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Soochna, March 04

***Special supplement on status of reliability
of critical powerpack components***

Study of defects & corrective actions

Change notices

Failure investigation reports

Important CPAs

Listing of trial fitments

Miscellaneous technical information

Important projects in hand

**Diesel Locomotive Works
Indian Railway
Varanasi**

Foreword

It gives us great pleasure to release the sixth issue of *Soochna*. As you are aware, five issues of *Soochna* (March 02, June 02, December 02, April 03 & August 03) have been published earlier, mainly with a view to apprising the Zonal Railways, Railway Board, RDSO, PUs and IRIMEE of all the changes/modifications, corrective actions and failure investigations undertaken by DLW. An electronic copy of the contents as well as the drawings referred to is also issued on a CD along with the *Soochna* booklet. It has now been decided that, with the reduction in complaints and consolidation of various improvements on diesel traction, a six-monthly periodicity of publication, instead of four-monthly followed till date, would be more than adequate. The next issue, therefore, would be brought out in September 04.

This issue consists of the following sections:

Section A	Special supplement on status of reliability of critical engine components
Section A 1	Summary of defects reported to and action taken by DLW
Section B	Summary of important Change Notices
Section C	Compendium of failure investigations
Section D	List of important CPAs (Corrective & preventive Action) raised and successfully closed by the standing machinery under ISO-9002)
Section E	List of trial fitments by DLW
Section F	Miscellaneous tech. information & notices
Section G	List of important projects at DLW

Special attention is invited to the special supplement on reliability of engine components. It may be seen that corrective actions have been taken on a very wide scale with a view to arresting engine failures. This is an important step towards meeting the relevant goals set in the Vision document for Mechanical department. **I request you to send meaningful response on this supplement, as we must attempt to consolidate the improvements made already.** Other suggestions for improvements are also welcome.

(S.Mani)
Chief Design Engineer

Soochna

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Section A
***Special supplement on status of
reliability of critical engine
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Special supplement on reliability of high hp DLW engines

Some relevant extracts from the vision statement for Mechanical department

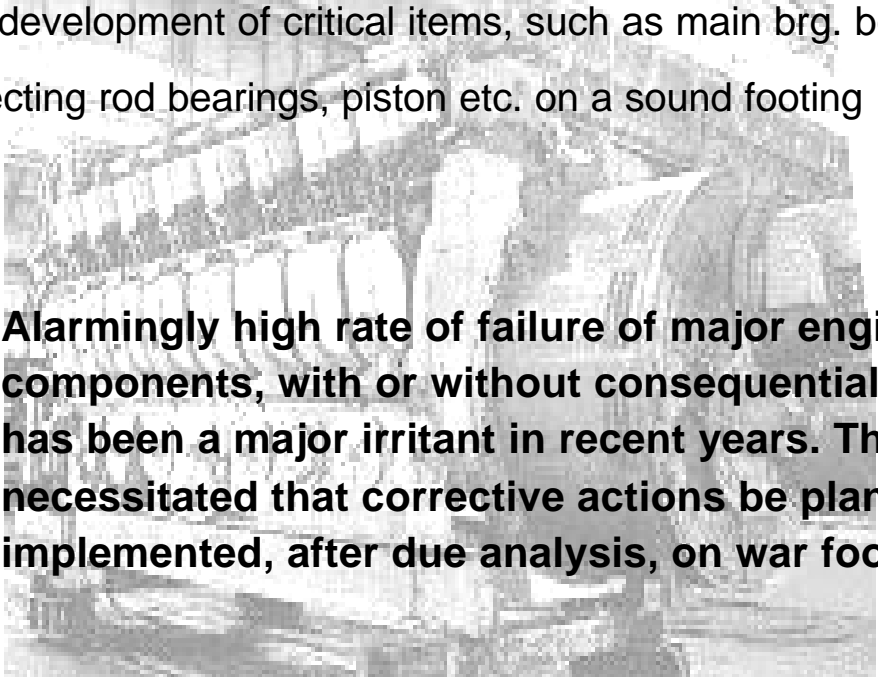
Progressive reduction in failures of major engine components

50% reduction in consequential damage to crankshafts

Manufacture of 3300 hp/3600 hp ALCo locomotives

Design validation of existing ALCo engine block

Vendor development of critical items, such as main brg. bolts, main & connecting rod bearings, piston etc. on a sound footing



Alarming high rate of failure of major engine components, with or without consequential damages, has been a major irritant in recent years. This necessitated that corrective actions be planned and implemented, after due analysis, on war footing.

Issues involved were addressed meticulously by DLW in recent years, employing the following multi-pronged approach :

- Data collection, management and analysis
- Failure investigation (at sheds and DLW)
- Review of design/drgs, manufacturing & maintenance practices
- Audit of vendors and inspection control
- Detailed study to adapt good features from other designs

In this section, an attempt has been made to summarize the measures taken by DLW. These measures have borne fruit and the rate of failure has come down significantly, in spite of increasing holding of 3100 hp locomotives, as tabulated below:

	No. of major failures on all high-power engines (excluding turbos)*
01-02	146
02-03	102
03-04	70

* Loco-wise details listed in annexure

The process, however, is continuous and ample scope exists for further improvements. What is important is that we are on the right path. It is not out of place to add that every single area has needed major inputs.

Considering the mistakes already made and resulting infection with “defective/substandard” components, some failures are bound to continue. Efforts are on to reduce even such failures by suggesting corrective actions to sheds, including planned replacement of certain components. As the exercise is on, suggestions for mid-course correction are welcome. For example, in the listed failures on the engines loco-wise, some information is occasionally missed out. We would be glad to incorporate additions/deletions. **This supplement has been a part of recent issues but a meaningful response is awaited. Your valued inputs, be it missing failure data or other suggestions, are solicited.**

**Corrective actions by DLW on problems reported on engines and turbochargers
(Including actions taken on suggestions by sheds)**

	Problem/Suggestion	Action taken
Crankshaft, engine block and main bearings		
1	Problems on engine block; distortion of main bearing bores, seizure of bearings, cracks on saddle & cam bush housing	<p>The problems have been studied in detail and the actions taken are as under in brief:</p> <ul style="list-style-type: none"> ▪ 100% check of alignment as per RDSO procedure after correct tightening of main bearing caps. ▪ Good features of Bombardier block introduced. ▪ CO2 welding instead of conventional welding for manual weld locations under introduction in stages. ▪ Ensuring MB stud hole in centre and higher mating area of serrations by building up saddle ends. ▪ Wider cam bearing block at No. 9 location. ▪ Cam bearing set-up fixture introduced and low cam bearing wall thickness problem eliminated. ▪ No 9 crank bore is finish-bored separately at reduced rpm; eliminates bore misalignment and radial distance problems; same for cam boring with HSS tool. ▪ 100% elongation check of MB studs ensured. ▪ Boring done only with validated studs. ▪ Oil groove provision in cap implemented on one engine successfully; full implementation in hand. ▪ Repair of the stress-relieving furnace to achieve specified temperature differential planned. ▪ Correct welding sequence implemented as per WI. ▪ Measurement of locked up stresses done in association with RDSO and found to be acceptable. ▪ Laser alignment systems studied; applicability not established. ▪ Extruded section spline on Bombardier pattern to be introduced. ▪ Strengthened cap & saddles; forging drawings revised after checking manufacturability. Prototype saddles fitted on block no. 3464; regular fitment started in end 03. ▪ Use of Rillenlager bearings at no. 3 & 7 locations. ▪ Review of heat exchangers, i.e., LO cooler and radiator in hand with a view to ensuring cooler LO. ▪ Drg. of cam bush housing no. 9 revised to call min.1/4" after machining; no more failures likely. ▪ Inspection on the welding of the cam bush support ribs for strengthening is being done as a part of checklist. This joint has been made into GMAW welding which has re-started for the last few days. Some of GMAW weld points have exposed very poor penetration after machining; this aspect was critically examined and revisions issued for good welding. ▪ Thorough inspection for poor welding (undersize) of cam brg welding ensured as part of the Check List. ▪ Strict check on quality of vendors for bearings in place, including frequent audit checks even after RITES inspection. ▪ Manufacturers like M/s GMH/Indore & PBW/Rajkot restricted/eliminated for supplies of main bearings ▪ Crush height audit checked regularly on main bearings ▪ Every failure of main/con rod bearing being meticulously investigated and documented ▪ Importation of all main bearings mooted at DMW meeting in end Aug 03, under consideration. Meanwhile, trials would be started in

2	<p>Structural/weld failures, cam u/size side sheet thickness, weld failure of inside wall joint with spline or with top deck, crack on side sheet in FIP support area, F.O. header crack, Leakage from push rod hole damaging fuel shelf control compt, leakage from fuel channel welding, channels drilled through gallery, water jumper hole drilled through bulging at fuel pump support mounting area, patches welded on inner wall etc.(TKD, ED, GOC, VSKP, GY, KZJ, BGKT etc.)</p>	<p>three sheds with Rillenlager bearings on all locations</p> <ul style="list-style-type: none"> ▪ The finish of MB stud holes, which was not called earlier, specified as 125 rms and change notice issued; inspection advised. The process needs to be modified for the same. ▪ It is proposed that the system of flushing the engine piping before test bed break in, as per ALCo recommendations, be started; the same has been in disuse for a long time ▪ The S pipe fitting at header end is at present non-standard and manufactured in shop; this practice has been stopped and procurement is now planned from ermetto fittings suppliers. <p>The problems have occurred mainly on blocks manufactured during the period when blocks were permitted on waiver. The corrective steps taken by DLW are listed below:</p> <ul style="list-style-type: none"> ▪ Waivers on block stopped except in rare cases. ▪ Targets machining re-qualified to avoid complaints of less thickness of sheets etc. ▪ Inspection after completion of side sheet & FR joints in HMS; in case of defects, rectification done by proper gauging and welding. ▪ SAW weldment improved in respect of controlled voltage and current leading to poor penetration (New power source for Lincoln m/c installed) and new m/c no. 3026 installed. ▪ SAW weld flux of only reputed & proven make to be used. The flux of M/s Lincoln found far superior with considerable improvements in weld quality and proposed to use only this flux. ▪ Use of alternative machines for edge preparation as old machines have outlived their life. ▪ Root run weld improved for water chamber. ▪ Improved flux application during welding. ▪ Hydraulic test at higher pressure. ▪ Rejections in Radiography and Hydraulic tests reduced drastically. ▪ Re-qualification of all welders on GM pattern. ▪ Good features of Bombardier block introduced. ▪ Detailed bead-wise record-keeping of blocks done. ▪ CO2 welding instead of conventional welding for manual weld locations under introduction in stages. ▪ Repair of the stress-relieving furnace to achieve specified temperature differential planned. • Implemented shot blasting of all components prior to set up to improve weld quality. ▪ Correct welding sequence implemented as per WI. ▪ Proper seating of middle deck against outside wall and spline ensured. If gap found, it is closed by flame heating of outside wall. ▪ The flux falling on the ground to be discarded. ▪ All internal seams flame heated prior to SAW. ▪ Since RDSO has approved a plethora of electrodes, DLW has developed its own list of vendors based of past performance. ▪ Most of the joints on positioner GMAW welded. ▪ With a view to improving the welding at F/R plate, the size of groove increased suitably. ▪ Special gauge now used for dimensional control of shelf to avoid puncture while drilling push rod hole as the shelves were fitted without proper profile/dimensional checks in some case. ▪ Thorough inspection after envelope machining to look for any opening in the weld at F/R plate to side sheet; in case defects detected, the block sent to HWS and proper rectification of the joint by gouging, re -welding and grinding ensured. QP revised.
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		<ul style="list-style-type: none"> ▪ 100% inspection of T1 joints to ensure full penetration for the weld with spline started. ▪ Thorough inspection after making FIP support cutout in side sheet has been ensured with template by mentioning it in the Check List since May' 2000. ▪ Quality of the angles for galleries is being monitored strictly. Shot blasting of the angle has been introduced before and after fit-and-tack on side sheet for better quality of welding. Drawing has been modified to provide separate welding of both angles. ▪ Change notice has been initiated by this office for procurement of angle as a cut ready for welding. ▪ Poor job of welding patches on the inner wall or strips along the fuel support cut out (KZJ and TKD cases), done in period 97-99 on some blocks discontinued and check point made for monitoring. ▪ Poor job of welding patches in critical places such as cylinder head stud hole due to incorrect drilling done in period 97-99 on some blocks (TKD) discontinued and check point made for monitoring. ▪ Strength of all top deck to wall weld improved after a series of failures on blocks manufactured in the period 97 to 2000 to ensure that similar failures are not repeated at all. ▪ Quality of welding of the boss of the header improved; special checks for ensuring proper welding of the boss included in the QP.
3	LO reg. Valve- sump pipe sump adapter sump to be 4 1/2" long for proper D coupling fitment (ET)	This problem was studied and it was found that the change over to a longer pipe on request of some sheds. This modification, however, resulted in difficulties in fitment of dessor coupling. The modification has since been reversed. Closed.
4	Poor hardness & cracks on DLW main brg studs (VSKP)	Verified at DLW. The problem lies in procedure of checks and not studs. Clarification sent to shed. Closed.
5	Cracks on the main bearing lug area	This issue was examined in detail with the manufacturers like KOEL and Gabriel. A process has been evolved by which bearings can be made totally crack free. Stringent check deduction at manufacturing stage itself has been introduced. One round check on all makes made and bearings found okay. RITES advised to pay special attention to this aspect. Closed.
6	Other miscellaneous complaints on engine block: Failure of two recent DLW blocks due to Cracks near fuel pump support area Leak off channels drilled through Water jumper hole drilled through Bulging at FP support mount area	With the improvement in SAW weld machine, its power source, flux quality and application and improved test standards, such problems are not likely to be encountered in recent blocks. Some problems were faced due to employment of "direct to use" flux from M/s Advani, which has since been discontinued. It is being ensured that only quality flux (Lincoln make) is employed. The problem of water jumper hole drilled through eliminated by increasing the thickness of top deck towards fuel control compartment. Checks on slight bulging at fuel pump support mounting area to be done. The side sheet thickness has been kept at min 16 mm eliminating this problem. Many of these issues are covered under para 2 also. Closed.
7	Base to block bolts loose & poor vacuum (NKJ, NGC & UDL)	The torque to be applied specified (300±25 lb.ft.) by calling in the drawing and tightening inspection. Closed.
8	Leakage of lube oil in fuel gallery 14953 due to angularity in push rod bore of the	With the introduction of GMAW welding and improved test standards, such problems are not likely to be encountered in recent blocks. This has been made a checkpoint. The angles under use for galleries are of poor quality. Rejection of

	block at R5 location (NKJ presentation).	some angles also done as complaints of laminations persisted. Decision taken to procure ready to use cut sizes of angles. (See para 2 also). Closed.
9	Water drainage from L/S bank not possible fully; water retained contaminating the oil whenever liner taken out (NKJ & GY).	It has been decided that drain would be incorporated for l/s water header in block by providing two special pipes for the purpose. Eight such blocks manufactured successfully but cut in delayed as the tube gets cut/ground during drilling of FIP support. Design reviewed and fitment on free end not possible. Shops advised to make proper WI and implement as per existing design. Meanwhile, DLW MRM has dropped this project. Sheds have been advised to comment on the advantages of the blocks already manufactured. Closed.
10	Cold breakage of crankshaft	Suspected cases of cold breakage of crankshafts have been analyzed by DLW in detail independently as well as through joint investigations with the manufacturers. Investigations have revealed that most of the cases are hot breakages, not due to any inherent defect in the crankshaft, except one case in which warranty claim was raised against M/s. NF, which was accepted. Investigations are a continuous exercise with M/s NF and DLW has been organizing the same regularly twice a year, apart from independent investigations by DLW in sheds/shops. Simultaneously, the spec for the induction-hardened crankshaft has been revised to call for fillet hardening. Induction of new crankshaft from sources other than M/s. NF is being done in a cautious manner. Waivers requested by M/s HEC are not agreed to in most of the cases due to criticality of application. Detailed investigations on two cases of M/s Ohio (WDP1s) also taken up awaited but meanwhile, the issue has been closed as the cases are not within warranty periods. Cases of cold breakage not reported in 03-04. Only one case of breakage of crank shaft is pending for joint inspection with NF(loc no. 17950; BGKT)
11	Cracks on thrust brg collar of GB make; incorrect groove radii. Both GB and Miba thrust brgs breakage at collar; collar found normal and nut to nut gap of exp coupling adequate, i.e., no adverse effect of incorrect gap (BGKT; 16869 & 14871)	Investigations in association with RDSO in hand. The firm has confirmed that corrective action taken to provide correct radius, which was not done earlier some years back. To be verified on the latest lot as and when received. The BGKT case needs to be investigated; the shed has been advised to send failed material.
12	Dislodged overlay on GB brg. detected avoiding seizure. (NGC, 14970)	Eleven bearing of M/s GB checked at DLW and no abnormality found. Further one half brg already checked by RDSO, was checked at DLW (the other half) and no abnormality found. Closed.
13	Absence of Ni dam in KOEL main brg. (Check by Parel; PA)	The case has been referred to the firm for comments with a view to making further checks at DLW. Ni dam to be checked on one sample KOEL bearing at DLW. Since the firm has not replied, deduction advice to be sent.
14	Wrong LO level; non-modified tube for new stick (NKJ)	Tube has since been modified & cut in. The markings on the tube are haphazard but RDSO confirmed that the same is correct. Graduation also verified at DLW. Closed.
15	LO not rising after a certain level for 250 litres (HWH)	Tube has since been modified & cut in. Graduation verified. Closed.

16	Problem of black spots on the brg. surface of GB make shell (Inter) due to poor packing (LDH)	The packing checked at DLW Stores and found as per specification. Ref. made to the firm and shed for further details.
17	KOEL main bearing no.2, 3,4 & 7, all shells found defective; lead & tin layer pealed off & Cu layer visible; peel off in such a way that at number of places the spots of lead & tin are also visible. (JHS; 18468).	This is a specific complaint of premature failure; the firm has been advised to visit.
Con rod		
1	Failures of connecting rods	<p>Failure of con rods, which is usually accompanied with major damage to the block also, has engaged the attention of DLW for some time and the actions taken, in brief, are as under:</p> <ul style="list-style-type: none"> ▪ Audit of SIFL done and a number of improvements incorporated in the process & spec; verified by RDSO also. With BFL drying up as a source, further ordering has to be done on SIFL. RDSO has been advised to conduct fresh audit of the firm. ▪ The process of rifle drilling through a new WI & inspection tightened. ▪ The oil hole blending improved. ▪ Spec. revised once again to both the materials specified in ALCo spec but Boron Steel made the alternative and not main material. Both longitudinal and transverse strength specified clearly stress is being made on use of material with required strength. ▪ Cleanliness of RM incorporated. ▪ Con. Rod nut & bolts being procured in pairs; Id-mark at serial key seat provided. ▪ Drawing revised to ensure that min. distance between locating lug and bolthole is achieved. ▪ Sample checks over and above RITES inspection being carried out on con rod forgings. One con rod would be got cut from the rifle hole every month and the quality of hole examined and metallurgical tests carried out. Photos/records kept for all audit checks. ▪ RDSO requested to issue an IB covering Magnaflux inspection of suspect SIFL con rods; done. ▪ The pie-tester attachment for the Magnaflux machine made functional and validation frequency spelt out & ensured accordingly. ▪ DLW has procured Keto's rings for the magnaflux m/c. ▪ The process of removal of excess material from the web improved. Arrangement made for measurement of thickness by a template. ▪ Modification to the drg. for packing SIFL with improvements to avoid dents on areas not machined; to be effective from next PO. Meanwhile, SIFL: advised to send one lot with revised packing. ▪ Since BFL is likely to dry up as a source, development by Fine Forge and Ahmadnagar Forge in hand actively. ▪ Detailed meeting held once again with SIFL to improve quality and the latest lot of 100 nos. is under evaluation. The revised QAP has been cleared by RDSO. ▪ Con rods of SIFL make rejected by sheds due to cracks(potential breakage) shown to SIFL with a view to revising their QAP; in hand

2	Free movement of con rod nut on bolt not available. Boltholes should be done in two stages on con rod. Permanent stretch on bolts also reported in some cases.	Con rod nut on bolt converted to one assembly & PL and only the best fasteners sources. Audit checks made on permanent set and the material in use found acceptable. A dev. Order placed on Boltmaster; not found up to the mark; MC advised not to consider as source. Experiment also carried out to check permanent set at 25 thou stretch and it was found that the material is okay. Trial on five engines in hand. Introduction as a regular measure at 22-23 thou stretch done. Improved fixture provided and machining improved; out of squareness of hole centre line and top surface still around 15 thou but permitted under concession. The quality is much superior to that turned out earlier and regular audit is being ensured. Closed.
3	Rejection of con rods due to shrinkage of big end bore at NKJ.	Detailed study carried out by Inspection and Design wings at NKJ and the problem found mainly on very old or new DCW make con rods. Ref. Made to Rly Board and RDSO. Closed.
4	Pitting marks noticed on the R-2 con. Rod bearing top shell during sch; make-GMH (NKJ, 14950).	M/s GMH deleted as a source for this item following complaint of poor life on main and con rod bearings. Closed.

Piston and piston pin

1	Seizure and disintegration of pistons	<p>The problem was faced to a large extent on IPL pistons and to some extent on GIL pistons. Details study with M/s IPL, including FEA for 3100 hp application, PFMEA and detailed failure investigations of six cases were undertaken. Supplies of piston from IPL were withheld for some months as the above job was in hand. After proper study and identification of measures needed, supplies have now been resumed. Detailed audit exercise as above has generated confidence in the piston design as well as manufacture. Further analysis of the samples of cracked pistons is in hand.</p> <p>Problem on 6-bolt piston of GIL design continues as seen in case of recent failures in BGKT, JHS, GD etc. The solution lies in gradual weeding out of this design with single bolt design, which incidentally coincides with the decision to change over to 11.75 CR pistons also. The matter taken up with Board; meanwhile, since pistons are expensive items and change over may take some time, RDSO advised to indicate to Railways if any special preventive examination could be introduced. Sheds advised that in the process of weeding out of 12.5 CR pistons from 3100 hp engines to 2600 hp engines, the first lot of pistons to be so weeded out should be the GIL 6-bolt pistons. With larger level of induction of 11.75 pistons, the no. of cases of failure has come down; gradual elimination of 6-bolt design is the solution as the design itself is weak. Closed.</p>
2	Failures of piston pins	<p>This issue has also been engaging special attention of DLW and the actions taken are as under in brief:</p> <ul style="list-style-type: none"> ▪ Improvement of the oil hole finish not only required a modification of process but also tighter inspection. Since implemented and the finish obtained at present is acceptable; chamfering, however, needs improvement which is in hand. ▪ Finish improved by introduction of reaming process. ▪ 'I' Mark for vendor of RM and finished piston pins incorporated in the drawing facilitating traceability. ▪ Sample checking of inclusion rating is called in our spec. RITES advised to tighten inspection. ▪ Introduction of new suppliers for seamless tube RM based on checks on their facilities. ▪ Identification mark for vendor of raw material and finished pin

		<p>incorporated in the drg for traceability.</p> <ul style="list-style-type: none"> ▪ Two-stage quenching introduced w.e.f. 1-12-2001. ▪ Stringent metallurgical check is being carried out at DLW on every heat and record keeping improved for complete traceability of the heat treatment done by DLW. One piston pin being cut from the oil hole every month and the quality of hole examined and metallurgical tests carried out. Detailed records of all audit checks, including photographs being kept. ▪ Strict 100% hardness check is being done at DLW. ▪ Quenching temp std. Audited for conformance with ALCo spec. ▪ Experimentation at DLW has shown that pickling, instead of sand blasting, achieves better result. Implementation planned. ▪ Std. Calibration samples for Magnaflux tests have been provided. ▪ Go/No-Go gauge used to ensure proper ID to sleeve fitment. ▪ 150 Nos. piston pins to be procured from trade from reputed auto-manufacturers. ▪ Annealing of pin sleeves being done since 4 -01.
3	Dented piston pins from LW/DMW(UDL)	Checks were made on the pins and it was found that the pins were not pf DLW make. Closed.
4	Working out of single bolt nut on a batch of GE pistons	Detailed meeting held with M/s GE and free replacement of the entire batch of 80 pistons arranged. Investigations have nearly been completed and the defect is related to poor workmanship on a particular lot. Detailed corrective and preventive action plan from GETS received and all defective piston have been weeded out. Audit check at Pune plant to be conducted by DLW office.
5	GE piston failures; washer breakage & crown crack (HWH, GD & LDH)	Detailed investigation report and corrective and preventive action plan from GETS received for the first two case at HWH and GD; while warranty replacements have been agreed to, no specific reason of failure could be detected. To be monitored. Further analysis after a failure at LDH revealed that the failure could have place due to a restriction in the oil passage on some pistons. This is a serious issue and fresh detailed action plan is awaited from GETS in respect of modification of QC measures and weeding out of defective ones in stores or in service.
6	Failure of piston pin bushing of Benara make (14934-NKJ)	Failed samples have been collected and investigations are in hand; the firm is not an approved supplier. Meanwhile, the firm has been kept in Cat "B" for other bushings also till their quality improves. Comparative rig test of KOEL & PBW make to be done at M/s BM.
7	Poor life on GIL SC due to excess ring gap on top groove (TKD, NKJ, LDH & GY); same reports on IPL (TKD, NKJ) and GETS (LDH) pistons	The phenomenon was initially observed by TKD shed. Data from other sheds collected as listed and the problem was found to be similar. A meaningful study on the subject has to be done by GIL in association with DLW; they have meanwhile engaged AVL for this study. It is also sent that similar problems reported on many IPL and some GETS pistons and this could largely be an engine design issue and not so much a QC issue of GIL
8	Con rod- GIL piston gap only 1.4 mm	GIL advised to change the drawing to a min of 3 mm. Reply of GIL still awaited.
9	Rotation of piston pin bush causing seizure/ damage to con rod.	This is a case of poor interference of the clinch butt bush in the con rod small end; basically a case of negligence. As a precaution, all the relevant issues; dimension control on small end, quality of the bush and the fitment procedure is being audited by DLW in detail.
10	Cracks at gudgeon pin area on IPL pistons, mostly detected during 1 st major schedule (ED,	This is a serious phenomenon and raises doubts about the design. This area has not been improved specifically in the new 11.75 design. The only step taken is to smoothen the oil hole at gudgeon pin bore on new supplies whereas for the existing pistons, an action plan has to be submitted by IPL. Meanwhile, sheds have been advised to

	GY & NKJ)	check this area carefully during major schedule. Supplies from IPL have been put on hold till a long term action plan id frozen among DLW, RDSO and the firm.
11	Leakage from piston pin sleeves on many locations in two locomotives; 14106 (M24); more failures reported later	Inspection staff deputed to conduct detailed checks at GD. Corrective action in hand.
12	KOEL make connecting rod bushing due to metal peel off. Peel off also reported by KJM (14589, 17560).	This is a specific complaint of premature failure; the firm has been advised to visit.
Split and cam shaft gears		
1	Failures of crankshaft split gears	<p>This problem has also been dealt in detail and the actions taken are as under in brief:</p> <ul style="list-style-type: none"> • Spec of forging revised to call for inclusion rating. • Protuberance hob introduced and the step at gear root eliminated. • Gear inspection, during and after manufacture, improved at DLW • Hardness increased to 341 -371 to avoid cases of pitting/breakage. • Drg. revised to call shot peening to guard against tooth breakage and it has been started. • Deburring on finished gear improved. • Development case (20 Nos.) in hand to obtain some supplies from reputed gear manufacturers. • Sample checks on forgings improved. • Pitch line checker procurement mooted so that shaving not done on bore distorted during hobbing. • Gap between the mating surfaces of the two split gears being checked with the help of feeler gauge. • Radial distance tolerance modified towards the error side to ensure proper backlash • Provision of outboard bearing on the pattern of that done for unit cam mooted; prototype trial fitment in hand & change notice to be issued after trial fitment. • RDSO has mooted case carburized design; under consideration for implementation as there are interchangeability and manufacturing issues. DLW is considering through hardening to higher hardness; requires commissioning of tooth grinding machine.
2	Breakage of split gear key or damage to keyway on crankshaft (BGKT, Vatva, ED)	The procedure followed for fitment of key made a strict QC check item. The key material made more restrictive than in the existing drawing; implementation in hand. After investigation in one case, it was found that one no split gear-coupling bolt of M/s UEE make permanently elongated. The sources for the bolt have been revised and the existing stock verified for quality. Meanwhile, checks made to ensure that the stock in hand was not defective; all the material of M/s UEE to be rejected.
Cam shaft		
1	Low life of camshaft	It may be mentioned at the outset that the life obtained on DLW camshafts is higher than that on camshafts of other sources and this has been confirmed by the users in the last two BIMs. There have, however, been some recent cases of failures of camshafts within months of commissioning. This has been investigated and the

		<p>reason appears to be due to poor dimensional QC on allied components like roller, pins, bush and lock plates, resulting in rotation of the pin and blockage of oil hole, seizure of bush and roller etc. It has been decided to exercise greater quality control on the dimensional aspects of these components and infant failures of the type reported recently should get reduced with this. Moreover, with a view to improving long term life, the measures taken are:</p> <ul style="list-style-type: none"> • Stringent check on surface finish. In the fuel cam-opening flank, 8-10 rms is being achieved (specified 5 rms). This has been achieved by introduction of 3M emery polishing and this practice has to be sustained. • Reduction in quenching cracks by process control. • Removal of quenching/grinding cracks by stoning, which was carried out earlier, stopped. • Use of Landis m/c 1180(old m/c) for finish grinding, which resulted in poor grinding, discontinued. • Repeated checks on 100% hardness checks carried out. Decision has been taken to introduce polymer quenching as it has superior spreadability contributing to uniform hardness • Improved handling of camshafts; assembled camshafts placed on proper wooden pallets instead of two point supports. Better stacking of finished individual camshaft segments on wooden pallets to avoid any damage started. • Palletisation; a safe system of transportation from shop to spares ward introduced to avoid damage during material transportation. • It is planned that transportation from shop to Stores would be done after protecting the lobes suitably. <ul style="list-style-type: none"> ▪ Checks on some reground camshafts revealed that the specified case depth is being obtained. ▪ Procurement of a camshaft buffing attachment to improve the finish further done and surface finish of 6-10 rms being obtained. ▪ RMS value at the plunge groove has been specified on the drawing as 250 RMS to eliminate fatigue failures initiating from sharp marks in this area. It is planned to introduce selective turning of the flange grooving by introducing final turning with the help of finishing tool to improve the finish. With a view to improving finish of plunge groove, all camshafts shall be made on CNC machines. Alternatively, use of carbide tools mooted. ▪ FE camshaft material changed to AISI 1080 for improving the fatigue strength of the shaft thus reducing pitting failures. Since this change requires the tooling to be modified, introduction is being done in a phased manner. ▪ One failed material received from UDL(not from the dowel hole at flange) for metallurgical examination. • A synthetic film for application on the cams instead of anti-rust paste in use at present to improve handling related damage. • Employment of a dry lubricant film on cam shaft/roller under consideration to avoid infant failure/damage. • Introduction of sources with greater commitment to quality in hand; one such source is M/s Cam-o-matic. • The spec of Cummins engine cam shaft under study to examine introduction of improved features.
2	Breakage of L4 & R4 snap ring of camshaft during removal(GY)	Correct method of removal has to be followed; advice sent to sheds. Closed.

3	NFRly reported that camshafts of some locos fitted with plain (not Nylock) nuts.	Loctite trial by DLW stopped and only Nylock nuts fitted at present. Closed.
4	Failure of cam gear nut reported by VTA.	The design has been modified to reduce the thickness of the lock nut split to ensure proper locking. The problem has been contained on modified cam gear nuts. Closed.
5	Cam gear snap ring works out during disassembly (GD & GY).	Checks done on the camshaft keyway as well opening of cam gear after assembly. Data collected from other sheds also. This is a problem of improper extraction; detailed instructions reiterated in Soochna also. Since the problem is, however, felt by nearly all the sheds, a fresh look is required with a view to improving maintainability by design improvement.
6	Tightening of FE camshaft nut by ring spanner difficult; gap bet nut & dia of shaft less; torque wrench access poor (GY)	Not a very serious problem as the spanner can be fitted with some difficulty. The design was looked into and fresh drawings made with reduced plunge diameter of the shaft and proper space for spanner. The prototype lot has been fitted on three locomotives and the performance is under watch.
7	Camshaft failure due to working out of bolts or breakage from bolt/dowel holes (TKD, LDH & NGC)	Checks carried out on co-bore for the chamfer and found okay; excessive play not found. Audit of M/s Sandeep Engg. Carried out and nylock nuts; defective materials rejected and supplies improved in recent lots. Strict control on quality necessary as the firm is not a reputed manufacturer but is in field due to low value of ordering by DLW. Development from M/s Pooja Forge/Symond Marshall in hand. Fixture for drilling stud holes/dowel repaired to ensure correct location of all the stud holes and dowel hole; the clamping fixture needs to be rectified to avoid rotation. Torquing of nuts enforced. Permanent elongation suspected in some studs; metallurgical examination of stud done in lab in detail & the material found to be okay. Taper of the mating flanges, as called in the drawing, not being obtained. This has never been done earlier. Although It was proposed to start providing this taper and but necessary tooling for the same could not be arranged. Detailed investigations carried out on failed materials of TKD and NGC. Detailed report made by DyCCMT/DLW, which did not suggest any material deficiency. Attributed to improper machining with incorrect dowel location. This has since been improved. Failure of this nature has not been reported on any camshaft manufactured since April 02. Under monitoring.
9	Failures of cam rollers, specially of Jalan make (NKJ)	One lot has recently been made with higher hardness than specified which is under investigation. Procurement of finished cam rollers not done by DLW at present; M/s Jalan delisted. Modified design with seamless tube as well as provision of crowning on the fuel roller mooted and purchase order placed on M/s SKF; prototype sample approved and fitted. Another issue under consideration is application of dry lubricant film instead of lubrifying.
10	DMW has suggested some improvement in the components and inspection of cam roller and allied assembly.	The suggestions were studied in detail and most of the areas do not need any fresh action by DLW. Drawing of Pin fuel cam roller was modified for slot width and depth and change notice issued; implementation expected by March 04. Two types of new gauges for cross head lifter oil hole alignment made available to shop for inspection.

11	Many cases of cam roller pin seizures taking place during first L/box. Existing clearance (0.0005" to 0.002") bet cam roller pin and PR lifter inadequate, as often the clearance tends to lower limit i.e. 0.0005" and should be changed to 0.001" to 0.003". (DMW)	Limit revised as the suggestion found acceptable. Change notice under issue.
12	Ex. Cam lobe left side section 1-2 loco worn out & unserviceable in less than a year. (NGC; 13010).	This is a specific complaint of premature failure; shed advised to send failed material.

Cylinder head and fuel pump support assembly

1	Yokes assembly is found to be misaligned. GY shed reported many rejections.	Inspection of checks on fixture to check yoke dimension tightened. Closed.
2	Incorrect location of water jumper pipe passage wrt locating holes.(RDSO)	Audit checks at DCM and AIW carried out and no such problem is faced at present. Closed.
3	Supply of valve locks to sheds only in pairs (CRly; RDSO report MP/Misc/52 Feb 97).	Carried out for DLW locomotives but not for supplies to sheds. Procedure of pairing explained to sheds and DCW and pairing may be done at fitment stage. Closed.
4	Failure of engine valves.	Vendor requalification was taken up afresh and due to poor performance and inadequate facilities, M/s. Shama has been delisted. Upgradation of facilities required at M/s. KOEL has also been identified and dialogue is on with the firm. In addition, the specification of the engine valve, especially in respect of test standards has been made more stringent and good features from GM loco practice incorporated, e.g., impact test. The revised specification issued. Closed.
5	Failures of push rods (Jalan make)(NGC)	The failure took place on one lot supplied against a development order. The ones in stock rejected. It has already been decided that no ordering shall be done on this firm for critical components. Closed.
6	Poor FIP support castings of KAC make(GY)	Similar complaints were received from DLW shop also; the firm has been delisted. Closed.
7	Critical engine components like Water jumper should not be painted, especially the rubber hose (NKJ)	The issue of painting has been taken up separately and those which have to be painted from outside or applied with rust preventive coating from inside have been identified, e.g., block, main base, turbo & FP support, back plate LO pump, lower housing, heat shield etc. shall be given rust preventive coating from inside. Similarly, gray painting of identified components shall be done from the outside. Inspection has been advised to cross check adherence. Closed.
8	One fulcrum pin of Jalan cracked within 9 months due to	The shed has sent rejected materials which was checked and found not cracked; checks not required as the source

	circ. Crack on 14970 (NGC)	has been deleted. Audit check done at DLW; no problem detected. Closed.
9	Problems on FP support(HWH) Less depth of threaded portion for FIP foundation bolts Defective support causing FIP not wkg Opening of timing adj nut Sound from supports FIP foundation bolts of 14966 broken due to over torquing (105 ft. lbs. Ag. 75 ft. lbs.); also No.4 LHS FIP foundation bolts sheared off due to breakage of its spring washer (NGC)	Inspection tightened as some FIP supports machined on CNC m/c have had this problem. Regular monitoring was done for a long time check that such a problem is not repeated. Closed. The quality of FIP bolts in use crosschecked and found to be of standard approved make. The quality of washer also checked and found okay. Further checks also taken in hand as it is basically a QC issue. Audit of spring washer quality completed and found acceptable. Closed.
10	LOC of all WDM2C locos, which have completed 12 months have abnormally increased. Valve guide clearances were found excess as one of the reason for high LOC at NKJ.	Valve guide drg modified to provide for recess at top, closer tolerance and harder material in line with 251 plus guides. Implemented successfully with the materials from M/s Perfect/Lonavala. Improved GE specification material also to be incorporated. M/s Ma Sidheshwari delisted; M/s Mukherji & Ma Vishalakshmi audited for checks on concentricity, taper & run out and found acceptable. Audit of M/s KCD done; sample testing results to be finalized. Performance of Mukherji modified guides to be monitored.
11	Cylinder exhaust yoke spring was broken; (SRly) R/S 8 Exh. Yoke spring broken. Issues related to testing/inspection of cylinder head springs	These failures have been arrested through strict vendor qualification. No problem reported from other sheds in recent past. During vendor qualification work, it was found that the drgs. Have certain lacunae. The issue was studied with the manufacturers to evolve the correct end coil type, inspection, pairing and identification marking etc. and the drawing has been revised. The supplies shall be taken in pairs with colour code. Project to improve spring material also taken up; advance samples for two loco sets received at DLW for fitment.
12	Failure of cylinder head assembly, especially nozzle cooling sleeves reported by SCRly, 25 failures on AIW make heads. Also reported recently on 5/6 locations on one locomotive. Failure of casting defects on cylinder heads reported by many Railways, showing poor life on AIW and DCM make heads.	Detailed meeting held with all the firms i.e., M/s DCM, AIW, KOEL and DEC four times thrice in last 18 months. In these meetings, measures to taken to improve the castings were also identified. Detailed action plan, including shed visits and audits has been drawn up and continuous improvement is expected. Audit checks at DCM conducted and firm advised. Performance of DCM heads, claimed to have improved in recent lots is under verification through checks in two Rlys; reports obtained from TKD, NKJ, LDH, HWH & UDL collected showing failures on lots supplied from April 02 onwards. Further data collection in hand; meanwhile upgradation of the vendor for assembled heads is on hold. The response of AIW and DEC is very poor and any categorization of these vendors is on hold. Drg revision for calling identification clearly completed.
13	Failures of swivel type water jumper gasket/O-ring; injector O-ring to be fitted (NKJ)	Material changed to SGC; procurement action in hand. The problem is under study with a view to improving the vendors, especially of the Viton O-ring. Checks made in the laboratory for these rings and the drg. standardized. Procurement action being done in a kit as per the latest change notice. Closed.

14	Leakage from conventional cylinder head plugs	Frost plug design in line with the 251+ cylinder heads has been adopted for conventional cylinder head also. The procedure for correct fitment has been audited in detail in the concerned section. In addition, poor supplies from M/s MTC have been rejected. Approval of quality firms for this item has been completed and M/s Prakash, Pooja Forge & Gala Springs are approved at present. Closed.
15	251 plus Cyl head decompression plug dummy leaky (HWH)	The plugs available have faulty threads. Vendor review of this item done and M/s Sarkar Brothers and similar poor suppliers removed. The drawing is also being changed to head type instead of Allen head.
16	Failure of engine valves locks resulting in consequential damages	With stringent checks on the valve lock and valve groove profile, failures have been reduced substantially. A project is in hand is to analysis the valve groove and lock design critically and a modified design has been prepared and given for non-stock procurement. Meanwhile, complaints of this nature have stopped.
17	Valve bushing found badly worn out and at the verge of seizure on new locomotives 14965, 14969 & 14970 within 9 months to one year (NGC)	The shed has sent rejected materials of all makes; BM, PBW & KOEL. Not reported by any other shed. Investigations taken in hand which DyCCMT has completed investigation and it was found that the bushings were rejected prematurely. Closed.
18	Yoke screws (3) cracked; one along axis and two at bottom side face on 14970 (NGC)	Failed material received; checks done and some defects in microstructure found. The RM available at DLW, however, is okay. No other complaint Closed.
19	Breakage of valve lever reported by UDL during DyCDE's visit. Many breakages reported by NKJ on new locos. 5R exhaust valve lever broken into 2 pieces due to fatigue; Push rod JE/06/01 Lever-E/4/2000 (NGC, 14966); Three valve lever shaft supports and two levers cracked near P/rod end on 14965 in one year (NGC). Rocker arm shaft failed (fracture) from Allen screw location, reported by Gonda shed.	Process audit done. Forging drg revised and machining drg also revised to avoid any possibility of notch formation. Inspection advised about the issue such that the levers now under manufacture are okay. This problem was closed but has been reopened on complaint of NGC. The failed materials (lever and supports) received from NGC and given for metallurgical examination. Report did not show any problem; the levers were not even cracked. The shed advised not to send good material as failed ones and this has resulted in unnecessary concern. Failed sample of support was brought in DLW from GD and investigated by DyCCMT. The microstructure was not found satisfactory as slag inclusion at the nucleus of the fracture was found. Sample check of the existing shaft was made and examined in lab but no abnormality was found in the existing lot. RM sources to be evaluated afresh but MC has indicated that M/s Prakash is the only good source at present. The firm advised to improve QC in future to avoid such failures. Closed.
20	Lube oil leakage from FIP base - T. Cross head clearance to be maintained (NKJ presentation). Leakage due to porosity; Porosity and other casting defects in fuel pump support	All the FP supports are being subjected to hydraulic test to ensure no leakage. Under inspection monitoring.
21	Failure of modified crosshead body at TKD, NKJ, HWH and GD Failure of SIFL make (no. SFL-SF-05003-2000) FP support arm	Critical study of design of crosshead body undertaken. Audit checks of manufacturing practices at DLW done. Metallurgical tests done on fresh and also on failed samples collected from TKD. The 5/64" radius provided on the crosshead body found improper. This was made as a checkpoint and correct radius implemented. The surface

	(lifter) 14905 (VTA); X head lifter broken on loco 14083; made of Class IV & not alloy steel (KJM). Failure of fuel pump lifter reported by GD	finish was also found improper and this aspect has been advised to inspection. Checks on hardness pattern revealed that it has been hardened up to the required point only. Forged type crosshead body also under development for trial. It is also suspected that the problem could have arisen due to a machining problem in the support resulting in fouling of the body and under load; the QP has been modified changed to ensure that such a defect is not permitted. Checks made at UDL where recent locos have been sent and it was found there has been no defect. Audit and metallurgical checks was taken in hand again; Checks were made by bluing and found that fuel pump support chamfer hitting with chamfer with lower retainer towards the edge. Cross head body guide bore of the fuel pump support was audited in the shop and found OK. Drawing of both have been modified (angular tolerances added on both i.e. FP support and Lower retainer parts to avoid hitting due to improper machining of chamfers and 2 mm height between retainer and fuel pump support added) Proposal change notice issued. The failure of cross head lifter at KJM was taken very seriously and the firm concerned, Ms/Vikas Forging has been given delisting notice. Checks were made on available stock at DLW and it no abnormality was found. It has also been found that there is a practice to weld the lifter at the dowel hole to avoid leakage in sheds. This has resulted in breakage in two cases; this should be discontinued by sheds.
22	Incorrect machining of 251 plus heads leading to difficulty in fitment of water jumpers at DMW and inadequate clearance with push rods	This has shown certain tooling defects at DLW, which has been rectified. Feedback on new supplies awaited. In respect of inadequate clearance with push rods, M/s GETS has been advised to have better dimensional control; would be verified in future supplies. However GETS have replied that they will inspect the same with gauge for this purpose and 100% check will be made.
23	Push rod seats manufactured by DLW have no slots for effective lubrication (GD)	This issue has been examined and it is found that the drawing was revised at DLW; the reasons could not be traced. The drawing has again been was modified for slot at both ends and implementation done. Closed.
24	Eccentric wear on valve guide (perhaps the defect existed at manufacturing stage itself on KCD make assembled cyl head(18421; RT M)	Firm advised to visit shed for joint check.
25	Push rod bent (NGC, 13012) and failure of push rod ends	Improved design of push rod with pressed ends taken in hand and non stock case sent for procurement.

Turbocharger, after cooler and allied systems

1	Deaerator outlet pipe elbows projecting outside hood requiring cutting of hood.	Change notice issued providing a hatch at this location for maintenance. Closed.
2	SCRly have reported that on WDG2 locos with GE turbos, lube oil pipeline of turbo filter is drawn zigzag increasing the turbo inlet.	Change notice issued standardizing the strainer to filter filter to turbo pipeline including improved clamping after ailed study. This will also help in improving the LO pressure turbo inlet.

	chances of failure. ED & NKJ sheds have reported that LO inlet pipe to filter is taken from bottom of LO pipe bet strainer & header dangling underneath the extension shaft, rubbing with metallic parts. Similarly flexible connected to pipe form strainer is also difficult to attend as a/cooler pipe, water pump suction pipe and w/p branch pipe leading to a/cooler are to be removed first. Clamping of these pipes also need to be improved. M/s GETS have also suggested that the pressure at turbo inlet be increased.	(SN 16 Eng, page A 5, Soochna 31-3, issued for ABB turbo; Change notice for GE turbo also (incorporating modified bracket, shortened & rerouted header to filter hose and modified PTFE coated and rerouted filter to turbo inlet hose) issued and implemented (with min pressure of 2.8 Kg at turbo inlet). Railways also advised for retrofitment. Closed.
3	Kinks observed in the water inlet to a/cooler hose in GE turbo locos(GD)	Water inlet to a/cooler hose elbow angle modified to 135° to avoid kink in the pipe. Closed.
4	Air maze to turbo adaptor extn piece is non-std on DLW locos(SER); dimension varying from 432 mm to 472 mm. Vatva shed reported that TSC exp joint burnt in two cases. Cyclonic duct muffler found to have its clamp shifted (NKJ). Filter housing distance piece tack welded at 4 places and has 1/4" gap circumferentially in loco 14870 due to which unfiltered air going to TSC causes increase of Si content; a piece with jubilee clamps to be fitted between TSC & Cyclonic filter housing. GE make TSC damaged on 11.6.03 due to air inlet rubber sucked inside the TSC. (LDH, 13003).	The arrangement has since been standardized and there are now no complaints of non-standard fitment. The complaints are now in respect of quality of the filter bag and this issue has been taken up in detail with the manufacturers. There has been only one case of foreign material getting sucked on recent DLW locos at LDH which has been investigated and it was found that the fixing of jubilee clamp needed improvement which has been done. Closed.
5	GE turbo vents should be flexible type; suggested by CRly. NKJ replaces bubble collector flexible with steel pipe.	Change notice issued to convert the pipe to flexible type with lagging. Closed.
6	Failure of ABB Turbochargers due to loose tablocks.	This issue was taken up with M/s. ABB very strongly and it was concluded that the loosening of tablocks is mainly due to weak design and not surging alone. With the help of Railway Board, M/s. ABB have been persuaded to retablock the turbochargers with old design of tablock. The logistics of the same is being worked out by the CMPE/Ds as this would lead to considerable improvement in reliability. Closed.
7	ABB turbo LO pipeline etc. (GE included in 31-3 Soochna) Complicated LO pipeline leading to the turbos in all types but specially poor in design for GE	The subject has been studied in detail and the pipeline has been modified for both ABB as well GE turbos. Change notices issued after modifying filter location. RDSO advised for issuing mod sheet for retro-fitment. No problem reported at present. Closed.

	TSCs resulting in very poor maintainability and reliability as well as loss of LO pressure.	
8	Provision of hatch in the turbo support for checking leakage on after cooler other side of support	Opinion of sheds obtained and considered not necessary. Closed.
9	Breakage of rotor shaft on loco no. 17522 at LDH on 10.5.02 (LDH) & 7 other cases since 98.	Make PECO. The firm asked to visit LDH and produce joint report; the firm failed to take any positive action. The firm delisted. Closed.
10	For the turbo adaptation part, the pipe threads are of local made and the threads are breaking. These are with seams. These should be preferably seamless and standard threads on standard pipes should be used. (TKD)	Use of seamless pipes for water piping ensured. Use of ring gauges to check the threads of pipes by the vendors ensured. Closed
11	The clearance between shaft flange and oil seal turbine end was provided by ALCO between 8 to 10 thou which has now been revised by DLW as 8 to 12 thou. Excessive clearance at turbine end oil seal results into oil throw; this needs re-examination. (GD)	Drawing revised to call clearance between shaft flange and oil seal turbine end between 8 to 10 thou. Closed
12	Problems with defective PECO make GI casings on MG turbos (Siliguri, Sabarmati & GOC)	The firm asked to visit Siliguri and produce joint report; the firm failed to take any positive action. The firm delisted. Closed.
13	Failure of GE/ABB turbos and their warranty settlement	The issue was analyzed threadbare based on independent investigations by DLW as well as joint investigation reports submitted by the shed and special reports of M/s. GETS. In three meetings held with GETS, the latter have agreed to replace fifteen out of twenty one turbochargers, which were suspected to be direct failure cases. With the upgradation of lube circuit and other measures suggested by DLW, the reliability of GE turbocharger has improved substantially. Since ABB/Hispano turbochargers have been fitted only in very small nos. since April 02, a very limited no. of warranty cases are pending for these turbochargers. There is no complaint today in warranty settlement.
14	Issues related with reliability of allied equipment of GE turbocharger	Problem studied in detail and solution implemented for each and every issue. See AnnexureB1A.
15	Repair of a/cooler core on GE turbos is difficult as it consists of 2 parts integral with housing and not detachable. On GE turbos, found bolt access is poor, turbo to be removed if water inlet seal ring perishes; water inlet to be provided on turbine casing(ED)	Required redesign to single volute turbo, which has been completed and the prototype has been fitted on locomotive no. 13018. Complete implementation in hand.
16	Distortion of shrouds on GE turbochargers (HWH & GD)	With the report of shroud deformation in four cases (GD and HWH), GETS has been asked to visit major sheds and examine a large sample of turbochargers in service to

		determine if there is any shroud deformation taking place; final report awaited. Meanwhile GD shed has reported that the radial clearance on many turbos is more than the specified showing distortion of the shroud. Further study on the subject has been done at GETS' works in association with the shed, GETS, RDSO and DLW. The following issues emerged: It seems that the problem took place due to unnecessary opening & reassembly of turbo by GD shed. Reduction of radial clearance is due to accumulation of some foreign material on the shroud; the same has been collected by GETS for analysis Before closing the issue, fresh checks required by GETS at LDH									
17	Poor quality of bag filter leading to damage to turbo (ED, ABR), dust passing through the filter(LDH & GY) switch over to older paper filter type design mooted by RDSO.	Matter taken up very strongly with both the suppliers, i.e., M/s Anfilco and Varun. Improvement already in place. Meanwhile, the design of WDG2/2C filters modified to 600mm length to avoid tearing of filter bag by air draft. Change over to fibre panel type design done but the problem of high Si content has surfaced again. DLW is of the clear opinion that the indigenisation effort of RDSO has clearly not been successful and we should switch back to FARR type filter media without experimenting any further as the engine is put to risk. Change notice is in hand for improved media as well as inertial filter tubes.									
18	Defects in intermediate casting of conv turbos(GY): 1.The std base dia of int casing for brg, bore is 2.3745"-2.375"; casings recd from DLW with max size of 2.375". 2.Blower end oil seal fixing screw hole threads provided on intermediate casing do not have full threads. 3.No space for tightening the ½" nut bet blower and int casing with a ring spanner as outer dia of int casing is machined oversized.	The first issue was examined and change notice has been issued and implemented. The other issues checked at other sheds and no complaint found hence no action required. Reply sent to GY. Closed.									
19	Turbine casings of Vardhaman make fail due to cracks; four cases in 03) (GY).	M/s Vardhaman is the only source at present. A drive has been taken to develop at least one more good source.									
20	Premature failure of KOEL/PBW make turbo supercharger bearing at LDH Shed:: <table border="1"> <thead> <tr> <th></th> <th>Dt of fitment</th> <th>Dt Failed</th> </tr> </thead> <tbody> <tr> <td>16101</td> <td>27.05.03</td> <td>14.10.03 (PBW)</td> </tr> <tr> <td>16353</td> <td></td> <td>10.10.03 (KOEL)</td> </tr> </tbody> </table>		Dt of fitment	Dt Failed	16101	27.05.03	14.10.03 (PBW)	16353		10.10.03 (KOEL)	Visit was made by the firm and replacement made. However, no defect was found in the bearings. Closed.
	Dt of fitment	Dt Failed									
16101	27.05.03	14.10.03 (PBW)									
16353		10.10.03 (KOEL)									
21	TSC lube oil filter casing of Filtronic make cracked at NFR/NGC on 13004 within four months of service	The failed material asked for but not received yet.									
22	Conv. Turbo intermediate casing should incorporate counter bore to provide four flexitallic gaskets (ED)	Suggestion accepted, revised drawings issued and implemented. Closed.									

23	Failure of two MG TBDAs of Engine Systems make(GOC)	Firm advised to conduct joint inspection, submit failure report and replace defective materials.
24	Failure of three BG TBDAs of Power Turbo make at PA and	Firm conducted joint inspection and has assured that blades would be replaced. The firm advised to submit detailed failure report.
25	Foundation bolt of ABB turbo broken (NKJ; 13027).	Under investigation
Cooling water pump and system		
1	The modification in the water pump casing as per rep no. MP/Misc.41 not done resulting in poor life of pump seal. (ABR).	The subject modification has been cut in by DLW. Closed.
2	No identification available on water pump water seal. [NGC]	Identification mark is provided by EPIL; clearly called in revised drawing also. Closed.
3	Rt side radiator to LO cooler inlet on horizontal pipe should be in vertical pipe as was the case in earlier design of locos. (LDH).	The problem was examined at DLW. This is specific to PTLOCs. Water inlet pipe cannot be made horizontal due to typical inlet location provided on the PTLOCs. No functional problem envisaged. Examined further with a view to modifying along with the CW system project but could not be implemented. Closed.
4	Water pump oil seal reliability to be improved (VSKP) Many LO oil seals of OMCO make failed due to excess ID i.e. 2.831" against 2.784"-2.806" or other reasons only giving 100 days service(LDH); WP seals of Omco received in July'03 failed left & right.; replacement supply also failed in similar way. (GD).	The drg. studied and found okay. Quality improvement by vendor control is in hand. New vendor, M/s Sujan, under trial. Dimensional and chemical tests conducted on oil seals supplied by OMCO. Dimensional variations found. Firm advised. Performance of oil seals supplied by new vendors Ms NPC and Siltan monitored and final view taken that the spec should be revised to Viton rubber. Change notice issued. In addition, import case mooted as per decision of BIM.
5	CRly reports (especially on DCW locos) use of sub-standard water seal of NPC make in water pump leading to premature failures. Water pump seal failures due to carbon worn out reported by NERly (loco no. 14061) and SCR. Best failed life of 10 m on EPIL & much poorer on NPC/Bergman makes(GY). PA shed has reported that Leakproof supplies rubber instead of ceramic seal; faster wear. EPIL seals with imported rubber kit is superior(NKJ). Water pump seal is leaking from water pump tell tale hole within 8 m of service (13009, NKJ). Also high rate of failure on 13 series locos (4-9 m). (NGC, 13009, 13010, 13012 and 13013).	This subject required that an established product be analyzed afresh. DLW have placed an order for 25 seals on M/s Kessler, which has been received. This will be used for reverse engineering as well as for establishing two years life performance. NPC/Unique is not DLW approved sources; Railways may indicate performance as the details available at present are conflicting. Similarly, Leakproof is a source under dev and order should not be placed by Railways. Meanwhile, drg. of the seal modified to obtain 18 month life and EPIL modified sample fitted at DLW. The product appears to be promising and further procurement shall be done only to this drawing. Modified seal samples of Leakproof, NPC and Apee have been fitted on engines. No leakage observed during testing at DLW. Field performance being monitored.
6	Low pressure in water system(ED)	The 10" impeller water pump has been cut in at DLW, leading to considerable improvement in water pressure in the system. In addition, higher speed of the drive gear, with the increased drive gear ratio has also lead to higher discharge. Closed.

7	Damage to water pump shaft at keyway; recommended to improve the shaft material(LDH)	The key material in use at DLW found to be harder than required. The same rejected and shop advised to use the correct material. The new supplies received from the trade was checked for hardness; found OK.
8	Breakage of water pump shaft from the change of section (JHS); Breakage of WP shaft. Sulphide inclusion of series 0.5-1 in unetched condition and pearlite & ferrite with slight banding in etched condition were found. (Jhansi, 18961).	The radii at the change of section was found inadequate. Audit check was made in the shop and no abnormality was found. However, Instructions given for strict inspection of this aspect.
9	LS water header pipe dummy found leaking. (NKJ, 13032)	Stray case.
LO pump and system		
1	Many cases of cracks on outlet as well as inlet bellow couplings of the LO filter drum(ED)	Use of bellow couplings totally discontinued as not found suitable for traction application. Closed.
2	LO pump failures at GD and NGC (cracking of bushes etc.), breakage of gears (TKD presentation). Failures on 14969(Supreme) and 14966(DLW at NGC). LO pump out let pipe found leaking from welded flange joint. (VTA)	GD pump called for investigation. NGC case also being studied. Quality plan of LO Pump assembly reviewed and check point to ensure casing dimensions at oil outlet added. CIO inspection restored. Based on latest failures at NGC, inspection tightened in resp of correct thrust value & drive spur gear lock nut tightness The pump design itself is also under review for introduction of Herringbone type gears in the lube oil pump with expected higher delivery and reliability. The first prototype herringbone gear type pump is under fitment.
3	LO strainer housing weld quality is poor and cracks reported. Similar failure of casings due to cracks on WDG2s also reported by GY, ET, NKJ & Vatva sheds on primary filter, secondary filter and LO strainer casings. (recent case LO strainer crack on 14768 UDL). CRly has modified secondary housing bottom to bowl-shape. (ET).	Change notice issued (fabrication using seamless pipe); implemented for fuel casings. Subsequently, it was found that even for the modified casings, the weld procedure adopted by the shop was not correct, which has now been rectified. In case of LO strainer housing, the design of seamless tube has been reviewed and the modification notice issued. The new design has been cut in recently. From 04-05, strainer assly made a Purchase item with seamless tube.
4	Many sheds have reported low LO pressure problem on new locomotives from DLW; the pressure obtained on DLW locomotives is less than on DCW loco or other locos of sheds. The problem has become acute after Low Idle modification.	This issue has been examined in detail. One of the major improvements done at DLW is stringent rig test, based on the lube oil pump delivery with the revised standards. Another improvement underway is increasing the capacity of lube oil pump by introducing increased gear ratio of the gear drive in the first phase. In next phase, use of Herringbone type gears in the LO pump should result in higher delivery/pressure. Prototypes received and fitment is in hand.
5.	Leakage from fittings leading to starvation of oil e.g. leakage from S-Pipes.	A detailed analysis of the leakages observed was carried out and it was decided that only superior Parker Hannifin type single ferrule ermetto fittings, which were in use for some time at some locations, shall be provided at all critical locations. Such types of fittings are in use since August 02 and are likely to last at least till POH i.e. on new locomotives turned out from DLW. Replacement of ermetto fittings by shed is, therefore, not required.

		Locations that are more critical identified. Subsequently, two indigenous quality vendors, M/s Hylock and Hyd Air have been engaged and procurement is under process.
6	Use of unreliable quality of Hi-flex make hoses on critical locations such as turbo inlet by DCW–reported by C.Rly. Hi Flex is not an approved source of DLW; no such problem reported on DLW built locomotives.	Hi Flex is only a source under development by DLW for limited ordering; not many cases reported on DLW built locomotives. Rejection advice also issued for some Hi Flex hoses. It has also been decided to include end fittings to be manufactured by reputed suppliers only. The approval status has revised to include vendors like Powerflex, IA and Super Seal and the drawings also revised to comply with the right standards.
7	Failure of LOP casings of Bhagyadevi and Ganesh make.	A project to source critical CI items like this taken up to source from quality vendors. The replacement supplies of M/s Ganesh are better but the quality needs to be improved further. In addition, certain items shall be purchased as machined from good suppliers.
8	Leakage from dressor couplings(UDL)	While manufacturing/inspection issue of proper alignment is being tackled through closer inspection, the design itself modified to GM type, which is combination of dressor cum Victaulic coupling and is less prone to misalignment-related failures. Fitment to start in Nov 03. Closed.
9	Lube oil pump discharge pipe bottom dummy leaking badly (NKJ, 13036).	Stray case.
10	LO leaking from strainer bottom drain cock adopter nut; strainer to drain cock steel pipe cracked near the top nut. (ED; 14127).	Under investigation
FO injection equipment and system		
1	Sheds have complained that the rack settings from DLW do not match with those recommended by RDSO. The subject has been studied in detail and both pump delivery and settings at DLW, including employment of a different linkage may be required based on some trial and error on engine test bed. Also, FIPs found with 75 cc delivery at idle. (SRly).	Detailed technical discussion held with MICO in respect of delivery pattern on their pumps and its non-conformance with the ALCo standards. Detailed analysis was done with MICO; there has been some improvement (tolerance closed from ± 20 cc to ± 15 cc. and implemented. MICO has indicated that enhancement of delivery further shall require change in design and investments. Proper idle delivery is also an allied issue. Change notice has been issued and implemented for employment of a modified link in the fuel linkage such that 0-30 rack setting is achieved. Fitment has started. (See miscellaneous notice also). Closed.
2	Fuel oil cross over pipe not secured with wooden cleats, center clamps and protection sleeve. The cleat also required to be modified. Fuel X-over pipe punctured. Make – AEI (NGC, 14969) and also recently on a new locomotive at PA.	Design modified & change notice issued. PVC sleeve on hose provided. Clamping at centre ensured. Further, change over to very high abrasion resistant hose mooted and samples received fitted successfully. Change notice issued for the modified design. In addition, the vendor list has also been revised to decategorize poor vendors and include some quality vendors like Powerflex, IA and Super seal. The problem has been eliminated; only the and the recent case at PA has to be studied.
3	PVC sleeve not provided in fuel cross over pipe, pipe uncoupled and PVC sleeve provided.(NKJ, 13028); In fuel system, flexible hoses to be fitted with PVC sleeve, same is being provided	Nil abrasion hose being provided at present hence not required. Closed.

	by shed (NKJ 13032).	
4	SRly suggested that fuel oil cross over pipe end fitting to be changed from bent elbow to st. fitting with a matching 90° elbow on the block.	The suggestion has been accepted and the drawing has been revised. Implementation in hand.
5	Failure of loco No.14104 due to leakage from R/S cross over pipe; the adopter elbow found broken from middle; 'O' ring was also perished (GD, 14104).	Nil abrasion hose being provided at present. The elbow also changed to 90 deg type with st fitting.
6	<p>All FIP racks sticking. SRly, GY and ET sheds have reported this problem. They have also reported frequent guide cup housing breakage.</p> <p>Every locomotive received from DLW has got problem of fuel rack jamming; reaming of bore has to be done all cases. (BGKT)</p> <p>Sticky elements in new supplies from MICO(NKJ)</p>	<p>Detailed technical discussion held with MICO & analysis/ investigations done. Meanwhile, action taken on to obviate use of dirty fuel oil at DLW. MICO has also rectified some defective pumps available at Sheds and large no. collected for rectification/replacement. Railways may contact MICO for rectification of FIPs, if any. M/s MICO shall also get back about the cases of sticky elements on new supplies.</p> <p>The matter was taken up in detail with MICO and after detailed dir and chip analysis on failed elements, it was decided to tighten the permissible dirt content (reduced from 5 mg to 3 mg) on the elements. This has been implemented.</p> <p>Air blasting of all items fitted after sec filter ensured.</p> <p>Periodicity of cleaning of o/head tank/tank filter (incoming line) replacement identified and implemented.</p> <p>To eliminate dirt ingress to FIP, instruction issued to shops to keep the plastic protection caps in place till the time of assembly. Plastic caps are kept in place even on failed FIPs.</p> <p>MICO has also advised that the fuel filter pore size be revised but it is still under consideration by RDSO.</p> <p>The issue of jamming of the linkage, which has not been reported by other sheds except cases of FIP sticking, was also checked and it was found that this could be a case of carelessness during manufacture.</p>
7	<p>Following leakage/problems on fuel T-jumper and banjo bolts (GY, SRly and ET sheds)</p> <p>Jumpers not tightened fully, leading to leakage.</p> <p>T-Jumper leaky as less draw in flexitallic gaskets & F/Oil header misalignment.</p> <p>Breakage of jumpers due at thinned wall due to excess machining for access to bolt.</p> <p>Shock absorber rubber rings not provided on both ends of the fuel header.</p> <p>Banjo bolt thread wear out/poor CU washer</p> <p>1R T-jumper bolt broke on 13017 within two months(NGC);</p> <p>8L fuel oil T jumper one no. bolt</p>	<p>Detailed study by Design and Inspection wings carried out.</p> <p>Torquing of jumper/banjo bolts restarted; torque values specified.</p> <p>Some Cu washers of defective quality were in use, same rejected.</p> <p>Machining of T-jumpers modified to eliminate chances of breakage of jumper from sharp corners.</p> <p>Header support design modified to single support to improve flexibility. Opinion of sheds about single/three point support of fuel header with a view to improving fuel jumper fitment obtained and the modification found to be acceptable. Since implemented.</p> <p>Drg of the fuel T-jumper changed to call for facing only on two sides and liberal radius as earlier be retained on the other two sides. Implemented.</p> <p>Use of step sized Cu washer (3.25,3.50,3.75) introduced to make a good joint without undue pressure.</p>

	found broken (UDL, 14770).	
8	Jumper with holes out of alignment & less land thickness for Cu washer to sit at tee Jumper (GY).	Checks made in MGR/DLW on the ones being made at present. Fixture problem identified. Included in QP as a checkpoint. Since arrested; kept under strict inspection.
9	Failure of new spec HP tubes of various makes; some case in case of IA make, a large no. in case of Triton & Injecto and an epidemic in case of AIC. Another aspect to look at is that over the period the 3R angle in FIT gets deformed and sometimes the technicians fit it forcefully from the head end causing breakage from cylinder head end near the tip (TKD).	Detailed investigations carried out including testing by MICO. The material used by AIC was found not imported from P & P/Germany. Status of AIC relegated from Cat "A" to Cat "B". The firm has replaced defective tubes at all sheds. Similar action planned for other defaulting firms. As far as other failures are concerned, CMPEs advised to check if the modified design failed at all; arrange education of staff in sheds about the modified design and to improve handling, especially at the time of cylinder head removal. Design of the tube sleeve modified to call surface finish, lower hardness & clearance done and drg revised. Spec modified to DIN 7300 (Grade ST 52.4) for loco below 3300 HP and PPSH for 3600 HP. All firms advised to supply material as per new drawing.
10	Breakage of nozzle tips from the tip or from the flange; (Itarsi, TKD & PA). Fuel injectors found dribbling. (SRIy).	The failures are mainly due to crack/breakage at ball, collar or at nozzle longitudinally. The corrective actions taken by MICO, e.g., electrochemical machining, improvement in radii at collar, education/tooling in respect of squareness of nozzle back face with nozzle centre, alignment of nozzle with holder etc, have not had the desired improvements. Analysis is on in association with MICO and RDSO. Meanwhile failed samples collected from many sheds and examined at DLW as well as samples also sent to MICO; nothing significant detected. The matter is still under detailed investigation by RDSO, DLW and MICO through a series of technical meetings and interaction as the problem has not reduced significantly.
11	Complaints of black smoke and dribbling nozzles on new locomotives	The practice of using every set of nozzle for break-in and overhaul before fitment discontinued. Only one set aside for break-in and new nozzles being fitted now.
12	Fuel pipe near governor found cracked. Wooden plug found in fuel line. (NGC)	Matter referred to shed for clarifying the problem but no response received. Closed.
13	Bushes with less id (0.687" whereas bushes should be reamed to 0.7185 to 0.7192") from M/s MICO(NKJ)	Checked at DLW; the supplies have no problem. This was a problem in spares supply to shed; both the shed and MICO advised to tighten inspection. Closed.
14	Breakage of her R/side no.8 F.I.P delivery valve holder from threaded portion.(MLDT; 16545).	Under investigation

Cylinder liner and allied areas		
1	Complaints of constricted movement of piston in the liner (part of failure investigations in seizure case)	Audit checks conducted on practices of liner pressing, sleeve measurement and employment of GO/NOT GO gauges. OD of liner is checked on 100% liners before plating. No complaints received recently. Closed.
2	Leakage of water from the bottom liner seal ring Liner & sleeve changed due to water leakage on 14986&	Audit of fitment of liner sleeves done in detail. Sources of seal inspected afresh and corrective actions advised to them. Similarly, after audit of liner sleeve manufacturers, those sources which did not have centrifugal casting

	14988 at JHS; Poor interference of sleeve as seen at LDH (14901) & ED(14994) & recently on 13005; also on one locomotive at GD as per DyCCMT's report. NGC has also complained less interference on new locomotives of 1496 series	facility deleted. No failure reported recently. This item was closed earlier but due to reports from JHS & NGC, fresh auditing of materials in use and fitment was taken up. No irregularity which can cause such a failure was found. Inspection has been advised to be more careful and to get 1st hand report from JHS. Meanwhile, fresh auditing by Inspection was taken in hand and it was found generally acceptable. No further complaints on recent locomotives. Closed.
3	Failures on account of peeling off the chrome layer have increased in recent plating and reports received from WRly, NRly, NERly, SCRly. & CRly.	Final rejection of liners after shot blasting on account of porosity in casting (detected by presence of oil on the inside surface) started to be ensured without exception. Machine repaired to avoid eccentric honing. It was found that liner seat was not uniform due to casting defects. In KCD make liners this problem is more pronounced; this results in uneven chrome plating in the plant at DLW. This check is being done in 100% liners. RITES also advised to check this aspect. Many cases of chrome layer peeling off are due to fitment problem. Process of sleeve and liner pressing audited in detail and improvements made. Detailed study of data shows that the breakage cases take place mostly on old liners. These have to be examined during 18-Mly schedule and weeded out of the system by Railways and shops. Marking of cylinder liners, casting, machining and chrome plating has been called out clearly for identification of the manufactures. RDSO asked to indicate adhesion test for chrome-plate layer(ultrasonic or otherwise) for cylinder liners. The drg. of the liner modified to increase the ID of the honed liner for increasing the chrome layer thickness such that biased wear on major thrust side is avoided; implemented. Subsequently, the thickness has been increased further based on the dimensions in GE liners; to be implemented from April 04. Audit was also conducted by RDSO and only some minor observations were made which have been taken care of. A consultancy case with IIT/Delhi and BHU for studying all the aspects and recommending the optimum solution was taken up and the contract is likely to be awarded to BHU.
4	There are some cases of liner breakage, at collar or otherwise.	As far as breakage of liners is concerned, a majority of the cases involves liners of M/s. Cooper Foundry. Due to various improvements done by them, the same has reduced substantially. A large number of liners with deep undercut in the collar area, however, are in service for which instructions from RDSO for checking and weeding out exists from RDSO. Detailed PFME has been carried out by M/s. Cooper in association with IT/Mumbai. They have submitted report. Findings out of investigation by CF were circulated to other vendors for implementation during manufacture. Implementation by other vendors confirmed. No. of failures has been eliminated completely. Closed.
5	Liner 'O' ring was found in torn condition right side no.2 (13015, NGC).	Checks made at DLW and noting found wrong in material. Failed material sent by NGC did not show any apparent failure. Complaints not received from other sheds. Closed.

6	L/S no.4 cyl. Head push rod grommet spacer gasket was in torn condition. (13016, NGC).	Checks made at DLW and noting found wrong in material. Closed.
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Centrifuge

1	Location of centrifuge not standardized. N Rly (LDH). SERly have added that new locos with GE turbo have been fitted with centrifuge in compressor compartment above RTMB with flexible hoses joined at many places. SCRly have reported that on these locos, the return pipe of lube oil centrifuge is too long with 3 joints and may fail due to vibrations. ED reported that the centrifuge hose obstructs OSTA removal.	Location standardized near R1 & R2 sump doors, doors modified, pipes made as per manufacturer's recommendations. Change notice issued. (SN 4 Eng, page A 3, Sochna 31-3). Subsequently, the location has been further modified taking the centrifuge back by approx. 35 mm to help in maintenance at R1 R2 locations. Closed.
2	Height of centrifuge stand should be reduced, one more leg added and thickness of plate increased to arrest vibrations (NKJ)	The design reviewed once again. Additional support provided between the two legs and also between stand and engine base. This has resulted in reduced vibration and performance has improved. Closed.
3	Breakage of Filteredge make centrifuge	The failures are mainly on DCW locomotives due to poorer securing. In any case, the failures were mainly related to design; modified by changing the base. The firm advised to change all old design type bases in sheds which they agreed to do for 30 months' old centrifuges. Closed.
4	Poor casting finish on Prag centrifuges on recent locos	Inspection of available units showed that finish on Prag centrifuges was not good. Matter referred to RDSO who have mentioned that the defects are not very serious. In nay case, RDSO has indicated the firm has been advised to improve the surface finish. Recent supplies checked and quality of the product found improved. Closed.
5	Centrifugal lube oil cleaner leaking due to breakage of cover clamp within 7 m service (NGC, 13015); Threads on the spindle of the rotor are found worn out within 7 m service (NGC 13016).	AVE Products (earlier M/s Prag) visited and reported that only on of these two is of their make. They have replaced the same. Meanwhile,. M/s Filteredge advised to replace the other centrifuge at NGC.

Miscellaneous

1	In the light-weight design of long hood implemented in early 2001, many problems, inter alia, have been reported in the power pack maintenance: It has single top door design instead of hinge type and out of course removal of cylinder heads, exhaust manifold is very difficult. Increased 14 mm height of the bottom vertical lagging causes inconvenience in attending main	All these problems, which are mainly of design and some of quality, taken care of in a new design of long hood already implemented from end 2002. The issues of poor maintainability have been addressed in detail in this design and the feedback from the sheds is very good. Closed.
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	<p>brg. and con rod bolts. The roof hatches are difficult to remove due to defective centering devices. Poor quality door locks/ hinges. Uncoupling of GE TSC requires removal of hood; Uncoupling of GE a/coolers requires removal of hood; uncoupling of expressor cannot be done without removing the TSC etc.</p>	
2	<p>CRly has reported that location of engine hood doors on WDG2s is incorrect resulting in requirement to cut both side doors at alternator end as spanner space is not available for uncoupling cam gear.</p>	<p>This has been rectified in new locomotives. Closed.</p>
3	<p>Locos released from DLW with 3-bolt armoured coupling required to be stopped; reported by CRly.</p>	<p>Implemented except some locations due to lack of space; LO filter to LOC near cooler, bubble collectors to rad & near LO strainer. Closed.</p>
4	<p>LO strainer top cover touches with hood. Strainer location, to be changed as removing of strainer/ L-1 power/assembly difficult. Gap bet strainer & hood required to be increased to avoid vibrations. (LDH)</p>	<p>Strainer has been re-aligned to ensure adequate gap between the top cover and hood; no problem on new locos. Closed.</p>
5	<p>Length of l/s vibration damper drain flexible pipe to be increased. (LDH)</p>	<p>Design modified, change notice issued and implemented. (SN 14 Eng, page A 4, Soochna 31 -3). Closed.</p>
6	<p>Conv. LO strainer casing fitted in primary filter location Conv. primary filter casing fitted in secondary filter location resulting in non-standardization & maintenance/stocking difficulties. 14893/14902 (ED)</p>	<p>Representative of DLW visited the shed and it was found that the complaint originated due to lack of awareness about the modified filter housing for 90-day primary and secondary filters. Closed.</p>
7	<p>LDH & GY sheds have reported that the value of TG deflection on new locos is found to be more than that prescribed.</p>	<p>As indicated earlier, audit checks taken in hand and subsequently detailed study carried out with RDSO at DCW also. The loopholes observed have been closed. No problem in recent locomotives. Closed.</p>
8	<p>No manhole on new WDG2 locos in fuel tank to remove foreign bodies/sediments, which enter into the fuel tank; new WDG2s do not have fuel drain dummies. (SERly & SRly)</p>	<p>Provision of fuel drain cock and manhole covered in a recent and change notice and implemented. (SN 18 Veh, page A 2, Soochna 31-3-02). Closed.</p>
9	<p>Different diameter fuel suction pipe on locos; GY shed reports dia varying from 28 to 36 mm. It was also reported that the location of fuel return pipe and suction pipe was interchanged on some locomotives.</p>	<p>In a recent change notice, the dia of suction & return pipes standardized and made interchangeable for use in any emergency repair. Closed.</p>

10	OST spring failure reported by GY; shed has fitted 6 cyl. engine spring; Spring tension less causing tripping(HWH). Square handle to be provided in OSTA instead of round handle at present (Vatva).	Change notice issued and implemented. Closed. As indicated earlier, Change notice issued but not implemented. It has now been decided to scrap the older material and procure the new material from trade on priority. Closed.
11	Plunger locking nut drop down causing picking of OST trip mechanism. Plain & not lock nuts used. (NGC, 14973); OST handle pin broken inside the cover (NGC, 13012 &13013) Special lever to shaft in the OST dropped down from due to improper fitment of dowel by DLW (NGC, 13016).	Checks to be made in the shop. But no such problem in the shop was found. It appears to be a stray case. As far as case of breakage of pin in side cover is concerned, the case is under examination.
12	Wear of vibration damper spiders	Detailed audit check at DLW of the manufacturing, particularly broaching has been conducted. Problem in broaching tool identified. Broaching tool has since been corrected. During assembly of intermediate ring and spider, dimensions are stringently checked. Closed.
13	Defective jointing sheet/gasketing: has deviated from the original ALCO specification. This needs to be examined as there are complaints of oozing from joints after some time in service (GY). Bursting of secondary filter gasket on two locomotives, 14070 & 71(VTA)	Although most of the sheds indicated that there was no problem on DLW locomotives; the drawing was studied and it was found that certain improvements were required. Drawings of all gaskets reviewed and standardized in line with the best available and suitable material conforming to the relevant IS 2712. Alternate material removed. Closed.
14	Defective ring/gasketing: material called in the old two-piece type water jumpers (GY)	Ref made to GY for detailed explanation as NKJ shed has indicated that there is no problem on DLW locomotives. Drawings of all gaskets being reviewed and standardized. Alternate material removed.
15	Extn shaft and fast coupling bolts broken; re-torquing required in shed. Vatva, NGC & LDH. Two failures have taken place on KE6 expressor due to key breakage at coupling hub. This aspect needs further study, as the bad workmanship appears to be of DLW. Other complaints of failure of fast coupling keyway/key on both exp/comp & engine end	Torque wrench is used at present. Failed materials required but not received from Vatva. Study showed that the problem was related to : <ul style="list-style-type: none"> • Inadequate draw during fitment of coupling • Poor quality of bolts supplied with the couplings • Minor irregularities in keyway dimensions and keys M/s AEI, which had supplied poor quality bolts, decategorized. The problem has since been set right. Closed.
16	Poor drain plug at engine sump outlet causing splash on TMs.	Proper plugging ensured. Closed.
17	Breakage of flange bolt connecting TA with engine (NGC)	DyCCMT has opined that the failure took place due to residual stresses in the bolt. New bolts being fitted at DLW were subjected to checks and found okay. No other complaint received. Closed.
18	Porosity on big spider and poor allowance on eccentric hole	It is planned to improve the sources of this CI item. A non-stock case taken in hand. Meanwhile, M/s Raj pattern, the

		current supplier and RITES advised suitably.
19	High oil throw from CC exhaust on WDG2 locos reported by NKJ and attributed to inadequate tightening of engine sump bolts.	Drawing does not provide torque value. Bolts are tightened by pneumatic spanners. Further exercise to compare the torque with different levels of pneumatic pressures usually available in shop is on. Not reported from many sheds. Checks made at DLW and NGC shed indicate vac level more than specified. The drg, has been modified to stipulate tightening torque. The capacity of CCM blower also reviewed. Two CCMs with 10% lower capacity also fitted on 13064 & 65 and the vac. Level was found acceptable. Final decision based on efficacy of CC exhaust inlet modification; matter referred to sheds.
20	Problems on exhaust manifold Large-scale failures of Ionic Finimatic make exhaust manifolds Failures of Ranflex make exhaust manifolds (JHS) Poor life due to cracks on exhaust manifold/bellow connectors Failures of Vikrant make V band couplings; reported that the bolt was found to be made of two different materials with respect to inner & outer core. (ET)	The failures have cropped up in one batch of manifolds supplied in 01-02 by Mss ionic Finimatic. Corrective action already taken and safeguards called in the drg., which has been revised. The firm advised to provide free replacements as well buffer stocks against the suspect batch. Delisting notice also issued to this firm. (See miscellaneous notice also). This is an old item with high level of reliability and therefore the failures, reported earlier by VSKP and TKD, were suspected to be due to poor quality control by the vendors. Audit checks were carried out and based on the findings orders were withheld in case of M/s Ransal & Vikrant and their product has been improved. In addition, another good vendor is being developed. Since failures are mainly due to cracks on bellows, modified bellow connectors with stainless steel mesh to replace sleeve has also been taken up for development; Staff sent to JHS also to check failed Ranflex manifolds. In respect of failures of Vikrant make V band couplings, the same was checked in DLW, But no such abnormality was found in the supplied made by the firms along with M/s Vikrant. The firm has, however, been warned to ensure compliance with specification on 100% supplies. Some failures have been reported recently on Ranflex and Ionic makes which are to be investigated.
21	Western Railway has reported that poor quality flexible pipes are being used in the water system in a/cooler & TSC; nitrile instead of neoprene. Spec to be modified. Complaints on HiFlex & AEI makes.	Meeting held with reputed manufacturers and it was decided to implement Gladiator type hoses for critical locations with chances of abrasion and R5R type hose s elsewhere. The drawings have been revised and implementation started. The drawings have also been revised to include end fittings manufactured by reputed suppliers only. RITES advised to check hoses as per the new spec to ensure quality and to weed out poor vendors in the long run. Analysis also showed that the problem could be fully solved by upgrading the vendors' list. The vendor list has been revised to decategorize poor vendors and include some quality vendors like Powerflex, IA and Super seal. M/s Soni have upgraded their facilities and installed impulse and abrasion testing machines. Closed.
22	OST handle strikes a/cooler on trip breaking handle pin(ET shed). 180 deg. rev. fitment done rev even with ABB turbo.	With the introduction of square handle, which is without pin, this problem would be solved. Fitment made first on loco no. 13038. Trade supplies have now been received and shall be regularly fitted on locos. OST fitment in the

		manner done earlier shall become standard with the introduction of GE single volute turbocharger. Closed.
23	LCP failures on recent lot of PG governors reported by NKJ	Investigations by M/s Woodward are in hand. No problem reported from other sheds. Woodward have agreed to provide steel elbow instead of brass with value of torque labeled to avoid over torque which causes LCP failure. To be supplied w.e.f. 1-12-03.
24	Replacement of WW gov due to erratic rpm on 14986 & 14987(JHS). Problems reported by NKJ, HWH, TKD in general. Engine RPM found 350/1000 for adjustment WW Gov. removed.	The list of problems was reviewed in detail with M/s Woodward. While some problems related to lack of awareness about fuel limit system, other problems are under fresh study by Woodward. Meanwhile a detailed workshop was held on the subject with wide participation from sheds. Inspection-related item. Proper adjustment being ensured as verified from records of last five locomotives. Performance to be verified at NKJ on new locomotives.
25	Threaded type amphenol plug for PG governor (LDH).	Opinion of sheds varies. M/s Woodward is willing to make the change. Drawing revised accordingly and RITES advised. Closed.
26	Link rod of EDC gov t/welded with the fork; fork should be threaded & screwed in (VSKP)	The complaint is correct and the shop as well as Inspection has been advised suitably .
27	Weld near drain plug on EDC gov sump cracked/ leakage (SN-1073-11-02). (NGC, 14973)	Under investigation.
28	Abnormally high oil throw from CC exhaust on WDG2 locos reported. Drain hole provided at bottom of pipe has not helped; metallic pipe has a suction window which is wrongly located	The design studied and arrangement modified to MG engine type design. A drain back from external pipe has also been added through a change notice. This modification did not succeed and another improvement providing MG type design with proper drain has been cut in. This design has been successful. The return flexible pipe diameter from oil accumulator also increased in a recent change notice no. CDE/V/523 dated 22-5-02. In addition, detailed study is in hand in respect of CC vac maintained at DLW/sheds & aux header ¼ inch nozzle in block for g/case. Under further monitoring.
29	Wobbling of extension shaft(GY)	Audit inspection at DLW did not reveal any defect. Audit Checks made in the shop; not a single case was found with run out more than 2 thou. Shed requested to provide more details. No further problem reported.
30	Poor quality locking plates/keys manufactured at DLW (FC roller pin, air elbow gasket, c/shaft key, exp. door on base, FP lever, base cover bar etc.	Decision taken to off-load the items to trade and procure through quality vendors. Locking plates have been made as purchase item through quality vendors. Change notice issued.
31	WW Gov nut which is fitted on governor cover broken on slight lift; other cover fitted (NKJ, 13029 & 13036).	To be checked in shed and referred to firm.
32	Spline shaft found coupled in opposite position (NKJ, 13036)	Under investigation
33	BAP sensing pipe badly rusted and choked (NGC, 13008).	To be audited on shop floor.

Issues related with allied systems of GETS turbocharger

	Problem	Action taken by DLW and decisions taken at meeting on 7/3/03 at TKD	Current status
1	3" dressor coupling of deaerator to rad. pipe touches with hood on GE turbo loco. Drg has to be modified showing some additional clamping for Cu pipes; no margin left to attend.	In modified long hood design this problem has been sorted out. Sr. DME (D)s confirmed that this has since been implemented during the recent supplied locos from DLW and the modification was accepted.	No more problem
2	Deaerator outlet pipe elbows projecting outside hood requiring cutting of hood.	Change notice issued providing a hatch at this location for maintenance.	-do-
3	GE turbo lube oil pipeline Problem of filter bracket mounting Failure of Teflon hose Pressure measurement flange at inlet to turbo Routing of pipeline	Change notice issued standardizing the strainer to filter and filter to turbo pipeline including improved clamping after detailed study. This will also help in improving the LO pressure at turbo inlet. (incorporating modified bracket, shortened & rerouted header to filter hose and modified PTFE coated and rerouted filter to turbo inlet hose) issued and implemented (with min pressure of 2.8 Kg at turbo inlet). Railways also advised for retrofitment. Subsequently, a locomotive was provided with these modifications at TKD for standardization and a report has been issued by RDSO. All suggestions, with some variation, were implemented by DLW for long except the vent connection modification.	Vent connection modification done as detailed in para 4.
4	Cross movement of piping bet turbo and a/cooler over exhaust manifold. Turbo and deaerator vent pipe getting damaged due to lagging-seating	It is proposed to use an 'F' adapter such that cross over of vent pipes can be avoided. To be implemented by DLW as cleared by GETS from water flow point of view.	Implementation made in loco no 13057 and onward.
5	GE turbo vents should be flexible type (refer SN 4 also) Some locos allowed by DLW without turbo & a/cooler connection to main vent pipe.	Change notice issued to convert the pipe to flexible type with lagging. Sr. DME (D)s confirmed that this has since been implemented during the recent supplied locos from DLW and the modification was accepted. This is a bad case of carelessness by DLW while implementing the above change notice.	Correct layout and connections started by DLW. Sheds advised to regularize the system and assistance offered by DLW in terms of materials.
6	Turbo flexible water pipe punctured; pipe longer in length rubbing with hood	It was observed that not only the layout of the flexible vent needed modification, the connections were wrong since	The same have been corrected and sheds advised to regularize

	angle (NGC; 13009)	inception.	on existing locos.
7	Kinks observed in the water inlet to a/cooler hose in GE turbo locos(GD)	Water inlet to a/cooler hose elbow angle modified to 135° to avoid kink in the pipe.	Already implemented by DLW.
8	Breakage of foundation bolts; breakage of bolts due to inadequate engagement on rear bolts Foundation bolt access poor resulting in switching over to new design bolt difficult.	New design bolts being fitted for the last one year. All sheds already supplied with the modified design foundation bolts. Sheds intimated by DLW about the loco no. from which the modified foundation bolts are being fitted at DLW. RDSO has to standardize the spanner with special adapter to be used by sheds for bolt tightening.	Already implemented by DLW.
9	Water inlet seal ring perishes (water inlet should be provided directly on the turbine casing) and length of turbo water inlet flexible pipe is too short, to be increased & metallic length reduced. To attend water leakage at turbine casing end joint pipe from water pump is very difficult, as engine hood & TSC are to be removed.	Study showed that this could not be solved in GE turbo design; requires switch over to redesign to single volute turbo. As far the inlet pipe is concerned, although replacement of the pipe poses some difficulty, it is not advisable to change the flexible length. In the modified long hood design, (cut in with loco 14991) extra width of the hood has been provided and this problem has been solved. Sr.DME (D)s confirmed that this has since been implemented during the recent supplied locos from DLW and the modification was accepted.	No problem on DLW locomotives. Single volute turbocharger fitted successfully on one locomotive. Cut in expected by January 04.
10	Deaerator pipe/water return pipe of twin a/cooler failures. Leakage from twin after cooler outlet pipe from threaded joints. The entire system of piping to be looked at. Failure reported recently on Rt side GE after cooler outlet 1-1/2" pipe nipple broken from bottom thread on loco 14942 at CRly. A/cooler water return pipe elbow touches with hood and is under tension causing water leakage.	Flexible clamp provided for outlet pipe. Lowering of hood to be done with wooden blocks placed on pipe. Till the modified hood is applied, proper alignment of after cooler water return pipe is being done to ensure that 2 nd elbow has adequate gap from the sidewall of the hood. Clamping system has been redesigned and the firms, which supply the pipes, have been visited and deficiencies indicated to them. Drg reviewed; use of ring/plug gauges by vendors introduced to standardize the threads on the pipe. The alternative design with flexible pipe alone (as suggested by GD shed) is under examination; Opinion of other sheds awaited (drg. has been kept ready). Modified a/cooler water piping arrangement as provided by DLW is problem-free as confirmed by SrDME/Ds.	DLW provided two complete modified kits of water circuit along with clamps and turbo supports by 25 ^h March for 2 loco sets which were fitted at TKD on one each DCW and DLW built WDM2C locos in presence of RDSO and later included in RDSO report, wherein fitment dressor couplings on the return pipe were suggested. No need to implement as there is no problem on the arrangement provided by DLW at present.
11	Both a/cooler water outlet pipe sockets are touching with a/cooler side cover plates.	Old stock modified after coolers were with defective water outlet pipe, M/s	M/s Saswad replaced the deaerator/water return pipe; being supplied properly.

12	For the turbo adaptation part, the pipe threads are of local made and the threads break; threads are with seams. These should be preferably seamless and std. threads on std. pipes should be used.	Use of seamless pipes for water piping ensured. Use of ring gauges to check the threads of pipes by the vendors ensured. Sr. DME (D)s confirmed that this has since been implemented during the recent supplied locos from DLW and the modification was accepted.	No problem at present.
13	Cracking of twin a/cooler; Failure of a/coolers on four locomotives at HWH and 14987(JHS); weld cracked bet side and top plate leading to leakage of water.	Problem mainly on supplies of M/s HTT, which has since been deleted by DLW. GETS approached to help in replacement of failed a/coolers. Performance of Saswad make twin after cooler is generally satisfactory except some failures reported due to crack on housing. Following failures on Saswad make, the drg, was studied critically and the following modifications have been implemented: Stiffener added Housing plate made a single piece GMAW introduced.	While sheds should approach M/s GETS directly for the twin after coolers supplied by M/s GETS, DLW has also taken up the matter with the firm and decided to make deductions from the pending bills to the firm if they do not react early. Moreover, a list failed after coolers should be given to DLW. (a tentative list has been handed over to M/s GETS for replacement).
14	Inaccessibility of GI casing bolts leading to improper tightening and leaking of gas.	Rectified In new supplies. M/s GETS advised to visit all the Sheds and rectify/replace all the GI casings bolts.	No problem on DLW locos; RDSO to monitor progress on existing locos in sheds.
15	Balancing and measurement standards specified by GETS for repair/ovh. too tight	DCW in the North and GOC in the South to do the centralized overhaul of GETS turbo.	RDSO to monitor progress.
16	Water leakage from aftercooler: water inlet pipe through 2" elbow and bottom nut, drain pipe pipe T-joint weld/flange joint, outlet flexible pipe, tell tale pipe (tube cracked) etc. Water leakage from A/C element vent pipe due to loose union nut. (NGC, 14977)	These are stray cases and could be due to poor maintenance; the design has been checked and no specific improvement is necessary.	No problem reported on recent DLW locos.
17	Rate contract for Teflon hoses	The Teflon hoses procured by DLW, except 3-4 Nos. from M/s Hi-Flex are satisfactory. Rate contract for Teflon hoses to be finalized by DLW early and also included in the vendor directory.	Items included in vendor directory. Rate contract to be done by CME/M DLW.
18	Nozzle end play in two locos – 14134/GD (DOF17.2.03), 14133/GD (DOF 3.3.03).	Problems referred by Gonda highlighted to GETS.	GETS response is still awaited from its Engg. Dept.

Failure/rejections of major Powerpack components on high hp locomotives since 1-1-01										Annexure to section A		
Loco No	Shed	Turbo	Piston Design 12.5/11.75 CR	Crank shaft	Brg seizure, saddle crack, bore shrunk	Block weld crack	Con rod	Piston & liner	Piston pin	Split gear	Cam bush	Camshaft breakage
14500			12.5									
14501	NGC		12.5									11/11/2002
14502	VSKP		12.5									
14503	NGC		12.5		6/23/2001							3/15/2001
14504	VSKP		12.5									
14505	VSKP		12.5									
14506	VSKP		12.5									7/30/2001
14507	VSKP		12.5			1/21/2001						
14508	VSKP		12.5									
14509	VSKP		12.5						7/31/2001			
14510	VSKP		12.5									
14511	NGC	NAP	12.5		6/12/2002				7/17/2001	7/17/2001		
14512	VSKP	ABB	12.5									
14513	VSKP	ABB	12.5		8/18/2001							
14514	VSKP	ABB	12.5									
14515	VSKP	ABB	12.5									
14516	VSKP	ABB	12.5									
14517	NGC	ABB	12.5	6/13/2001			6/14/2001					
14518	VSKP	ABB	12.5		9/11/2002							
14519	VSKP	ABB	12.5									
14520	VSKP	ABB	12.5									
14521	VSKP	NAP	12.5									
14522	VSKP	NAP	12.5									
14523	VSKP	NAP	12.5									
14524	VSKP	NAP	12.5									
14525	VSKP	ABB	12.5									
14526	VSKP	ABB	12.5									
14527	VSKP	NAP	12.5									
14528	VSKP	ABB	12.5									
14529	VSKP	ABB	12.5		7/7/2001							
14530	VSKP	ABB	12.5									
14531	VSKP	ABB	12.5									
14532	VSKP	ABB	12.5									
14533	VSKP	ABB	12.5		7/3/2001				7/27/2001	9/19/2001		
14534	VSKP	ABB	12.5						11/21/2001	11/21/2001	11/21/2001	
14535	VSKP	ABB	12.5									
14536	VSKP	ABB	12.5				9/18/2002					2/7/2002
14537	VSKP	ABB	12.5						7/24/2001			
14538	VSKP	ABB	12.5						3/17/2001	3/17/2001		
14539	VSKP	ABB	12.5									
14540	VSKP	ABB	12.5			9/9/2003	5/1/2001		5/17/2001	5/17/2001		
14541	VSKP	ABB	12.5		9/19/2001							
14542	VSKP	ABB	12.5		3/23/2001							
14543	NKJ	ABB	12.5									
14544	VSKP	ABB	12.5									
14545	NKJ	ABB	12.5		10/15/2002							
14546	VSKP	ABB	12.5									
14547	VSKP	ABB	12.5		7/16/2002							
14548	VSKP	ABB	12.5	6/17/2002	1/11/2001							
14549	VSKP	ABB	12.5		6/5/2003							
14550	VSKP	ABB	12.5		5/11/2001							
14551	GY	NAP	12.5									4/30/2002
14552	GY	NAP	12.5									
14553	GY	NAP	12.5									
14554	GY	NAP	12.5									
14555	NKJ	ABB	12.5					1/24/2004				
14556	NKJ	NAP	12.5		30/09/01							
14557	NKJ	NAP	12.5									
14558	NKJ	NAP	12.5									
14559	PA	NAP	12.5									
14560	NKJ	NAP	12.5									
14561	NKJ	NAP	12.5						2/8/2001			
14562	NKJ	NAP	12.5					10/30/2001				
14563	PA	NAP	12.5									
14564	NKJ	NAP	12.5									
14565	PA	NAP	12.5									
14566	PA	NAP	12.5									
14567	NKJ	NAP	11.75									
14568	NKJ	ABB	12.5									
14569	NKJ	NAP	12.5		11/26/2001			5/29/2001				
14570	NKJ	NAP	12.5									
14571	GY	NAP	12.5									
14572	GY	NAP	12.5					4/30/2002				
14573	GY	NAP/ABB	12.5				9/24/2001					
14574	GY	NAP	12.5									
14575	NGC	NAP	12.5									
14576	GY	NAP	12.5									
14577	GY	NAP	12.5									

Annexure to section A (high hp engine failures)

14578	GY	NAP	12.5						6/20/2001		
14579	GY	NAP	12.5					7/20/2001			
14580	GY	NAP	12.5		15/03/01 27/09/01		1/18/2001			3/20/2003	
14581	GY	NAP	12.5		3/15/2001				2/11/2001		
14582	GY	NAP	12.5			7/21/2002					
14583	GY	NAP	12.5								
14584	GY	NAP	12.5								
14585	GY	NAP	12.5								
14586	GY	NAP(ABB)	12.5			12/24/2002	1/24/2001			1/11/2001	
14587	GY	NAP	12.5								
14588	GY	NAP	12.5	9/22/2002							
14589	GY	NAP	12.5								
14590	GY	NAP	12.5		4/3/2001					3/11/2001	
14591	GY	NAP	12.5								
14592	NKJ	NAP	12.5		10/15/2002						
14593	NKJ	NAP	12.5								
14594	NKJ	NAP	12.5								
14595	NKJ	NAP	12.5								
14596	NKJ	NAP	12.5								
14597	NKJ	NAP	12.5								
14598	NKJ	NAP	12.5	9/20/2002							
14599	NKJ	NAP	12.5								
14600	NKJ	NAP	12.5								
14601	VSKP	NAP	12.5								
14602	VSKP	NAP	12.5	24/12/01 22/02/02							
14603	GD	NAP	12.5								
14604	VSKP	ABB	12.5			4/10/2003					
14605	VSKP	ABB	12.5								
14606	NKJ	ABB	12.5		3/8/2003						
14607	NKJ	NAP	12.5								
14608	NKJ	ABB	12.5								
14609	NKJ	NAP	12.5					1/19/2001			
14610	NKJ	ABB	11.75		9/28/2003						
14611	NKJ	ABB	12.5								
14612	NKJ	ABB	12.5								
14613	ED	ABB	12.5								
14614	ED	ABB	12.5								
14615	ED	ABB	12.5								
14616	ED	ABB	12.5								
14617	GY	ABB	12.5								
14618	GY	NAP	12.5		9/15/2002			1/22/2001		2/8/2001	
14619	GY	NAP	12.5								
14620	GY	NAP	12.5		2/25/2001						
14621	GY	NAP	12.5		7/15/2001						
14622	GY	NAP	12.5		4/24/2001		6/21/2001				
14623	GY	NAP	12.5								
14624	GY	NAP	12.5		3/22/2001						
14625	GY	NAP(ABB)	12.5		4/28/2001						
14626	GY	NAP	11.75								
14627	GY	NAP	11.75					6/11/2001			
14628	GY	ABB	11.75								
14629	GY	NAP	12.5								
14630	GY	NAP	12.5					5/2/2002			
14631	GY	NAP	11.75								
14632	GY	NAP	12.5			11/23/2002					
14633	GY	NAP	12.5		5/3/2001						
14634	GY	NAP	11.75								
14635	GY	NAP	12.5								
14636	ED	NAP	12.5								
14637	ED	NAP	11.75								
14638	ED	NAP	12.5								
14639	ED	NAP	12.5								
14640	ED	NAP	12.5								
14641	ED	NAP	12.5								
14642	ED	NAP	12.5					5/19/2002		1/14/2003	
14643	NKJ	NAP	12.5								
14644	NKJ	NAP	12.5								
14645	NKJ	NAP	12.5								
14646	NKJ	NAP	11.75								
14647	KYN	NAP	12.5								
14648	NKJ	ABB	12.5								
14649	ED	ABB	12.5								
14650	VSKP	ABB	12.5								
14651	VSKP	ABB	12.5								
14652	VSKP	NAP	12.5					9/24/2002			
14653	VSKP	ABB	12.5								
14654	VSKP	ABB	12.5						12/2/2003		
14655	GY	ABB	12.5		6/5/2001						
14656	GY	ABB	12.5		7/20/2001						
14657	GY	ABB	12.5							7/30/2002	
14658	KZJ	ABB	12.5								
14659	GY	NAP	12.5								

Annexure to section A (high hp engine failures)

14660	ED	ABB	12.5									
14661	ED	ABB	12.5									
14662	ED	ABB	12.5									
14663	ED	ABB	12.5									
14664	ED	ABB	12.5									
14665	ED	GE	11.75									
14666	ED	ABB	12.5									
14667	ED	ABB	11.75									
14668	ED	ABB	12.5									
14669	ED	ABB	11.75									
14670	ED	ABB	11.75							1/6/2003		
14671	ED	ABB	12.5									
14672	VSKP	ABB	12.5									
14673	VSKP	ABB	12.5									
14674	VSKP	ABB	12.5									
14675	VSKP	ABB	12.5								5/29/2003	
14676	PA	ABB	12.5									
14677	PA	ABB	12.5									
14678	PA	ABB	12.5									
14679	PA	NAP	12.5									
14680	PA	ABB	12.5									
14681	UDL	ABB	12.5									
14682	ABR	NAP	12.5									
14683	ABR	NAP	12.5									
14684	GY	NAP	12.5		8/23/2001	3/12/2003						
14685	GY	NAP	12.5					8/1/2001				
14686	GY	NAP/ABB	12.5									
14687	GY	ABB	12.5			3/20/2002						
14688	GY	ABB	12.5									
14689	GY	ABB	12.5						3/18/2001	3/18/2001		
14690	GY	ABB	12.5									
14691	ED	NAP	12.5									
14692	ED	NAP	12.5									
14693	ED	NAP	12.5			1/28/2002						
14694	BGKT	NAP	12.5						3/6/2001			
14695	BGKT	NAP	12.5									
14696	BGKT	NAP	12.5									
14697	BGKT	NAP	12.5									
14698	BGKT	NAP	12.5									
14699	GY	NAP	12.5					4/16/2002				
14700	GY	NAP	12.5									
14701	GY	NAP	12.5									
14702	GY	NAP	12.5			12/4/2002						
14703	ABR	NAP	12.5									
14704	UDL	NAP	12.5						1/15/2003			
14705	UDL	NAP	12.5						4/21/2003	4/21/2003		
14706	ABR	ABB	12.5									
14707	ABR	NAP	12.5		9/7/2001							
14708	ABR	ABB	12.5									
14709	ABR	ABB	12.5									
14710	LDH	ABB	12.5					12/15/2001				
14711	LDH	ABB	12.5		7/2/2002							
14712	LDH	ABB	12.5						14/05/01 21/09/01	14/05/01 21/09/01		
14713	BGKT	ABB	12.5				1/24/2002					
14714	GY	ABB	12.5									
14715	GY	ABB	12.5									
14716	GY	ABB	12.5									
14717	VTA	ABB	12.5									
14718	ABR	ABB	12.5									
14719	ABR	ABB	12.5									
14720	VTA	ABB	12.5									
14721	ABR	NAP	12.5									
14722	VTA	NAP	12.5		11/1/2002							
14723	ABR	NAP	12.5									
14724	UDL	NAP	12.5									
14725	VTA	NAP	12.5									
14726	LDH	NAP	12.5									
14727	BGKT	NAP	12.5									
14728	LDH	NAP	12.5		6/24/2003							
14729	LDH	NAP	12.5						4/14/2001			
14730	LDH	NAP	12.5						7/23/2002			
14731	LDH	NAP	12.5									
14732	LDH	NAP	12.5						5/19/2001			
14733	NKJ	NAP	12.5		7/24/2003							
14734	NKJ	NAP	12.5									
14735	NKJ	NAP	12.5									
14736	NKJ	NAP	12.5									
14737	NKJ	NAP	12.5									
14738	NKJ	NAP	12.5									
14739	ED	NAP	12.5									
14740	ED	NAP	12.5									
14741	ED	NAP	12.5									
14742	ED	NAP	12.5									

Annexure to section A (high hp engine failures)

14743	LDH	NAP	12.5									
14744	LDH	NAP	12.5		2/12/2002							
14745	LDH	NAP	12.5		3/12/2002							
14746	LDH	NAP	12.5					29/04/02 25/07/02				
14747	ABR	NAP	12.5									
14748	ABR	NAP	12.5					6/4/2002				
14749	ABR	ABB	12.5									
14750		NAP	12.5									
14751	NKJ	NAP	12.5		4/12/2003							
14752	ABR	NAP	12.5									
14753	NKJ	NAP	12.5									
14754	NKJ	NAP	12.5									
14755	NGC	NAP	12.5									
14756	NGC	NAP	12.5		4/12/2002							
14757	NGC	NAP(GE)	12.5					5/13/2002				
14758	NGC	NAP	12.5								5/1/2003	
14759	NGC	NAP	12.5									
14760		NAP	12.5					8/25/2002				
14761	NGC	ABB	12.5									
14762	NGC	ABB	12.5									
14763	NGC	ABB	12.5									
14764	NGC	ABB	12.5									
14765	VTA	ABB	12.5									
14766	ABR	ABB	12.5									
14767	ABR	ABB	12.5									
14768	UDL	ABB	12.5						10/3/2003			
14769	ABR	ABB	12.5									
14770	UDL	ABB	12.5								7/26/2003	
14771	UDL	ABB	12.5									
14772	UDL	ABB	12.5									
14773	UDL	ABB	12.5									
14774	UDL	ABB	12.5									
14775	GY	NAP	12.5									
14776	GY	NAP	12.5				4/21/2003				6/23/2002	
14777	GY	ABB	12.5									
14778	GY	ABB	12.5									
14779	KZJ	ABB	12.5									
14780	KZJ	ABB	12.5									
14781	KZJ	ABB	12.5									
14782	KZJ	ABB	12.5									
14783	KZJ	ABB	12.5									
14784	KZJ	ABB	12.5					28/09/02 23/06/03				
14785	GY	ABB	12.5									
14786	KZJ	ABB	12.5									
14787	KZJ	ABB	12.5						12/16/2003		2/16/2003	2/16/2003
14788	GY	ABB	12.5					9/27/2001				
14789	KZJ	ABB	12.5									
14790	NKJ	ABB	12.5					1/16/2004				
14791	NKJ	ABB	12.5									
14792	NKJ	ABB	12.5									
14793	NKJ	ABB	12.5									
14794	NKJ	ABB	12.5									
14795	ED	ABB	12.5									
14796	ED	ABB	12.5									
14797	ED	ABB	12.5								9/8/2002	
14798	ED	ABB	12.5						9/24/2002			
14799	ED	ABB	12.5									
14800	LDH	ABB	12.5		9/26/2003							
14801	LDH	NAP	12.5		1/1/2003							
14802	LDH	NAP	12.5		2/10/2002		4/25/2001		12/21/2002			
14803	LDH	NAP	12.5						8/10/2001			
14804	LDH	NAP	12.5		3/7/2003							
14805	LDH	NAP	12.5		2/15/2002	2/15/2002		5/15/2001			10/17/2002	
14806	LDH	NAP	12.5				11/15/2001	5/25/2001				
14807	LDH	NAP	12.5				12/22/2003		01/01/01 25/10/03		6/12/2002	6/12/2002
14808	BGKT	NAP	12.5					2/20/2001				
14809	LDH	NAP	12.5									
14810	PA	NAP	12.5									
14811	PA	NAP	12.5									
14812	PA	NAP	12.5									
14813	PA	NAP	12.5									
14814	PA	NAP	12.5									
14815	PA	NAP	12.5		1/19/2001							
14816	PA	NAP	12.5									
14817	PA	NAP	12.5									
14818	PA	NAP	12.5									
14819	PA	NAP	12.5									
14820	GY	NAP	12.5									
14821	GY	ABB	12.5									
14822	IVSKP	ABB	12.5						11/13/2003			
14823	IVSKP	ABB	12.5								11/23/2001	

Annexure to section A (high hp engine failures)

14907	GY	GE	12.5					11/12/2001	9/3/2002			
14908	VSKP	GE	12.5									
14909	UDL	GE	12.5									
14910	NGC	GE	12.5		10/18/2002							
14911	VSKP	HS	12.5									
14912	NGC	ABB	12.5									
14913	VSKP	HS	12.5									
14914	NGC	ABB	12.5									
14915	NKJ	ABB	12.5					12/17/2001				
14916	NGC	ABB	12.5									
14917	GY	ABB	12.5									
14918	GY	ABB	12.5									
14919	GY	ABB	12.5									
14920	GY	HS	12.5							11/23/2001	11/23/2001	11/23/2001
14921	GY	HS	12.5					1/4/2002				
14922	GY	ABB	12.5									
14923	GY	ABB	12.5					12/18/2001				
14924	GY	ABB	12.5			2/10/2002						
14925	GY	ABB	12.5									
14926	GY	ABB	12.5									
14927	GY	ABB	12.5									
14928	GY	ABB	12.5					8/30/2001				
14929	GY	ABB	12.5		1/3/2003							
14930	NKJ	ABB	12.5				4/7/2003					
14931	NGC	GE	12.5				1/12/2003					
14932	VSKP	ABB	12.5									
14933	VSKP	GE	12.5		1/31/2003			1/24/2002				
14934	NKJ	ABB	12.5									
14935	VSKP	ABB	12.5				9/21/2002					
14936	NGC	GE	12.5								12/8/2002	
14937	GY	ABB	12.5			2/21/2002						
14938	GY	ABB	12.5									
14939	GY	ABB	12.5					9/19/2001				
14940	GY	GE	12.5		9/21/2002							1/12/2002
14941	GY	GE	12.5					11/5/2002				
14942	GY	GE	12.5									
14943	GY	GE	12.5									
14944	ED	GE	12.5									
14945	NKJ	GE	12.5									
14946	NKJ	GE	12.5									
14947	NKJ	GE	12.5									
14948	NKJ	GE	12.5									10/31/2001
14949	NKJ	ABB	12.5					12/18/2001				
14950	NKJ	GE	12.5									
14951	GY	GE	12.5									
14952	NKJ	GE	11.75									5/2/2002
14953	NKJ	GE	12.5			1/20/2002						
14954	NKJ	ABB	11.75									
14955	NKJ	ABB	12.5									
14956	NKJ	GE	12.5									
14957	NKJ	GE	12.5									
14958	NKJ	GE	12.5									
14959	NKJ	ABB	12.5									
14960	NKJ	ABB	12.5					8/17/2002				
14961	NKJ	GE	12.5									
14962	NKJ	GE	11.75					1/10/2004				
14963	NKJ	GE	12.5									
14964	NKJ	GE	11.75									
14965	NGC	GE	12.5									
14966	NGC	GE	11.75									
14967	GY	ABB	11.75									
14968	GY	HS	11.75									
14969	NGC	HS	11.75					12/16/2003				
14970	NGC	ABB	11.75									
14971	GY	GE	11.75									
14972	GY	GE	11.75									
14973	NGC	GE	11.75									
14974	GY	GE	11.75					3/28/2004				
14975	JHS	GE	11.75									
14976	NKJ	GE	11.75					2/27/2004				
14977	NGC	GE	11.75									
14978	NKJ	GE	11.75									
14979	NKJ	GE	11.75									
14980	NKJ	GE	11.75					10/28/2003				
14981	KYN	GE	11.75									
14982	KYN	GE	11.75									
14983	KYN	GE	11.75									
14984	GY	GE	11.75									
14985	NKJ	GE	11.75									
14986	NKJ	GE	11.75									
14987	JHS	ABB	11.75									
14988	JHS	GE	11.75									
14989	JHS	GE	11.75									
14990	JHS	GE	11.75									

Annexure to section A (high hp engine failures)

14074	VTA	ABB	12.5									
14075	ED	ABB	12.5			02/04/03 20/05/03						
14076	VTA	ABB	12.5									
14077	KJM	ABB	12.5							2/5/2003		
14078	VTA	GE	12.5	8/15/2003								
14079	VTA	GE	12.5									
14080	ED	GE	12.5									
14081	ED	GE	12.5			6/9/2003						
14082	KJM	ABB	12.5							7/5/2002		
14083	KJM	ABB	12.5									
14084	KJM	ABB	12.5							4/23/2003		
14085	ET	ABB	12.5					1/17/2002				
14086	ET	ABB	12.5					10/19/2002				4/20/2002
14087	GD	ABB	12.5					12/8/2002				
14088	GD	ABB	12.5	7/7/2003				3/14/2003				
14089	ABR	ABB	12.5									
14090	VSKP	ABB	12.5					10/25/2002				
14091	ET	ABB	12.5									
14092	VTA	ABB	12.5									
14093		ABB	12.5									
14094	ET	ABB	12.5									
14095	BGKT	ABB	12.5	8/15/2003								
14096	BGKT	ABB	12.5									
14097	VTA	GE	12.5									
14098	VTA	ABB	12.5	8/7/2003								
14099	ET	ABB	12.5							11/16/2002		2/26/2002
14100	ET	ABB	12.5									
14101	ET	ABB	11.75				12/26/2002					3/16/2002
14102	ET	ABB	12.5									
14103	LDH	ABB	12.5									
14104	GD	ABB	12.5									
14105	LDH	ABB	12.5									
14106	GD	ABB	12.5									
14107	LDH	ABB	12.5					3/25/2002				
14108	ET	ABB	12.5									
14109	ET	ABB	12.5									
14110	GD	ABB	12.5									
14111	GD	GE	12.5									
14112	GD	GE	12.5									
14113	ET	GE	12.5									
14114	ET	GE	12.5									
14115	GD	ABB	12.5			12/3/2002						
14116	GD	ABB	12.5				1/10/2004	1/10/2004				
14117	BGKT	ABB	12.5									
14118	GD	ABB	12.5	10/13/2002				5/25/2002				
14119	GD	GE	12.5									
14120	GD	GE	11.75							1/12/2003		
14121	BGKT	ABB	12.5				5/11/2003					
14122	BGKT	ABB	12.5					4/18/2003				
14123	ED	ABB	12.5									
14124	ED	ABB	12.5				10/15/2003	2/22/2004				
14125	ED	GE	12.5									
14126	ED	ABB	12.5				11/26/2003					
14127	ED	GE	12.5									
14128	HWH	GE	11.75					2/22/2004				
14129	HWH	GE	12.5									
14130	HWH	ABB	12.5									
14131	HWH	ABB	11.75					8/13/2003				
14132	HWH	ABB	11.75									

Annexure to section A (high hp engine failures)

14133	GD	GE	11.75					5/20/2003				
14134	GD	GE	11.75					7/25/2003				
14135	TKD	GE	11.75									
14136	TKD	GE	11.75									
14137	HWH	GE	11.75									
14138	HWH	ABB	11.75									
14139	ED	GE	11.75									
14140	ED	GE	11.75									
14141	HWH		11.75									
14142	HWH		11.75									
14143												
15500	xxxxxx											
15501	GOC	NAP	11.75									
15502	GOC	ABB	12.5									
15503	GOC	ABB	12.5							1/23/2003		
15504	GOC	ABB	12.5									
15505	GOC	ABB	12.5									
15506	TKD	ABB	12.5				3/20/2001			9/11/2003		
15507	TKD	ABB	12.5				8/1/2001			2/28/2002	2/28/2002	
15508	TKD	ABB	12.5		1/5/2001							
15509	TKD	ABB	12.5			1/1/2001						
15510	TKD	ABB	12.5		2/17/2001							
15511	TKD	ABB	12.5		1/22/2001							
15512	TKD	ABB	12.5		8/31/2001		4/23/2001					
15513	TKD	ABB	12.5									
15514	TKD	ABB	12.5		1/24/2001							
15515	GOC	HS	12.5									
15516	GOC	HS	12.5							5/31/2003		
15517	GOC	HS	12.5			11/9/2001						
15518	GOC	ABB	12.5							11/1/2003		
15519	GOC	ABB	12.5							12/16/2003		
15520	TKD	ABB	12.5				1/25/2001					
15521	TKD	ABB	12.5						11/15/2001			
15522	TKD	ABB	12.5									
15523	TKD	GE	12.5									
15524	GOC	GE	12.5									
15525	TKD	GE	12.5				6/26/2001				12/4/2003	
15526	TKD	ABB	12.5									
15527	TKD	GE	12.5						8/7/2001			
15528	TKD	ABB	12.5									
15529	TKD	GE	12.5								9/15/2001	
15530	TKD	GE	12.5									
15531	TKD	ABB	12.5									
15532	GOC	ABB	12.5									
15533	GOC	ABB	11.75					9/19/2001				11/8/2001
15534	GOC	GE	12.5						5/22/2003	12/27/2003		
15535	GOC	ABB	12.5						11/2/2003			
15536	TKD	GE	12.5						8/27/2002			
15537	TKD	ABB	12.5									
15538	TKD	GE	12.5					07/11/03 03/01/04	5/27/2002			
15539	TKD	GE	12.5						25/05/01 30/10/01 16/04/02			
15540	TKD	GE	12.5			9/9/2003			9/30/2002			7/27/2003
15541	TKD	HS	12.5						3/22/2002			
15542	TKD	HS	12.5									
15543	TKD	HS	12.5									
15544	TKD	HS	12.5		7/11/2002		7/11/2002					7/27/2003
15000	xxxxxx	xxxxxx										
15001	TKD	xxxxxx	12.5									
15002	TKD	xxxxxx	12.5									
15003	TKD	xxxxxx	12.5									
15004	TKD	xxxxxx	12.5									
15005	TKD	xxxxxx	12.5									
15006	TKD	xxxxxx	12.5									
15007	TKD	xxxxxx	12.5									
15008	TKD	xxxxxx	12.5							11/23/2002		
15009	TKD	ABB	12.5									
15010	TKD	xxxxxx	12.5									
15011	TKD	xxxxxx	12.5									
15012	TKD	xxxxxx	12.5									
15013	TKD	xxxxxx	12.5									
15014	TKD	xxxxxx	12.5									
15015	TKD	xxxxxx	12.5									
15016	TKD	xxxxxx	12.5		9/18/2002							
15017	TKD	xxxxxx	12.5									
15018	TKD	xxxxxx	12.5									
15019	TKD	ABB	12.5									
15020	TKD	ABB	12.5									
15021	TKD	ABB	12.5									
15022	TKD	ABB	12.5		6/14/2002	6/14/2002						
15023	TKD	ABB	12.5									
15024	TKD	ABB	12.5									

Annexure to section A (high hp engine failures)

15025	TKD	ABB	12.5									
15026	TKD	ABB	12.5									
15027	TKD	ABB	12.5									
15028	TKD	ABB	12.5						10/15/2002			
15029	TKD	NAP	12.5									
15030	TKD	NAP	12.5									
15031	TKD	ABB	12.5									
15032	TKD	ABB	12.5									
15033	TKD	ABB	12.5									
15034	TKD	ABB	12.5			10/26/2003						
15035	TKD	ABB	12.5									
15036	TKD	NAP	12.5		1/7/2002							
15037	TKD	NAP	12.5									
15038	TKD	NAP	12.5									
15039	TKD	NAP	12.5		7/5/2002							
15040	TKD	NAP	12.5		10/17/2003							
15041	IKZJ	NAP	12.5									
15042	TKD	NAP	12.5									
15043	IKZJ	NAP	12.5									
15044	TKD	NAP	12.5									
15045	IKZJ	NAP	12.5									

Annexure to section A (high hp engine failures)

15046	KZJ	NAP	12.5									
15047	KZJ	NAP	12.5									
15048	TKD	NAP	12.5		10/19/2003							
15049	KZJ	NAP	12.5									
15050	KZJ	NAP	12.5									
15051	TKD	ABB	12.5									
15052	KZJ	ABB	12.5									
15053	TKD	ABB	12.5									
15054	KZJ	NAP	12.5									
15055	TKD	ABB	12.5									
15056	KZJ	ABB	12.5		7/6/2001							
15057	KZJ	ABB	12.5									
15058	KZJ	ABB	12.5		8/24/2001		6/15/2002					
15059	KZJ	ABB	12.5		7/24/2001							
15060	KZJ	ABB	12.5									
15061	TKD	ABB	12.5		10/21/2001							
15062	KZJ	ABB	12.5		8/3/2001							
15063	KZJ	ABB	12.5									
15064	KZJ	ABB	12.5		7/4/2001							
15065	TKD	ABB	12.5									
15066	KZJ	ABB	12.5		5/9/2001							
15067	KZJ	ABB	12.5									
15068	KZJ	ABB	12.5									
15069	KZJ	ABB	12.5									
Summary		(Excluding turbocharger)										
Year 2001		156										
Year 2002		113										
Year 2003		79										
Till macrh 2004		10										

Section A1
Summary of defects reported
and
action taken

**Corrective actions by DLW on problems reported by Zonal Railways
(Including actions taken on suggestions by sheds)**

	Problem/Suggestion	Action taken
	Mechanical (Engine)	See special section on engine
	Mechanical (Vehicle)	
1	Failure of Shastri fuel pumps at ET, ED, KJM and LDH; failure of these pumps on 14988 & 14990 at JHS & 14996 at UDL recently.	DLW had earlier worked to improve the quality of this source with some positive results but not fully acceptable results. Recently, a large lot of M/s Shastri make pumps was rejected at DLW and the seal of provided by M/s Shastri was improved to ceramic type and the drawings revised; much less problems reported on modified supplies. Another source M/s Trien Engg tried out and performance reports have been satisfactory so far; this source has also been advised to use improved seals. Railways were requested to indicate other good source (so if any but no response received. In any case, the performance on recent locomotives has improved and complaints not received on modified pumps. Closed.
2	Failure of eight modified fuel relief/reg valves of M/s Electromech due to piston jamming at DMW Fuel oil relief and regulating valve overhauled due to fuel oil pressure not maintaining (NKJ, 13036).	The issue resolved by replacement of units by the firm; no such problem has been faced by DLW. Tin plated spring replaced with imported powder coated one. No further problem. Closed.
3	Failure of two horn operating valve assly of Elbe make at DMW	This valve has been eliminated by switching over to magnet valve+switch. No problem any more. Closed.
4	GE make TSC damaged on 11.6.03 due to air inlet rubber sucked inside the TSC. (LDH, 13003).	The design and material in use found okay; this primarily took place due to improper fitment at DLW. Inspection advised suitably. Closed.
5	Load meter stud resting on air brake system pipe causing GR operation; AB pipe removed and modified pipe fitted. (NKJ, 13029; 13032).	Design modified changing the tapping rail location and introducing clamps for individual pipes. Implemented w.e.f. 13083. Closed.
6	Loco failed on 30.11.03 due to its radiator fan universal shaft coupling needle bearing seizure which has resulted damage to ECC bearing housing & also its universal shaft got uncoupled (NGC, 13010)	This was of International Motors make which is not an approved source. Suitable action has been taken to ensure that such orders are not repeated by DLW. Closed.
7	NS1 red valve of different makes, have been fitted on locos. This should be standardized with N1 reducing valve, which is superior to the former(PA)	Design changed to N1 reducing valve. Closed.
8	Provision of mounting brackets for spare vacuum hose pipe, BP hose in nose compartment. (NKJ); No arrangement for safety item (fire extinguishers, PFT, Wooden wedges spare BP, FP and Vac. hoses) in the cab; kept in nose compartment where, no protection plate provided over the pipe lines to and from the panels. (PA, 13 series locos)	Suggestion accepted. Drawing modified to provide arrangement for fire extinguishers and hoses provided in the partition door. Closed.
9	HWH shed has commented that the wiper arm is	The problem studied and it was found

	Problem/Suggestion	Action taken
	OK but the rubber fails in 3-4 months(HWH)	that complaints have not been received from other sheds. The firm called for technical discussion. Failed samples asked from the sheds. Referred to other sheds also for opinion.
10	Right side fuel oil glow rod found defective (UDL, 13018).	Stray quality problem in old design. New Borosil glass type design implemented. Closed.
11	Failure of wiper motors, Make 'EM' & 'JP' all cases are of nylon pinion only. (LDH)	Design improved to much more reliable GM type and implemented. Matter, however, referred to firm for replacement; firm has provided Al die cast type as replacement. Closed.
12	'J' type filter after MR1 not provided impacting on filtration and life of costly pre-coalescer and desiccant of air dryer. (PA, 13 series locos)	This is not required as per RDSO scheme. The apprehension of the shed is misplaced as the filter is provided with the air drier and the design is working satisfactorily. Closed.
13	Bye pass arrangement for air dryer not provided as RDSO's letter No.MOD.BK 05.27.00RV 00 dt. 28.7.00. Due to non-availability of material; malfunction of components such as PCB, double seated valve etc., bye pass reqd. in emergency. Instead of removal of the arrangements, decision should be left to shed. (PA, 13 series locos)	This was done based on specific request of sheds and review by RDSO/DLW. At this stage RDSO can review but there is no need for DLW to take up the issue. Closed.
14	Vacuum train pipe on 4" duplex vacuum gauge on left control stand is not done. If it was not required, then a single point vacuum gauge should have been provided. (PA, 13 series locos)	This was done only to exhaust the existing stock; technically it is not incorrect though not aesthetically correct. The practice has now been stopped. Closed.
15	BP/FP angle cock should be covered by a protecting frame against cattle run over. (NKJ)	Since with the provision of addl cocks, this is not very necessary and also as it will be aesthetically very poor, referred to other sheds for their opinion and not agree by sheds. Closed.
16	Expressor HP discharge gasket burst 14992 & 96 at UDL recently. Complaints received earlier from Vatva also.	This is basically a manufacturing quality issue and has been addressed accordingly. It was also checked with a view to improving the design but it was seen that such a change was not warranted. Inspection advised to keep the item for special checks. Closed.
17	Tightening of components like manifold bend clamps, exhaust elbow nut, inlet elbow nut water riser pipe bolt is a tiresome job in new superstructure. Also engine hood door near L8 obstructed by dust exhauster pipe on the new design hood (NKJ)	Both the problems have been studied. It is felt that the problem is of a minor nature and considering the advantages of the modified head, do not warrant a design change. The sheds can rig up suitable stands to attend the tiresome jobs. The engine hood door near L8 modified to remove the obstruction and implemented. Closed.
18	The problem of permanent set of exp valve springs seen on new springs only; the old design was better (GD).	It could be the issue of defects in the modified valve on Elgi expressors. Shed advised to clarify the make and nature of problem but no response received. Meanwhile, the issue of valve design

	Problem/Suggestion	Action taken
		has been examined in detail and the design employed by ELGI has been modified suitably with good results. Closed.
19	Poor welding of the compressor supports in the underframe leading to vibrations in on WDP2 locomotives(TKD)	While the manufacturing was not proper in respect of welding the drawing also needed modification to call for better welding and support. Modified drawings given to shed. Implementation in hand by shed. Closed.
20	CBC drive gear stopper developing cracks in housing; eight cases reported recently. Welding quality needs to be checked.(GY)	The design has to be looked into by RDSO. Referred to RDSO along with the other issues on locomotives employed on Castle Rock section. Moreover, the chamfer on the stopper was not being provided by DLW leading to poor weld; this has been rectified and made a special check point. Closed.
21	Failure of LO filter drum from weld	Change notice issued for dish type bottom. Implementation done. Closed.
22	End bracket assembly weld poor leading incorrect alignment of brake lever(JHS)	The problem already under CA-II at DLW; It occurs due to poor QC of the fabricated bracket leading to unwanted gap. Welding fixture has been made and the quality has improved. Closed.
23	Length of B.P. and F.P. angle cock pipe with resp to buffer plate to be standardized; protection bracket on both cocks being provided by the shed against failure due to cattle run over. (NKJ, 13028)	There is only some minor variation in the length due to manufacturing inaccuracies; Inspection advised suitably.. Provision of protection bracket on both cocks left to sheds as all sheds do not agree with this proposal. Closed.
24	Railing provided in the new locos fouls with pit catwalk; problem during barring tool(NGC, UDL)	The loco design is within MMD; the platforms provided in some sheds may be closer than the standard as similar problem not reported by NKJ or GY sheds where new locos have been sent. Design of Rail bracket therefore has been modified suitably such that these locomotives can be homed all over IR with no problems. Implementation done w.e.f. March 04. Closed.
25	Driver seat Arkay make broken within a period of one month. (PA, 13055 & 13048).	The firm visited the shed and it was found that the seats were taken down by the shed; in any case, rectification has been done by the firm. No problem reported on the modified make other than this complaint. Closed.
26	Walkie-talkie holding bracket and charger to be provided. (NKJ)	To be implemented along with cab AC as a 230 V point would be available. Closed.
27	Fuel oil regulating valve to gauge pipe not modified to flexible type at valve end (ED).	The small part which is attached to the regulating valve & the part which goes to gauge made "nil abrasion" flexible type in the design. Change notice issued and implemented. Closed.
28	Addl. cock for SA9 not working (UDL, 14993)	RDSO design. Improved COC design

	Problem/Suggestion	Action taken
		under consideration. Closed.
29	Angle cut out cock gasket burst (UDL, 14724)	Stray case perhaps related with quality of gasket. Gasket quality checked at DLW and found okay. Closed.
30	Air dryers flexible conduit rubbing with pipes, break system etc. alternative conduit layout reqd. (BGKT Shed). Poor air dryer conduit welding (NGC)	The design issues with M/s Knorr taken up for future supplies. Meanwhile, Inspection also tightened in respect of welding quality. The situation has definitely improved. Closed.
31	A large no. of failures reported on ELGI expressors; exp. oil seal, cooling fans, unloader valves et. (HWH, NKJ). Expressor all ex liners/pistons changed as oil throw on disc on higher notches (991; UDL).	The performance of M/s Elgi has deteriorated whereas that of M/s KPC has improved. This has reflected in the ordering being done this year. Detailed technical interaction is being done by DLW and M/s Elgi have made a series of improvements in the intercooler, valves and strainer. RDSO been requested to take up as they are RDSO approved. Complaints dealt under specific heads now. Closed.
32	Frequent failure of expressor oil seal on Elgi compressor (NKJ,LDH,HWH & GY)	Fitment and factory trials of carbon grade seal-MY10K conducted at Elgi factory environment and found suitable. Also introduction of improved carbon MY10K seal done by them. It was also found that crankshaft end float play requires controlling within 0.127mm to 1.27mm and this has now been implemented. The failure should come down substantially. Closed.
33	Failure of lube oil pump on Elgi and KPC expressor/compressors (VTS, TKD, LDH).	The critical parameters identified as problem areas were validated by Elgi, viz. material Composition, assembly procedures for gear alignment, geometrical & dimensional parameters etc.; found okay. The firm analysed and increased suitably the corner/fillet radius on idler gear shaft to prevent breakages and implemented w.e.f. Nov. 2003. The firm to monitor performance of new supplies. The no. of failures on KPC make is also high but apart from a series of manufacturing improvements done in early 2003, no specific response is forthcoming from them. Referred to RDSO also.
34	Frequent failure of expressor inlet valves on Elgi expressors (HWH, GD & GY)	The firm employs improved design valves from a reputed manufacturer which DLW proposes to standardize. Meanwhile, due to these problems, the decision is held up. The firm has modified the valve and fitted at LDH and HWH sheds; performance under watch.
35	Intercooler safety valve blowing continuously; spring not seating properly in all new locos(HWH)	Referred to ELGI for investigating the case in detail as such complaints were not received earlier. Investigations

	Problem/Suggestion	Action taken
		showed that it was basically an issue of defects in the modified unloader valve. Action plan being worked out by ELGI.
36	Engine cyclonic filter outlet pipe should be taken out straight down straight such that it is not routed through an opening in the door as this opening causes ingress of unfiltered air (NGC)	The design has been revised and the pipe layout has been modified suitably to solve this problem. Modified supplies are expected from April 04.
37	Compact panel for brake valves have difficulty in valves removal specially C2 and C3W. They have used manifold concepts for mounting of multiple valves. Hence for removal of one valve complete manifold has to be removed (NKJ, GY and DLW seminar); Tinplate panel of SWIL very difficult to maintain since for attention of valve e.g. Add. C2 relay valve, entire block containing RR magnet valve, Air flow measuring valve, R6 relay valve needs removal. (PA, 13 series locos)	Issue has already been taken up with the firms and modified design shall be cut in w.e.f. March 04.
38	Performance of D24B feed valve even with Nylatron seat is not satisfactory; performance of Escorts design is better (HWH & DLW seminar); D24B feed valve is fitted on feed valve system, which is not reliable. Instead, F2 feed valve or modified arrangement (C2+NS1) to be fitted. (PA)	DLW has decided to switch over to Escorts design. Expected implementation by Aug 04.
39	Poor performance D-I Auto drain valve giving frequent trouble (ER); SIL make 2 ADC defective in many new locomotives (HWH)	The mounting has been modified earlier to eliminate chances of infringement etc. Taken up with the firm; basically an issue to quality as well ingress of dirt etc. Adoption of GM type design is also under consideration.
40	MGM & AK Industries rubber kits are not satisfactory in performance(all participating sheds in DLW seminar)	We should not procure in bulk from them. It has been decided to order on these sources only after RDSO's fresh clearance for VA1B diaphragms.
41	Problem with Benzo fitting on Knorr Bremse air driers. (participating sheds in DLW seminar)	The firm has carried out modification; status to be obtained.
42	Sheds complain about breakage of housing and mismatch in two gauges in a loco on Gluck India make. (participating sheds in DLW seminar)	Firm stated that problem is due to RDSO drawing specifying aluminum housing as well as provision of back plate. Earlier housing was of sheet metal. Handling and fitment practice of gauges are poor resulting in damages of gauges at DLW. They also stated that we should use longer bourdon tube to improve the performance. Bourdon tube of stainless steel should be better. DLW to work with existing firms to upgrade the design and improve the quality. Design of GM for Air Brake may be taken as reference.
43	No arrangement on cab glasses to avoid frost formation.	The options of using automobile type glasses with embedded elements or modified wiper with tap for hot air under consideration.
44	Failure of Parag make FRP fan due to working out of the metal protection at the leading edge(ED)	M/s Parag, is required to improve the fixation of metallic protection; advised.
45	All pneumatic and vacuum gauges on control have	Poor quality of the pipes, not meeting

	Problem/Suggestion	Action taken
	been fitted with rubber pipes. They occupy more space and get clogged in a few months due to inside rubber pieces peeling off. (PA, 13 series locos)	the spec, may be the reason for such failure. Alternative synthetic design, manufactured by quality vendors, under consideration for this location.
46	Regulating valve to sump pipe is prone to failure and should be redesigned (SRly)	Referred to other sheds for opinion as problem not reported by other sheds.
47	SWIL make addl C-2 Relay valve exhaust choked; choke size below std. (NGC 13011). Addl. C2 relay valve air leak(UDL, 13001).	Firm advised; Detailed response with investigation report awaited.
48	Burn out of supply rubber seat on C2 relay valve of MGM make (LDH)	Under investigation
49	C2 Relay Valve of SWIL & SIL are received in two different designs; In the first design, supply valve seal is of stainless steel with groove dia 0.430", supply cage inner dia 0.630" and supply valve seal housing outer dia 0.620" and in the other design, the seal is made of brass with groove dia 0.492", valve cage inner dia 0.684" and valve seal housing outer dia 0.678"(SER) 'O' ring of the kit supplied by M/s Swan rubber meant for supply valve seal groove is not of proper size, hence not fitting in the groove of supply valve brass seal housing (second design) but suits the SS type supply valve seal housing. (GRC)	The matter has been advised to RDSO and internal valve design is approved by them. Response awaited.
50	Poor quality of GD 80 filters like flap valve always open & orifice place 1 -1/4 inch at the train pipe inlet to GD80-D found missing in many locos. Design inadequacy as reported by NKJ due to: Bottom plate not seating properly; air leakage; welding gave up in many cases. Possibility of foreign particles clogging the filter Paper filter reduces sweep area Problems with paper filter also highlighted in the workshop held at DLW on vehicle issues	Problems reported by NKJ studied at other sheds also by officers during their visits and similar problems reported. These issues have been addressed in the new design of compact panel but there was the issue of horizontal mounting of filter in SIL panel resulting in difficulty in extraction of filters. This has been sorted out by redesigning the panel layout in both makes and modified supplies are now being received. There is, however, a need for RDSO to look into the complaints about the paper filter quality as well misbehaviour of the flap valve in GD 80 E filter due to horizontal mounting. RDSO advised suitably to review.
51	COC in the feed valve inlet has not been provided. This has been the part of 28 LAV1 and IRAB1 circuit. It is required to facilitate closing of the system in case of mal-function of valve, leakage of any joint (loco can work without this in emergency and it can be replaced without shutting down the locomotive. (PA, 13 series locos)	Suggestion accepted and change notice issued. To be cut in w.e.f. April 04.
52	A cock each for MR eq and BC eq. provided at one end, whereas 2 cocks each for MR & BC eq. at one end to be provided (at both sides of one end). (PA)	This requirement has not been indicated by any other shed; the shed to provide more details for further action.
53	Both control stand top covers made in single piece; changing of A9/SA9 valves need removal of electrical switches. Instead these should be in 2 pieces. (PA, 13 series locos)	Suggestion per se not technically feasible. The issue of ease of removal of A9/SA9 valves under study.

	Problem/Suggestion	Action taken
54	Three WDM3As failed due to FTTM blower trouble (BMG, 14142, 14138, 14141).	The issue involves BHEL supplied PTU as well as blower. Firm advised to visit and one no. blower replaced by firm; also one no. PTU repaired by BHEL. Further details like failure investigation report called for.
55	Anti slip floor mat peeled off from middle joint in one place and swelling type spot observed at entrance of L/S cab door in some locos (NKJ)	Checked at NKJ & the supplier advised that the edge sealing of floor mat should be done. Meanwhile, feedback being collected from other sheds.
56	Problem in replacing glass of sliding window, particularly in M/s AW make (NKJ)	Firm advised to make arrangement to easy removal of glass panel.
57	Cracks in the chassis underneath the compressor bed (14806, LDH).	Visits made to shed; under review.
58	Defects develop in ball type COCs where there is frequent operation; 3/4 inch COC in loco cab for additional C2 valve, COC for MR drain & 2 nos. 1/2 inch COC for A 9 valve. Plug type COC (instead of ball type) in locations where airflow is not important & frequent operation is required. Plug type 1/12" BSP drain cocks at R1, 2 and 'J' filter to Drg. No.TPL 0042 are prone to failure. Only ball type cocks to RDSO Drg. No.SK.DP-2877 Alt. 4 to be fitted. (PA)	Referred to RDSO as it involves change in schematic. RDSO has in turn referred to all sheds for their opinion. Meanwhile, DLW plans to change to GM design of cocks.
59	3/8 inch steel pipe of EP governor thrown out due to inner thread worn out (UDL, 14772).	
60	Centrifuge return flexible pipe (3") had punctured along with seam joint longitudinally to its full length (ED, 14127).	
61	Suction of fuel booster pump was found nil (13004, NGC).	

**Corrective actions by DLW on problems reported by Zonal Railways
(Including actions taken on suggestions by sheds)**

	Problem/Suggestion	Action taken
Mechanical (Bogie)		
1	Pedestal cap bolts should be drilled head and wire locked and axle box end cover bolts should also be drilled and wire locked. (NKJ)	Suggestion accepted for axle box cover bolts but not for pedestal bolts. Implemented. Closed.
2	Incorrect trammeling on bogies as reported by some sheds earlier(UDL)	Trammeling of bogies started not only by DLW but also RDSO inspected bogies from vendors. Closed.
3	Breakage of outer coil springs on recently turned out WDG3As(NGC) on new WDG3A locos 13006, 13009, 13013 within 30 days of service reported earlier. Another loco no.13014 had given failure of outer coil spring breakage. There are 14 locos identified to be running with suspected coil springs which need immediate replacement.	Problem generally not been reported earlier on WDG3As in service. Springs are procured from RDSO sources only. In this case, broken springs are of GB make and investigation is being carried out by RDSO. Meanwhile, DLW has decided not to place orders on this firm till the investigation is completed by RDSO. DLW has also recommended to RDSO that this source be deleted. Meanwhile, some cases of breakage of Frontier make springs have also been observed and the same is under investigation by RDSO. DLW has, however, taken initiative to encourage M/s Coventry and RSK to start supplying these springs. The former has accepted the order and execution and fitment is in hand.
4	Shifting of load pad due to drop down of side bearers bolts in almost all locos was found in all 1300 series locomotives. (NGC)	Fitment reviewed; s/bearer bolts now fitted with the bolt head on top and nuts tightened properly. Locating dowels were earlier removed from s/bearers on insistence of RDSO for maintaining interchangeability; this could have lead to this problem; meanwhile pending clarification by RDSO, design reverted to that with locating dowels. Closed.
5	Incorporation of double-lock system (C clamp on collar side) for pins in brake rigging such as hanger end & centre lever pins (NKJ)	The modification is accepted and necessary change notice has been issued. Implementation in hand.
6	Dropping of centre pivot pin assly (NKJ;14648 & 14793)	A failure on the modified design, which was hitherto failure-free. DLW staff visited NKJ; Under investigation further. Final report awaited.
7	Long hood side stopper bottom and other component found dropped in Loco No.14648 & 14793 as all three bolts found sheared. (NKJ)	This investigation is linked with the one about dropping of centre pivot pin assembly.
8	Improvement in the dampers of WDP3A bogies to make them more reliable(TKD)	It is planned to fit bush to clamp the dampers on these locos. The drg. for damper bkt assembly ready for release; modified bogies being supplied by DLW have this arrangement. Closed.
9	Vertical through crack on centre block assly (14831 WDG3A; LDH)	This type of failure was also hitherto unknown; investigation done; failure took place due to less wall thickness of

		the pivot block.
10	Brake block centralization to be checked strictly; brake block found riding on the wheel flange (NKJ: 13 series locomotives)	Problem solved to a great extent with design and manufacturing control; appears to have surfaced again and fresh inspections are in hand.
11	Cracks on bogie frame of Loco No.14096 (BGKT)	Under investigation by RDSO.
12	Hairline crack on bogie frame was found near left side wheel on RT frame (No.SL2 March'98) (15535, SR-GOC)	Investigation completed. Undercut found at the horn. The manufacturing defect accepted by M/s Simplex who will repair the bogie. Closed.
13	Distortion of horn cheeks of bogie frames (13005 & 14712, LDH).	Visits made to shed by DLW and RDSO; final report awaited from RDSO.
14	Some cases of composite brake block cracking were observed by shed from its width near center portion of Escort make(NKJ)	Under investigation.

**Corrective actions by DLW on problems reported by Zonal Railways
(Including actions taken on suggestions by sheds))**

	Problem/Suggestion	Action taken
Electrical		
1	<p>Problems on main alternator Stator windings of 2 TAs at VTA earthed due to internal insulation failure (Sr No. 4601833 & 4601705) and another two, one at LDH and RTM (4601661). Failure of TA of Locos No.14065 & 14088 due to fan welding crack badly & rotor rubbing with stator due to loose of field coil pole. (GD); Breakage of TA fan bolts and damaging of TA end oil catcher due to defective bolts (BHEL, SN-4602001). (NGC, 14977) as well as some more case at NGC; latest case 3 Nos. (head portion) TA Fan bolts found broken in transverse from as the thread of 6/7L threads from head end side. (UDL, 13018) Felt seal of alternators leaking on 5 WDP2s(TKD); also reported by ED & GY. GY found improper machining of oil return hole. Heavy oil on slip ring resulting in sparking & failure(TKD; TA 4601948; loco 14136); Slip ring/ brushes found oily; brushes jammed in brush boxes/slip ring/brushes overheated (ET; TA 4601793; loco 18602); oil leakage as felt squeezed on PTUs of three locos (HWH)</p>	<p>See SN 1(a) also. While the incidences of stator winding failures are not too many but those that occur are not analyzed properly to make this a zero failure item. Detailed report for all cases required from BHEL, which have been delayed unnecessarily. RDSO also requested to pursue but reports not received. Although further failures have not occurred, response of BHEL needs correction for which the matter is being taken up at the highest level. Oil leakage form felt seal is a serious quality problem at BHEL involving fitment of improper seal or damage to seal during fitment. QC/Inspection to be tightened by RDSO. BHEL also advised to employ RTV with the seal as in case of AG felt seals. Latest review shows that the performance has improved in all respects except fan bolt failures which have been listed as a separate complaint. Closed.</p>
1(a)	<p>Breakage of TA fan bolts and damaging of TA end oil catcher due to defective bolts (BHEL, SN-4602001). (NGC, 14977) as well as some more case at NGC; latest case 3 Nos. (head portion) TA Fan bolts found broken in transverse from as the thread of 6/7L threads from head end side. (UDL, 13018)</p>	<p>Cases of fan bolt had earlier occurred mainly on DMW locos but on some recent DLW turned out locos also. Care has to be taken by BHEL to ensure no varnish deposit on fan bolts and use of correct std. bolts. Detailed report from BHEL awaited. DLW ensures that catchers as per drg used. Fan bolt shank broken in one case/foreign material (washer) in another. Since failures were reported on a recent loco also, has been taken up afresh with BHEL.</p>
2	<p>Interlock readjustment of BKT, Rev & Contactors needed in sheds; reported by NKJ, NGC and HWH. Latest reported on 13 series locomotives at NGC & NKJ.</p>	<p>Taken up with RDSO inspection primarily and DLW inspection also tightened for rejecting defective equipment in locomotive sets supplied by BHEL. Examined by BHEL in detail at NKJ & HWH with AIO/DLW for reducing commissioning time at sheds. Subsequently addressed in number of interactions with BHEL in the recent months. Complaints have reduced in the latest locomotives turned out by DLW. Closed.</p>
3	<p>Misc. problems; Reversers/BKTs Rev/BKT loops condition very poor(NKJ); main contact working out due to bent spring. Insulating sleeves catching fire(LDH). Excess finger block guide holes dia & poor power shunts leading to short ckt etc.(LDH).</p>	<p>BHEL have not yet responded to these complaints clearly yet and tended to treat these complaints as stray ones. This is, however, not the case as confirmed in the recent coordination meeting at BHEL in Aug 03 and also during visits in connection with</p>

	Problem/Suggestion	Action taken
	Loose connections in Rev/BKT (and PCs) & Reverser main contact overheated SN 510710025. (NGC, 13000 series)	standardization of commissioning schedule. BHEL to respond and RDSO to monitor; It has been decided that joint observations to be made with BHEL at PA and UDL sheds once again before closing the complaint.
4	Other problems; Power contactors Sluggish operation of Power contactors & Power contactor operation not proper. P/C P1, S1, P22, S21 always required to change. (Late pick up and late drop). Lubrication not proper and P22 main contact tip welded on 13026 (NKJ). Loose connections in contactors (NGC), Power contactor interlocks defective. (NGC; 13009 & UDL); S31 power contactor magnet valve operating coil found open (UDL, 13001)	Oiling started at DLW and the problem reduced on new locomotives. Examined by BHEL in detail at NKJ & HWH with AIO/DLW for reducing commissioning time at sheds. BHEL also approached for development of PTFE piston and referred to RDSO to take up with BHEL. Subsequently addressed in number of interactions with BHEL in the recent months. Complaints have reduced in the latest locomotives turned out by DLW. Closed.
5	WR-10 resistance open (UDL, 14994).	Investigation report awaited from BHEL.
6	Problems on relays Interlock springs work out on relays; these are secured with araldite after taking out all relays during commissioning (LDH; HWH). Interlocks are open circuited after repeated operation and require changing for better reliability(NKJ, HWH). Less over travel fixed contact bent & cage broken.(HWH). WSR coils burnt/oc (NKJ,JHS,NGC), WSRR open(13001 & 993 UDL) ERR – ERR relay contact brazing joint broken (UDL, 14992).	Large no. of failures reported by HWH shed but failed relays could not be shown to BHEL rep. Packing of relays has been improved by BHEL on insistence of DLW. Some relays have been rejected by DLW in super checks on contact pressure and over travel. RDSO inspection, which has been advised, should be tightened. Also examined in detail by a team of BHEL engineers and AIO/DLW in detail at NKJ & HWH sheds for reducing the commissioning time at sheds. Subsequently addressed in number of interactions with BHEL in the recent months. Complaints have reduced in the latest locomotives turned out by DLW. Closed.
7	Problems on BHEL VRPs VR-96; NFR: 21 failures. GD: all VRPs removed from service. ED: 8 failures in 01 on VRPs mostly of VRL1 relay. SERly: failure rate as high as 70 cases per 100 loco per yr. SCRly: wide voltage fluctuation and voltage not building up on 7 VRPs of locos of Aug-Oct 01. VRPs with latest mod put into service from Oct 01 onwards. Other reliability issues like failures of VRL1 relays, VL1 inductors, SCR1s, VC6, RD9 diode and humming/chattering sound etc.; NGC reported many failures of "Kaptron" make 1000 MFD capacitor (VC-6) of VR-96;; many cases of BX card C2 cap. short (UDL)	BHEL had procured some devices from Portugal, which have caused a spate of problems; to be taken up with BHEL. This component has been off-loaded to trade and the new supplies are expected to be much more reliable. Fitment of these VRPs has been started in May 03 and the initial performance report is satisfactory. DLW has taken action to develop IGBT - based VRPs for application on 25 locomotive sets as the initial reports of similar designs are good. Closed.
8	Problems of roller suspension bearings Failure/breakage of M-12 & M-36 bolts. These are inadequately torqued, them opening easily (TKD, LDH); TM N. 2 & 5 bolts can not be torqued in position. Also, Allen key bolts (M-12) for adj washer hold can not be tightened in situ. Low backlash observed bet gear/pinion	Action being taken as per the decision in the latest DMG; information required by RDSO given by DLW. Further action by RDSO. Inspection at DLW(and later at RDSO also) tightened to ensure that motors with inadequate backlash are not provided on new locomotives as was done in the period July 00 to May 01.

	Problem/Suggestion	Action taken
	<p>Sealant between Traction Moor suspension unit not being applied; no sealant used in adjustment washer. Lower half of the adjustment washer falls during run. Hardening of gear case compound;</p> <p>Study of problems reported by SERly, GY & ED shed (SN 80/18, 80/68 & 82/27) etc on both TM 4907 & L/Wt motor. These bearings are expected to give trouble free and maintenance free service and to take care of problems, if any, due to incorrect dimensions of the tube or due to improper fitment, feed back from railways is required.</p>	<p>Proper torquing of bolts is being ensured at present but not fully at specified value. New torque wrenches under procurement.</p> <p>End play being adjusted between 2 to 6 thou.</p> <p>BHEL to employ only std. LPS, Pooja, TVS or PFL bolts. Checks made at DLW also.</p> <p>BHEL's TMX has no reports of failures on recent supplies (2002 onwards). As per DLW records also, there is only one complaint of roller brg. Failure (PA). Breakage of both types of bolts breakage is rampant(LDH). This issue has been addressed separately and the main complaint can be taken as fully addressed. Closed.</p>
8(a)	Although there are no suspension roller brg. Failures, breakage of both types of bolts breakage is rampant(LDH).	The issue is under investigation in detail with BHEL and RDSO.
9	Breakage/high wear of Tacho nylon gear; reported by LDH. Also reported by HWH on loco 14130 recently.	While LDH complaint did not concern DLW fitment that at HWH is of DLW. No progress; BHEL asked to check early and but no response received. No other complaint. Closed.
10	<p>Problem on micro-processor based governors (reported by ED, NKJ, BGKT and HWH sheds), which, inter alia, include: Overshooting of rpm up to 1200 Engine not loading fully causing wheel slip Fouling of terminals, cables etc. with box Failure of devices Dry solder on connectors Securing arrangement of keypad</p> <p>Problems on MCBGs of Medha reported by NGC; spring failure, poor conduits, gibberish messages, incorrect rack display etc.</p>	<p>Microprocessor based governor is an RDSO controlled item but DLW has taken pro-active interest from the beginning of the project. A special drive was taken by BHEL to educate the sheds as many problems took place due to lack of understanding. A special service bulletin has also been issued. Many problems appeared to have been licked as failure reports had stopped and some issues have resurfaced. BHEL has examined further at NKJ, UDL & GY, where the problems were faced recently. Failures of connectors etc. continue. BHEL still have to examine the problems at BGKT, JHS and VSKP; this is a continuous process in respect of equipment already fitted by DLW.</p> <p>In respect of M/s Medha, although RDSO had indicated that the product has been proved out, DLW decided to tread cautiously and placed all the locomotives in one shed with a view to proving out the same further. Accordingly, all the locos were sent to NGC since this product has a good future in case it is proved out. The concerned source i.e. M/s Medha has been advised clearly that future of their product is linked directly with success at NGC shed. SrDME/NGC has also been advised to this effect. In any case, the firm has deputed their team to NGC shed, camped there & resolved most of the issues.</p>

	Problem/Suggestion	Action taken
		The performance of Medha governors is found to be definitely superior to that of BHEL. Fitment of BHEL MCBGs stopped except 2/3 more on WDM3Ds. Closed.
11	Abnormal sound from brg/inner rotor rubbing with drum on new ECCs of BHEL; NTN/Japan make bearing of ECC in the newly turned out locos by DLW are failing.; brg. designation is 2310 (ED)	Matter referred to Director/Inspection at RDSO. Under monitoring at DLW also; no further complaints. Issue of oil filling observed at DLW and found that the same is carried out correctly. NTN issue advised to BHEL for immediate response.
12	TKD shed reported problems like burst lead on interpoles and open main field coils on lt. wt. motors. BHEL should indicate the corrective action proposed.	This aspect needs to be checked in detail by RDSO/BHEL as procurement of light-weight motors continues. Improvements in main field coil placement design made by BHEL and all further supplies has been with this improvement. No further problem reported. Closed.
13	Distortion of TA bull gear (S Rly.)	BHEL was to work out solution with RDSO. No progress; BHEL asked to react early.
14	Heavy flash over on CK-1 & CK-2 during cranking(NKJ,UDL & NGC)	Studied at HWH with BHEL and complaints found on new locomotives and sheds confirmed this problem. Inspection related issues addressed. It has been decided that joint observations to be made with BHEL at PA and UDL sheds once again before closing the complaint.
15	Adoption of extended range DB to be done to reduce wear of brake blocks	Trials planned earlier at ED are now scheduled at KZJ.
16	CPR21/CPR22 diode failure (12 FMR 100); (JHS & ED). The diode 16 FMR -120 fitted for AFL modification found punctured; as a result BKR was getting supply & resulting 4 th notch rpm & high 1 st notch current (GD)	BHEL to investigate; response awaited. Detailed ref. also made to BHEL in respect of usage of only approved makes of diodes.
17	Leakage of oil on AG/EG (14975, 14986 & 14989 of JHS & 14991 & 996 of UDL)	This problem was contained with a series of modifications but has reappeared again. RDSO advised to examine. Since the expressor type seal has been very successful, RDSO has been requested to adopt the same. Meanwhile, RDSO and BHEL advised to investigate on new locomotives at UDL, HWH, JHS and NKJ. Recently, NKJ shed mentioned that the problem can be licked to a large extent merely by filling oil to lower level in the TA gear case. In any case, RDSO is engaged to close the issue.
18	Axle gen. rubber coupler broken(HWH).	The supplies available at DLW checked and found okay. Shed advised to send failed sample to BHEL/DLW; no action taken by shed. Closed.
19	GR reset knob restricted movement (HWH); two cases at NGC (14970 & 14966) due to GR-1 resetting plunger getting stuck even with plunger fouling with barrel on resetting	Taken up with BHEL and the problem has been eliminated in the new locos. DLW will monitor further.
20	Failure of bull gears on new locos (ED & NGC)	This is a serious type of failure as the same has not been reported earlier. RDSO advised

	Problem/Suggestion	Action taken
		to investigate in detail. No report received; advised repeatedly to expedite but DLW has not received any communication. In any case, concerns RDSO primarily.
21	Breakage of brush box pin and damage to the commutator on AGs; improper hold of pin across two sidewalls of brush box due to pin head dia marginally more than hole of the brush box wall; pin slips off the walls. [ET]; AG holder and its support pin (14991, 14994 and 13018, UDL) broken; problem also on other AGs also	BHEL and RDSO advised to look at the design/quality of manufacture. BHEL rep visited UDL and assured early investigation report which is awaited.
22	Working out of Cu damper plate on TDR armatures due unscrewing; the plate tk is also very less leading to tearing(LDH). TQ rod breakage and spring missing.	BHEL advised DLW to improve handling of TDR relays in the shop and ensure that no impact load comes on relay fingers. BHEL, during rectification, will follow instructions given in maintenance manual (MI 85129). It is felt that a review of the design is called for early. Under study by BHEL.
23	BCI meter always showing discharge zone (Make-UBA, SN-217219). (NGC, 14965). BA and Load meters defective on new (13025 & 26) locomotives at NKJ.	Detailed ref. also made to BHEL in respect of usage of only approved makes of meters. No further complaints. Closed.
24	Non-loosening of indicator washer in diode assemblies of power rectifier (LDH, 14804).	Complaint addressed by BHEL in detail to LDH directly.
25	Power ground caused by dropping of top carbon brush holder of no.5 TM(NGC; 14969)	Investigation report awaited from BHEL.
26	Loop wire provided on ECP on JK and AZ terminal (NKJ, 13028).	This is a requirement of sheds for bypassing Low Idle feature; DLW can not adopt. Closed.
27	Failure of 492 cards within 18 months; latest case VR-28 on 14977 of NGC. Card No.188 found defective due to failure of PWM reactor causing EPT power transistor (800 c/s) (LDH, 13003).	Investigation report awaited from BHEL.
28	GF contactor found defective UDL(13046).	Investigation report awaited from BHEL.
29	Problems on stick type master controller Failure of stick type master controller due to special type of screw used for supporting notch locking roller was found broken rendering the controller inactive. Complaints of mounting screws also. (SR). Other issues raised during the workshop held at DLW. BKR interlocks not taking contact(14988 & 14990; JHS) Failure of stick type master controller; NO T-Interlock in idle position is sometimes getting closed due to slackness on the camshaft. (NGC, 13000); Failure of Master controller S/N 8142 of Asian Plastics Make due to improper profile of notching sector disc and excess spring tension. (PA, 13040) Apart from these pin pricks, Railways have been complaining about pin pricks on the stick type master controller. In fact many problems came to light only during the	The mounting screw design is changed to Allen Key type and cut in done. The auxiliary contact body changed to fire retardant plastic to stop burning of the adjacent contacts after some flashover in one contact; implemented. Key problem related more with the key itself. is in locked In respect of no cover over the handle opening, it has been decided to provide a canopy type cover under the top cover to protect the live portion; to be implemented by the firm; can be implemented by sheds also. E-beam cables cut in QC checks on roller pin improved The gear for the BKCP is the reason for hard operation; the cast iron painted gears should be replaced by dry lubricated steel case carburized gears.

	Problem/Suggestion	Action taken
	<p>seminar held at DLW in July 2003. Some of the problems which the firm/BHEL has to resolve are as under:</p> <ul style="list-style-type: none"> • Problem of melting of contacts, particularly the braking contacts. • Sometimes reverser locking gets unlocked even if key is in locked position on moving the throttle handle. • It will be convenient if single Allen key be used to open the cover & handle grip. • Dust/metal chips etc enter the controller as there is no cover over the handle opening. Dust sealing felt to be provided. • Commercially available hardware from a reputed firm only has to be used. • Use of only E-beam cables for inter connections inside the Master Controller. • Every roller pin should go through D.P.T. <p>Service bulletin for issues like; handle of higher strength, "glass filled nylon" of higher thermal rating for contacts, increased groove depth and increased spring tension, case carburized roller pins M-6, plastic name plate 'F-O-B' replaced by metal one, drawings of special tools reqd. by sheds.</p> <p>A one rupee coin found in control drum shorting studs, connecting wires 16 & 5 causing energization of 'D' solenoid of governor and no fuel injection. (13055, PA)</p>	<p>The cam should be manufactured by machining from Al stock instead of providing discs on a hex rod; under examination by BHEL.</p> <p>BHEL has been advised once again to provide a service bulletin on the issues mentioned herewith.</p>
30	<p>Verma Trafag/Rewari ETS Temp setting gets disturbed; moves free of spindle (10-12 failures at TKD). Poor performance of Deltronic make electronic ETS also reported. Deltronic ETS normally get oc & Alpha ETS normally gets sc. (BGKT)</p>	<p>Details to be collected from TKD and NKJ and firm advised to take necessary corrective action. Adverse performance of other makes not reported by sheds except stray cases on Indfoss. M/s Verma Trafag decategorized. No problem with Indfoss and Rupa make. Closed.</p>
31	<p>Extremely poor wiring of LT harness in nose compartment; wires not taped/secured or passed through conduit on all locomotives from 13022 onwards</p>	<p>Poor work was carried out on these locomotives for a long time which was hidden by the larger size brake panel; the same has been exposed. The layout and conduiting is has been redesigned and change notice implemented. Closed.</p>
32	<p>Oil pressure switch (Indfoss make) fail. (TKD); OPS pick up & drop found totally erratic; removed and overhauled. (NKJ: 13022, 23, 25)</p>	<p>Problem taken up with the firm. Not many cases reported by other sheds. Under study; the firm also called for detailed technical discussion to improve all pressure switches. No problem with Indfoss make at present after improvement. Closed.</p>
33	<p>Problems on EDC governors Hydraulic governor pilot valve harness wire No.31Z female plug was making intermittent contact, resulting engine became over speed and shut down (UDL) GE Governor pilot valve sticky on 3 locomotives (NGC)</p>	<p>EDC governor problems are well known and the firm has been advised once more to look into these recent quality issues and submit report. The response is awaited; looking into the past performance of the firm, a meaningful response is not expected.</p>

	Problem/Suggestion	Action taken
	Arm A & B cam followers broken (13023); oil leakage from sump pipe(13022); leakage from pressure adj screw(13026)	
34	<p>Failure of small DC motors reported within three months of service, HWH, NGC, NKJ, JHS, PA etc.</p> <p>CCM brg. Failure continue(TKD); same brg as FPM although rpm is higher. Basically, existing DC motor bearings need to be improved- Clearance of heavy duty to be incorporated, quality of grease-high temperature to be used. (TKD Shed); Failure of DEM (SN 4216) at NKJ due to heavy sparking at comm.; FP motor S/N 02-12106 armature balance weight worked out (PA, 13039); DEM carbon brush found near condemning size, Comm. found blackish;(PA, 13039, 13044 & 13064).FPM S/N 02-12410 rocker arm breakage (PA, 13040); FPM CE brg seized (UDL, 14996).</p>	<p>These were basic quality issues with M/s Elgi. Detailed technical meeting held with the firm; workshops would be held at three sheds. The firm has meanwhile arranged special training programme for sheds.</p> <p>The bearing rpm issue referred to manufacturers and suitability of the bearing for the rpm was confirmed. The problem also referred to RDSO for study.</p> <p>It has also been decided to employ 2RS type rubber seal bearings only w.e.f. 1-7-04. Improvement of grease also under consideration.</p> <p>DLW to develop another supplier till AC motors become fully reliable; being pursued with M/s Mane and Patil but their reliability has also been found poor. Since problems on small motors continue, this item is under further monitoring.</p>
35	<p>Sheds have mentioned that terminal shoes of 16 SWG are found loose crimped. Other sheds report that the control wire harness of WDG3A is not yet standardized. Thimbling quality is not good. Thimbles are undersize in most of the cases. (NR-LDH).</p> <p>Similar complaints have been received from other sheds like NGC and UDL.</p>	<ul style="list-style-type: none"> •Regular load test on crimped joints started. In addition, a team nominated to conduct audit checks like pull tests on crimped joints as per RDSO MI procedure; comprehensive drop tests based on this MI also planned (Modification details circulated vide specification no. MP-0.5200.04 & MP.MI no.1470). •Modifications like removal of insulation on control cable sockets for higher size cables taken to avoid improper crimping. •Periodicity of changing of crimping dies fixed. •New Amp type hand crimping tools put in use; use of plier type tools discontinued. •New Amp pneumatically operated crimping machines commissioned and crimping work started with definite improvement. •Drawings check and re-qualification based on Dowell's practice done. •M/s Varanasi Terminals decategorized after audit inspection. •M/s Amp, a GM loco lug supplier of good quality, put in the directory and lugs procured for trial application. •New pneumatic crimping machines installed. <p>The report from some sheds, e.g., that from NGC was rather vague with the omnibus statement that all power and control cables connection found loose in all locos. Sheds requested specific areas of the problem be indicated to enable us to take further corrective action.</p> <p>Latest review shows that the performance has</p>

	Problem/Suggestion	Action taken
		improved substantially. Closed.
36	Failures of Hem and Elmec make buzzers	Most of the failures are on Hem make buzzers. The firm called for technical discussion but no improvement has taken place; the firm has been deleted and the existing order reduced by 30%. In case of Elmec there have been stray cases only for which the firm has been advised to improve their QC. Ref. made to other sheds for performance details as not many similar failures reported. Development of electronic buzzer taken in hand and PO has been placed. Closed.
37	A reliable water level indicator in cab be developed as std equipment. There are failures of locos in electrified territory due to "ASD due to LW". & and the practice is to check water level at loco roof, which is risky in electrified territory. Water level gauge provided in the rad. room is not effective because the glass goes yellow.(SCR &ED).	M/s Allied and Hem Electric decategorized and procurement by Railways should be stopped. Performance spec prepared by DLW for electronic water level indicator cum switch. Aston make was provided in all WDM3Ds initially; cut in for WDG3A implemented from 04-05. Meanwhile, M/s Danfoss & Pricol also approached to develop the item and dev. orders shall be placed shortly. Closed.
38	Use of Rotex magnet valves instead of GPRs(GY)	Testing of suitability of the valve for EP contactors done and the response found superior. BHEL advised to fit on ten loco sets to begin with. Closed.
39	Failure of circuit breakers of KKI make (LDH) Review of circuit breaker spec required due to complaints of variation in tripping time etc.; Other issues raised during the workshop held at DLW.	The matter referred to RDSO for review of specification. Meanwhile, the performance of M/s KKI is being monitored. Some cases reported. All zonal railways have been requested to give the details for study & further action. Development order on M/s Esprit is also being pursued and type tests completed successfully. It is under consideration that breakers be made BHEL kit items and only GE/GM spec breakers, as used on WDG4/P4 or micro locos. Meanwhile, the issues were taken up in detail with M/s KKI and sheds educated about correct adjustments as tampering can lead to "dolly free" type complaints. Complaints have reduced. Closed.
40	Failures of Hirect make self-cooled rectifiers, e.g. Failure of power rectifier S.No.2001/H1004 of Loco No.14968 WDG3A(GY); Failure of AC fuel pump motor with built in inverter on self-cooled rectifier on Loco No.14966 - NFR/NGC. PDR (Hind) breaking of insulator and no spare(NKJ) Failure of one modified Mane Patil motor on 14958 due to shorted comm. Segment at NKJ	The firm has modified the DC blower motor and its mounting. Free replacements done for 35 blowers and the modified design is working satisfactorily. Under monitoring as two cases in which the temp switch did not work have come to light; the rectifier got burnt in these cases as the same was under operation with the blower turned off. It has been decided to implement NKJ suggestion for this circuit for future procurement, if any. Performance of AC motors on rectifiers was monitored and it has been decided not to use them. Breakage of insulator has been

	Problem/Suggestion	Action taken
		investigated; design change not felt necessary.
41	Failures of AC f/p & c/c motors, e.g., Inverter circuit of fuel pump motor found defective on Loco No.14122 - NWR/BGKT; Failure of AC f/p motor Loco 14119/NER/GD; starting to run but getting stopped immediately. AC FP motor is taking excessive current in two phases (KJM, 14999).	Performance of AC motors is under close monitoring by RDSO and DLW and full implementation has not yet been decided. Detailed meeting with RDSO and the firm done at DLW and improvements to be made identified for action by the firm. Since failures and problems continue, decision on switch over to AC motors is on hold.
42	AAL make paperless speedometer not working due to CPU card loose as its holding bracket broken (SN- TDM-0203019). (NGC, 14965, 14970); Age no. of similar complaints from other sheds on AAL make. Complaints in respect of inadequate memory	Supplies from the firm withheld and detailed investigation taken in hand in association with RDSO. The firm has improved the memory and other aspects and the same has been cleared by RDSO. No problem being reported at present. Closed.
43	General workmanship from electrical side regarding quality of crimping, tightness of connections improper securing of various cables causing power ground due to rubbing with each other and with loco body. (NGC)	Refer para 35 also. The complaint is very omnibus in nature . In any case, since this has been a weak area of DLW, an officer is specially nominated to keep making checks in this area for continuous improvements. Complaints have been eliminated. Closed.
44	Water ingress/accumulation in Venus & Matsushi LED marker lights (NKJ, 13026, 13027, 14946)	Although the design is water proof, this defect has cropped up due to quality problem of vendors. RDSO advised to make special testing during the fresh vendor approval exercise in hand at present. Closed.
45	Improvement in aesthetics of swtich box of KKI make required (UDL)	The issue was addressed by DLW in detail and proper fabrication as well as powder coating has been introduced. Closed.
46	Head light failed on 8.8.03 due to 52-M wire crimping got cut (KJM, 14999).	See SN 35. Closed.
47	Poor performance of Laxven make Speed Recorder (KJM, 14999; KJM, NKJ, NGC).	Serious complaint was lodged by NGC. The issue has been addressed by shed and the complaints existed mainly in the first lot of 14 recorders. All the problems have been resolved at NGC and there are hardly any complaints from other sheds. Closed.
48	Harness wire near ACCR rubbing with pipe, same secured properly. (NKJ, 13033).	This is basically a workmanship problem and does not need any design change. Shop has been advised. Closed.
49	CK-1, CK-2 connection cables rubbing with frame; securing done properly (NKJ, 13033).	Design changed in respect of layout of cables and implemented. Closed.
50	CCM connection wires conduit pipe clamping not done and clamping done. (NKJ, 13032).	This is basically a workmanship problem and does not need any design change as conduiting exists in the drawings. Shop has been advised. Closed.
51	BKBL 'O' ring of air chamber to prevent air found missing; same fitted (NKJ, 13029).	This is basically a case of overlooking provision by shops. Shop/inspection has been advised. Closed.
52	Cables/busbar connection found loose, same tightened & separator given. (NKJ, 13029).	Shop/Inspection advised to modify the size of separator to avoid loosening with vibrations. Closed.
53	GFLOR ckt to be modified as per RDSO IB; protection of reset coil due to prolonged pressing of GFLOR push button(ED)	Implemented. Closed.

	Problem/Suggestion	Action taken
54	FPC not picking up due to 13 no. wire loop at b/panel not passing supply; main wire at back panel found broken behind thimble inside sleeve due to poor crimping. (LDH, 14105).	See SN 35. Closed.
55	Push button provided for horns, and other electrical application giving problem i.e. plastic portion came out(NKJ)	Push button type (mushroom construction) and location changed to arrest these failures. No problem at present. Closed.
56	Failures of GM Loco design of LWS fitted on new locos 13052 & 13044 WDG3A(PA)	These LWSs work correctly on GM locomotives. It is possible that a mistake has been made in connecting pipe line. The issue is under examination.
57	WW governor resistor pack found open circuited on loco 17889 failed resulting in loadmeter fluctuating and jerk LDH)	This appears to be a stray case as no other case reported. The firm has been advised to visit the shed and submit investigation report.
58	No. 6 TM "FF" cable term. shoe & carbody cable "FF6" overheated though the connection bolts & nuts were tight; this is due to improper crimping of cable. FF Cable crimped by DLW during commissioning of loco 14798 (ED)	The shed has been advised to send the failed cable to DLW which has not been received yet.
59	Loco14131 failed due to IR value of TM armature (no. 4689897) found zero. This traction motor was commissioned on 08.06.02 and failed on 11.02.04 (HWH).	This is a serious case as such failures have almost been eliminated. BHEL has been asked to submit failure report early.

Specific inspection-related complaints

Problem		DLW's observation
1	LO leakage from dummies, flanges and adapters on new locos from DLW (UDL) LO cooler inlet flange jt leaking on 3 locos (HWH) Lube oil leakage from main header gasket	AIO/V deputed to visit UDL and study the problem first hand. With the PTLOC, LO cooler inlet flange joint is not under pressure; only a quality problem. In respect of LO leakage as a whole, detailed checks are in place, including use of paper below vulnerable joints to detect leakages; the situation is much better than earlier. Closed.
2	Air dryers flexible conduit rubbing with pipes, break system etc. alternative conduit layout reqd. (BGKT Shed). Poor air dryer conduit welding (NGC)	The design issues with M/s Knorr taken up for future supplies. Meanwhile, Inspection tightened in respect of welding quality. Closed.
3	All FTTM and RTTM blower base bolts work out very fast; quality of workmanship and the bolts to be improved.(GOC)	Quality of available RTMB bolts found correct. Many bolts of non-std make like HiFast, J-mark etc., however, in stock. Advice given for rejection and not employ any non-std bolts. Closed.
4	Radiator & expressor compartment cracked(HWH)	Shed requested to elaborate, no serious issue found. Closed.
5	Improper fitment of gauge pipes and the control cables resulting in rubbing and failure of cable leading to ground(13003 & 5; LDH).	Pipe layout improved and implemented. Under strict inspection.
6	Diff bet vac. level on dummy & 8 mm leak hole test plate should be 3 cm and on 8 mm leak hole, vac. level of at least 53 cm should be achieved. Problem reported in many locomotives from ER, GY and NKJ. Fluctuation problem also reported even on recent locomotives (13018; UDL)	Extensive action has been taken by DLW to stick to the guidelines but practical difficulty is obtained due to minor variations in equipment like Sabwabco VA1B valves. Efforts are made to eliminate even very minor leakages by conducting flame tests etc. Placed under strict inspection as this is basically an issue of marginal design and quality problems.
7	Abnormal sound from brg and inner rotor rubbing with drum on newly manufactured ECCs of BHEL	Matter referred to D/Inspection RDSO. Under monitoring at DLW also.
8	The nipple of copper pipe connecting water riser to turbo vent pocket becomes loose & works out at the water riser end, which causes water leakage. (HWH)	Sample checks made and no specific problem detected. Likely to improve with introduction of double ferrule fittings.
9	Air leakage from nipple at air flow indicator causing malfunction of auto flasher on two loco s (HWH). Control air leakage from flexible pneumatic hose as its cone was loosened due to improper feruling by DLW (NGC & HWH).	This problem would be eliminated with the introduction of double ferrule fittings. Meanwhile workmanship has to be improved at DLW. Control air leakage to be monitored specifically.
10	GE make TSC damaged on 11.6.03 due to air inlet rubber sucked inside the TSC. (LDH, 13003).	The design and material in use found okay; this primarily took place due to improper fitment at DLW. Inspection advised suitably.
11	WW Gov. setting 350-1000 RPM. WW Gov. removed for overhauling and RPM setting done (NKJ, 13032).	Inspection advised to tighten checks in this area.
12	U/frame cables should not be painted(UDL).	Inspection advised to tighten checks in this area.

Problem		DLW's observation
13	BAP sensing pipe badly rusted and choked on 13 series locomotives. (NGC)	This may be a stray case. Inspection advised to make checks and ensure that this is not permitted.
14	Bubble collectors are not fully aligned on some 13 series recent locomotives even after the design modification done by DLW1(GY & NKJ)	Fitment of ABB/Hispano turbos at DLW was very occasional in recent past but the same has started. This aspect to be under special inspection as the design modification done for the same should solve the problem.
15	Sanding not working on many locos (UDL) Sanders not working as wire No.64 uncoupled from back TB or wire no.4 on R/C/S of sanding magnet valve found uncoupled from lug. Lug changed and connection done. (NKJ:13025 &26) Sanders not found in wkg condition. (NKJ, 13036)	Inspection advised to check specifically in future.
16	Tacho Gen. Backlash found 0.004", same adjusted. (NKJ:13022 & 23); Right side cam gear cover uncoupled & gasket of 1/16" added for tacho gen backlash as found less i.e. 010".(NKJ,13029 & 33)	Checks introduced to avoid recurrence.
17	Expressor: 0.030" misalignment (sides) and 0.015" misalignment (top/bottom) found against maximum specified 0.006" in new locos 964, 966 & 969 (NGC).	Placed under strict inspection earlier. Cross checks done to measure alignment before dispatch of locomotives; found to be disturbed from the values before load test. Under study.
18	Exp discharge pipe found worked out from flange as the 60 mm pipe had no grip on the flange; the male threads on pipe worn out.(NFRly. & Vatva). Expressor HP discharge gasket burst on 14992 & 96 at UDL and one 13 series locomotive on SCRLy.	It was also checked with a view to improving the design but it was seen that such a change was not warranted; basically a quality issue to be addressed accordingly.
19	Length of B.P. and F.P. angle cock pipe with resp to buffer plate to be standardized (NKJ, 13028).	There is only some minor variation in the length due to manufacturing inaccuracies; Inspection advised suitably.
20	Paper or plastic getting sucked form the swan neck causing failure of brake system on new locomotives(NKJ).	A net is to be provided near swan neck permanently as per drg. but not being done at present.
21	PCS indication on; PCS found defective, same changed. (NKJ:13022 &23).	Inspection wing advised for checks
22	5"X1" metal piece found in N.2 T/M (BHEL make) causing repeated power ground. (NGC, 14965).	Inspection wing advised for checks
23	Air leakage observed in under truck; air pipe line joint e.g. MR equalizing pipe union nut, brake cylinder equalizing pipe union nut. (NKJ;13025).	Inspection wing advised for checks
24	Lube oil pump discharge pipe bottom dummy leaking badly. (NKJ, 13035 & 13036)	Inspection wing advised for checks
25	Shot blasting shot found in CP and control stand (UDL, 13046)	Inspection wing advised for checks
26	Engine sump lube oil drain, water header and LO pump discharge pipe dummies found loose on new locomotives or leaking (NKJ & NGC).	Inspection wing advised for checks

Section B
Change Notices

Summary of Important & relevant Change Notices (August 03 onwards)

R/DESIGN/CHANGE/MONITOR

S/N	Brief Description of Modification.	Change Notice Number and date.	Loco type	Cut in point (loco No. month & yr.)	Major Drg. No. (if retrofittable)	RDSO Ref.	Retrofittable (✓ or x)		
							DMW	POH SHOP	SHED
1 Veh	For supply sufficient air to operate window wiper motors, 04 nos. window wiper valves have been incorporated in place of 02 nos.	CDE/V/WDG3A& WDM3D/628 dt. .22.01.04	WDG3A/ WDM3D	With immediate effect	TPL-8646/11566838, 11565688 Alt-c, 11568483/ Alt-a, 1568495/ Alt-a ,11568100/ Alt-b,11459888/ Alt-c	-	x	x	x
2 Veh	1.Cab floor support used in place of wooden beam in floor assly 2. Aluminium finish strip used in flooring in place of MDF finish strip & threshold piece. 3.Driver seat & floor covering revised.	CDE/V/WDS6 /626 dt. 03.01.04	WDS6	WDS6-518	228V095740 /11048141 Alt-e	-	x	x	x
3 Veh	Cab lining made applicable with metal sheets (steel sheet in side & Aluminium perforated sheets in roof) in place of MDF.	CDE/V/WDM2, BR, WDM3A, WDG3A & WDM3D / 627 dt. 06.01.04	WDM2BR WDM3A WDG3A WDM3D	WDM3A-14114, WDM2-2626, WDG3A-13091, WDM3D-11106	TPL-9098/11541477 Alt-d TPL-2719/11541970 Alt-d TPL-6760/11540620 Alt-n TPL-2763/11543516 Alt-a	-	x	x	x
4 Veh	To prevent dropping / loosening of axle box end cover bolts, wire locking has been incorporated.	CDE/V/WDG3A/ 619 dt. 23-10-03	WDG3A/ WDM3D	With immediate effect	TPL-8688/ 11029730 Alt-b TPL-8690/11027400 Alt-b TPL-8689/11028592 Alt-a TPL-3351/11028944 Alt-c	-	✓	✓	✓
5 Veh	For mounting of visor assy, cab window visor arrgt. revised and pad tapping incorporated.	CDE/V/WDG3A/ 622 dt. 08.11.03	WDG3A WDM3A	WDG3A -13128 WDM3A-14144	247V901225/11041201 Alt-c TPL-8518/11458562 Alt-a	-	✓	✓	✓
6 Veh	For elimination of MDF completely and better quality, aluminium finish strip has been incorporated in flooring.	CDE/V/WDG3A/ WDM3D / 620 dt. 28-10-03	WDG3A/ WDM3D	With immediate effect	TPL-6755/11540618 Alt-e	-	✓	✓	✓
1. Eng	New drawings made for ABB TPR-61 Turbocharger for high HP locomotives (3300 hp & 3600 HP).	CDE/ENG/16 CYL/ 2003/030 dt. 07.10.03	WDG3A WDP3A WDM3A WDM3D	WDG3A-13086 WDP3A -15545 WDM3A-14144 WDM3D-11111	SKE-1296/10083662 Alt- Nil	-	✓	✓	✓
2. Eng	Cylinder Head less valve assy. made and product structure revised accordingly.	CDE/ENG/16 CYL/ 12 CYL/ 2003/026 dt. 23.09.03	WDM2 WDP1 WDM3A WDP3A WDG3A	WDM2-2623 WDP1-15073 WDM3A-14144 WDP3A -15545 WDG3A-13067	SKE-1176 Alt.-s, 22A 71170 Alt.-s,SKE-1261 Alt.- Nil	-	✓	✓	✓

3. Eng	To avoid breakage of bend area, 90° elbow end fittings in fuel oil cross over hose revised to straight end fittings.	CDE/ENG/6 CYL/ 2003/034 dt. 21.10.03	WDG3A WDP3A WDM3A WDM3D	WDM2-2537 WDM3D-11111 WDP1-15073 WDG3A-13108 WDP3A -15545 WDM3A-14144 DG Set-0014	40AA77796-2/10010208 Alt-'J', TPE-19-0024/ 11329324 Alt-'nil'	-	✓	✓	✓
4. Eng	For drainage of rain water from exhaust stack in 6 cyl turbo, Steel tube incorporated,	CDE/ENG/6CYL/ 2003/033, dt 18.10.03	YDM4/ VNR	Routine	SKE-1177/ 10010968 Alt-'c' 26AA71750/ 10121158 Alt-'f' 40C74068-95/ 10235966 Alt-'a'	-	✓	✓	x
5. Eng	To arrest the leakage during service from fittings of lube oil header, the fittings made purchased.	CDE/ENG/16CYL/ 12CYL/2003/037 dt. 01.10.03	WDG3A WDM3D WDM2C	With immediate effect	40D71068-3/10060029,Alt-'VD'	-	✓	✓	✓
6. Eng	Machining drawing revised due to narrow & small zone of both side of M.B. cap bearing made flat to overcome technical difficulties during production of M.B. cap (forging) as expressed by the firm (M/s SIFL & FFL)	CDE/ENG/16CYL/ 12CYL/2003/039 dt.15.11.03	WDG3A WDM3D WDM3A	WDG3A-13068 WDM3D-11110 WDP3A -15545 DG Set-0007	14A72150-4/10142034 Alt-'f'	-	✓	✓	x
7. Eng	GE Single volute Turbocharger introduced for easy maintenance & interchangeability with other Turbos like ABB, NAP & Hispano-suiza	CDE/ENG/16CYL/ 2004/005 dt. 10.01.04	WDG3A	WG3A - 461 (NTPC)	SKE-1294 / 10083625 Alt-'nil'	-	✓	x	x
8. Eng	To avoid failure & proper fitment, the quantity of taper dowel has been revised as given bellow. 1. Taper dowel to part no. 10240299, qty 2 was 1. 2. Taper dowel 10240287, qty 1 was 2.	CDE/ENG/16CYL/ 2003/041. dt.21.11.03	WDG3A WDM3D WDM3A	With immediate effect	36AA76391/10050188 Alt-'a'	-	✓	✓	✓
9. Eng	To Improve the quality of yoke control linkage by changing the item from fabrication to forge.	CDE/ENG/16CYL/ 12CYL/6CYL/ 2004/03 dt. 07.01.04.	WDG3A WDM3D WDM3A WDP1 WDS6 YDM4	Oct-2004/ WDG3A-13133	32D74285-2 / 10140785, Alt-'XDB' 32D74299/10140761 Alt-'YDB' 32D74285-1/10140773 Alt-'XDB' 36D76146-1/10141030 Alt-'XDA'	-	✓	✓	✓

10. Eng	Nut (special) to part no. 10080120 is replaced by part no.10082955 for easier fitment of cylinder head 251 plus (GE)	CDE/ENG/16CYL/ 12CYL/6CYL/ 2004/04 dt.08.01.04.	WDG3A WDM3D WDM3A WDP1 WDS6 YDM4	WDM2-2637 WDG3A -13133 WDM3D-11111 WDM3A -14144 WDP3A -15545 Dgset-0011 WDP1--15073 WDS6-0516	15A72150/10082955 Alt-'c'.	-	✓	✓	✓
11. Eng	For quick & easy drainage of lube oil from C.C. exhauster, the following has been changed 1. Hole 3/4" pipe tap was 1/2" pipe tap. 2. 1/2" hex soc. Pipe plug to part no. 11304285 deleted. 3. 3/4" hex soc. Pipe plug to part no. 11291709 added.	CDE/ENG/16CYL/ 12CYL/2003/038 dt.05.11.03	WDG3A WDM3D WDM2C	WDG3A -13078 WDM3D-11106 WDM3A -14144	16A74207 / 10120040 Alt-'f' 35EE71073 / 10010040 Alt-'c' SKE-1233 / 10124846 Alt-'a' TPE-01-0055 / 10011055 Alt-'a'	-	✓	x	x
12. Eng	To arrest the looseness of oil seal, close tolerance on bore dia has been provided..	CDE/ENG/16CYL/ 2004/009, dt. 21.01.04	WDM3D WDM3A	WDM2-2629	126A79013 / 0120506	-	x	x	x
13. Eng	To increase the chrome plate thickness, the I.D. of machined liner has been increased.	CDE/ENG/16CYL/ 12CYL/6CYL/ 2004/007 dt. 13.01.04	WDG3A WDM3D WDM3A WDP1 WDS6	WDM2-2637 WDG3A -13091 WDM3D-11106 WDM3A -14144 WDP3A -15545 Dgset-0005 WDP1--15073 WDS6-0003	SKE-1001/10124603 Alt-'c' TPE-01-0051/10123416 Alt-'q'	-	✓	✓	x
14. Eng	For better lubrication of cam roller pin, depth & width of pin oil hole pocket modified.	CDE/ENG/16CYL/ 12CYL/6CYL/2004/ 010 dt. 21.01.04	WDG3A WDM3D WDM3A WDP1 WDS6	WDM2-2628 WDM3A -14144, WDM3D-11106, WDG3A - 13068 WDP3A -15545, Dgset-0004 WDP1-15073 WDS6-0511	10211720 Alt – 'j', 10215529 Alt-'a'	-	✓	✓	✓

15. Eng	For preventing leakage during service, the following has been changed/incorporated in testing of G.I Casing (MG) 1 Testing of gas passages revised to 100 PSI, with hot water at 80°C. 2 For critical welding joints, radiographic testing incorporated. 3 For welding, the electrode is specified as E-6020 & 6.3-mm dia.	CDE/ENG/6CYL/ 2003/046 dt.26.12.03.	WDS6 YDM4	With immediate effect	26AA72354-2 / 10080636 Alt-'a' 26AA71353-2 / 10122655 Alt-'a'	-	x	x	x
1 Elect	To prevent rubbing of cables, the layout of TM 2 & 5 cables has been changed.	CDE/EL/WDG3A/ 2003-27/2358 dt. 09.10.03.	WDG3A	With immediate effect	12001119 (R17)	-	✓	✓	✓
2 Elect	Provision of Electric Horn in BR Locos.	CDE/EL/WDM2/ BR/2003-8/2359 dt.19.11.03	WDM2/BR	With immediate effect.	12003608 (R2)	-	✓	✓	✓
3 Elect	G.M. Type Wire Terminal to part no.18340234 has been provided In place of Wire Terminal to part no. 12347097.	CDE/EL/ALL TYPE /2003-29 / 2360 dt.02.12.03	WDG3A	WDG3A -13158	According to Wire cutting chart	-	✓	✓	✓
4 Elect	To improve the quality of (Modified) C.P. for WDG3A by incorporation of T.Bs., Grommets, Rubber channels on BKT & Reverser mounting channels etc.	CDE/EL/WDG3A/ 2004- 01/2361 dt. 05.01.04	WDG3A	With immediate effect.	12005332 (R2)	-	✓	✓	✓
5 Elect	To improve the quality of WDM3D, loco control desks with provision of automatic switch on flasher light & OK Signal light. has been incorporated.	CDE/ EL /WDM3D/ 2004-2/2362 dt..06.01.04	WDM3D	With immediate effect.	12003773 (R1), 12003761 (R1)	-	✓	✓	✓
6. Elect	Drawing for microprocessor control desks of GE made common with Siemens.	CDE/ EL/ WDG3A/ μp/2004-3/2363 dt.14.01.04	WDG3A/ μp	With immediate effect.	12003748 (R3), 12003750 (R3)	-	x	x	x

Other change Notices (August 03 onwards)

1 Veh	Steel plate changed to steel angle due to problem in bending in s hop.	CDE/V/WDG3A/ WDM3D/623 dt. 10.12.03	WDG3A/ WDM3D	WDG3A -13073 & ONWARD WDM3D-11103 &ONWARD	TPL-8861/11544363 Alt-e TPL-8860/11544351 Alt-e TPL-2924/11544636 Alt-c TPL-2925/11544648 Alt-c	--	x	x	x
2 Veh	Drg. of Long hood assly. updated for hinge & lock.	CDE/V/WDG3A/ 614 dt.12.09.03	WDG3A	WDG3A -13077 & onwards	TPL-8737sh.1of2/11543541Alt-e	--	✓	x	x
3 Veh	To avoid cutting of cable in short hood, cable truf incorporated.	CDE/V/WDG3A/ 617 dt. 16-10-03	WDG3A	WDG3A -13068 & onwards	TPL-6903/ 11036163 Alt- aa	--	✓	✓	✓
1. Eng	Link (Gov. Control Linkage) is to be procured as finished ready for improvement in quality.	CDE/ENG/6 CYL/ 2003/032 dt. 14.10.03	YDM4		36D 76107/ 10192748,Alt-'XDA'	--	✓	✓	✓
2. Eng	Support valve lever (m/c) and air elbow made purchased finished in placed of casting to overcome the problem of loss of man- machine hours in workshop.	CDE/ENG/16CYL/ 12CYL/6CYL/ 3300HP/3600HP& ABOVE/2003/035 dt .28.10.03	WDM2, WDM3D WDP1 WDM3A WDP3A DGSET	WDM2-2637, WDM3D-11111 WDP1-15073 WDM3A -14144 WDP3A -15545 DG SET-OO14	24B 72077 / 10120026 Alt -'d' ,28A71142-2 / 10120294,Alt-'JDC'	--	✓	✓	✓
3. Eng	New drg. made for main base (machining) to reduce the risk of failure of foundation bolts due to vibration of 3600 hp. DG set	CDE/ENG/16CYL/ 2003/040 dt.19.11.03	DG Set	DG Set-0001	SKE-1299/ 10021449 Alt-'Nil',SKE-1300/10241760 Alt-'Nil'	--	✓	x	x
4. Eng	Lube oil piping (Strainer to filter & filter to turbo inlet) has been incorporated in the drawing to update the product structure.	CDE/ENG/16CYL/ 2003/042. dt.21.11.03	WDG3A WDM3D WDM3A	WDG3A -13090	SKE-1042 / 10082979 Alt-'a'	--	✓	✓	x
5. Eng	Assy. fuel injection Tube for 3600 HP DG set will be separately purchased due to modified material.	CDE/ ENG/16 CYL. -3600HP/ 2003/045 dt. 20.12.03	DG Set	DG set- 0001 & on ward	SKE-1320 / 10052082 Alt-'a'	--	x	x	x
6. Eng	To improve in quality, lever Gov. control linkage made purchase item from shop manufactured.	CDE/ENG/16CYL/ 12CYL/2003/043 dt.06.12.03	WDM2, WDM3D WDM3A WDP3A WDG3A	WDM2-2637, WDM3D-11111 WDM3A -14144 WDP3A -15545 WDG3A -13108	36D76182 / 10220320 Alt - 'Nil'	--	✓	✓	✓

7. Eng	To improve the quality, 7 engine locking plates made purchase item from s hop manufacture.	CDE/ENG/16CYL/ 12CYL/6CYL/2003/ 044 dt.17.12.03	WDM2, WDM3D WDM3A WDP3A WDG3A	WDM2-2637, WDM3D-11111 WDM3A -14144 WDP3A -15545 WDG3A -13086	10180412 Alt - 'b' 10180266 Alt - 'a' 10184302 Alt - 'a' 10190089 Alt - 'a' 10191367 Alt - 'a' 10191343 Alt - 'a' 15313268 Alt - 'e'	--	✓	✓	✓
8. Eng	To avoid welding crack, lube oil strainer housing made purchase.	CDE/ENG/16CYL/ 12CYL/2004/001 dt. 2.1.04	WDG3A WDM3D WDM3A WDP1	WDM2-2637, WDP1-15073 WDM3A -14144 WDP3A -15545 WDG3A -13114	SKE-1150 / 10062956 Alt-'d' 10063122,TPE-06-0093,Alt-'Nil'	--	✓	✓	✓
9. Eng	Description corrected as Flexible Shaft for OST (6 Cyl. Engine)	CDE/ENG/6CYL/ 2004/02 dt. 05.01.04.	WDS6 YDM4	With immediate effect	10240950/72-00115-001,Alt- 'f'	--	✓	✓	✓
10. Eng	To avoid fouling with after cooler housing, top corner of the mounting bracket modified.	CDE/ENG/16CYL/ 2004/006 dt. 10.01.04	WDG3A WDM3D WDM3A WDP3A Dg set	WDG3A -13091 WDM3D-11106 WDM3A -14144 WDP3A -15545 Dgset-0005	10083145 Alt-'f', 10083091 Alt-'d', 10083194 & 10083200Alt-'b'	--	✓	✓	x
11. Eng	To improve the quality of assy. fuel pump control lever (double spring) and assy. cross-link RS to LS control shaft made purchase finished item.	CDE/ENG/16CYL/ 12CYL/6CYL/ 3300HP/3600HP/ 2004/008 dt. 10.01.04	WDG3A WDM3D WDM3A WDP1 WDS6	WDM2-2635, 2637 WDG3A -13127, WDM3D-11106, 11111 WDM3A -14144, WDP3A -15545, Dgset-0014 WDP1--15073 WDS6-0516, 0521	32 A 74309/10050772, 10051144,10051156, 10051152,10050164	--	✓	✓	✓

Section C
Failure investigations

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**FAILURE INVESTIGATION OF CON ROD BEARING OF LOCO NO. 17686
RECEIVED FROM DSL SHED/ NKJ**

BACK GROUND:

It was stated that the R-4 top connecting rod bearing of the above loco was found broken into two pieces during 3 yearly schedule examination on 28.05.03. This bearing was fitted at KJM on 08.09.01. The defective bearing was sent to DLW for failure investigation vide letter no. NKJ.DM.01.1 dtd. 13.08.03.

VISUAL EXAMINATION:

Marking on the broken bearing is KOEL 12 99 G. It had broken into two pieces. Photograph showing the breakage is printed below,



The central portion of the plated side shows biased wear in the area which had broken and separated.

Shed had also sent the corresponding bottom bearing. Marking on this bearing is KOEL 10 99 H. There was no abnormal wear or peel off in this bearing. Both these bearings, however show abnormal scoring and impregnation of foreign material on the plating surface.

CHEMISTRY:	% OF	OBTAINED	SPECIFIED
Over layer	Sn	8.70	8-12
	Cu	2.20	2-3
	Pb	Remainder	Remainder
Middle layer	Sn	2.6	2-3
	Pb	23.02	23-27
	Cu	Remainder	Remainder
Steel back	C	0.10	0.08-0.13

MICRO EXAMINATION:

Micro specimen cut from undamaged area was examined. It revealed that, the thickness of over layer was 1.5 thou against specified 0.8 to 1.8 thou, thickness

of middle layer was 32 thou against specified 15 to 35 thou, nickel dam was present and distribution of lead was uniform in the middle layer.

REMARKS:

Tests carried out indicate that, there was no deficiency in the material of the bearing. This is further confirmed by the fact that the lower bearing which is of the same make is in good health except for abnormal scoring and impregnation of foreign material.

Visual examination indicates that the lube oil was dirty and the bearing was over loaded in the middle. This could be due to improper surface of the con rod housing/ crank shaft pin or presence of some large size foreign material between the bearing and the crankshaft pin. The crank shaft pin appears to be normal because the lower bearing does not show any distress. Therefore the con rod big end housing may be the culprit. This housing needs to be opened and examined, because in such case the bearing subsequently fitted also may be showing distress. In case there is no distress in the newly installed bearing or in case no such defect was noticed at the time of installation of the new bearing, the breakage of the bearing reported above may be due to overload owing to ingress of some large size foreign material. Other evidences also indicate that the lube oil was dirty.

No. C & M /F-74

Dt. 28.11.03

**FAILURE INVESTIGATION OF CON ROD BEARING SHELL OF LOCO NO.
14950 RECEIVED FROM DSL SHED/ NKJ**

BACK GROUND:

It was stated that, pitting marks were noticed on the R-2 con rod bearing top shell of the above loco on 07.07.03 during schedule examination. This loco was commissioned at DLW on 23.11.01. The defective bearing shell was sent to DLW for failure investigation vide letter no. NKJ.DM.01.1 dtd. 11.08.03.

VISUAL EXAMINATION:

Marking on the above bearing is GMH 05.01. The photograph of the failed bearing, which is printed below shows pitting and progressive crack of the bronze layer in about 4"x1" area in one corner. There is no evidence of any abuse of the bearing. Even the plating does not show any wear, except few small networks of cracks (in plating) in the same area where pitting of the middle layer has been observed.



CHEMISTRY:

	% OF	OBTAINED	SPECIFIED
Over layer	Sn	8.90	8-10
	Cu	2.2	2-3
	Pb	Remainder	Remainder
Middle layer	Sn	2.72	2-3
	Pb	22.98	23-27
	Cu	Remainder	Remainder
Steel back	C	0.12	0.08-0.13

MICRO EXAMINATION:

Micro specimen was cut from undamaged portion. Thickness of over layer was 1.5 thou against specified 0.8 to 1.8 thou. Thickness of middle layer was 34 thou against specified 15 to 35 thou. Nickel dam was present . Distribution of lead was uniform in middle layer.

REMARKS:

Chemical composition of the different layers is satisfactory. Microstructures also are satisfactory. Visual examination reveals chip out of the sintered (middle) layer in fatigue mode in small chips. There is no evidence of any abuse of the bearing. This sintered layer had chipped out because it could not withstand loads. The bearing was not sintered properly.

No. C & M /F-73

Dt. 29.11.03

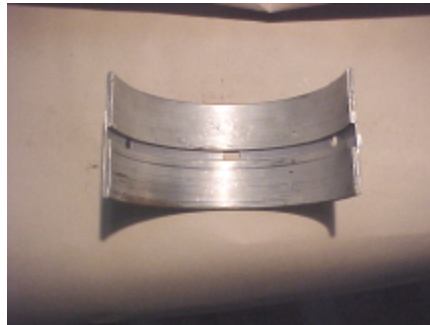
FAILURE INVESTIGATION OF M.B.SHELL OF LOCO NO. 14946 RECEIVED FROM DSL SHED/ NKJ

BACK GROUND:

It was stated that loco no. 14946 was stopped on 07.06.03 for yearly schedule. During the schedule examination main bearing no.7 top shell was changed as copper top layer was badly peeled off. This loco was commissioned on 1.11.01. ACMT /Katni had observed in his investigation report that higher concentrations of silica were reported earlier in the lube oil of this loco. The damaged shell was sent to DLW for failure investigation vide letter no. NKJ.DM.01.01 dtd. 13.08.03.

VISUAL EXAMINATION:

Marking on the M.B.Shell is GMH indicating that it is Gletlager make. Several scoring marks; some of them quite deep; were noticed on the plated side of the above bearing. There was no evidence of wear, but about 5% of the plating had peeled off from the area which was badly scored. Photograph of the damaged shell is printed below.



CHEMISTRY:	% OF	OBTAINED	SPECIFIED
Over layer	Sn	8.50	8-12
	Cu	2.22	2-3
	Pb	Remainder	Remainder
Middle layer	Sn	2.90	2-4
	Pb	23.02	23-27
	Cu	Remainder	Remainder
Steel back	C	0.10	0.08-0.13

MICRO EXAMINATION:

Micro specimen cut from undamaged area on examination revealed that,

- i) Thickness of over layer was 1.5 thou against specified 0.8 to 1.8 thou.
- ii) Thickness of middle layer was 30 thou against specified 15 to 35 thou.
- iii) Nickel dam was present and,
- iv) Distribution of lead was uniform in the middle layer.

REMARKS:

There is no metallurgical deficiency in the bearing material. Visual examination shows presence of deep scoring marks. These scoring marks had developed due to presence of foreign particles in the lube oil. Miner peel off was due to these scoring marks.

No. C & M /F-75

Dt. 27.11.03

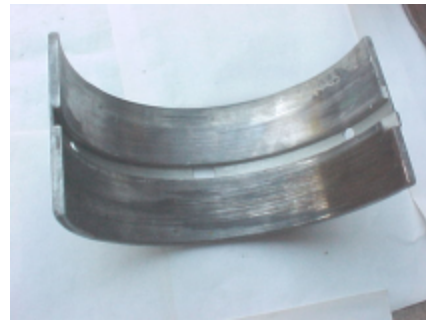
FAILURE INVESTIGATION OF M.B.SHELL OF LOCO NO. 17947 RECEIVED FROM DSL SHED/ LUDHIANA.

BACK GROUND:

It was stated that M.B.Shells of location 2 & 3 of the above loco were found in distressed condition during yearly examination on 16.07.03. This bearing was installed on 17.01.01 The damaged bearing was sent to DLW for failure investigation vide letter no. DSL/LDH/Tech/7 dtd. 21.11.03.

VISUAL EXAMINATION:

U3 and L3 bearings were sent to DLW for investigation. Marking on them indicates that they were of GMH make. The upper bearing revealed scoring of over layer in half of the bearing making streak mark. There was no any other damage. The lower bearing had broken into two parts from the oil groove. Machining of the groove showed absence of radius at the change of section. Its plated side revealed biased removal of over layer and streaking in the middle layer. The wear was excessive in the affected half side towards one of the edges. The bronze layer viewed bluing besides deep and numerous scoring marks. There was evidence of miner fretting on the bearing back; but lugs were in good condition. Photograph of both the bearings is printed below,



CHEMISTRY:

	% OF	OBTAINED	SPECIFIED
Over layer	Worn out.		
Middle layer	Sn	2.62	2-4
	Pb	23.10	23-27
	Cu	Remainder	Remainder
Steel back	C	0.11	0.08-0.13

MICRO EXAMINATION:

Micro specimen cut from undamaged area on examination revealed that,

- iii) Thickness of over layer was 1.5 thou against specified 0.8 to 1.8 thou.
- iv) Thickness of middle layer was 30 thou against specified 15 to 35 thou.
- iii) Nickel dam was present and,
- v) Distribution of lead was uniform in the middle layer.

REMARKS:

Chemical compositions are satisfactory. Visual examination reveals that the bearing was not getting properly lubricated in about 40% of the plated section, resulting in biased loading. In fact one of the studs appears to have been over tightened. Visual examination also reveals that formation of the oil groove was not proper. Both these factors appear to have contributed towards its breakage after serving for little more than two years. Presence of deep and numerous scoring marks indicates that, the lube oil filtration needs greater attention.

No. C & M /F-102

Dt. 10.12.03

FAILURE INVESTIGATION OF M.B.SHELL OF LOCO NO. 14098 RECEIVED FROM DSL SHED/ VATVA.

BACK GROUND:

It was stated that indications of bonding failure of overlay was noticed in all except those fitted at location 2 & 5 main bearings of the above loco during M18 examination. One of these bearings (location 8 bottom) was sent to DLW for failure investigation vide letter no. M 233 /161/01/4dtd. 19.11.03. It was fitted on 15.12.01 and removed on 20.07.03.

VISUAL EXAMINATION:

Marking on the bearing is GB 08 01. Examination of steel back side revealed slight fretting and examination of plated side revealed blackening in about 30% of the surface area in center besides several deep scoring marks all over. No failure of overlay or of the middle layer was noticed. Photograph of the above bearing is printed below,



CHEMISTRY:

	% OF	OBTAINED	SPECIFIED
Over layer	Sn	9.56	8-12
	Cu	2.70	2-3
	Pb	Remainder	Remainder
Middle layer	Sn	2.80	2-4
	Pb	23.20	23-27
	Cu	Remainder	Remainder
Steel back	C	0.10	0.08-0.13

MICRO EXAMINATION:

Micro specimen cut from undamaged area on examination revealed that,

- vi) Thickness of over layer was 1.5 thou against specified 0.8 to 1.8 thou.
- vii) Thickness of middle layer was 32 thou against specified 15 to 35 thou.
- iii) Nickel dam was present and,
- iv) Distribution of lead was uniform in the middle layer.

REMARKS:

Chemical compositions are satisfactory. Microstructure also is satisfactory. There is no manufacturing defect in the bearing. It has developed i) black spot in the center due to overheating owing to deficient lubrication and ii) several deep scoring marks due to presence of foreign material in the lube oil.

Operating and maintenance aspects need to be looked into.

No. C & M /F-104

Dt. 11.12.03

FAILURE INVESTIGATION OF M.B.SHELL OF LOCO NO. 17654 RECEIVED FROM DSL SHED/LUDHIANA.

BACK GROUND:

It was stated that during yearly schedule of the above loco on 28.06.03, main bearings at number two location were badly seized and overlay of the bearings of location 1&3 was worn out. The seized bearing of location two was sent to DLW vide letter no. DSL/LDH/Tech/7 dtd. 21.11.03. This bearing was fitted on 14.7.02 by the shed.

VISUAL EXAMINATION:

Marking on both the bearings is KOEL 02 02 1470. Both of them show blackening in one half side of the oil hole, excessive wear of the plated and fusion & fatigue failure of sintered layer. Only about 20% area in one of the bearings did not show any wear. Lugs of both the bearings are undamaged. Photographs of these bearings are printed below,



CHEMISTRY:

	% OF	OBTAINED	SPECIFIED
Over layer	Worn out.		
Middle layer	Sn	2.48	2-4
	Pb	23.08	23-27
	Cu	Remainder	Remainder
Steel back	C	0.11	0.08-0.13

MICRO EXAMINATION:

Micro specimen cut from undamaged area on examination revealed that,

- viii) Thickness of over layer was 1.5 thou against specified 0.8 to 1.8 thou.
- ix) Thickness of middle layer was 28 thou against specified 15 to 35 thou.
- iii) Nickel dam was present and,
- x) Distribution of lead was uniform in the middle layer.

REMARKS:

There is no metallurgical deficiency in the material of the bearings. They have not fretted either. They have seized predominantly towards one side due to lack of lubrication. Probably clearance between the bearing and the shaft was less. Fitting aspects need to be looked into.

No. C & M /F-103

Dt. 12.12.03

FAILURE INVESTIGATION OF MAIN AND THRUST BEARINGS RECEIVED FROM DSL SHED/ NKJ

BACK GROUND:

It was decided during BIM held in Dec 03 that, few main bearings which were changed prematurely, will be sent by diesel shed NKJ to DLW for investigation, so that a decision regarding import of bearings or otherwise may be taken by the Board. Accordingly 8 bearings were sent vide letter dated 11.12.03.

VISUAL EXAMINATION:

LOCO NO. 17397 T-3

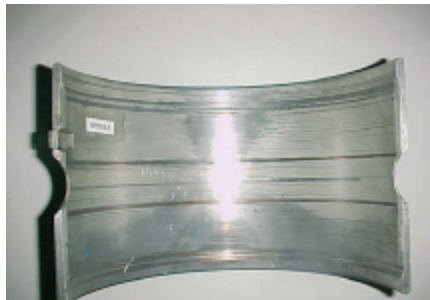
Marking on the bearing is GB.06 00 INT 10150018, P003. Photograph of this bearing is printed below,



Visual examination indicates that, the bearing has several deep scoring marks & the tin flash has peeled off from about 10% of the bearing surface. There is no other damage like layer peel off or chip out.

LOCONO. 14958 T-5

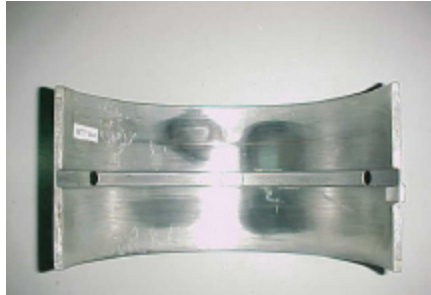
Marking on the bearing is KOEL 10, 01 10150020.



There are several very deep scoring marks on the bearing surface, besides slight exposure of the bronze in between two of such scoring marks. The tin flash also is thick. There is no evidence of layer peel off or chip out.

LOCONO. 16777 B-9

Marking on the bearing is GB 01, 02 INT 10150018 P 007. Photograph of the bearing is printed below,



Visual examination shows that the bearing surface has blackened at four spots. This black spot is surrounded by wear marks. There is also evidence of deep scoring mark at one place and few scratch marks at places. The bearing however does not show any evidence of layer peel off or chip out.

LOCONO. 14958 T-5

Marking on the main bearing is KOEL 10 01 10150020 .



There are several deep scoring marks on the bearing surface. Otherwise, there is no evidence of peel off or chip out.

LOCONO. 17715

Marking on the bearing is GMH 12, 99, 10150018.



Bronze layer of this bearing is exposed in the middle in about 4"X1" area. There are several –several deep scoring marks. No evidence of layer peel off or chip

LOCONO. 14949 T-9

Marking on the thrust bearing is GB 10, 00 10150031 .



The bearing surface shows negligible distress. The bearing shows crack in the fillet of the collar .

LOCONO. 14735

Marking on the thrust bearing is GB 01, 001 10150031.



This bearing also shows crack in the fillet of the collar. There is otherwise no evidence of any damage.

LOCONO. 17261 B4

Marking on the bearing is GMH 12, 99 10150018.



Bronze layer is exposed in about 15% of the bearing area. Steel back shows lack of proper contact with the housing. There are several shallow scoring marks. There is no evidence of any layer peel off or bearing metal chip out.

REMARKS:

- I) Over layer at the top or the bronze layer in the middle has not failed in any case. This indicates that the bearing metal specified is able to withstand loads and quality of manufacture is good. There is no need to change the specification no there is any deficiency in Indian main bearings.
- II) Almost all bearings show deep and several scoring marks. Cleaning of the system during oil change and quality of lube oil filtration is not up to desired level.
- III) Two bearings reveal exposed bronze layer in small area. This is normal wear and has taken place due to deficient lubrication, which is generally the case when engine is started. However such bearings should be replaced once the power assembly has been opened.
- IV) GB make flange bearings have broken from the collar. This problem has been investigated earlier, wherein it was noticed that the depth of the undercut on the back of the collar provided in GB bearings is more than specified. This can be improved without any difficulty. Flange bearings of another make have been found to give flawless service during limited field trials.
- V) In two cases, tin flash has peeled off. Sheds normally assume this as over layer peel off, which is not correct. This layer is provided mainly for aesthetic value addition. Bearing manufacturers have been advised earlier to keep this layer to the bare minimum. This needs to be reiterated.

No. C & M /F- 119- 126 /2003

Dt. 24.12.03

FAILURE INVESTIGATION OF CROSS HEAD BODY PIN AND CROSS HEAD LIFTER OF LOCO NO. 14129 RECEIVED FROM DSL SHED/ HWH

BACK GROUND:

Sr. DME/ HWH had sent one sample each of cross head body with broken pin in side the retainer & broken cross head lifter of loco no. 14129 for failure investigation. Further details were not given. It was not clear if both the above components were involved in single incidence. This loco was turned out from DLW in May 02.

CROSS HEAD BODY PIN :

VISUAL EXAMINATION:

Both the pieces of the broken cross head body pin were received. There was no identification mark on either of them. One of them was pressed in the retainer. Fractured faces of both the pieces were smooth. When examined under magnification, beach marks associated with fatigue type cracks were not visible. The fractured face looked to be smooth due battering. Patches of crystalline failure were noticed in between the battered areas. There were several notches on the outer side of the fractured surface. Photographs of the above two pieces are printed below,



CHEMISTRY:

% OF	OBTAINED		SPECIFIED
	Sample -1	Sample -2	
C	0.44	0.47	0.43-0.50
Si	0.22	0.15	0.10-0.30
Mn	0.68	0.77	Not specified
P	0.037	0.016	0.040 max.
S	0.045	0.006	0.040 max.
Cr	0.21	0.25	Not specified

HARDNESS:

	Sample -1	Sample -2	Specified
(RC) Case	40	49,50	40-50
Core	19,20	19,20	Not specified

MACRO EXAMINATION:

Both the sample were deep etched with 50 % HCl at 70⁰C for half an hour. After examination it did not reveal any abnormality.

MICRO EXAMINATION:

Micro specimen were cut from hardened portion and polished. In unetched condition either of them did not reveal any abnormal inclusion. After etching with nital, case revealed tempered martensite and core revealed pearlite & ferrite. Case depth of hardened portion was 0.046" against 0.031"-0.046" specified.

CROSS HEAD LIFTER:

VISUAL EXAMINATION:

Marking on the cross head lifter is 2002, R, 10140931 E-2. Its one flange was broken from change of section. The fractured face is crystalline. There is evidence of one half inch long crack at the radius of this change of section. Also there is evidence of sharp change at this radius. Photograph of failed cross head lifter is printed below,



CHEMISTRY:

% OF	OBTAINED	SPECIFIED
C	0.41	0.38-0.43
Si	0.25	0.20-0.35
Mn	1.25	0.75-1.00
P	0.026	0.040 max.
S	0.025	0.040 max.
Cr	0.44	0.40-0.60
Mo	0.16	0.15-0.25
Ni	0.56	0.40-0.70
HARDNESS (BHN)	286	269-321

MACRO EXAMINATION:

Did not reveal any significant abnormality on the fractured surface after etching in hydrochloric acid 1:1 for one hour at room temperature

MICRO EXAMINATION:

Micro specimen was cut from the failed cross head lifter. It was polished and seen under microscope. In unetched condition it did not reveal any abnormal inclusions. When etched with nital, it disclosed tempered martensite.

DISCUSSIONS:

There is no abnormality in chemistry or metallurgy of the above samples. The cross head body pin had failed in sudden mode, with machining marks acting as notches. In order to further investigate the quality of pins, LMS store of DLW was inspected. Seven pins were found in stock. All of them were examined. It was observed that one of them had deep machining marks and all the pins were rusted.

The cross head lifter also had failed in sudden mode. There was a sharp change at the radius of the flange of the lifter. This could have acted as a notch.

CONCLUSION:

Both the above breakages have taken place due to sudden impact. As stated above it is not known if both the components had broken in one single incidence or on two occasions.

No. C & F-67, 68 /2003

Dt. 16.10.03.

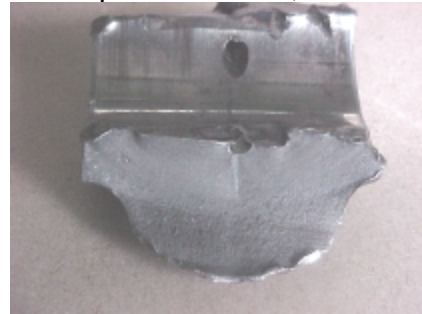
**FAILURE INVESTIGATION OF FUEL PUMP LIFTER OF LOCO NO. 14120
WDM₃A RECEIVED FROM DSL SHED/ GONDA**

BACK GROUND:

Fuel pump lifter and the associated bushing of the above loco was found broken during M-3 schedule. This loco was commissioned on 14.04.2002. Failed components were sent to DLW for failure investigation vide letter no. M/DSL/STAT/DLW/2003/14 dtd. 06.06.2003.

VISUAL EXAMINATION:

Marking on the fuel pump lifter is SFL-SF05, 668, 10140931. It had broken into two pieces from center. Photograph of the broken lifter is printed below,



About 40% of the fractured faces are smooth, remaining areas are crystalline. Associated bushing also had broken in two pieces. Photograph of the one of the pieces is printed below,



There is no evidence of any casting defect or abnormal wear. Its failure appeared to be consequential. Detailed analysis of this bush was therefore not taken up

CHEMISTRY:	% OF	OBTAINED	SPECIFIED
	C	0.36	0.38-0.43
	Si	0.22	0.20-0.35
	Mn	0.70	0.75-1.00
	P	0.039	0.04 max.
	S	0.026	0.04 max.
	Cr	0.50	0.40-0.60
	Mo	0.18	0.15-0.25
	Ni	0.46	0.40-0.70
HARDNESS (BHN)		286	269-321

MACRO EXAMINATION:

Nothing abnormal was noticed.

MICRO EXAMINATION:

Micro specimen which included nucleus of the fatigue crack was polished & viewed under microscope. In unetched condition it revealed thick oxide inclusion 1-2 series. It also disclosed heat affected zone and weld deposit over the parent metal. Microstructures of the parent metal revealed tempered martensite .

REMARKS:

The lifter had failed due to development of fatigue crack initiated from weld location. This welding was done to plug the hole, which is dowelled at DLW. This is not possible at DLW. Shed may have exercised this option to prevent oil leakage.

No. C & M /F- 51 - 52

Dt. 18.10.03

FAILURE INVESTIGATION OF AIR & EXHAUST VALVES RECEIVED FROM DIESEL SHED/ GONDA.

BACK GROUND:

It was stated that 25nos of Air & Exhaust valves of deferent makes, taken out from deferent locos were found to have cracked prematurely from welding joint. Four of these valves were sent to DLW for investigation vide letters dtd. 12.11.03 & 09.12.03. This issue raised by the shed during the BIM held at DLW on 04.12.03.

VISUAL EXAMINATION:

Marking in the above valves is KOEL 08 01 B 214, KOEL 08 01 B 213, KAR 07 01 B 50340, KAR 04 01 INCL 5232A.

DYE PENETRANT TESTS

All the above valves were subjected to dye penetrate test. No cracks were visible at their weld joints. These valves were further examined under illumination and magnification. No cracks were visible.

REMARKS:

There is no crack in the valves.

No. C & M /F-106, 117 & 118,

Dt. 16.12.03

FAILURE OF A & E VALVES OF DIESEL SHED/ GONDA

BACK GROUND:

Sr. DME/DSL Gonda vide his letter dtd. 03.10.03 had complaint DLW that, nine cases of valve guttering were reported at their end in the year 2003. He had sent two failed valves, one each of KOEL and KR make for detailed metallurgical investigation vide the letter referred to above. The KOEL make valve was fitted on 10.02.02 and failed on 09.06.03. The KAR make valve was fitted on 11.02.02 and had failed on 01.08.03.

VISUAL EXAMINATION:

Marking on the above valves is KOEL 0101 B 176 and KAR 12/98 22268. It is evident from the above photograph that guttering had taken place in both the cases. Also deposits on the seats are not very heavy and there are few pits in the seat area.

CHEMISTRY:

Only 21-4N portion was evaluated because the damage was only in this area.

		OBTAINED		SPECIFIED
	Marking	KAR	KOEL	
%OF	C	0.49	0.50	0.48-0.58
	Si	0.19	0.23	0.25 max.
	Mn	8.78	8.20	8-10
	Cr	22.06	21.29	20-22
	Ni	3.65	4.45	3.25-4.50
HARDNESS:(RC)		34	35	32-40

MICRO EXAMINATION:

KAR: Microstructure reveals that the carbides are uniformly distributed in austenite matrix, the grain size is 6-8 and the black etching component is about 30%.

KOEL : Microstructure reveals that carbides are uniformly distributed in austenite matrix, the grain size is 6-8, black etching component is about 30%.

REMARKS:

There is no metallurgical deficiency in either of the valves. Both of them had failed due to guttering. Guttering is an after effect of leakage of hot gases through the valve seat. It generally takes place due to poor sealing. Reasons for poor sealing need to be looked into.

No. C & M /F-89, 90

Dt. 10.11.03.

FAILURE INVESTIGATION OF SPLIT GEAR OF LOCO NO. 16031 WDM2 FROM DSL SHED/ GONDA

BACK GROUND:

It was stated that the above loco had failed on line on 08.06.03 due to breakage of split gear teeth. This loco was POHed at CB on 19.10.01. The broken split gear was fitted during POH. It was sent to DLW for failure investigation vide letter dtd. 18.06.03.

VISUAL EXAMINATION:

Marking on the split gear is DLW 796. Thirteen of its teeth were broken. Photograph of the failed split gear is printed below.



Fractured surfaces show varying degree of progressive cracks, being around 70% in the first of the broken tooth. These cracks had started from root fillet. Almost every one intact tooth shows abnormal wear and abnormal pitting in addendum and dedendum.

CHEMISTRY:	% OF	OBTAINED	SPECIFIED
	C	0.42	0.38-0.43
	Si	0.19	0.20-0.35
	Mn	0.79	0.65-0.85
	Cr	0.88	0.70-0.90
	P	0.025	0.04- MAX
	S	0.010	0.04- MAX
	Mo	0.26	0.20-0.30
	Ni	2.04	1.65-2.00

HARDNESS (RC) :

on teeth	34, 35	32-36
On the body	34,35	32-36

Hardness was also surveyed about 2mm below the surface on the profile of one of the teeth. The observed values varied between 33 – 36 RC.

MICRO EXAMINATION:

A micro specimen was cut from the gear, it was polished and seen under microscope. Examination in unetched condition showed negligible inclusions. The sample was etched with nital and examined for microstructure. It revealed temper martensite.

REMARKS:

Chemical composition is satisfactory.

Hardness and microstructure also are satisfactory. There is no material deficiency.

Visual examination indicates abnormal wear and pitting at addendum and dedendum. Abnormal wear indicates abnormal metal to metal contact - lubricant is not able to transfer the load. Pitting is indicative of surface fatigue.

The gear had failed prematurely due to tooth bending fatigue initiated from inadvertent stress raisers formed at the root due to excessive wear because of over load. DLW is studying the possibility of increasing the strength of gear material. This however may not be enough, unless overloading is reduced through maintenance of proper backlash. We must also examine the possibility of improving the EP properties of engine oils in association with RDSO.

No. C&M/F- 54 / 2003

Dt. 20.11.03

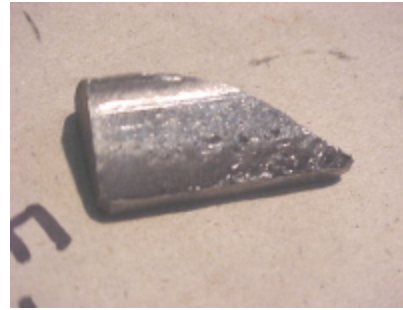
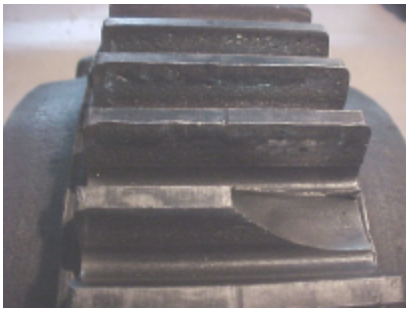
**FAILURE INVESTIGATION OF SPLIT GEAR OF LOCO NO. 16726 WDM2
RECEIVED FROM DSL SHED/ GONDA**

BACK GROUND:

It was stated that one teeth of the split gear of above loco was noticed broken during M9 schedule after one year and two months of service on 25.05.03. This gear was fitted during POH at KGP on 25.3.02. The broken gear was sent to DLW for failure investigation vide letter no. M/DSL/GD/DLW/2003/14 dtd. 12.06.03.

VISUAL EXAMINATION:

Marking on the broken gear is SFL 977 DLW4116. One of the teeth was found broken. The fractured face revealed fatigue crack initiated from one side of the root. Most of the teeth revealed severe pitting and plastic flow of metal. The pitting and plastic flow however was not one sided. Photograph showing the breakage and pitting is printed below,



CHEMISTRY: % OF	OBTAINED	SPECIFIED
C	0.42	0.38-0.43
Si	0.18	0.20-0.35
Mn	0.55	0.65-0.85
P	0.014	0.04 Max.
S	0.016	0.04 Max.
Cr	1.03	0.70-0.90
Mo	0.18	0.20-0.30
Ni	1.52	1.65-2.00
HARDNESS(RC)	34,35	32-36

Hardness was measured on one separately cut sample using Brinell machine. The values observed were comparable with the above values.

MICRO EXAMINATION:

A micro specimen was cut from the gear it was polished and viewed under microscope. In unetched condition, it showed negligible inclusions and in etched condition it disclosed tempered martensite structure.

REMARKS:

Chemical composition is satisfactory.

Hardness and microstructure also are satisfactory, indicating the heat treatment was satisfactory. There is no deficiency in the material

The gear had broken prematurely in tooth bending fatigue mode due to overload.

Marking on the gear is SFL. It is not an old supply. SFL is not approved vendor.

No. C&M/F- 55 / 2003

Dt. 25.11.03

**FAILURE INVESTIGATION OF CONNECTING ROD OF LOCO NO. 14064
WDM₃A RECEIVED FROM DSL SHED/ GONDA**

BACK GROUND:

It was stated that the above loco had failed on 26.09.03 due to breakage of connecting rod of R7 location. This DLW built loco was commissioned on 29.12.00, but due to seizure of all main bearings, its engine block was changed on 31.12.01 during M18 schedule. The other components broken during this failure include, i) one connecting rod bolt of the above connecting rod, ii) cylinder liner, iii) piston. Also all cylinder head valves and both side push rods were bent.

VISUAL EXAMINATION:

Marking on the connecting rod is SIFL (03/01) 1015 D 0107 DCW. Photograph of assembled pieces of broken connecting rod is printed below,



It had fractured from two locations. The fracture in the web area is battered and the fracture in the small end area shows about 70% progressive crack. Photograph showing this fractured face is printed below.



CHEMISTRY:	% OF	OBTAINED	SPECIFIED
	C	0.48	0.38-0.43
	Si	0.42	0.20-0.35
	Mn	0.87	0.65-0.85
	P	0.014	0.025 max.
	S	0.013	0.025 max.
	Cr	0.56	0.70-0.90
	Mo	0.17	0.23-0.30
	Ni	0.52	1.65-2.00
HARDNESS (BHN)		302	277-321

MICRO EXAMINATION:

Micro specimen cut polished and examined at 100 X in unetched condition did not reveal any abnormal inclusion. On etching with nital, it revealed tempered martensite structure.

REMARKS:

Chemical composition, hardness and microstructure of the connecting rod material are satisfactory. There is no material deficiency in the connecting rod material.

Visual examination reveals that the connecting rod had broken prematurely due to development of fatigue crack initiated from corner of the bore of the small end.

This loco was involved earlier in seizure; which involved seizure of all main bearings. There is a possibility of the connecting rod being overloaded during this seizure causing formation of stress raiser, which developed further resulting in the failure of the connecting rod.

No. C & M /F-87

Dt. 17.11.03

FAILURE INVESTIGATION OF PISTON PIN OF LOCO NO. 15539 WDP3A FROM DSL SHED/ TKD

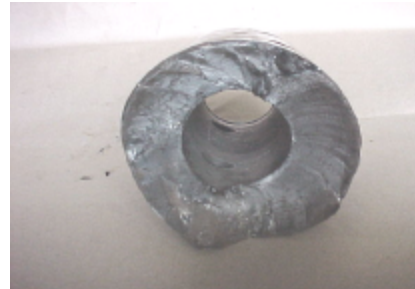
BACK GROUND:

It was stated that the above loco had failed on 24.09.03 while working train no. 4645 in Delhi division due to working out of crankcase cover and draining out of lube oil. After detailed examination in the shed, it was found that, i) cylinder head, valve etc. were intact ii) steel cap piston was secured with aluminium body, the aluminum body was damaged badly, rings were broken and damaged, iii) cylinder liner had broken into pieces. There was no seizure mark on the liner bore, iv) connecting rod was intact, the small end bush was damaged, v) engine block was damaged at liner sleeve position, vi) crankshaft was satisfactory, vii) piston pin was broken into two pieces.

Shed had concluded that all the above damages had taken place due to breakage of L-3 piston pin. Broken pin was sent to DLW vide letter dated 13.10.03 for failure examination.

VISUAL EXAMINATION

The marking on the broken piston pin is DC-98. It had broken into two pieces. Photograph of the broken pieces is printed below,



The smaller of the above two pieces revealed presence of a longitudinal crack extended up to the lubricant hole. This crack was opened by saw cutting from the other side. The opened surface showed presence of multinuclear progressive crack. On further examination under magnification it was noticed that several micro cracks were present on the boundary of case and core encompassing the corner of the lubricant hole, from where the progressive cracks had initiated. Machining marks also were noticed in the bore of the lubricant hole.

CHEMISTRY:	% OF	OBTAINED	SPECIFIED
	C	0.22	0.18-0.23
	Si	0.22	0.20-0.35
	Mn	0.67	0.70-0.90
	P	0.024	0.025 max.
	S	0.020	0.025 max.
	Cr	0.59	0.40-0.60
	Mo	0.21	0.15-0.25
	Ni	0.57	0.40-0.75

HARDNESS (RC)

Case	56	56-62
Core	20,21	Not specified

MICRO EXAMINATION:

Case – Tempered martensite.

Core – fine pearlite & ferrite with no banding.

REMARKS:

Chemical composition is satisfactory. Microstructure also is satisfactory; indicating that the heat treatment was proper. The pin had broken due to development of multinuclear fatigue crack initiated from corner of the inner as well outer side of the lubricant hole. Micro cracks present at the boundary of the case and core had acted as nucleus for the fatigue crack. The fatigue crack had initially progressed up to about 1.5 inches in longitudinal direction and then had changed its path to transverse direction. Micro cracks mentioned above may have developed due to overloading during some minor seizure/ constriction in the power assembly sometimes in the past. In fact piston pins involved in any constriction should be withdrawn from service.

The pin was manufactured at DCW in 1998.

No. C & M/F-91/2003

Dt. 13.11.03

FAILURE INVESTIGATION OF CAM SHAFT OF LOCO NO. 14770 RECEIVED FROM DSL SHED/ ADL

BACK GROUND :

It was stated that the above loco had failed on 26.07.03 due to breakage of flange of 8R location. All bolts joining 7R/8R camshaft with 5R/6R camshaft were also reported to have broken. This camshaft was fitted at DLW on 10/99. M48 schedule of the loco was carried out on 25.1.03. Statement received from the shed states that the failed item was not attended during the M48 schedule. A small piece of the flange was sent to DLW for failure investigation vide letter no. ADL/STAT/13/03 dtd. 12.09.03.

VISUAL EXAMINATION:

Only a small piece covering about 3" of circumferential length was received. There was no identification mark on the sample. Photograph of the broken pieces of flange is printed below,



The bolt hole shown above is enlarged. Inner face of the flange is showing deep machining marks. The fractured face shows about 25% fatigue crack, about 25% final rupture and the remaining area is battered.

CHEMISTRY:	% OF	OBTAINED	SPECIFIED
	C	0.47	0.48-0.53
	Si	0.24	Not specified
	Mn	0.67	0.6-0.9
	P	0.013	0.025 max.
	S	0.014	0.025 max.
	Cr	0.21	0.15-0.3
HARDNESS (BHN)		207	190-230

MICRO EXAMINATION:

Micro specimen was polished & seen under microscope. In unetched condition, it revealed no harmful inclusions. In etched condition, it revealed pearlite & ferrite structure with grain size 5 to 6. There was no banding.

REMARKS:

There is no metallurgical deficiency in the camshaft material. Machining marks present on the inner face of the flange, although undesirable, do not appear to have caused the failure. Elongated bolt hole indicates that the bolts were loose. It was also stated that all the bolts had broken. This is possible if the bolts were loose. Conversely if the flange had broken first, the camshaft would have been supported by other bolts and there would not have been any failure.

CONCLUSION

Breakage of the camshaft from the flange location appears to have taken place because of loose bolts. Shed's practice of not attending these bolts during M48 schedule needs to be reviewed.

No. C & M /F-80

Dt. 28.10.02

**FAILURE INVESTIGATION OF WATER PUMP SHAFT OF LOCO NO. 18961
RECEIVED FROM DSL SHED/ JHANSI**

BACK GROUND:

It was stated that the above loco had failed on 31.10.03 while working train no. 1521 in BNDA-MKP section due to premature breakage of water pump shaft. It was also stated that one more shaft of the same lot which was supplied by DLW vide sale order no. 24/621/53 dt 12.07.02 had failed prematurely in the same mode. The failed shaft of the above loco was sent to DLW for failure investigation vide Sr.DME (DSL)/JHS's letter no. JHS.M.DSL.M.05 dtd. 02.12.03.

VISUAL EXAMINATION:

There was no marking on the shaft. It had broken from a change of section at the location where oil seal bush is pressed on the shaft. The fractured face shows multinuclear fatigue crack (about 65%) initiated from a sharp change of section. Photograph of the failed shaft in assembled condition and the fractured face is printed below,



CHEMISTRY:

% OF	OBTAINED	SPECIFIED
C	0.22	0.18-0.25
Si	Tr	0.10-0.30
Mn	0.78	0.80-0.90
P	0.021	0.04 Max.
S	0.052	0.05 Max.
Cr	--	Not specified
HARDNESS (BHN) :	112	Not Specied.

MICRO EXAMINATION:

Micro specimen, in unetched condition revealed sulphide inclusion of series 0.5-1 and in etched condition it disclosed pearlite & ferrite with slight banding.

REMARKS:

Chemical composition satisfies the requirements of the specification. Inclusions are within limit. Microstructure shows slight banding.

Visual examination shows that the shaft had broken from sharp change of section. Visual examination of the shafts available on the shop floor revealed that some of them did not have proper undercut/radius at the change of section from which the above failure had initiated.

Premature failure of the above shaft is attributed to improper machining. Presence of banding in the microstructure has also contributed

No. C & M /F-114

Dt. 15.12.03

**FAILURE INVESTIGATION OF VALVE LEVER BUSHINGS OF LOCO NO.
14965, 14969 & 14970 RECEIVED FROM DSL SHED/ NGC**

BACK GROUND:

DLW had received 35 nos of valve lever bushings of different makes removed from loco nos 14965, 14969 and 14970 due to high copper content in engine lube oil vide letter no. NGC/D/TR/DLW dtd. 12.09.03. It was stated that these bushings were worn out. The above locos were commissioned in July- Aug-2002. In a separate letter shed had also complained that hexane insoluble in engine oils of these locos was on higher side. Spectrograph results showing high copper were however not made available to DLW.

VISUAL EXAMINATION:

35 bushings of different makes were received. 19 of them were of Bimetal make, 6 of them were of PBW make, 6 of them were of Kirloskar make and in remaining three samples, there was no identification mark. All the 35 bushings were carefully examined. There was no evidence of failure of the copper, tin, lead, sintered layer in any one of them. Almost all of them were showing wear in the loaded area. In one case, the bronze layer was exposed and steel portion was visible in about 10% of the ID.

One sample of each manufacturer was selected for detailed investigation.

CHEMISTRY:

Bronze layer	PBW	BM	KOEL	31PD 5704
Sn	9.40%	9.50%	9.40%	9.0-11.0%
Pb	9.20%	9.82%	9.60%	9.0-11.0%
Cu	78.02%	77.50%	77.2%	77% min.
Steel Back				
C	0.10%	0.11%	0.10%	0.08-0.13

MICRO STRUCTURE:

Micro specimen cut from the samples selected for chemical analysis were examined for microstructure. The following was revealed,

BM	Thickness of bronze layer	=	18 thou.
	Lead distribution	-	uniform
PBW	Thickness bronze layer	=	16 thou.
	Lead distribution	-	uniform.
Kirloskar	Thickness of Bronze layer	=	17 thou.
	Lead distribution	-	uniform.

REMARKS:

There is no chemical or metallurgical deficiency in the valve lever bushings of the above three manufacturers. There is no evidence of failure of lining in any case. There is however, evidence of biased wear in all cases. Valve lever is a oscillating member of the valve lever assembly. Its biased wear in the loaded area is normal. Reasons for presence of higher percentage of copper, therefore need to be investigated elsewhere. In case other bearings are showing normal wear, the results of spectrographic analysis should be evaluated more objectively. As regards, the higher percentage of hexane insoluble, it is mentioned that this problem is not common on Indian Railways. Various aspects including the quality of oil, quality of fuel, performance of filters, quality of combustion etc. are required to be investigated. Since RDSO is the co-coordinating agency for most of these activities, their services may be commissioned.

No. C &M/F-81/2003

Dt. 23.10.03

FAILURE INVESTIGATION OF SPLINES FAILED IN VIETNAM LOCOS

BACK GROUND:

It was stated that three splines of the After Cooler Blower of Vietnam locos had broken during service. One of the broken splines was brought by DY.CMgM and was given to DY.CCMT for failure investigation; vide DY.CME/Design's letter no. m.65.41 dtd. 06.12.03

VISUAL EXAMINATION:

Marking on the broken spline is 5.2K 96. It had broken into three pieces about 6 inches away from the gear end. The fractured face is crystalline. The failed sample also shows abnormal wear and damage to the teeth of the spline at the gear end. Photograph of the broken spline in assembled condition and also the fractured faces is printed below,



CHEMISTRY:

% OF	OBTAINED	SPECIFIED
C	0.41	0.38-0.43
Si	0.05	0.20-0.35
Mn	0.53	0.60-0.80
P	0.027	0.04
S	0.027	0.04
Cr	0.97	0.07-0.9
Mo	0.20	0.20-0.30
Ni	2.20	1.65-2.0
Hardness (BHN)	402,430,418	372-415

MACRO EXAMINATION:

The sample was subjected to macro etching with 50% HCl at 70°C for 15 minutes. It showed several longitudinal quenching cracks.

MICRO EXAMINATION:

Micro specimen was cut from broken area. It was polished & viewed under microscope at 100x. In unetched condition, it revealed sulphide inclusions of thin series between 0.5-1. In etched condition, it revealed tempered martensite.

REMARKS:

Chemical composition is satisfactory. Minor variations in Si, Cr and Ni are inconsequential.

Hardness and microstructure are satisfactory.

Macrostructure shows presence of several longitudinal *cracks* on the spline.

CONCLUSION:

The spline had broken prematurely due to presence of longitudinal cracks. Wear at the gear end appears to be consequential.

No. C & M /F- 115

Dt. 09.12.03

Section D
Important CPAs

CORRECTIVE ACTIONS CLOSED SINCE OCTOBER 2003

S. N.	CA NO & DATE	DESCRIPTION	DATE OF CLOSURE	ACTION TAKEN
1	D-21/02 25.04.2002	DM water not used in engine cooling system .	10/1/2003	Resin procured. DM plant resited and water is being filled in the locomotive.
2	D-05/02 16.01.2002	Cam shaft Gear backlash problem in Engine Erection Shop.	10/1/2003	Radial distance changed and fixture setting also changed accordingly. With this there is no problem of backlash.
3	D-14/3 09.08.2003	Rejection of spider big 10124512/10120014	10/3/2003	Now sources identified and included in vendor directory.
4	2/MKT/50/03 03.09.2003	High fuel consumption due to problems of fuel injection nozzle and leakages from fuel oil system resulting in thick black exhaust.	10/3/2003	Break in nozzle are being used during testing and fresh nozzle are being fitted on engine before dispatch. With this the problem of black exhaust has been eliminated.
5	2/LOC/36/03 15.07.2003	Welding of Cyclonic Motor bracket is not done properly due to piping in fringement WDG3A loco	10/6/2003	Welding of Cyclonic Motor brackets is now being done in LFS itself, where it is possible to do downhand welding. This has eliminated the problem of poor welding
6	2/Loc/38/03 29.07.2003	Throttle handle and A-9 and SA-9 handle fouling with NID control stand (PVC) top.	11/13/2003	Design of A-9 and SA-9 has been modified thus eliminating fouling problem.
7	D-09/03 26.06.2003	Failure CL holders due to ground fault and open contact.	11/13/2003	Firm (M/s Allied Engineering) addressed and they have improved quality in subsequent supplies. Thus eliminating the problem.
8	D-48/02 21.09.2002	Dimensional accuracy of Brake Equaliser levers not maintained.	11/18/2003	Brake equalizer liver has been made 'P' item and supplies received from trade are of good quality.
9	2/MKT/53/03 03.09.2003	Failure of speedo meter pulse, generator in VNR locos.	11/11/2003	The drawing of drive pin has been revised thus avoiding failures.
10	2/MKT/56/03 03.09.2003	Failure of Turbo charger casings in BR locos	11/13/2003	Vendor has been delisted and new vendor added.
11	2/MKT/60/03 03.09.2003	Lack of inter changeability of gauges due to non uniform size of opening.	11/13/2003	Cut out or opening for gauges is done . CNC Turret Punch Machine which is accurate. This has eliminated problem of interchangeability.
12	2/MKT/61/03 03.05.2003	Leakage of water vent pipe from LWS to cross over pipe and swan neck to cross over pipe in VNR locos.	11/13/2003	Drawing has been modified duly providing clamp for the pipe and clamp sent to VNR under warranty.

CORRECTIVE ACTIONS CLOSED SINCE OCTOBER 2003

S. N.	CA NO & DATE	DESCRIPTION	DATE OF CLOSURE	ACTION TAKEN
13	2/MKT/68/03 08.10.2003	Bogie frame cracks in BR locos.	11/10/2003	Inspection of Bogie frames by RDSO introduced.
14	2/MKT/69/03 08.10.2003	Failure of Radiator in BR locos.	11/13/2003	Existing Vendor has been relegated from Cat. A to Cat B. In 3 locos of BR, radiator from good sources fitted.
15	2/MKT/73/03 08.10.2003	Failure of copper pipe from bellow connector to expansion tank	11/13/2003	Drawing has been changed and hose pipe has been provided in stead of rigid copper pipe.
16	2/MKT/70/03 08.10.2003	Traction Moter no 2 & 5 inspection cover is fouling with bogie.	11/4/2003	Junction box has been removed to avoid rubbing of cable with bogie frame.
17	D-13/03 09.08.2003	Misalignment problem of fuel oil header (10050231) with fuel injector pump.	12/3/2003	Misalignment of fuel header was due to not checking of a dimension before drilling operation on the block . Gauge to measure this dimension manufactured and checking started .
18	2/MKT/72/03 08.10.2003	Failure of speedo meter in BR locos.	12/31/2003	Problem of speedo meter has been attended by M/s Medha at Bangladesh. After that there is no fresh case of failure.
19	2/MKT/76/03 08.10.2003	Failure of buffer for BR locos.	12/31/2003	Buffer has been replaced under warranty. Matter also takenup with M/Shindustan Foundry.
20	2/MKT/46/03 03.09.2003	Rain water entering in turbo charger water exhaust of VNR locos	12/31/2003	The drawing has been modified thus eliminatng problem of rain water entering.
21	2/MKT/52/03 03.05.2003	Failure of Carbon burshes of traction alternator and traction motor in VNR locos.	12/31/2003	To avoid this, partition height has been increased by 10 mm. With this modification there will be no problem.
22	2/MKT/82/03 03.11.2003	Welding cracks in lube oil pipes.	12/31/2003	Welding cracks were due to use of in correct electrode and bad workmanship. Correct electrode is now being used and staff have been counselled.
23	2/MKT/71/03 08.10.2003	Failure of Air driers in BR loco	12/31/2003	Timer circuit of Air Driers has been modified by WABCO and modified timer replaced under warranty.

CORRECTIVE ACTIONS CLOSED SINCE OCTOBER 2003

S. N.	CA NO & DATE	DESCRIPTION	DATE OF CLOSURE	ACTION TAKEN
24	2/MKT/79/03 03.11.2003	Breakage of air brake pipe on the bogie of BR loco	12/31/2003	The breakage of the air brake pipe was due to improper location of the clamp. Location of clamp has been revised.
25	2/MKT/45/03 03.09.2003	Repeated problem with unloader valves of compressor of VNR locos.	12/31/2003	Design modified by Elgi. Modified design unloader valve replaced under warranty.
26	2/MKT/64/03 08.10.2003	Failure of driver seats in WDM2 loco .	12/31/2003	Modification done. Modified seats have been procured and are being fitted in the locos.
27	2/LOC/107/02 04.10.2002	Problem in NID control desk i) Terminal volt mounting plate ii) LED indicating pannel cut out under size iii) Cut out of throttle and reversal handle iv) Fouling of flasher mounting unit.	12/31/2003	M/s Tech. Force has improved the quality of NID control desk and now there is no problem
28	D -51/02 23.09.2002	Oil groove is not being provided in MB Cap.	10/31/2003	Problem in machining on existing machines was eliminated by doing this item on newly procured HMC. 100% MB Caps are provided with oil grove
29	2/INS/89/03 03.11.2003	Curvature between spring seat & damper bracket is not maintained as per drawing.	1/20/2004	Due to constraint in getting required curvature on existing machines. this item has been planned to be purchased from trade.
30	2/MKT/87/03 03.11.2003	Leakage of acid from Battery Box in BR locos.	1/20/2004	The design of Battery Box has been amended .
31	2/MKT/84/03 03.11.2003	Failure of Auto drain valve cum cock in BR locos.	1/20/2004	The drawing of drain cock has been amended.

CORRECTIVE ACTIONS CLOSED SINCE OCTOBER 2003

S. N.	CA NO & DATE	DESCRIPTION	DATE OF CLOSURE	ACTION TAKEN
32	2/MKT/85/03 03.11.2003	Loosening of Engine foundation bolts in BR locos.	1/16/2004	Drawing of locking plate has been amended.
33	2/LOC/90/03 03.11.2003	Problem in removing the exhaust gas , from Engine compartment resulting in its spreading to long hood.	1/30/2004	Drawing of exhaust stack cover assembly has been amended.
34	2/MKT/47/03 03.09.2003	Problem of fuel pressure dropping on VNR/ LOCos.	1/30/2004	Design of relief valve /regulating valve modified. The defective supply was from M/S OA SIS Instrument & M/S MAC , who have since been deleted from the Vendor Directory.
35	2/MKT/59/03 03.09.2003	Fuel Pump Motor mounting arrangement not satisfactory in VNR locos.	2/5/2004	The drawing of Fuel pump Motor mounting arrangement modified .
36	2/INS/62/03 03.10.2003	Surface finish of Connecting Rod not achieved .	1/30/2004	Grinding wheel quality was not satisfactory .Grinding wheel specification revised and with required surface finish achieved.
37	2/MKT/74/03 08.10.2003	Failure of bus bars in BR locos.	2/5/2004	Bus bar connector in the CP has been provided with additional clamps.
38	2/LOC/94/03 22.11.2003	Terminal board to be provided on both C/S for the mechanical gauge wires inside the control stand.	2/5/2004	The wiring diagram and wire cutting chart has been has been modified & terminal board provided.
39	2/INS/101/03 11.12.2003	Short ciucuit problem in contactor R1&R2.	2/5/2003	Problem eliminated by doing proper cleaning of CP.
40	2/INS/105/03 24.12.2003	Failures of WP shaft at change of radius.	3/23/2004	Design of shaft amended. The change of cross section has been made more gradual by changing the radius of under cut.

CORRECTIVE ACTIONS CLOSED SINCE OCTOBER 2003

S. N.	CA NO & DATE	DESCRIPTION	DATE OF CLOSURE	ACTION TAKEN
41	2/MKT/106/03 26.12.2003	Stagnation of oil/water due to inadequate provision for drainage on locomotives supplied to VNR	3/23/2004	Modification done in the under frame and provisions made for sufficient drainage.
42	2/MKT/86/03 03.11.2003	Breakage of stainless steel railing (at welded joint to the chasis) in BR loco.	3/10/2004	Breakage was due to use of incorrect electrode. Suitable stainless steel electrode has been identified, procured and being used.
43	2/INS/103/03 15.12.2003	Recurring problem of fuel line of WDG4 locos, no. of case are WDG4 (008)- 07, WDG4 (0034) - 01	3/1/2004	New design of fuel line is being fitted.
44	2/INS/102/03 12.12.2003	Oil accumulation below ECC-2 and battery charging resister in WDG4 loco.	3/5/2004	Design has been modified duly deleting the dummy.
45	2/ENG/99/03 03.12.2003	Booster air pressure of HISPANO SUZA turbo is not found as per specification	3/5/2004	RDSO approached. They have revised minimum booster air pressure value rfrom 57" - 67" to 48" to 66"
46	2/MKT/75/03 08.10.2003	Misalignment of Brake Blocks in BR locos.	3/5/2004	Following action has been taken 1) Fabrication of guide bracket using fixtures 2) Introducing in-process checks for the locations of guide brackets, when welding on to the frame
47	2/MKT/88/03 03.11.2003	Clogging of gear case in winter due to solidification of Cardium Compound in BR locos	3/6/2004	Matter was referred to BHEL and they have supplied gear case with bigger opening of filling cap .
48	2/INS/10/04 22.01.2004	5/16" hole length is not being maintained in fuel pum cross head lifter.	2/5/2004	For measurment pluge gauge has been manufactured and 100% checking introduced.
49	2/LOC/12/04 22.01.2004	Improper sitting of outer and inner spring in equaliser spring seat assembly	3/20/2004	The problem has been eliminated by providing shim above and below spring suspension.

Section E
List of trial items

LOCOWISE TRIAL ITEMS

Loco No.	Shed	Self cooled Rectifier with DC blower motor	6-point LED indication panel	8-point LED indication panel	Micro control Based Governor	LED type Classification Light	AC F.P Motor With Inverter	AC Cyclonic Motor with Inverter	E-beam cable	AC CCE motor	MCB (150A & 200A)	GM Cab Fan
13047	CR/PA	✓				✓		✓	✓			✓
11101	SWR/KJM			✓					✓			✓
13048	CR/PA		✓			✓			✓			✓
13049	SWR/KJM		✓			✓		✓	✓			✓
13050	SWR/KJM	✓		✓		✓		✓	✓			✓
13051	CR/PA		✓			✓		✓	✓			✓
13052	CR/PA		✓		✓	✓		✓	✓			✓
13053	SWR/KJM		✓		✓	✓		✓	✓			✓
13054	CR/ PA		✓		✓	✓		✓	✓			✓
13055	CR/PA		✓		✓	✓		✓	✓			✓
13056	SWR/KJM		✓		✓	✓	✓	✓	✓			✓
13057	NCR/JHS		✓		✓	✓	✓	✓	✓			✓
13058	NCR/JHS		✓		✓	✓	✓		✓			✓
13059	CR/PA				✓	✓	✓		✓			✓
13060	CR/PA			✓	✓	✓			✓			✓
13061	NCR/JHS			✓		✓	✓		✓			✓
13062	NCR/JHS			✓		✓	✓		✓			✓
13063	CR/PA			✓		✓	✓		✓	✓		✓
13064	CR/PA			✓	✓				✓			✓
13065	NCR/JHS			✓	✓	✓			✓			✓
13066	CR/PA			✓	✓				✓			✓
13067	SCR/GY	✓		✓					✓			
13068	SCR/GY			✓	✓				✓			✓
13069	SCR/GY			✓	✓			✓	✓	✓		✓
13070	SCR/GY				✓			✓	✓			✓
13071	SCR/GY			✓	✓			✓	✓	✓	✓	
13072	SCR/GY			✓				✓	✓	✓	✓	✓
13073	ER/UDL			✓	✓			✓	✓	✓	✓	
13074	ER/UDL			✓				✓	✓	✓		
13075	SCR/GY			✓				✓	✓	✓		
13076	ER/UDL			✓	✓			✓	✓			
13077	ECoR/VSKP			✓	✓				✓			
13078	ECoR/VSKP			✓	✓				✓			
13079	ECR/PTRU			✓					✓			

LOCOWISE TRIAL ITEMS

Loco No.	Shed	MCB (15A)	V R P	LWS	Low maintenance lead acid battery	Cab light	Melonite Liner M/s Mexico	Nitrided Liner M/s Cooper Satara	Steel Cap Piston 11.75 CR M/s GIL/Banglor	Crank Shaft M/s ZDLW	Turbo TPR-61 M/s ABB	Turbo M/s Turbo-meca/ France
13047	CR/PA		✓		✓	✓				✓		
11101	SWR/KJM		✓		✓	✓			✓			
13048	CR/PA		✓			✓						
13049	SWR/KJM		✓	✓						✓		
13050	SWR/KJM			✓	✓					✓		
13051	CR/PA				✓	✓				✓		
13052	CR/PA					✓						
13053	SWR/KJM		✓			✓				✓	✓	
13054	CR/ PA		✓			✓				✓		
13055	CR/PA					✓				✓		
13056	SWR/KJM				✓	✓				✓		
13057	NCR/JHS		✓		✓	✓				✓		
13058	NCR/JHS		✓		✓	✓					✓	
13059	CR/PA		✓		✓	✓				✓		
13060	CR/PA		✓		✓					✓		
13061	NCR/JHS		✓			✓				✓		✓
13062	NCR/JHS		✓			✓				✓		✓
13063	CR/PA		✓		✓	✓				✓		✓
13064	CR/PA		✓		✓	✓				✓		✓
13065	NCR/JHS		✓		✓	✓		✓		✓		✓
13066	CR/PA		✓		✓			✓		✓		
13067	SCR/GY				✓			✓		✓		
13068	SCR/GY		✓		✓	✓		✓				
13069	SCR/GY		✓		✓	✓	✓	✓				✓
13070	SCR/GY		✓		✓	✓		✓				
13071	SCR/GY	✓	✓		✓	✓						
13072	SCR/GY		✓		✓	✓						✓
13073	ER/UDL		✓		✓	✓		✓				✓
13074	ER/UDL		✓		✓	✓	✓					✓
13075	SCR/GY				✓							
13076	ER/UDL				✓	✓						✓
13077	ECoR/VSKP				✓	✓						
13078	ECoR/VSKP				✓	✓			✓			
13079	ECR/PTRU				✓	✓						✓

LOCOWISE TRIAL ITEMS

Loco No.	Shed	Inertial Air Filtration system M/s Polymer	Plasma Coated Piston Ring M/sGoetze	Cent. Lube oil filter M/s Alfa Laval	Water seal WaterPump M/s Kessler/ USA	Oil Seal Water pump with Viton Rubber M/s T&G/Luck	LOP (Herring-bone type) M/s SIW/ Mumbai	Modified LOP M/s SIW / Mumbai	Modified Drive gear LOP M/s SIFL	Modified Drive gear WP M/s SIFL	Modified Drive gear Ext. shaft M/s SIFL
13047	CR/PA										
11101	SWR/KJM										
13048	CR/PA										
13049	SWR/KJM										
13050	SWR/KJM										
13051	CR/PA										
13052	CR/PA										
13053	SWR/KJM										
13054	CR/ PA										
13055	CR/PA										
13056	SWR/KJM										
13057	NCR/JHS										
13058	NCR/JHS										
13059	CR/PA	✓					✓				
13060	CR/PA										
13061	NCR/JHS										
13062	NCR/JHS										
13063	CR/PA										
13064	CR/PA										
13065	NCR/JHS										
13066	CR/PA										
13067	SCR/GY			✓							
13068	SCR/GY			✓	✓	✓					
13069	SCR/GY		✓		✓	✓					
13070	SCR/GY										
13071	SCR/GY										
13072	SCR/GY				✓						
13073	ER/UDL		✓			✓					
13074	ER/UDL		✓								
13075	SCR/GY				✓						
13076	ER/UDL				✓						
13077	ECoR/VSKP				✓						
13078	ECoR/VSKP				✓		✓	✓	✓	✓	✓
13079	ECR/PTRU				✓		✓	✓	✓	✓	✓

LOCOWISE TRIAL ITEMS

Loco No.	Shed	Copper Washer for fuel oil inlet M/s SSE	Mech. Bonded Radiator M/s Saswad	Mech. Bonded Radiator M/s Kessler	Mech. Bonded Radiator M/s Youngs	Mod. Panel Mounted Brake-system M/s SAB WABCO	RTMB M/s BEC	RTMB M/s Nadi	Fuel Booster Pump M/s Trien	Driver Seat M/s Patra & Chanda	Panel Mounted Brake-system M/s SIL
13047	CR/PA					✓					
11101	SWR/KJM										
13048	CR/PA		✓								✓
13049	SWR/KJM				✓	✓					
13050	SWR/KJM				✓						✓
13051	CR/PA			✓							✓
13052	CR/PA				✓					✓	✓
13053	SWR/KJM							✓			✓
13054	CR/PA		✓			✓					
13055	CR/PA					✓					
13056	SWR/KJM			✓		✓					
13057	NCR/JHS			✓		✓	✓				
13058	NCR/JHS			✓		✓	✓				
13059	CR/PA			✓		✓		✓			
13060	CR/PA				✓	✓	✓				
13061	NCR/JHS			✓		✓		✓			
13062	NCR/JHS			✓		✓	✓				
13063	CR/PA			✓		✓					
13064	CR/PA			✓		✓					
13065	NCR/JHS			✓		✓					
13066	CR/PA					✓					
13067	SCR/GY					✓					
13068	SCR/GY					✓					
13069	SCR/GY			✓		✓					
13070	SCR/GY	✓		✓		✓					
13071	SCR/GY	✓		✓		✓					
13072	SCR/GY	✓	✓			✓				✓	
13073	ER/UDL	✓		✓		✓				✓	
13074	ER/UDL	✓		✓		✓				✓	
13075	SCR/GY			✓		✓				✓	
13076	ER/UDL				✓	✓					
13077	ECoR/VSKP				✓	✓					
13078	ECoR/VSKP				✓						✓
13079	ECR/PTRU			✓							✓

Section F
Miscellaneous technical
information

Miscellaneous technical information relevant to maintainers

1. Nyloc nuts

To increase reliability of elastic stop nuts, the certain improvements have been incorporated in the design viz. nuts of elastic stop nut should be cold forged, material of nut revised from C-1118 / C 1117 to AISI 1010 or AISI 1015 or AISI 10B21, as the grades C-1118 & C-1117 are not easily available in India & nuts can not be cold forged due to its high sulphur content, specification of nylon inserts i.e. Nylon 66. Plating revised from Cd to Zn. New source in vendor directory i.e. M/s. Pooja Forge Ltd./ Faridabad included as a Cat 'A' vendor,

2. GE Piston

Some new GE pistons of the recent lot have been found to have the oil inlet holes in the piston pin bore groove partially blocked due to incomplete drilling. This can cause over heating of piston crown and cracks may appear in the same.

Corrective action at manufacturing stage as well as checks on new/used pistons shall be carried out by GETS in a phased manner. Details shall be indicated separately. Some checks have already been conducted in sheds by GETS on new pistons. Meanwhile, it is requested that all the sheds under your control may be advised to check these oil inlet holes on newly received as well as used pistons during fitment in major schedule or whenever the opportunity arises i.e. when the piston is taken down for some other reason.

It may be mentioned that even if one such piston is put in service, it may cause seizure of the engine and therefore immediate instructions may be given to the sheds for conducting this check.

3. Out Board bearing for 3100 HP loco:

The out board bearing arrangement has been introduced in the 3100 HP locomotive. This bearing is provided at the generator end side of the block. The end pieces of both banks of camshafts were redesigned and induction hardening machine modified to harden the enhanced length.

This design will provide an additional support at the ends of camshaft with camshaft gear behaving like simply supported load instead of cantilever. This will considerably reduce the deflection due to weight of camshaft gear and hence will ensure better meshing and give longer life of camshaft and crankshaft gear. This will also help during dismantling of the camshaft sections.

4. LOP with Herring Bone Gears

The lube oil pump helical type design has been modified to herringbone type gear to increase reliability and life of pump. Both the gears of this pump i.e. driver as well as driven gear have been made in two halves with their helix angle directing to each other. With this design, thrust has reduced considerably and directed towards the gears itself and not side collars. The pump have been fitted in the followings locos:

13059, 13060, 13062, 13077, 13082 and on wards.

5. Water Seal (Imported)

Twenty five modified water seal water pump have been procured from M/s. Kessler International Corporation USA and same have been fitted in the following locos. 13068, 13069, 13072, 13075, 13076, 13077, 13078, 13079, 13080 and onwards. These are expected to give a minimum life of 24 months. The trial needs to be monitored closely.

6. Modified Oil Seal Water Pump with Viton Rubber

Three modified seals have been fitted on loco no. 13068, 13069, & 13073. These are expected to give a better life than silicon rubber seal and are expected to give a minimum life of 24 months.

7. High Gear Ratio/ Modified LOP Gears

Lube Oil Pump with modified gear along with modified extension shaft gear (gear ratio changed from 67 to 63) has been fitted on loco no. 13078, 13079, 13080 and onwards. The lube oil pressure at hot engine condition has been increased by 0.5 to 0.7 Kg/Cm². This will eliminate a long standing problem of low L.O.pressure and engine shut down.

8. Improved Flexitallic and HP sheet gasket

Flexitallic and HP sheet gasket drawings are going to be revised as flexible graphite in place of asbestos, which is injurious to Environment.

These are the following advantage of graphite (Graphoil) in the flexitallic gasket.

1. On bolting up condition, the graphite will flow uniformly and effectively which will result in better and reliable sealing than the asbestos.
2. Less torque is needed for sealing.

These are the following disadvantage of HP sheet gasket

1. Under temperature service condition, asbestos becomes brittle whereas the graphite will always be malleable and flowable.
2. The graphite is a flowable material, therefore, effectively flowing into the deficiencies of the flange surface.
3. The tanged gasket effectively seals the joint even under low bolting condition.

9. Valve seat insert

The valve seat insert Exhaust and Air makes interchangeable with 251 plus cyl. head and conventional cyl. Head (ALCO). The interference for Inconel exhaust valve seat insert in both the cases i.e conventional as well as 251 plus cylinder head assembly, have been made similar. The interference in air valve seat insert has been rationalised. The incorporation of these changes has resulted in the drawing as given below.

S/N	Part no.	Description
1.	10240380 Alt 'j' (Conventional Exhaust Valve)	valve seat insert (Stellite)
2.	10249254 Alt 'g' (251 plus Air Valve)	valve seat insert (Weltite)

Section G
***List of important
projects in hand***

A listing of projects

1. Locomotive design projects

a) Locomotive design projects currently in hand

1. End-cab type WDM3D
2. 3100/3300 hp locomotives with indigenous micro-processor based controls
3. 3100/3300 hp locomotives with Siemens microprocessor based controls
4. Light-weight WDG3A with GM loco type fabricated center sill type underframe, cab and superstructure(WDG3s on WDM3D type platform)
5. 4000 hp AC-DC mixed service locomotive with microprocessor controls
6. 2 X 3300 hp twin-platform locomotive with capability to cater to hotel load
7. 12 tonne axle-load MG locomotive for export
8. 3300 hp BG WDG3C/WDM3C locomotives (BHEL electrics with TM field weakening)
9. WDS6 with improved cab & long hood with inertial engine filter
10. 2000 hp MG locomotive with Cummins engine

b) New locomotive designs developed in 01-02 & 02-03

1. 2300 hp, shorter wheel base BG loco with hotel load arrangement and for SL Railways.
2. 2300 hp, MG, dual cab, full width, locomotive for export.
3. 3100 hp WDG3A locomotive with lightweight traction motors.
4. 3100 hp WDG3A locomotive with imported GETS μ p based controls.
5. 3100 hp WDG3A locomotive with BHEL microprocessor based engine governor
6. 3100 hp WDG3A locomotive with Medha microprocessor based engine governor
7. 3100 hp WDG3A locomotive with creep control for NTPC
8. 2600 hp, BDR locomotive- completed & implemented
9. New design underframe, superstructure and cab (POH of 1350 hp MG BR loco)
10. 1350 hp AC-DC MG locomotive for Vietnam
11. 3300 hp BG WDG3C locomotive with existing BHEL electrics.
12. 3300 hp dual brake 19.5t axle load WDM3D with alternator-mounted rectifier & μ p control system & modified light wt TMs.
13. 3100 hp AC cab WDG3A locomotive for Defence
14. 2600 hp, modified BR locomotive; repeat order for three locomotives

2a. Equipment and component design projects (projects in hand)

Major projects in hand (other than locomotive designs)

	Project description	PDCs		Remarks
		Proto.	Series	
1	Improved control compartment for WDG3As locomotives (E type)	31-10-03	1-1-04	
2	Improved control compartment for WDG3As locomotives with self-load feature	31-10-03	1-1-04	
3	Air conditioning of driver's cab	1-9-01	1-7-04	Decision for series application not taken
4	Durable oil and water seals	30-10-03	1-7-04	
5	Upgraded expressor for enhanced overhaul interval	1-7-04		Dev. by KPC/ELGI
6	Radiator fan with FRP fan blades	1-3-02	-	Series application after extensive trials
7	Compact control stand for driver	1-12-03		-do-
8	High adhesion bogie without eq. and comp. beams	30-9-04	-	Drgs. In hand by RDSO
9	High adhesion bogie with CRU	30-9-04	-	

10	Electronic load meter	1-7-04	1-7-05	
11	Improved gasketing	1-12-03	30-9-04	
12	Moatti type LO filter	1-7-04	-	Series application after extensive trials
13	High-efficiency all aluminium large after cooler	31-10-02	-	Series application after extensive trials
14	Single volute design for GETS turbocharger	1-7-03	1-7-04	
15	Aesthetically & ergonomically designed driver's cab with suitable amenities	1-11-02	1-11-03	
16	FRP cab module	1-7-04		Series application after extensive trials
17	Upgradation of 16 cyl engine to 3600 hp & manufacture of 3600 hp locomotive	-	-	Electrics not finalized yet.
18	Comprehensive project on liner, piston & rings		31-3-05	
19	Development of high-efficiency blowers	1-7-04	-	Series application after extensive trials
20	Micro-controller based engine governor	1-1-00	1-4-05	
21	Carbody inertial air-filtration without exhauster	1-7-04		Series application done.
22	TM 4907 with laminated interpoles and reduced weight	1-6-04	-	Series application after extensive trials
23	Alternator-mounted rectifier on alternator assembly type 10102EV	30-9-03	-	Presently applicable for WDM3D only.
24	WDG3A/WDM3D bogies without comp/eq beam arrangement	30-12-04		Series application after extensive trials
25	Incorporation of Event recorder, VCD and creep control(optional)	1-7-04	1-9-04	
26	IGBT based VRPs	1-7-04	1-4-05	
27	Polyamide cage comm.-end brg for TMs	1-4-04	1-4-06	
28	Nylatron bushings and liners for bogies	30-9-02	-	Series application after extensive trials
29	Micro-processor based control system (imported)	31-3-02	1-4-05	
30	Modification to WDP3A bogies	1-6-04	-	
31	Indigenous mechanically-bonded radiators	1-4-03		
32	Micro-processor based control system (indigenous system)	31-11-03	1-4-05	Prototype at GY
33	Electronic fuel injection system	1-1-04	-	
34	AC motor for fuel pump & crankcase	1-10-01	-	-do-
35	AC dust exhauster blower motor for engine filtration system	1-10-01	-	-do-
36	ABB TPR series high-efficiency turbocharger	31-7-03	-	Series application after extensive trials
37	Improvements in FIPs (and Niigata make FIPs)	1-12-00	-	Series application after extensive trials
38	Amp fastons and improved crimped type terminal ends	30-9-03	1-12-03	
39	Provision of GM type roof-mounted DBRs	1-7-04	-	Design in hand by BHEL
40	Herringbone gears for LO pump	1-11-03	31-12-04	Series application after extensive trials
41	Double helix type FIPs	1-5-02		Series application after extensive trials
42	Modified air duct boot (without reinforced fabric)	30-10-02	-	Series application after extensive trials

43	Improved FE cam shafts	28-2-04	1-1-05	
44	Improved Fast and Flexible couplings	1-11-03	-	Series application after extensive trials
45	GM type headlight, cab, exterior and engine room lights	30-9-03	-	Presently applicable for WDM3D only.
46	Higher speed LO & water pumps	1-10-03	1-4-04	
47	Stainless steel piping with double ferrule fittings	1-3-03	1-4-04	Series application after extensive trials
48	Upgradation of 12 cyl engine to 2700 hp	-	-	In hand by RDSO
49	Finned type after cooler for brake system	30-9-03	1-7-04	Series application after extensive trials
50	Notch separation on E type controls	30-9-03	-	Series application after extensive trials
51	Relocated LED type marker Lights and GM type MU receptacles	30-9-03	-	Presently applicable for WDM3D only.
52	LED type flasher light	1-1-03	-	
53	Ni-Cd Batteries	1-4-04		-do-
54	LED based focus lights	1-11-02	1-1-05	
55	Higher stall current on WDG3As	1-10-03	-	
56	High capacity buffers	1-10-03	-	
57	E-beam irradiated air brake kit gaskets, O-rings and diaphragms	1-1-04	-	Series application after extensive trials
58	Improved high TE traction motor	1-10-04		Series application after extensive trials
59	Provision of GM type roof-mounted DBRs on WDP3A locomotives	-	-	
60	TM 4501 with roller suspension arrangement	1-1-04	NA	
61	Traction motor for standard gauge application	1-1-04	NA	
62	Microcomputer based AC-DC electrics with electrically driven auxiliaries	-	-	Case with Board.
63	Longer life engine-mounted FO filters (92 days sch.) for WDM3Ds			Referred to RDSO
64	Improved engine filtration system	1-7-04	1-3-04	

Misc. design changes in hand

- Modified layout, flow and clamping of LO and CW systems
- Modified valve and lock assembly
- Polycarbonate glass for cab
- Pressure sensing type level gauges
- FRP guards for RTMB/ECC
- Rotex type magnet valves for EP contactors
- ABB type driver's chair
- Improved partitioning of engine and alternator rooms
- Modified bellow connectors with stainless steel mesh to replace sleeve
- FRP covers for engine
- Improved expessor valves
- FRP gear case
- Improved single ferrule pipe fittings for engine
- Improved valve springs
- Aux panel in short hood for misc. equipment like cocks, magnet valves etc.
- Arcing studs for TMs

- Mica based material for DBR trays
- Customized pipe clamping for engine
- Modified low idling schedule
- Cast wheels
- Helical gear/pinion set for WDM2 loco gear case for generator/alternator
- Improved air flow through alternator
- Development of modified ducting arrangement for equalized air flow to TMs
- Fuses instead of circuit breakers
- Modified stick-on type window frames
- Pressed end type push rods
- Higher life bogie dampers
- Fluorescent component labels
- Improved DC-DC convertor instead of resistances for head light
- Staggered design footsteps
- Modified fire extinguisher bracket
- Thermal insulation for HP pipe
- Rear view mirror
- Modified air duct boot with pressure spring and without reinforced fabric
- Modified structure for radiator room and short hood with fabricated carline
- Modified valve groove & lock
- Happy pads for bogie coil springs
- Vent arrangement in cabs
- Improved GM/GE type circuit breakers
- Improved cab floor structure
- GM type improved dressor couplings
- Crowned cam rollers
- Improved GM type cut out cocks
- Improved Salem type J-1 filter
- Improved Salem type drain valves
- GM type roof mounted DBR and controls in a cubicle
- Slip ring modifications, including GM type slip ring design for alternators
- Modified cattle guard on GM pattern
- GM type horn
- Modified inertial air filtration, with FARR type tubes, for carbody
- Modified terminal ends for control and power cables on lines of GM
- GM type design concept for alternators (Hotel load alternator
- GM type roof mounted DBR, Controls and alternator in a cubicle
- Computer controlled brake system integration on ALCo locomotives
- Improve differential pressure gauge for LO filter
- Modified rubber base door gasket
- Injection moulded side bearers
- Chrome-plated liners for compressors/expressors
- Modified UG-generated piping layout, clamping and fittings for LO and CW system

2b. Major projects (other than locomotive designs) implemented in recent years

- 1 Plate type LO cooler
- 2 Modified inertial air filtration system (92 days sch.)
- 3 Air dryer
- 4 Panel-mounted brakes for air brake locos

- 5 Improved high adhesion bogie
- 6 Modified radiator fan and its mounting
- 7 Ergonomic design for driver's cab
- 8 Wider cab sliding windows with modified frames
- 9 Panel-mounted brakes with auxiliary panel for dual air brake locos
- 10 92 days LO filter
- 11 RTMBs with spherical roller & ball bearings with sealed housings
- 12 Inconel exhaust valves
- 13 Improved fuel injection tubes
- 14 251+ cylinder heads
- 15 Single bolt design steel cap piston
- 16 Longer life primary & secondary FO filter (92 days sch.)
- 17 Improved LO system and modified & relocated LO strainer
- 18 GE turbo with twin after coolers
- 19 Improved high-cap SS slip ring alternator- 10102 DW
- 20 Mycalex brush holder pins
- 21 Case-carburized shot-peened gear/ pinion
- 22 Light Wt. TMs with roller susp brg (92 days sch.)
- 23 Fluonlex cables for TMs
- 24 TM 4907 with roller susp brg (92 days sch.)
- 25 Rectifier with built-in blower (92 days sch.)
- 26 Development of stick type master Controller
- 27 PCB based cards
- 28 Low maintenance battery (92 days sch.)
- 29 Rivetless bearings for traction motor pinion-end
- 30 E-beam cables
- 31 Twin beam halogen headlight
- 32 Modified LO Piping
- 33 Pressurized control cubicle
- 34 LED type class. Light
- 35 TM 4906/7 with fully-insulated interpole coils
- 36 Development of PTFE Seals for gear case
- 37 Improved brush-holder pins
- 38 Anti-climbing posts
- 39 4-pole AGs with flexible inter connectors
- 40 Paperless speed recorder
- 41 Automatic switching 'on' of flasher light
- 42 Modified light-weight new look superstructure for WDG3As
- 43 Modified high tensile coupler
- 44 Compact panel-mounted brakes for air brake locos
- 45 Improved insulation scheme for traction motors
- 46 Open grain cylinder liners
- 47 Inertial filters for carbody
- 48 Improvements in conventional cylinder heads
- 49 Non-asbestos arc-chutes
- 50 Improved fuel tank for WDG3A & WDM3D locomotives
- 51 Vibration-free LO centrifuge with standardized location & mounting
- 52 Improved pressurized CPs for WDM3Ds
- 53 Modified piston rings and piston to reduce LOC
- 54 Reliable VRP for AG 3101 suitable for low idle & high charge current
- 55 Rivetless type bearings for traction motor commutator end
- 56 Improved abrasion-resistant flexible hoses with crimped end fittings
- 57 Modified LO and FO filter housings
- 58 Improved cab lining/furnishing

- 59 Incorporation of Hispano-Suiza turbocharger and associated design work
- 60 Rubber cable cleats
- 61 Improved cable conduiting, sleeving and heat shrinkable tubings
- 62 Thermal insulation for exhaust manifold
- 63 Modified low loss low maintenance cooling water system
- 64 Modified oil-free GD-80 filter (92 days schedule)
- 65 Modified underframe for improved reliability of systems for WDG3A locomotives
- 66 Modified high adhesion bogies
- 67 Electronic LWS

Misc. minor design changes completed

- Underslung battery boxes and control cubicles
- Modified design including mech strengthening for 16 row larger and twin after coolers
- Hand rails along walkway
- Modifications to turbo LO & water pipe layout
- 92 day turbo LO filter
- Sun visor
- Hollow Centre pivot Pin for WDG3A locomotive
- PU Paint
- Anti slip cab floor mat
- Push button type elect. Operated horn
- Composite brake blocks
- Modified FRP filter inertial air filtration system (92 days sch)
- Electronically commutated cab fan
- GM type frame-mounted sand boxes and conveyors
- GM type wiper & pantograph for cab glasses
- Improved air flow through alternator
- GM type LWS
- Improved softer cable ties
- Improved high stretch con rod bolts
- Improved door locks and sealing for CPs
- GM type pressurization cap for cooling water system
- Rotex magnet valves for sanding and misc air circuits
- Slip ring modifications including sleeve improvements
- Brush holder mod on all m/cs particularly AGs.
- Modified LED Focus Light
- Modified TBUs
- Indigenous multigrade CC oil
- Non-chromate inhibitor
- Napthenic base compressor oil (shell Corena P-150)
- Improved primary damper bracket & lock arrangement of traction bar nut of MK5 bogie
- Modification in TM 4906 for improving flash-over performance
- Improvement in air compressor design on WABCO pattern
- Release and run position modification on diesel loco for air bk pass. train
- Modified feed valves
- Modified design of bubble collector
- Anodised window frames