

ABOUT US

INTRODUCTION

DMW is a state-of-the-art Production Unit of the Indian Railways having integrated facilities to manufacture, upgrade & rehabilitate Locomotives and extend maintenance support to the Diesel Locomotive fleet of Indian Railways by providing high precision components and sub assemblies. Diesel Component Works (DCW) was set up at Patiala with the laying of foundation stone on October 24, 1981 and production started in 1986.

The Midlife Rehabilitation of Diesel Locomotives was started in 1989 after a service life of 18 years. The name of DCW was changed to Diesel Loco Modernisation Works (DMW) in July, 2003 to signify the modernisation of Diesel Locomotives being done. DMW has, now, also started manufacture of new Locomotives since March 2011. Two Multi Gen Set locos have also been rolled out till March, 2014.

DMW is equipped with ISO 9001:2008, ISO 14001:2004 & IS 18001:2007 certified by M/S BIS, Chandigarh.



A view of Administrative Building



A bird's eye view of Workshop area

2.0 ROLE OF DMW IN THE GROWTH OF INDIAN RAILWAYS

DMW is the prestigious Production Unit over Indian Railways engaged in Manufacture/Rebuilding, Upgradation and Modernization of Diesel Locos. DMW started rebuilding activities with the outturn of 3 Locos and 15 Powerpacks in the financial year 1989-90 and has gone on to achieve a Record Breaking Performance of 156 Locos including 75 rebuilt locos, 80 new Locos (WDM3D/WDS6) & 01 Multi Gen Set Loco and 156 Powerpacks in 2013-14.

DMW has taken another giant leap with successful manufacture of WDM3D locomotive for the first time in 2011 and the first 2400 HP Multi Gen Set Loco in 2013 conforming to US EPA TIER II Environmental Norms on Indian Railways .

During rehabilitation, up-gradation of Horse Power of Locomotive from 2600 HP to 3100/3300 HP is done along with fitment of latest sub-assemblies like Microprocessor, AC-DC power transmission, Fuel Efficient Engine Kits, Roller Bearing Suspension System, and Crew Friendly Features. This ensures that the trip schedules of Locos are extended to 30 days and Locos give better reliability, availability, improved performance during service with better fuel efficiency.

DMW has rebuilt 1841 locos (2600/3100/3300 HP) since its inception in 1989 and has manufactured 160 New WDM3D/WDS6 locos till March 2014. DMW has achieved an all time high turn-over of Rs.1737.89 Crs in 2013-14.



Manufacture of 1st Multi Gen Set Loco



EFI fitted Locomotive



Manufacture of New WDM 3D 3300 HP Loco



2000th Power pack being turned out



Rebuilt 3300 HP Loco



A view of Steam Engine model

3.0 IMPORTANT MILESTONES

- | | |
|--|---------|
| • Foundation Stone of the Project laid | Oct'81 |
| • Loco Components manufacture started | Jan'86 |
| • First Rebuilt WDM2 Locomotive Turned Out | Nov'89 |
| • First Rebuilt WDM3A (3100 HP) Locomotive turned out | Jan'00 |
| • First Rebuilt WDM3C (3300 HP) Locomotive turned out | Nov'02 |
| • First WDM3D ALCO Locomotive manufactured | Mar'11 |
| • Fitment of Electronic Fuel Injection System in ALCO Loco | Aug'11 |
| • Fitment of Auxilliary Power Unit | Oct'12 |
| • First Multi Gen Set Loco manufactured | Mar'13 |
| • Highest ever outturn of 156 Locos | 2013-14 |

4.0 SALIENT FEATURES

- | | |
|---|---------|
| • ISO 9001:2008, ISO 14001:2004 & IS 18001: 2007 Certified Production Unit | |
| • Workshop area (Sq m) | 837936 |
| • Covered area in shops (Sq m) | 89058 |
| • Township area (Sq m) | 1416800 |
| • Electrical Energy Consumption (lacs of units/year) | 168 |
| • Total staff quarters | 1755 |
| • Total Staff strength | 3770 |
| • Township is self sufficient in all basic amenities such as Hospital, School, Shopping Centers, Bank, Post Office, Recreational and Sports facilities. | |

5.0 PRESENT ACTIVITIES AT DMW

- Manufacture of 2400 HP Multi Gen set Loco



- Manufacture of WDM 3D Locomotives with 3300 HP.



- Rehabilitation & Upgradation from 2600HP to 3100/3300 HP & Modernization of Diesel Locomotives.



- Manufacture and Remanufacture of Power Packs (3100/3300 HP)



- Manufacture of 345 types of high precision & critical components required for open line maintenance.



- Manufacture of WDM3A/ WDG3A/ WDM3D type Motorized Wheel Sets Assly for 3100/3300 HP Locos



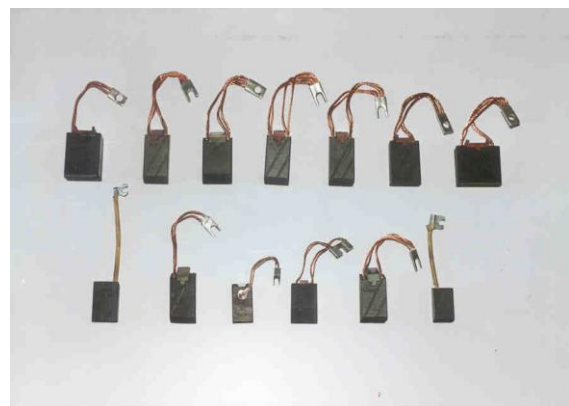
- Manufacture/Remanufacture of High speed Bogies for WDM3D and WDM3A Locos



- Rehabilitation of Engine Blocks & Traction Machines



- Manufacture & Supply of all types of Carbon Brushes of Diesel Locos to Zonal Railways.



6.0 PRODUCTION PERFORMANCE DURING 2013-14

During 2013-14, performance of DMW has been the best ever since its inception. DMW has achieved the highest production figures in all major areas of activities, i.e. New Loco manufacturing, Supply of Motorised Wheel Set Assemblies, Remanufacture of Traction Motors etc. DMW has manufactured 64 new WDM3D locos, 16 new WDS6 locos, 01 Multi Gen Set Loco, 75 rebuilt locomotives and achieved the highest ever turnover of Rs.1737.89 Crs. in 2013-14.

Production performance vis-à-vis Targets fixed for the year 2013-14 has been as under;

S. No.	Item	Annual Target 2013-14	Out turn 2013-14	% age improvement
1.	New Locos Manufactured	75	80+1*	8%
2.	Locomotives Rebuilt	69	75	9%
3.	Power Packs (for ZRs)	20	20	-
4.	Power Packs (Total)	156	156	-
5.	Motorised Wheel Sets	550	553	1%
6.	TM Assembly (All types)	1514	1564	3%
7.	Carbon Brushes	480000	485012	1%
8.	LMS manufactured items (Rs. Cr.)	131.05	136.81	4%
9.	Total out turn (Rs.Cr.)	1597.12	1737.89	9%

*Including 01 Multi Gen Set Loco manufactured.

PRODUCTION PERFORMANCE DURING 2013-14 VIS-À-VIS 2012-13

Comparative position of the financial year 2013-14 vis-à-vis last year 2012-13 is as under :

S. No.	Item	Out turn 2012-13	Out turn 2013-14	%age improvement
1.	Locomotives Rebuilt + Manufactured	133(79+53*+1**)	156(75+80*+1**)	17%
2.	Power Packs (for ZRs)	25	20	-
3.	Power Packs (Total)	155	156	1%
4.	Engine Blocks (for Zonal Rlys)	82	116	41%
5.	Motorised Wheel Sets	550	553	1%
6.	TM Assly(TM+EMD AC Motor)	1486	1564	5%
7.	Carbon Brushes	443803	485012	9%
8.	LMS manufactured items (Rs. Cr.)	120.15	136.81	14%
9.	Total out turn (Rs.Cr.)	1455.00	1737.89	19%

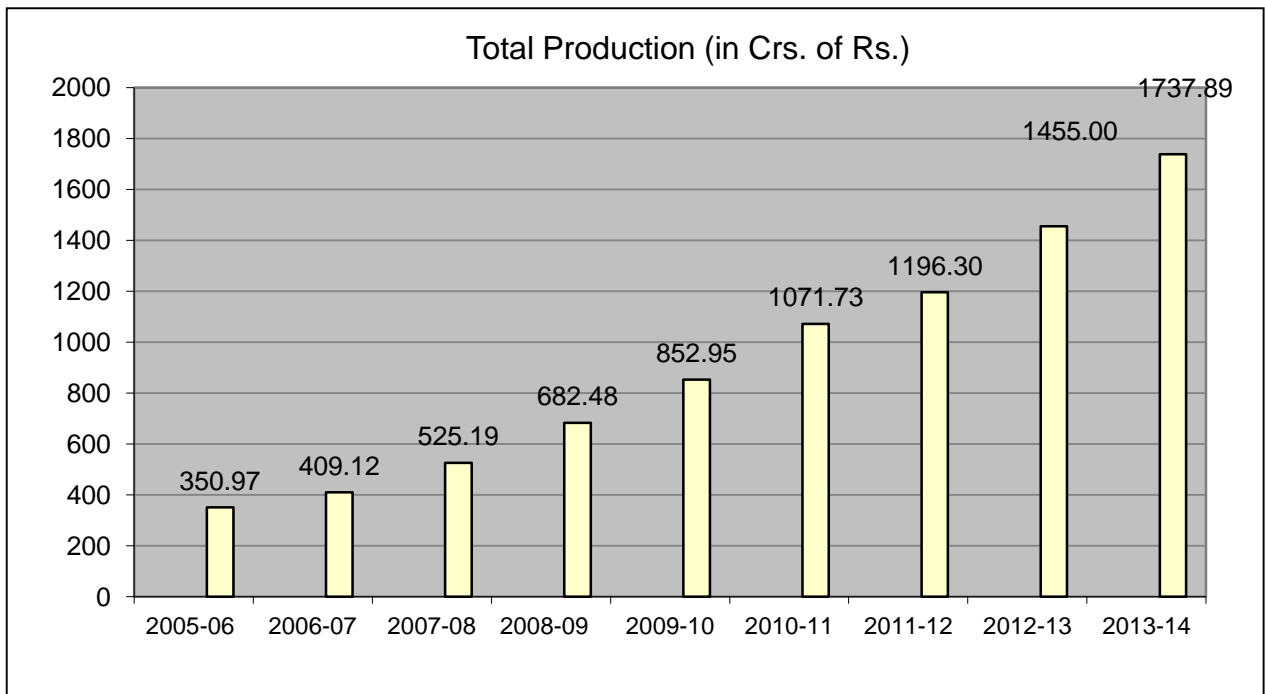
*New Locos (WDM 3D and WDS6) manufactured.

**Manufacture of second Multi Gen Set Loco

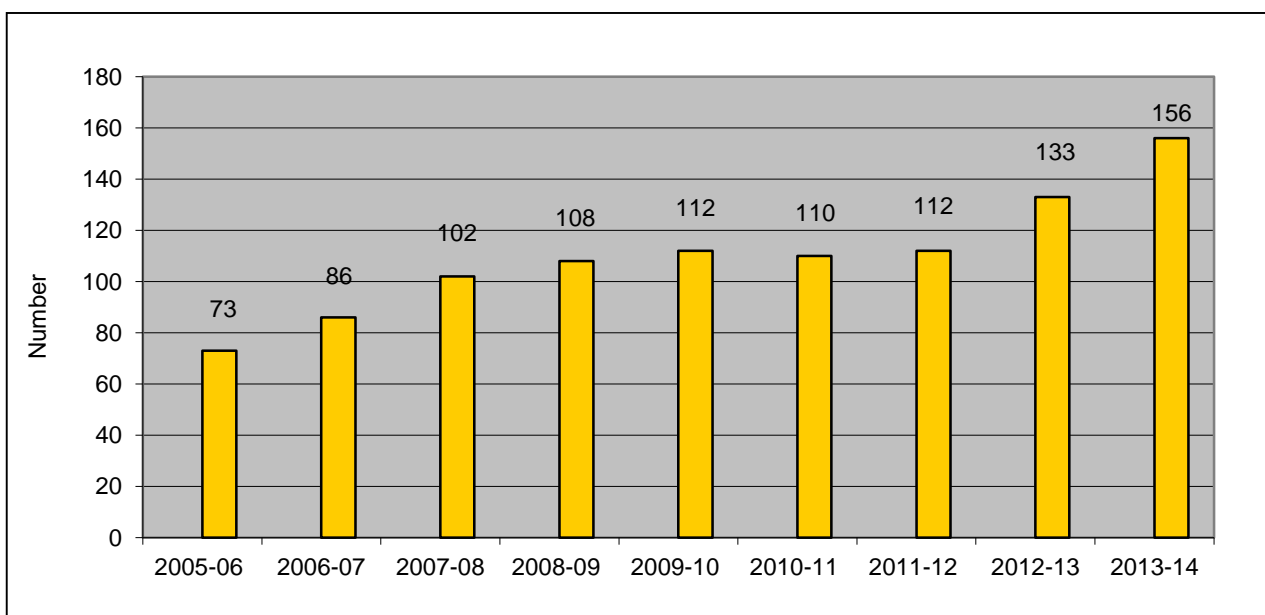
As can be seen, there has been considerable improvement in all areas of production compared to targets as well as the actual performance achieved during last year.

7.0 DMW PRODUCTION OVER THE LAST FEW YEARS

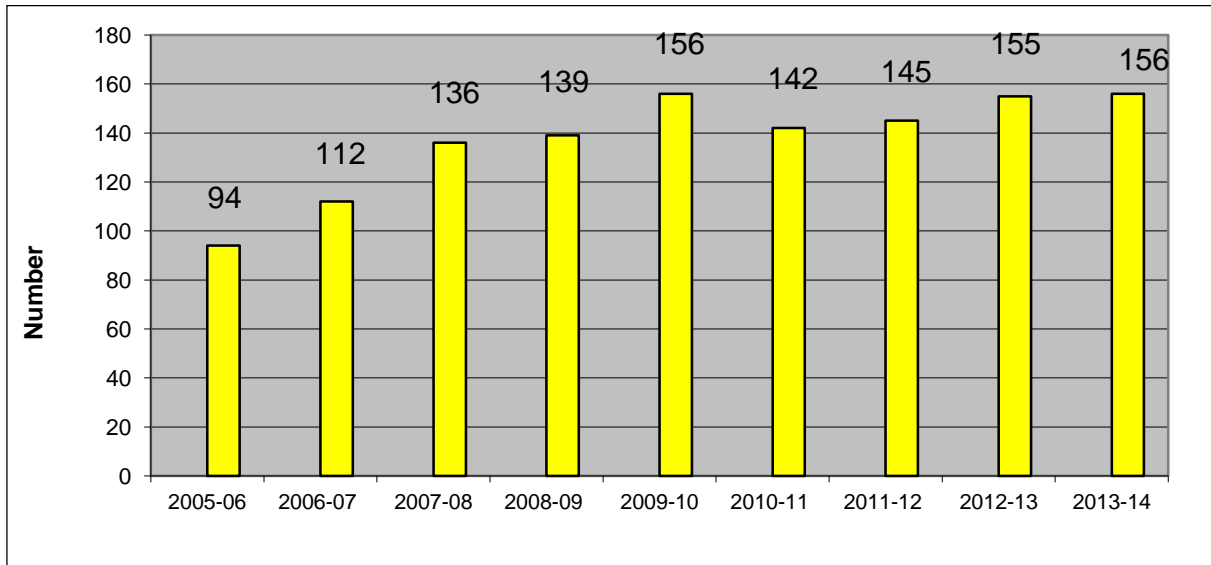
- **OVERALL PRODUCTION VALUE ACHIEVED OVER THE LAST SOME YEARS**



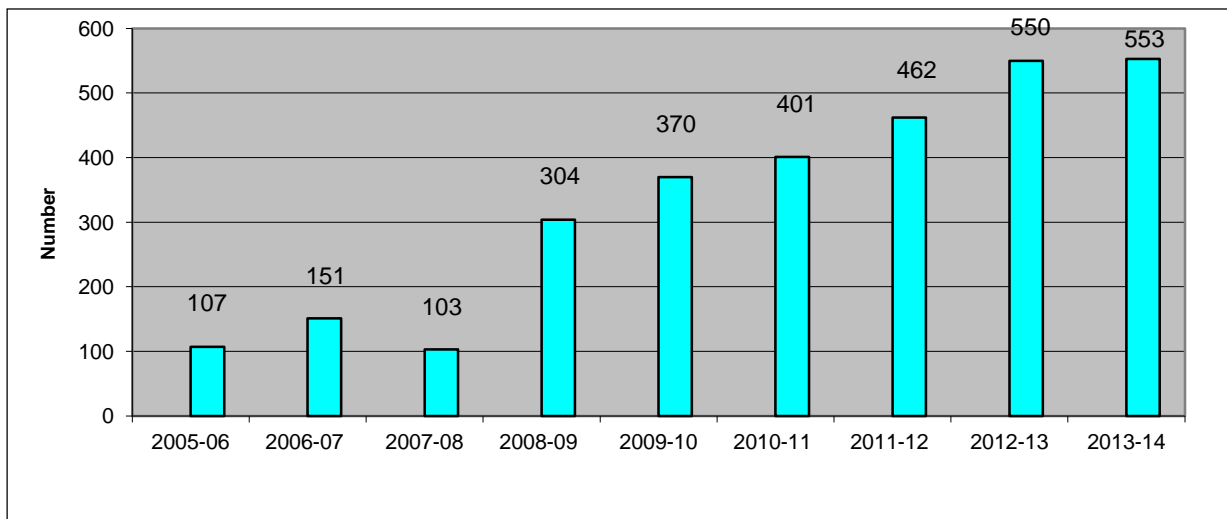
- **LOCO OUTTURN**



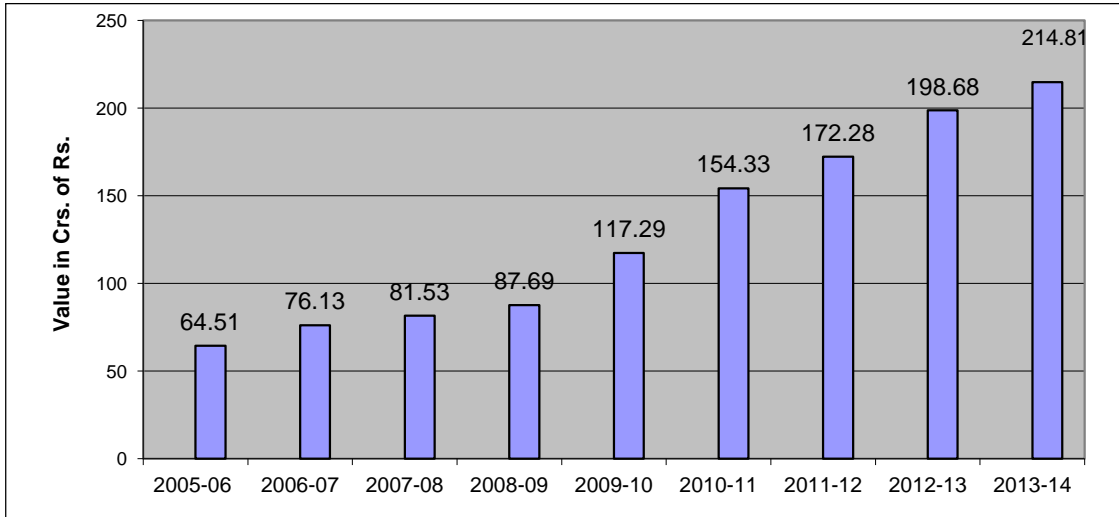
- **POWER PACK OUTTURN**



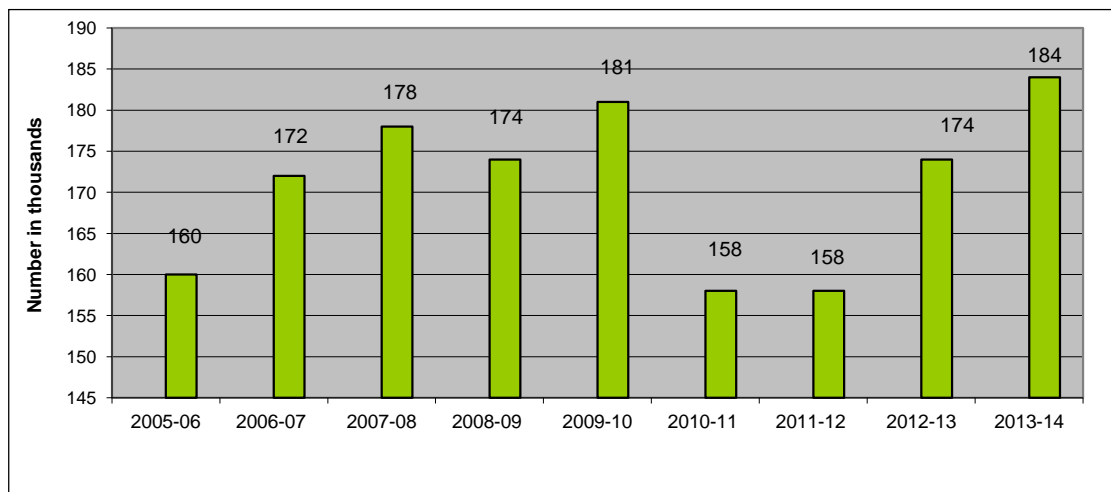
- **MOTORISED WHEEL SET**



• **VALUE OF ANNEXURE 'N' ITEMS OUTTURN (including trade)**

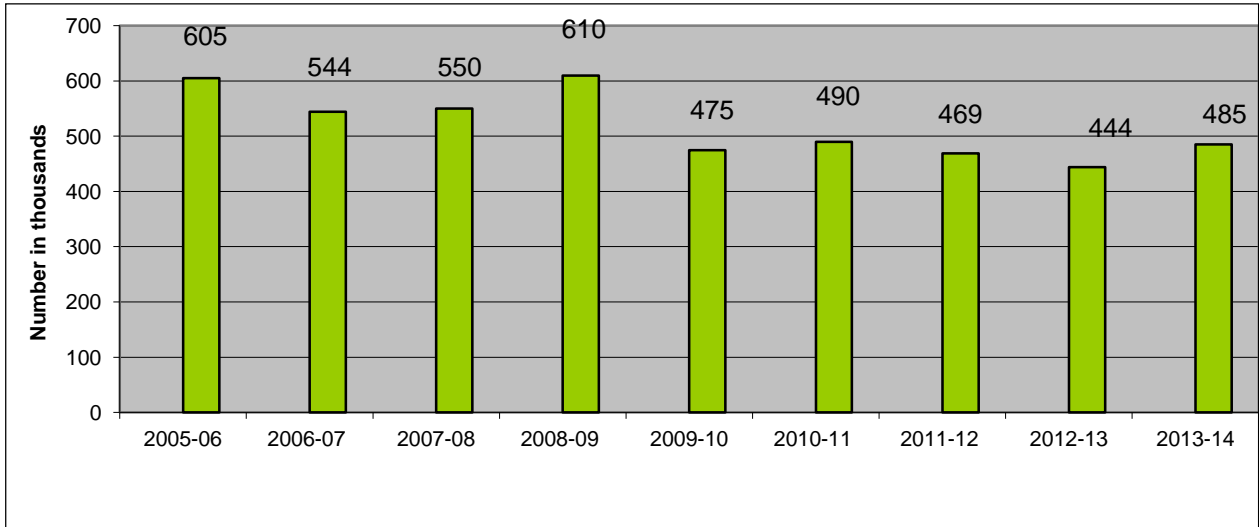
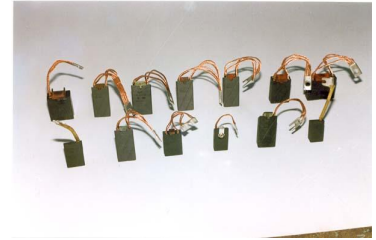


• **ENGINE BLOCK OUTTURN (HMS)**

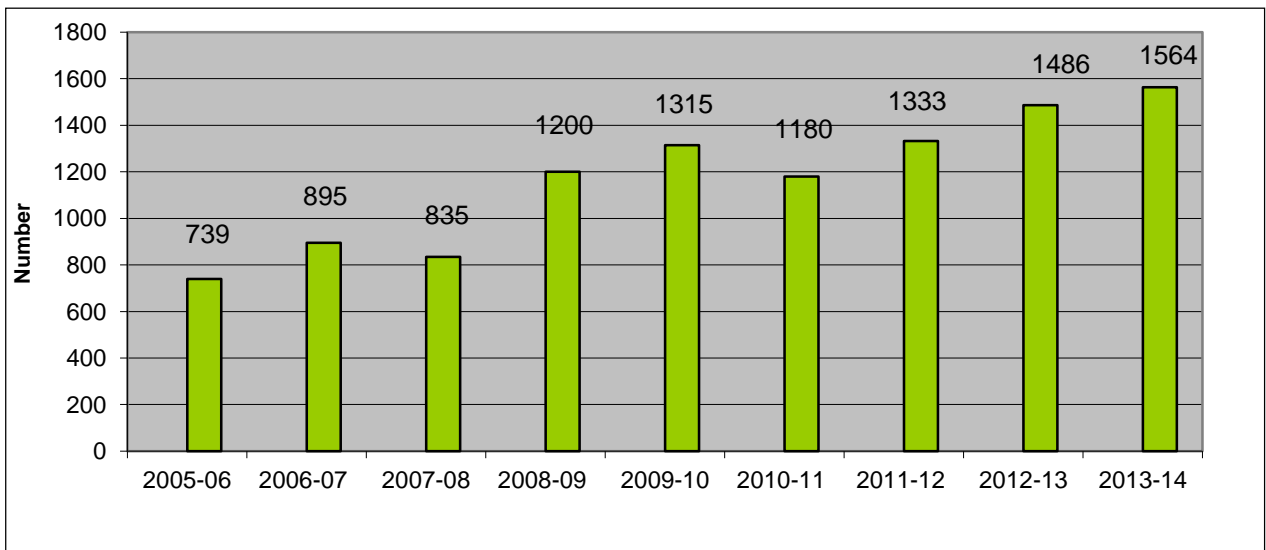


Note_ Production in 2010-11 & 2011-12 with only one PAMA machine

• CARBON BRUSH OUTTURN



• TRACTION MOTOR ASSEMBLY



8.0 WORKSHOP FACILITIES AVAILABLE AT DMW

Shops set up under Phase-I of the project are mainly Manufacturing Shops & Support Shops

- Light Machine Shop
- Heat Treatment Shop
- Traction Machine Shop
- Heavy Machine Shop
- Carbon Brush Shop
- Plant Maintenance Shop
- Tool Room
- Electronics Lab

Shops set up under Phase-II are

- Loco Rebuilding Shop
- Power Pack Shop
- Bogie Shop
- Superstructure Shop
- Transmission Repair Shop
- Air Brake & Pipe Shop
- Loco Testing & Paint shop

MANUFACTURING SHOPS

Light Machine Shop

About 345 spare parts required by DMW and Zonal Railways for locomotive maintenance including Connecting Rod, various types of Camshafts, Cam & Split Gears, Bull Gears, Valve Gear Components, Equaliser Beams, Axles, Armature shafts, Gas inlet casings, etc. are manufactured in the Light Machine Shop. DMW was the first Production Unit of the Indian Railways to adopt NC-CNC machines on a large scale.



A General view of Light Machine Shop



A view of Critical Components manufactured by LMS

Special Purpose Machines:-

Light Machine Shop has 132 light & heavy duty machines for manufacturing of various types of locomotives components. More than 52 machines are CNC. Important machines in LMS are;

- ❖ *CNC Cam Grinding Machine*
- ❖ *CNC Gear Grinding Machine*
- ❖ *CNC Gear Hobbing Machine*
- ❖ *CNC Horizontal Machining Center*
- ❖ *CNC Turning Centres*
- ❖ *CNC Axle Turning Lathe*

❖ **CNC CAM GRINDING MACHINE**

Various types of cam shafts can be grounded on this machine.



❖ **CNC GEAR GRINDING MACHINE**

This machine is being used for teeth grinding of various types of gears of diesel locomotive such as Cam Shaft Gear, Bull Gear, Pinion and Crank Shaft Gear.



❖ **CNC GEAR HOBBIING MACHINE**

This machine is being used for cutting of teeth on various types of gears of diesel locomotive such as Cam Shaft Gear, Bull Gear, Pinion and Crank Shaft Gear.



❖ **CNC HORIZONTAL MACHINING CENTER**

It's a 05 Axes machine. This machine is capable to manufacture Armature Shafts, Connecting Rod, Connecting Rod Cap, MB Cap, Lifter Cross Head, Lifter Push Rod and Equalizer Beams.



- ❖ **CNC AXLE TURNING LATHE**

This machine is being used to manufacture various types of axles. This machine is also capable to achieve super finishing on axles with roller burnishing attachment.



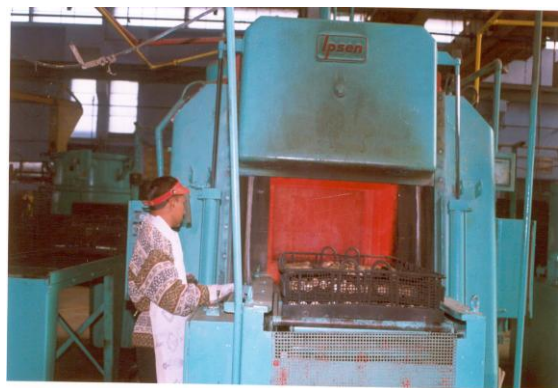
- ❖ **CNC VERTICAL TURNING LATHE**

This machine is being used for machining of crank shaft gear, cam shaft gear, bull gear and back plate.



- **Heat Treatment Shop**

Requisite heat treatment viz. induction hardening, case carburizing etc. is carried out in the Heat Treatment Shop to develop optimum properties in the finished components.



View of Tempering Furnace

- **Heavy Machine Shop**

Engine Blocks of Diesel Locomotives and Traction Motor Magnet Frames are remanufactured and brought to as good as new standards. Precision machining of the Engine Blocks is carried out on CNC Horizontal Boring & Milling Machine of PAMA, Italy make CNC machine after complete welding of Engine Block at newly commissioned Robotic Welding Machine.

Special Purpose Machines;

- ❖ PAMA Machine Centre
Operations of Cam & Crank bore machining, Face serration milling, Liner bore machining and Drilling & Tapping of Engine Block are done on this machine.
- ❖ Robotic Welding Machine
- ❖ G&L Milling Machine
Operations of Magnet frame boring, Milling, Facing, Drilling & Tapping are done on this machine.



PAMA Machine Centre



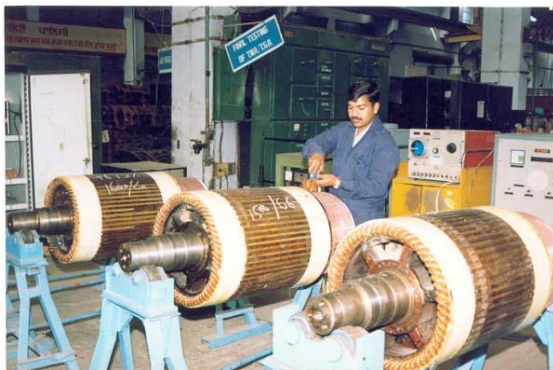
Robotic Welding Machine



G&L Milling Machine

- **Traction Machine Shop**

A wide variety of Traction Motors, Traction Generators and Alternators are rewound / remanufactured in this shop. Facilities include Proceco Cleaning and Vacuum Drying Plant, 500 T Hydraulic Press for shafting/deshafting, Glass Bead Blasting Machine, Vacuum Impregnation Plant, HYT Lathe, Dynamic Balancing Machine, etc.



A view of Traction Machine Shop and its activities/products



A view of Coil Shop and its activities/products

Special Purpose Machines being used;

- ❖ Washing Vacuum Drying Machine



- ❖ Vacuum Pressure Impegration Plant



- ❖ Dynamic Balancing Machine



- ❖ Mica undercutting Machine

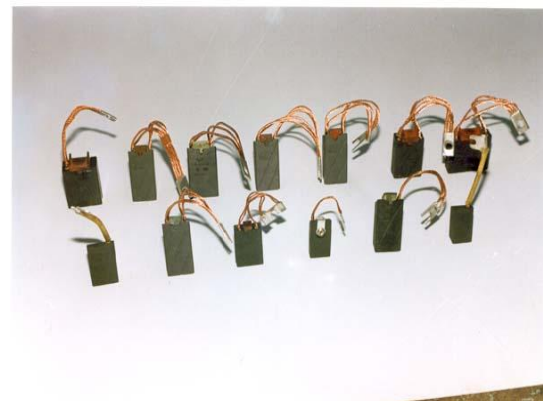


- ❖ Back to Back TM Test Console .



- **Carbon Brush Shop**

The Carbon Brush Shop manufactures 23 types of carbon brushes required for Traction Generators, EMD Main Alternator, Companion Alternator, D.B. Grid Motor, Traction Motors and Auxiliary Electrical Machines.

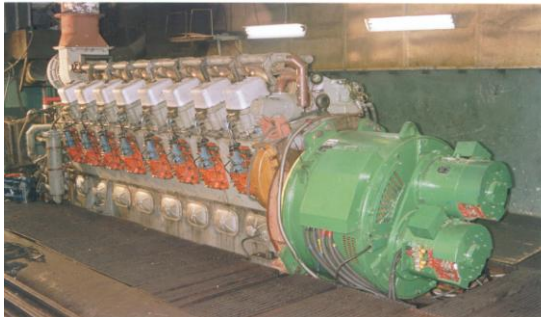


Carbon Brushes made at DMW

LOCOMOTIVE REBUILDING SHOPS

- **Power Pack Shop**

Power Pack Shop is primarily engaged in assembly of new Power Packs for WDM3D and WDM3A for rebuilt locos as well as supply to Zonal Railways to meet their requirements of unit exchange spare power pack. Engine blocks for spare power packs to Railways are supplied from the pool of engine blocks being received by HMS for repairs.



Power Pack Assly



Engine Block on Manipulator

Power Pack Shop is turning out 3100 and 3300 HP power packs along with up-gradations. Power pack Shop has implemented important modifications with the latest technology in consultation with RDSO and based upon customer feed back. Some of the latest features are already incorporated in WDM3A & WDM3D Power Pack viz 3RV Piston kit, 18mm Fuel Injection Pump, Microprocessor control based Governor, AC Crank case motor, Auto frettage Fuel injection tubes etc. Power Pack shop has also manufactured one Power Pack with EFI system fitted in Loco which is currently under trial at AMV Shed.

Quality initiatives are being taken from time to time to improve customer satisfaction through Service Improvement Group teams and prompt redressal of Customer complaints.

- **Locomotive Rebuilding Shop**

Locomotive Rebuilding facilities include dismantling, repairs and reassembly of the complete Locomotive including under frame. A manipulator has been developed for ensuring downhand welding during the repair of under frame and chassis.

During rebuilding, Locomotive sub-assemblies are brought to as good as new condition. The Locomotive is technologically upgraded and made more fuel-efficient

with lesser maintenance requirements. The Rebuilt Locomotive is subjected to a rigorous test schedule under simulated full load conditions in a well-equipped test facility for better reliability in service.

Air Brake and Paint Shops constitute the supporting activity areas for Locomotive Rebuilding. New Power & Control Cables are fitted during Rebuilding.



A view of Loco rebuilding activities

- **Bogie Shop**

Bogie Shop is primarily engaged in manufacturing and remanufacturing of High speed Bogies for WDM3D and WDM3A Locos respectively. Bogie Shop also manufactures Motorized Wheel Set Asslys. for Bogies of WDM3A, WDG3A and WDM3D Loco and supply to Zonal Railways to meet their requirements against RSP items.



Motorised wheel set Assly



Assembled Bogie

Bogie Shop is using latest machines for manufacturing Bogie components and have latest M&Ps for the above said precise activities viz 500 T Wheel Press, Vertical Turret Lathe (VTL) for wheel boring, CNC Wheel Profile machine etc. All bearing fitment related activities are carried out in dust free environment in Bogie Shop.

Bogie Shop has latest measuring and monitoring devices which are used for inspection of components and record of run test of bogies / MWS like Digital inside and outside Micrometers, non contact Pyrometers, Shock Pulse Meter, Online digital Grease Meter to ensure accurate quantity of grease filled in Suspension Tube bearings etc. to ensure quality of the product.

SUPPORT SHOPS

The various activities of DMW are adequately supported by competent workforce of staff and supervisors of Plant Maintenance Shop, Tool Room, Main Receiving Station and other support shops.



A view of CNC Jig Boring Machine- SIP-720 of Tool Room



A view of Universal length measuring machine - ULM-600 of Tool Room

- **Electronics Lab**

There is a full-fledged Electronic Lab to cater to maintenance need of highly sophisticated CNC machines and component / subassembly level trouble shooting of PCBs, Servo Drives, Microprocessor based controllers and electronic units. This Lab also supports other Zonal Railways in repair of PCBs.

Important Machines:-

(i) Reverse Engineering System:

It helps tracing PCB tracks between components in given circuit board whose detail is not provided by the OEM.

(ii) Automatic Test Equipment :

With its library having more than 30,000 components details, it helps in-circuit testing of digital and analog devices mounted on latest PCBs.



A view of Electronics Lab in DMW

NEW INITIATIVES:

• MANUFACTURE OF MULTI GEN SET LOCO:

DMW has manufactured second 2400 HP Environmental friendly, fuel efficient Multi Gen Set Locomotive having nominal axle load of 18.8 ton. It is the only loco conforming to US EPA TIER-II environmental norms on Indian Railways. It is equipped with IRAB Panel and AC Motor driven Air Compressor. Multi Gen Set Loco saved 18%-20% of fuel during utilization in passenger service on WCR vis-à-vis similar WDM2 locos. These locos will be very useful for yard shunting and passenger trains. Highlights of this loco are:



- ❖ Potential to reduce fuel consumption by 25-30%.
- ❖ Only loco conforming to US EPA TIER II Environmental Norms on Indian Railways.
- ❖ Drastic reduction in particulate matter and polluting gases.
- ❖ Crew friendly loco cab is provided with air conditioning and heating arrangements, which would reduce crew fatigue. Noise levels reduced from 90 db to 65 db.

• MANUFACTURE OF NEW WDM3D & WDS6 LOCOMOTIVES:

In 2013-14, DMW has manufactured 80 locos (including 31 Parel manufactured locos, i.e. 15 WDM3D & 16 WDS6 locos) against a total target of 75 locos. DMW plans to manufacture 90 WDM3D/WDS6 locos in 2014-15.



Manufacture of New WDM 3D 3300 HP Loco



2000th Power pack being turned out

• FITMENT OF ELECTRONIC FUEL INJECTION SYSTEM IN ALCO LOCOS:

DMW added another feather in its cap by the first ever fitment of EFI system in Loco No. 16502. The loco was flagged off by Member Mechanical on 13th Aug, 2011.

This loco has provided 4% improvement in fuel consumption under test conditions. Alambagh Shed, where this loco is based, reported fuel saving in the range of 3-4% during initial trial period of six months.

Electronic Fuel Injection technology has following advantages over present system:

- Variable Injection Timing resulting in improved SFC
 - Elimination of large number of mechanical components thus, reduction in maintenance and increase in reliability.
 - Lesser maintenance.
 - Improvement in reliability.
 - Better emission standards
- **OVERHAULING OF 3 PHASE AC MOTORS OF EMD LOCOS:**



With a view to provide technical support to Zonal Railways in the light of increasing EMD loco population, DMW has taken the initiative to develop facilities for overhauling of 3 phase AC motors. First AC Motor was overhauled in August, 2011. 151 AC motors have been overhauled till March 2014, replacing mechanical components on condition basis.

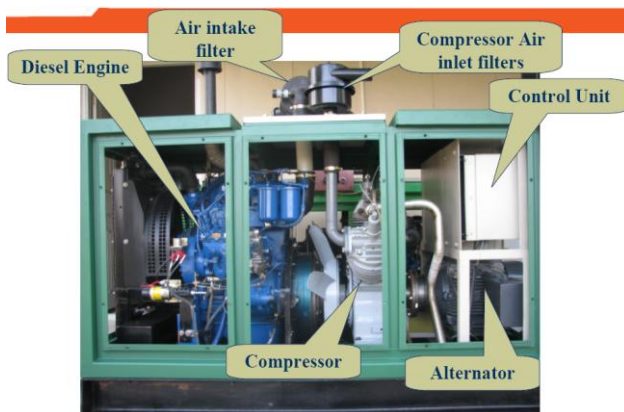


- **FITMENT OF AUXILIARY POWER UNIT (APU)**

DMW, Patiala has fitted Auxiliary power units in 53 Locos (34 WDM3D and 19 WDM3A locos) till March 2014. These APUs are expected to have saved 3,60,000 litres of HSD oil during idling of locos till Mar'14. This has resulted in saving of Rs.2.34 Cr during 2013-14.

An APU fitted loco is expected to result in following advantages:-

1. Smaller engine having low SFC produces required limited HP.
2. Baby compressor maintains BP pressure and the train can be started as and when required.
3. APUs charge low batteries while the main engine is shut down.
4. Reduction in fuel oil and lube oil consumption.
5. Reduction in emission.
6. Extended engine life.



Some visuals of APU from different angles

- **Fitment of Computer Controlled Brake System**

CCB can be interfaced with microprocessor control system for blended brake feature/ distributed power control feature. Till 31st March 2014, 47 CCBs have been fitted on locos.



Benefits:

1. Blended brake facility available between dynamic brake & pneumatic brakes.
2. Better reliability as pneumatic valves replaced with solid state electronic components.
3. Electronic brake valve controller provides precise control of control pressure.
4. Compatible with Micro controlled Brake System
5. It has built in self diagnostic feature.

10. IMPROVEMENTS AND UP-GRADATIONS IMPLEMENTED/ PLANNED ON REBUILT LOCOMOTIVES FOR ENHANCED & IMPROVED PERFORMANCE:

The following performance enhancement & technological upgradations have been implemented and planned during rebuilding/manufacturing of loco:

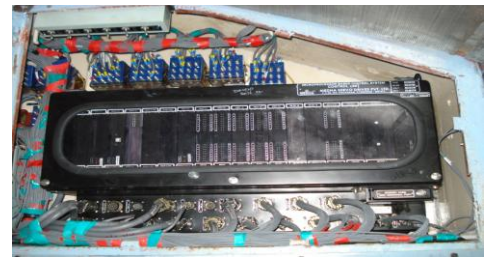
SL No	Description	No. of Locos on which fitted upto Mar'14	Planned in 2014-15
1	Auxiliary Power Unit	53	100% for new & Rebuilt Locos
2	Microprocessor Control System including Governor	799	100% for new & Rebuilt Locos
3	Computer controlled brakes	47	30 New Locos
4	REMMLOT (Remote monitoring management of Locomotive & Trains).	196	100% for new locos
5	Tight Lock Coupler & Soft Draft Gear with Yoke	365	100% for new locos

6	Roof Mounted Dynamic Brake Resistance (RMDBR)	433	100% for new & Rebuilt Locos
7	Electronic Fuel Injection System (EFI)	01	05
8	3 RV Piston Kit	577	100% for new & Rebuilt Locos
9	18 mm Fuel injection Pump (FIP)	383	100% for New & 3300 HP Rebuilt Locos
10	EMD type Air Horn	561	100% for New & Rebuilt Locos
11	FRP Interior in Driver Cab	01	09

Some of the visuals of modifications/upgradations carried out on Rebuilt locos;



LCD Display unit



Microprocessor Control System



Roof Mounted Forced Dynamic Grid Hatch Assembly



Modified hand brake assly



Tight Lock Coupler and Soft Draft Gear Arrangement



11.0 QUALITY, ENVIRONMENTAL AND OCCUPATIONAL HEALTH & SAFETY MANAGEMENT SYSTEMS:

DMW is an ISO 9001:2008, ISO 14001:2004 and IS 18001:2007 certified by M/s. BIS, Chandigarh. Integrated Quality, Environment and Occupational Health and Safety Management Systems are in operation.

Renewal audit of all the above Systems was conducted from 5th to 8th Feb'14 successfully by Certification body i.e. by M/s. BIS, Chandigarh. The audit team has recommended for renewal of the above three Management Systems for a term of three years.

One Management Review Meeting (MRM) and two internal audits of each of the above Systems were conducted during the year 2013-14.

12.0 EXPORTS

DMW is exporting spares of Diesel Locomotives to countries like Malaysia, Sri Lanka, Vietnam, Bangladesh, Tanzania, Sudan, Angola & Mozambique through M/s RITES/Gurgaon & M/s IRCON/NDLS. An order for Rebuilding of two MLW Class 88 Canadian built Tanzanian Railway Locomotives was also executed by DMW in May 2009.

DMW is associating with M/s RITES to tap indigenous market for undertaking rehabilitation of Diesel Locomotives.



Rebuilt Tanzanian Railway Loco

13.0 THE ROAD AHEAD:

- **DMW & Parel to manufacture 90 (WDM3D/WDS6) locos in 2014-15.**



- **To manufacture 30 EMD Locos from 2017-18 onwards.**



- **To manufacture 3600/4000 HP Multi Genset Locomotives.**



- **To develop new manufacturing facilities of 3 Phase A C Traction Motors for EMD Locomotives.**
- **Manufacture of LNG (Liquefied Natural Gas) locos.**
- **Fitment of Common Rail Direct Injection (CRDI) fuel system on ALCO Loco.**
- **Manufacture of New Generation Powerpacks to achieve low emission standards and high fuel efficiency.**
- **Fitment of miller timing Camshaft and Turbo-superchargers to achieve further saving of SFC by 2% and reduction in emissions (NOx) level by 20%.**