated below:

Item	Each use	First month or 20 working Hrs.	Every 3 months or 50 working Hrs	Every 6 months or 100 working Hrs	Every Year or 300 working Hrs
Engine oil	Check level	Change	-	Change	-
Air Cleaner	Check		Clean	Clean	Replace
Sediment cup				Clean	
Spark plug				Clean	Replace
Idle speed					Check/adjust
Valve clearance					Check/adjust
Combustion chamber	Clean after every 500 working Hrs.				
Fuel tank &Filter				Clean	
Fuel Tube	Check every 2 years (Replace if necessary)				

6. Spare parts of Prime mover

A. List of spare parts used for GX-200 SD,GX 200 QX and GX 200 QTB models (spares are common for all the three models except engine oil alert sensor)				
Sl.No	**Name of Spare Part**	**Part No**	**Unit**	**Quantity**
1.	Piston :STD	13101Z4V800	Nos.	1
2.	Piston (0.25mm)	13102ZDB000	Nos.	1
3.	Piston (0.50mm)	13103ZDB000	Nos.	1
4.	Piston Ring STD	13010Z4K004	Set	1
5.	Piston Ring {0.25mm}	13011ZDB003	Set	1
6.	Piston Ring {0.50mm}	13012ZDB003	Set	1
7.	Connecting Rod STD	13200Z0T800	Nos.	1
8.	Connecting Rod {0.25mm}	13300Z0T800	Nos.	1
9.	Connecting Rod {0.50mm}	13400Z0T800	Nos.	1

10.	Piston Pin	13111Z4M000	Nos.	1
11.	Piston Pin Lock	90551ZE1000	Nos.	2
12.	Bearings-6205	91001Z4X003	Nos.	2
13.	Engine Packing Kit	11381ZH8801	Nos.	1
14.	Crank Oil Seals	91202YA0P01	Nos.	2
15.	Valves {Inlet}	14711ZF1000	Nos.	1
16.	Valves {Out let}	14721ZF1000	Nos.	1
17.	Valve .Locks	14773Z4X000	Nos.	2
18.	Valve Guides	12204ZE1306	Nos.	2
19.	Lifter Valve	14731ZL0000	Nos.	2
20.	Cam Shaft	14100ZL0000	Nos.	1
21.	Crank Shaft	13310ZL0020	Nos.	1
22.	Head .Gasket	12251ZL0003	Nos.	1
23.	Ignition Coil	30500ZDA003	Nos.	1
24.	Exhaust Muffler	18310Z4V010	Nos.	1
25.	Exhaust Muffler Cover	18320Z4M000	Nos.	1
26.	Bore sleeve	183100V2100	Nos.	1
27.	Carburetor	16100ZOT712	Nos.	1
28.	Governor Link Rod	16555Z4M000	Nos.	1
29.	Throttle Spring	16561Z4M010	Nos.	1
30.	Governor Spring	6562Z4M000	Nos.	1
31.	Governor Arm	16551ZL0000	Nos.	1
32.	Governor Wheel & Bush	16510ZDA000	Pair	1
33.	Governor Steel Washer	9410106800	Nos.	1
34.	Barrel Assy. Cylinder	12000Z4V901	Nos.	1
35.	Engine Chamber Cover	11300Z4M630	Nos.	1
36.	Spark plug	9807956846MC	Nos.	1
37.	Spark Plug Cap	30700ZDAD01	Nos.	1
38.	Stem Oil Seals	12209Z4M801	Nos.	1
39.	Valve Spacer	14781ZE1000	Nos.	1
40.	On/Off Switch	35120ZDB003	Nos.	1
41.	Breather Pipe	15721ZH8000	Nos.	1
42.	Petrol Pipe	950014514540	Nos.	1
43.	Carburetor Packing kit	16221ZH8801	Nos.	1
44.	Air Filter Bowl white	17402ZDA810	Nos.	1
45.	Air Filter Bowl Black	17401ZDA810	Nos.	1
46.	Air Filter Elbow (base)	17401ZDA810	Nos.	1
47.	Air Filter Element (Round)	17403ZE1810	Nos.	1
48.	Air Filter Element (Square)	17211ZE1000	Nos.	1
49.	Air filter Element (Metal)	17210ZE1822	Nos.	1
50.	Stay Fan Cover	19610Z4M000	Nos.	1
51.	cooling Fan	19511ZE1000	Nos.	1
52.	Crankshaft Nut	90201Z0T800	Nos.	1
53.	Head Cooling Cover	19630ZH8000	Nos.	1
54.	Fuel Tank Filter & Collar	17672ZE2W01	Set	1

55.	Fuel Tank	17510ZDA000	Nos.	1
56.	Fuel Tank Caps	17620Z1T800	Nos.	1
57.	Carburetor Flange	16211Z4V000	Nos.	1
58.	Governor Lever Assy	16500Z4M820	Nos.	1

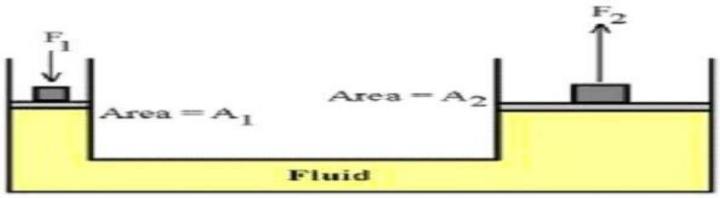
B. List of Spare Parts Used For GK-200 Engine				
Sl No	**Name of Spare Part**	**Part No**	**Unit**	**Quantity**
1.	Piston :STD	131018 83004	Nos.	1
2.	Piston (0.25mm)	131028 83003	Nos.	1
3.	Piston (0.50mm)	131038 83003	Nos.	1
4.	Piston Ring STD	13010YA0004	Set	1
5.	Piston Ring {0.25mm}	13011YA0004	Set	1
6.	Piston Ring {0.50mm}	13102YA0004	Set	1
7.	Connecting Rod STD	132008 98000	Nos.	1
8.	Connecting Rod {0.25mm}	1320089 8305	Nos.	1
9.	Connecting Rod {0.50mm}	132008 98306	Nos.	1
10.	Piston Pin	13111 883000	Nos.	1
11.	Piston Pin Lock	90551 883000	Nos.	2
12.	Bearings-6205	96100 6205000	Nos.	2
13.	Engine Packing Kit	113818 83800	Nos.	1
14.	Crank Oil Seals	91202YA0P01	Nos.	2
15.	Valves {Inlet}	147118 83000	Nos.	1
16.	Valves {Out let}	147218 83000	Nos.	1
17.	Valve Locks	147718 83010	Nos.	2
18.	Valve Guides	121338 83306	Nos.	2
19.	Lifter Valve	1473688 3010	Nos.	2
20.	Cam Shaft	141108 98000	Nos.	1
21.	Crank Shaft	13310883V10	Nos.	1
22.	Head Gasket	122818 83801	Nos.	1
23.	Ignition Coil	30560YA0T00	Nos.	1
24.	Exhaust Muffler	18300883N00	Nos.	1
25.	Exhaust Muffler Cover	18320883N00	Nos.	1
26.	Bore sleeve	18310YA2100	Nos.	1
27.	Carburettor	16100YA0035	Nos.	1
28.	Governor Link Rod	16555YA0790	Nos.	1
29.	Throttle Spring	16562 883010	Nos.	1
30.	Governor Spring	16561YA0U80	Nos.	1
31.	Governor Arm	16551YA0790	Nos.	1
32.	Governor Wheel & Bush	165128 98010	Pair	1
33.	Governor Steel Washer	9410106800	Nos.	1
34.	Barrel Assy. Cylinder	12100YA0R10	Nos.	1
35.	Engine Chamber Cover	11300YA0W11	Nos.	1
36.	Spark plug	980765 471601	Nos.	1
37.	Spark Plug Cap	3060088 9003	Nos.	1
38.	On/Off Switch	3610088 3812	Nos.	1

39.	Breather Pipe	15721 883611	Nos.	1
40.	Petrol Pipe	16852YA0000	Nos.	1
41.	Carburettor Packing kit	162698 83800	Nos.	1
42.	Air Filter Bowl white	17402YA0U90	Nos.	1
43.	Air Filter Bowl Black	17401YA0U90	Nos.	1
44.	Air Filter Elbow (base)	17411YA0U90	Nos.	1
45.	Air Filter Element (Round)	17403 841000	Nos.	1
46.	Stay Fan Cover	19610YA0790	Nos.	1
47.	coolingfan	19510883N70	Nos.	1
48.	Crankshaft Nut	90201YA0790	Nos.	1
49.	Fuel Tank Filter & Collar	17672ZE2W01	Set	1
50.	Fuel Tank	1751A0S000	Nos.	1
51.	Fuel Tank Caps	17620ZCSN40	Nos.	1
52.	Carburetor Flange	162118 98000	Nos.	1
53.	Governor Lever Assy	16570YA0U80	Nos.	1
54.	Fuel cock (2 way cock)	16950ZR9S40	Set	1
55.	Fuel Drain cock	16960YA0V40	Nos.	1

Appendix-II

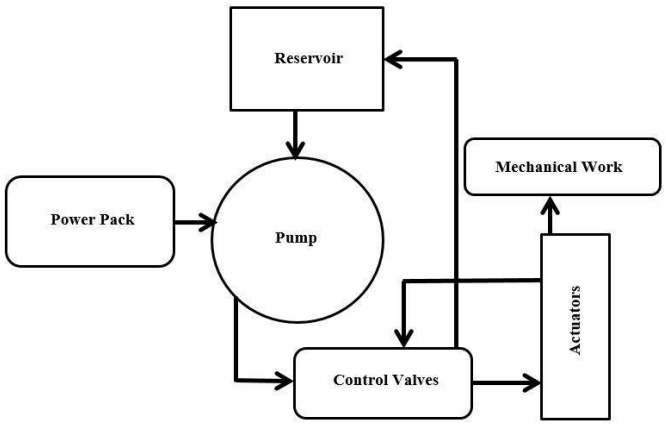
HYDRAULICS

1. **General:** Hydraulics is a technology and applied science using engineering chemistry, involving the mechanical properties, that operates though the force of liquid pressure Although, prime mover is the heart of the STM, hydraulics system play an important role in working of STMs like Weld Trimmer, Hydraulic Track Jack and Hydraulic Rail Tensor etc.
2. **Need for Hydraulic systems:** Hydraulic systems are capable of moving heavier loads as well as providing greater force than mechanical, electrical or pneumatic systems. The fluid power system can easily cope with a large weight range without having to use gears, pulleys or heavy levers.
3. **Working Principle of Hydraulics:** Hydraulic works on the principle of **Pascal's Law**. States that pressure applied to an enclosed fluid will be transmitted without change in magnitude to every points of the fluid and to the walls of container.
   According to Pascal's principle, the original pressure (f_1) exerted on the small piston (A_1) will produce an equal pressure (f_2) on the large piston (A_2)



With the above picture we can concur that, small force applied on small area is being converted to large force applied to large area.

FLOW CHART



The Basic design of hydraulics for STMs is as above.

4. Component of Hydraulic system

The Basic Hydraulic components are:

- Drive Motor (Engine)
- Hydraulic Pump
- Hydraulic Reservoir/ Tank
- Control/Direction Valves
- Actuators (cylinder)
- Hydraulic Pipe
- Hydraulic Oil

(1) Drive Motor Pack (Engine)

The shaft of the drive motor (Engine) is connected to the hydraulic pump via gear coupling.

(2) Hydraulic Pump

There are two types of pumps used in hydraulics

(a) Non positive displacement or Hydrodynamic Pumps

E.g.: Centrifugal Pumps.

(b) Positive displacement or Hydrostatic Pumps

E.g.: Piston Pumps.

The Pump is coupled to the engine with a gear coupling and the pump is driven by it. The pump used is 3 lobe radial plunger pumps. Radial plunger pump is a positive displacement (Hydro static) pump which delivers constant discharge and has a variable pressure output. These pumps generate high pressure output (in the order of 1000 bar) and are very much likely to be used in hydraulic applications of STMs.

(3) Hydraulic Reservoir/ Tank

The pumps are required to constantly supply the hydraulic oil. If it is not done so, the pump over heats. The reservoir tank ensures to supply hydraulic oil for interrupted delivery of power and prevention of overheating.

(4) Control valves

There are different types of control valves

- Non-return Valve (NCV)
- Flow control valve (FCV)
- Pressure control valves (PCV)
- Direction control valves (DCV)

a. Non return Valve

A non-return valve allows a medium to flow in only one direction and is fitted to ensure that the medium flows through a pipe in the right direction, where pressure conditions may otherwise cause reversed flow.

b. Flow Control Valve

A flow control valve adjusts and controls the volume flow of hydraulic oil within a hydraulic system. They can often be used to adjust the speed of operation of an actuator.

c. Pressure Control Valve

Pressure valves are hydraulic valves that gradually (control) or suddenly (switch) change in position. The most common types of pressure control valves are the pressure relief valve and the pressure reducing valve. Pressure relief valves control the system pressure by relieving part, or all, of the flow to tank.

d. Direction Control Valve

Direction control valves are hydraulic valves that start/stop/change the direction of the flow.

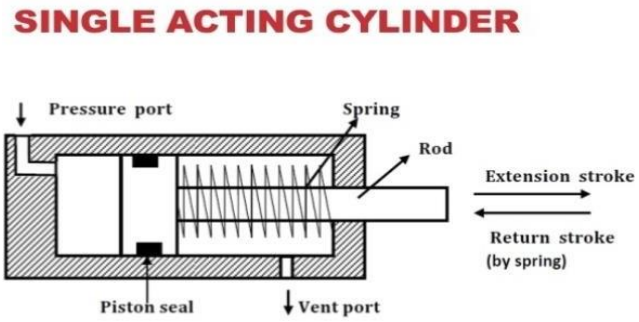
(5) Actuator (cylinders)

There are two types of actuators

- Single acting actuators
- Double acting actuators

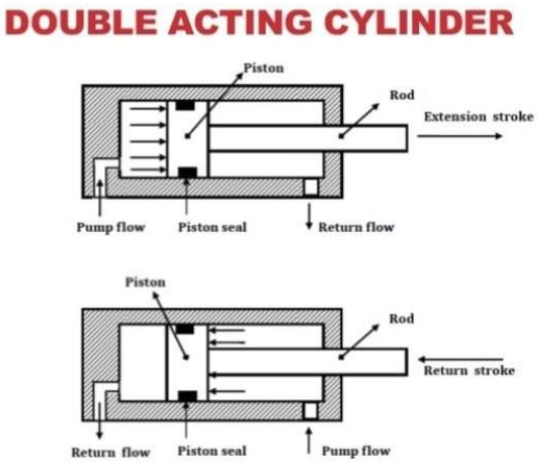
a. Single Acting actuators

Single acting actuators only extend by pressure from a pump and then retract by the weight of the load or by an inbuilt spring. (Hydraulic Track Jack).



b. Double acting Actuators

A Double acting cylinder uses hydraulic power to both extend and retract. (Weld Trimmer).



Hydraulic track jack and hydraulic rail tensor has the same hydraulic system except the power pack is replaced with a hand operated piston pump.

(6) Hydraulic Pipe:

The pipe is defined by its diameter and its capacity to take pressure: Different type of pipe available in market and their capacity is given below:

- Most of the common hydraulic pipes used in STMs are 3/8 inch with 10000 psi capacity.

(7) Hydraulic Oil:

The hydraulic oil used in STMs are:

- **N 68** of reputed make.

(8) Oil seals and O-rings

- Commonly used Oil seals in Weld Trimmerare **42-55-12** and **35-45-10** made of polyurethane.
- O-rings differ with manufacture and can be chosen as per requirement.

(9) Failures in hydraulic system

1. Leakage of Hydraulic oil: This may occur because of
    - Damage of Piston Seal
    - Damage of piston
    - Damage of cylinder
    - Damage of Hydraulic pipe
    - Leakage in connection of hydraulic pipe and cylinder
2. Damage to valve
3. Pump failure.

Appendix-III

Consumables, Lubricants and Essential Spares used in STMs

i. Consumables used in some of the important STMs

Sl.No	STMs	Consumables
1.	Abrasive Rail cutter	Abrasive cutting disc
		Petrol
2.	Rail Drilling Machine	Drilling bit
		Petrol/Kerosene
3.	Rail Profile Grinder	Grinding stone
4.	Compressed Air Petrol Pre heating Machine	Petrol/Kerosene
		Blow torch
5.	Double Action Weld Trimmer (Power pack version)	Petrol/Kerosene
		Shear Blades
6.	AC/DC generator	Petrol/Kerosene
7.	Hydraulic Jack	Nil
8.	Hydraulic Rail Tensor	Nil
9.	Toe LoadMeasuring Device	Nil

ii. Details of Lubricants used in some of the important STMs:

Sl.NO	STMs	Lubricants		Quantity per every use.	Annual estimated Quantity
		Type	Grade		
1.	Abrasive Rail Cutter	Engine Oil/Lube oil	**10w30 to 20w40**	700ml	2.5Litre
		Grease	**EP-2**	30g	100g
2.	Rail Drilling Machine	Engine Oil/ Lube oil	**10w30 to 20w40**	700ml	2.5 Litre
		Grease	**EP-2**	3kg	6 kg
3.	Rail Profile Grinder	Grease	**EP-2**	1 kg	2 kg
4.	Compressed air petrol pre heating system	Engine Oil/ Lube oil	**10w30 to 20w40**	700 ml	2.5 litre
		Gear Oil	**C 90**	900 ml	2 Litre
5.	Double Action weld trimmer	Engine Oil/ Lube oil	**10w30 to 20w40**	700 ml	2.5 litre
		Hydraulic oil	**N 68**	5-6 litre depending upon the manufacturer	12 Litre
6.	Generator	Engine Oil/ Lube oil	**10w30 to 20w40**	600-1000ml depending upon the model	3 Litre
7.	Hydraulic Track Jack	Hydraulic Oil	**N 68**	1-2 Litre depending upon the manufacturer	4 Litre
8.	Hydraulic Rail Tensor	Hydraulic oil	**N 68**	3 Litre	6 Litre
9.	Toe Load measuring Device	-	-	-	-

iii. Details of Essential spares to be replaced frequently in some of the important STMs:

Sl.No	STMs	Essential spares	Classification	Qty.
1.	Abrasive Rail cutter	Engine pulley	2Ax3''	1
		Frame Pulley	2Ax3.5''	1
		V belts	A 31	2
2.	Rail Drilling Machine	Engine pulley	1Bx3''	1
		Frame Pulley	1Bx5''	1
		V belts	B 27	1
3.	Rail Profile Grinder	Carbon Brushes	As per manufacturer std.	1 Pair
4.	Compressed Air Petrol Pre heating Machine	Engine pulley	2Bx3''	1
		Frame Pulley	2Bx6''	1
		V belts	B 42	2
		Air Hose pipe	1'' double mesh , 1270 bar	3m
		Petrol Hose pipe	Nylon reinforced, 10 mm hose pipe	3m
		Ball valves	1'' brass valve	2
		Pressure Gauge	0 – 1.0 kg/cm^2	1
5.	Double action Weld Trimmer (Power pack version)	Oil seals	As per manufacturer std.	Set
		O-rings	As per manufacturer std.	Set
		Hyd. Hose pipes	3/8th '' single mesh 10000psi with female coupling	Set
		Male T joints	3/8th stainless steel.	set
6.	Generator	Capacitor	60µFd, 40 µFd(as per the capacity of the generator)	1
7.	Hydraulic Jack	Oil seals	As per manufacturer std.	Set
		O-rings	As per manufacturer std.	Set
8.	Hydraulic Rail tensor	Oil seals	As per manufacturer std.	Set
		O-rings	As per manufacturer std.	Set
		Hyd. Hose pipes	3/8th '' single mesh 10000psi with female coupling	Set
		Male T joints	3/8th stainless steel.	set

Note: *The above instructions are for general usage in STMsonly.The consumables, lubricants and essential sparescan be procured as per OEM standards also.*

CORRECTION SLIPS

Sl. No.	Correction slips no. and date	Reference