

Chapter II: Effectiveness of Army Base Workshops

2.0 Importance of overhaul

The Indian Army has a large inventory of weapon systems and equipment which need to be maintained and sustained in battle worthy condition. The decision to overhaul equipment is based on the maintenance philosophy promulgated at the time of induction for the envisaged life cycle as enumerated in Equipment Management Policy Statement (EMPS). The targets of overhaul to be undertaken by ABWs are decided by MGO depending on combination of factors such as periodicity of overhaul as stated in EMPS and condition of equipment, backlog of overhaul, capacity of ABWs and supply of spares by DGOS and various spares supplying agencies.

2.1 Equipment profile

Indian Army holds 23 Class “A” vehicles in its inventory that includes Armoured Fighting Vehicles (AFV), Infantry Combat Vehicles (ICV), Armoured Recovery Vehicles (ARV), Guns and Snow Vehicles. All supporting vehicles are classified as Class “B” equipment.

Considering the important features and criticality in war scenario, the following AFVs/ICVs and ARVs along with their overhaul agencies have been covered in audit based on the workshop selected for the performance audit as indicated in Table 2 below.

Table-2: Features of the selected Class “A” equipment and their overhauling agency

Equipment	Year of Induction	Important features	Overhauling Agency
Tank T-90	2002	It is the main stay of Armoured Corps.	Overhaul due from 2018. Overhaul Agency yet to be decided. Only component level repair ⁶ at 505 ABW decided.
MBT Arjun	2004	An indigenously developed Tank with 120 mm rifled bore gun. Critical in NBC war scenario.	Overhaul due from 2020. Overhaul agency yet to be decided.
Tank T-72	1979	It is the Main Tank of the Army. Fitted with 780 HP super charge engine and 125mm smooth bore gun.	505 ABW & Heavy Vehicle Factory (HVF), Avadi
BMP-II	1985	It is an Infantry Combat Vehicle (ICV) with amphibious capabilities and high degree of mobility and provides additional safety to Infantry soldiers.	512 ABW & Ordnance Factory, Medak (OFM)
ARV WZT-3	1999	It is Armoured Recovery Vehicle (ARV) for Tank T-72 and T-90 and its variants.	Consultancy contract for creation of facility at 512 ABW has been concluded.
ARV VT-72B	1994	It is Armoured Recovery Vehicle (ARV) for Tank T-72 and T-90 and its variants.	
ARV WZT-2	1981	It is a recovery vehicle for Tank T-55 and its variants	512 ABW

⁶ Component Level Repair- In this facility pool of MUAs (Major Unit Assembly) will be maintained to replace when they become defective. This facility will be setup in the Corps Zone Workshop so that repairs can be carried out in forward areas and Tanks put on road in serviceable state with minimum downtime. The defective MUAs will be repaired and returned to the pool using the proposed “Component Level Repair Facilities”. This will enable sustainment of the Tank while providing mission readiness and reliability.

2.2 Maintenance Philosophy and Intervention Norms

MoD published (April 1987) maintenance philosophy for AFVs, ICVs and ARVs based on envisaged service life of 30 years. This was applicable to all the AFVs, ICVs and ARVs in service as well as those to be inducted in future. These norms were revised by the Army HQ in December 2003 and again in February 2014 as shown in Table 3 below:-

Table- 3: Intervention period for maintenance of Class “A” vehicles

Intervention for main-tenance	Periodicity as per Policy of 2003 (whichever is earlier)		Periodicity as per Policy of 2014 (whichever is earlier)	
Medium Repair (MR-1)	8-10 Years	2000-2500 KM	10 Years	2400 KM
Overhaul (OH- 1)	15-16 Years	2500-4000 KM	16 Years	3700 KM
Medium Repair (MR -2)	21-22 years	5250-5000 KM	23 years	5400 KM
Overhaul (OH – 2)	-----	-----	29 Years@	6700 KM
Medium Repair (MR -3)	26-27 Years	6500-6750 KM	35 Years#	7900 KM

@For equipment to serve beyond 35 years. Balance equipment to undergo MR instead and de induct after 35 years

Only for OH-2 equipment and service up to or beyond 40 years

Similarly, class ‘B’ equipment viz. Radars and DG sets are required to be overhauled after 10 years from the date of induction. Second overhaul is due after seven years of first overhaul. In case of Battle Field Surveillance Radar (BFSR), first overhaul is due after seven years.

2.2.1 Maintenance Process

As per extant procedure, an ABW is to be nominated to overhaul particular equipment at the introductory stage itself in order to facilitate long range forecasting and planning. Every year, during overhaul target fixation meeting, targets for current production year are reviewed, and are fixed for the next year and a roll on plan prepared for next three years. The inputs received from ABWs, DGOS, OFB and DPSUs form the basis for revision of targets. The overhaul process starts at ABWs with issue of AHQ repair programme and targets are intimated to all the supply agencies for them to gear up for timely manufacturing, provisioning and supply of spares to ABWs. After receipt of overhaul programme, workshop issues calling in notice demanding the repairable from the feeding depots.

2.3 Backlog in overhaul of important class ‘A’ equipment

We noticed that the maintenance philosophy and intervention norms for overhaul for class ‘A’ equipment as implemented, resulted in prolonged delays and backlog in overhaul of important class ‘A’ equipment as indicated in Table 4 below:-

Table 4:- Backlog of overhaul of important class 'A' equipment

Equipment→	BMP-II and IIK#				ARV WZT-2				Tank-T-72#			
Year	a ⁷	b ⁸	c ⁹	d ¹⁰	a	b	c	d	a	b	c	d
2010-11	2240	949	72	877	222	222	00	222	2418	811	98	713
2011-12	2329	928	124	804	222	222	02	220	2418	793	83	710
2012-13	2368	912	72	840	222	220	02	218	2418	789	126	663
2013-14	2412	939	121	818	222	218	02	216	2418	727	140	587
2014-15	2412	980	145	835	222	216	03	213	2418	664	160	504
2015-16	2412	892	90	802	222	213	13	200	2418	612	133	479

Overhauled BMPs include BMPs overhauled by OF, Medak and overhauled T-72 Tank include Tanks overhauled by Heavy Vehicle Factory, Avadi.

It can be seen from the Table above that, on the average, 35 *per cent* of the total fleet of BMP has been due for overhaul during 2010-11 to 2015-16, which has reduced the effective availability of the fleet for the operations. Since 512 ABW and OF Medak had together annually overhauled only 104 BMPs on an average during this period, the possibility of liquidating the backlog to make the entire fleet operational in near future does not look bright.

In case of ARV WZT-2, where the entire fleet was due for overhaul in 2010, only 22 (10 *per cent*) of the total fleet had been overhauled during the period 2010-11 to 2015-16 and 168 were held at CAFVD, Kirkee and 512 ABW in Class V (off-road) condition awaiting overhaul.

Though the backlog in overhaul of Tank T-72 has been reduced from 713 in 2010-11 to 479 Tanks in 2015-16, it is still on higher side representing 20 *per cent* of the total population, as T-72 is a main battle Tank of the Indian Army.

2.3.1 Backlog in overhaul of important Signal equipment

We noticed that non-observance of the maintenance philosophy and intervention norms of the signal equipment coupled with prolonged delays resulted in backlog of its overhaul as indicated in Table 5 below:-

Table-5: Backlog of overhaul of Signal equipment

Equipment	Induction years	Total population held	Total due for overhaul	Equipment overhauled up to 31.03.2016			Backlog of first and second overhaul
				1 st over-haul	2 nd over-haul	Total over-hauled	
Radar Fly Catcher	1987 to 2008	215	1 st OH-168 2 nd OH-77	138	58	196	1 st OH- 30 2 nd OH- 19
Radar TC reporter	1996 to 2005	92	1 st OH-74 2 nd OH-00	49	00	49	1 st OH-25 2 nd OH- 00

⁷ a- Total population

⁸b- Equipment due for OH as of March each year including backlog from previous years

⁹c- Overhauled during the Year.

¹⁰d-Backlog

Battle Field Surveillance Radar (BFSR) Medium Range	2001 to 2013	252	1 st OH-201	159	00	159	1 st OH- 42
19 KVA DG set	Records not available in ABW	307	1 st OH-242 2 nd OH-77	187	58	245	1 st OH- 55 2 nd OH- 19

We observed backlog in first overhaul of 18 *per cent* of Radar Fly Catcher, 34 *per cent* of Radar TC Reporter and 21 *per cent* of Battle Field Surveillance Radar.

We observed that the backlog in overhaul of the equipment as discussed above was due to the deficiencies in implementation of its maintenance philosophy and intervention norms such as downward revision of the targets every year and delay in overhaul. These have an adverse impact on operational readiness. The performance of each selected ABW is commented in succeeding paragraphs.

2.4 505 Army Base Workshop (ABW), New Delhi

505 ABW undertakes the overhaul of Tank T-72 including its engines, Scania vehicles, AM-50 bridging system. The 505 ABW obtains the repairables and handover the overhauled equipment to Central Vehicle Depot (CVD), Delhi which is designated feeding depot for 505 ABW.

2.4.1 Non achievement of overhaul targets

Our scrutiny of minutes of Mid-term Review meetings held during the audit period revealed that every year targets were revised. The details of targets originally assigned, subsequently revised and achieved are indicated in Table 6 below:-

Table-6: Non-achievement of Overhaul Targets at 505 ABW

Equipment→ Year	Tank T-72			Engine T-72			ColosTatra		
	O ¹¹	R ¹²	A ¹³	O	R	A	O	R	A
2010-11	50	40	35	50	60	30	Nil	20	20
2011-12	50	50	10	100	21	07	30	20	06
2012-13	60	50	50	136	80	71	10	10	10
2013-14	50	40	30	100	80	72	10	10	10
2014-15	50	40	40	100	60	60	03	03	03
2015-16	50	50	40	100	100	100	Nil	Nil	Nil

As seen from the above table, there was shortfall in achieving the targets *vis a vis* original targets in respect of Tank T-72 ranging from 17 to 80 *per cent*. In respect of Engines of T-72, it ranged between 0 and 93 *per cent*. 505 ABW could not achieve the original and the revised targets that were fixed in the Midterm Review meetings.

¹¹ 'O' Original Target

¹² 'R' Revised Target

¹³ 'A' Achievement. The overhauls completed during the year are reflected as achievement

MGO, in reply (May 2016) stated that delay in overhaul was mainly due to non availability of spares by OFs and DPSUs. The contention of MGO is not plausible as the responsibility for availability of spares also rests with MGO. Hence it was incumbent on them to make sure that the spares authorized as per overhaul scales were made available in full range and depth before the start of production year.

The non-availability of critical spares and production hold up items as noticed during current review has been discussed in Para No 4.1.1 of Chapter IV.

2.4.2 Delay in overhaul

In order to effectively and efficiently manage the overhaul of various equipments, BWG had specified norms indicating the maximum time required for the activity. We however observed that despite the downward revision in target during the currency of the year, there was inordinate delay in overhauling the equipment as against the stipulated timelines.

As per existing norms, the overhaul of Tank T-72 is required to be completed within 144 days. We however observed that Tank T-72 could not be overhauled in stipulated time frame. Actual time taken for overhaul of each Tank during 2010-11 to 2013-14 exceeded the norm of 144 days and delay ranged between two to three years. Table 7 below explains the status of delay in overhaul during the last six years which shows the status of Tanks taken up for overhaul during that year and time taken for their overhauling by the ABW.

Table 7: Delay in overhaul of Tank T-72

Year	Eqpt. taken up for OH (No.)	Overhauled (No)	Overhauled within time frame	Time take for overhaul (days)		Time taken for overhaul excluding time frame	
				Minimum	Maximum	Minimum	Maximum
2010-11	54	53 ¹⁴	00	378	877	234	733
2011-12	29	29	00	372	980	228	836
2012-13	36	36	00	247	914	103	770
2013-14	15	15	00	456	688	312	544
2014-15	40	40	00	356	577	212	433
2015-16	50	40	00	212	408	68	264

MGO in reply stated (May 2016) that the delay in overhaul was solely due to non-availability of spares. Contention of MGO is not plausible as the responsibility for availability of spares also rests with MGO.

2.4.3 Delay in issue of overhauled Tank T-72 to Units

On completion of overhaul, the overhauled equipments are collected by the feeding Depots. Thereafter, DGOS issues release orders, after consulting MGO Branch, Line Directorate (Users) and MISO (Management Information System Organization), to feeding Depots for issue of the overhauled equipment to concerned field units.

As per the policy on improving the quality of overhauls, the overhauled equipments are required to be handed over to the Depots by the Workshops within seven days. After receipt

¹⁴ One tank T-72 has been declared Beyond Economic Repairs (BER)

of the overhauled equipment, the depots inform DGOS regarding availability of equipment for issue of release orders. We observed that in most of the cases, the ABWs adhered to the laid down time schedule for issue of overhauled equipments. The efficiency of the Workshops in timely issue of the equipment was however defeated by the delays in release and dispatch of equipment by the Ordnance Depots.

We observed that as far as release of equipment by DGOS and time frame for dispatch of equipment by Depots to the units was concerned, no laid down Standard Operating Procedure (SOP) had been framed. As a result, there was no consistency in issue of release orders (RO) by AHQ. In some cases, the release orders were issued even before completion of overhaul while as in other cases RO was delayed by more than a year.

a. Delay in issue of Release Order (RO)

We observed that out of 181 overhauled Tanks, only in five cases ROs were issued before collection of tank by CVD. ROs in 151 cases were issued within two months and in 11 cases ranged from two months to a year. In two cases of Tanks overhauled in 2011-12, ROs are yet to be issued. Details as indicated in Table 8 below:

Table-8: Delay in issue of RO in respect of overhauled Tank T-72

Year	No of overhauled T-72 Tanks collected by CVD	Issue Orders floated by AHQ					
		Prior to collection	0-60 days	61-120 days	121-180 days	181-365 days	366 days & above
2010-11	17	00	01	08	02	06	00
2011-12	33@	02	26	03	00	00	00
2012-13	35	02	26	04	02	01	00
2013-14	28	01	23	04	00	00	00
2014-15	28	00	28	00	00	00	00
2015-16	40@	00	27	01	00	00	00
Total-	181	5	131	20	4	7	0

@ In two cases of 2011-12 and 12 cases of 2015-16 Release orders are yet to be floated (March 2016)

Contrary to the facts, in reply, MGO stated (July 2016) that there was no delay on their part to initiate release order, which was done within two weeks.

b. Delay in dispatch

Out of 181 overhauled Tanks collected by CVD Delhi Cantt, 23 Tanks are yet to be issued to the units and in 78 Tanks, there was a delay ranging from two to 24 months in issue as indicated in Table 9 below:

Table-9: Time taken in dispatch of overhauled Tank T-72 collected by CVD

Year	No of overhauled T-72 collected by CVD	Time taken in dispatch of overhauled T-72 collected by CVD.						
		Up to 2 Months	2 to 4 Months	4 to 6 Months	6 to 12 Months	12 to 24 Months	24 Months and above	Yet to be issued
2010-11	17	13	01	00	03	00	00	
2011-12	33	19	04	03	01	04	00	2
2012-13	35	21	03	07	00	03	01	-
2013-14	28	07	01	04	07	04	05	-
2014-15	28	11	06	05	02	02	01	1
2015-16	40	09	03	04	02	01	01	20
Total	181	80	18	23	15	14	8	23

2.4.4 Quality Index of overhauled equipment and engines

The aim of overhaul of equipment is to restore the Army equipment in readiness by neutralizing the effects of age, usage and deployment. The Technical Group EME (TGEME) functioning under DGEME, had suggested (August 1994) a detailed procedure for improvement in quality of overhauled equipment. The procedure necessitated thorough inspection at various stages by inspection staff of ABWs, at critical stages by Resident Inspectors (RI) and final inspection of the completely Overhauled equipment by RI.

HQ BWG, with an aim to improve the quality of overhauled equipment, engines and major assemblies also issued (August 2004) a Technical Directive to measure the Quality Index (QI) of overhauled equipment. QI is a performance indicator to evaluate the quality performance of an overhauled equipment against specifications laid down by the manufacturers. QI will be low if equipment is found to have defects during final testing by the Quality Control of the BWG.

As per the directive, QI for overhauled Tank T-72 should be 95. We observed that the QI achieved was below the limit prescribed in Technical Instruction and the equipment had been cleared for issue to the depots despite the shortfall. The Quality Index achieved in respect of Tank T-72 is shown in Table 10 below:

Table-10: Quality index of overhauled Tank T-72

Year	Tank T-72	
	Minimum	Maximum
2010-11	87.8	91.98
2011-12	86.51	92.44
2012-13	84.73	91.93
2013-14	90.3	92.20
2014-15	83.80	92.13
2015-16	87.25	92.2

In reply, MGO (May 2016) attributed non achievement of the target quality index to non-availability of spares and the shortfall was made from reclamation and self-manufacture of spares. The reply was suggestive of the fact that purpose of overhaul to achieve 'Zero Hour Zero Kilometer' status could not be achieved.

2.4.5 Issue of overhauled equipment without testing

We observed that due to non availability of certain vital test facilities, the overhauled equipment were issued to the units without testing as detailed below:-

i. Issue of over hauled Tank T-72 without test firing

The ABW lacks test firing facility for T-72 Tanks. However, MGO Branch had accorded special sanction to roll out the Tanks without test firing on the condition that activity would be carried out during initial firing of the affected units.

ii. Vital deficiency of Special Machine Tools (SMTs), Special Tools Equipment (STEs) and Tools/Jigs (TJs)

We observed that the ABW was deficient in Special Machine Tools/Special Test Equipment/Tools Jigs like universal gun pull back apparatus, composite ring required for Quality Checks (QC) on the Gun portion of T-72, Multipurpose sling device for carrying out quality checks on auto portion of T-72, Eye bolt for mounting and dismounting gear box and Guard disc for installation and removal of road wheels without disconnecting the tracks. The deficiency of vital SMTs/STEs/TJs was reported since 2011-12.

2.5 512 Army Base Workshop (ABW), Kirkee

The 512 ABW is assigned the task of repair and overhaul of BMP II & their variants, ARVs and engines pertaining to BMPs (UTD-20 Engine). The ABW obtains the repairables and handover the overhauled vehicles to CAFVD which is the designated feeding depot for 512 ABW.

2.5.1 Non achievement of overhaul targets

512 ABW also could not achieve the original and revised targets that were fixed in the Mid-term Review meetings. Details of targets originally assigned, subsequently revised and achieved as indicated below in Table 11:

Table- 11: Non-achievement of Overhaul Targets at 512 ABW

Equipment→	BMP II/IIK			ARV WZT-2			UTD- 20 Engines		
Year	O	R	A	O	R	A	O	R	A
2010-11	120	46	46	10	4	Nil	150	135	135
2011-12	100	85	85	10	2	2	150	110	110
2012-13	116 + 4 (IIK)	96	85	2	2	2	150	50	41
2013-14	114 + 6 IIK	120	102 + 2 (IIK)	2	2	Nil	150	150	115
2014-15	145 + 5 (IIK)	96 + 9 (IIK)	97 + 9 (IIK)	2	10	03	150	135	147
2015-16	150	150	70	20	13	13	150	150	150

As seen from the above table, there was shortfall in achieving the targets *vis a vis* original targets in respect of BMP ranging from 13 to 62 *per cent*, in respect of ARV WZT-2 ranging from 0 to 100 *per cent* and in respect of UTD-20 engines, it ranged between 0 to 73 *per cent*.

512 ABW while agreeing with the audit findings stated (July 2015) that failure to supply repairable or spares in time as per requirement led to non-achievement of laid down targets and consequent downward revision. They further stated that 110 overhauled BMPs were held by them due to non-availability of certain critical spares/assemblies, for which deviation¹⁵ sanctions were awaited.

Thus despite assurance by the Ministry in 2005 to improve the availability of spares, ABWs did not get sufficient spares to meet their overhaul targets leading to backlog and consequently impacting operational readiness. However, as far as availability of repairable was concerned, we found that 512 ABW was holding more BMPs than the target assigned to them, hence non availability of repairable cannot be a reason for non-achievement of targets.

2.5.2 Delay in overhaul

As per existing norms, the overhaul of BMP vehicle is required to be completed within a timeframe of 153 days. For overhaul of an Engine in ideal conditions, 512 ABW had set a time frame of one month.

We however observed that BMP and engines could not be overhauled in stipulated time frame. During the period under review, the time taken for the overhaul of BMP ranged up to 1512 days. Hence not only was the availability of the equipment denied by such delay, even the effective life (13 *per cent*) of the equipment was also lost due to the hold up. Similarly, average time taken for overhaul of each UTD-20 engine for BMP was 308 days which was 10 times of the stipulated time frame of 30 days. Table 12 below indicates the status of delay in overhaul during the last six years.

Table 12: Delay in overhaul

Year	Equipment	Eqpt. taken up for OH (No.)	Over hauled (No)	Over hauled within time frame	Time taken for overhaul (days)		Time taken for overhaul excluding time frame	
					Minimum	Maximum	Minimum	Maximum
2010-11	BMP	73	73	00	243	1512	90	1359
	UTD engine	130	130	00	167	799	137	769
2011-12	BMP	53	53	00	324	1154	171	1001
	UTD engine	116	116	00	209	829	179	799
2012-13	BMP	79	79	00	737	962	584	808
	UTD engine	56	56	00	257	693	227	663
2013-14	BMP	113	113	00	502	618	349	465
	UTD engine	61	61	00	88	521	58	491
2014-15	BMP	56	36 [#]	00	333	616	180	463
	UTD engine	78	68	00	406	152	376	122
2015-16	BMP	96	00 [#]	00	-	-	-	-
	UTD engine	156	66	00	310	74	280	44

Twenty BMPs taken for overhaul in the year 2014-15 and all the BMPs taken for overhaul in the year 2015-16 were pending for overhaul as of 31 March 2016.

¹⁵ **Deviation Sanctions-** Deviation means deviating from the standard norms prescribed for overhaul of a particular equipment *i.e.* Fitment items not fitted, not carrying out all the tests, use of retrieved material *etc.* These sanctions are accorded by MGO in consultation with line directorates.

MGO in reply stated (May 2016) that the ideal through put time was based on the premise that spares authorized as per overhaul scale were placed before the start of the Production year. Delay in overhaul was solely due to non-availability of spares.

2.5.3 Delay in issue of overhauled equipment to Units

Delay caused due to late issue of RO and delayed dispatch by CAFVD, Kirkee is analysed as follows:

(a) Delay in issue of release order (RO):

Delay in issue of RO by DGOS in respect of 102 out of 499 BMPs overhauled by 512 ABW and collected by CAFVD during the period under review ranged from two months to more than a year, as indicated in Table 13 below:

Table-13: Delay in issue of RO in respect of overhauled BMPs

Year	No of overhauled BMPs collected by CAFVD	Release Orders issued by AHQ					
		Prior to collection	0-60 days	61-120 days	121-180 days	181-365 days	366 days & above
2010-11	110	47	09	15	19	18	02
2011-12	51	45	-	-	-	-	06
2012-13	54	38	09	02	03	02	-
2013-14	24	09	08	02	-	05	-
2014-15	77	40	35	-	01	01	-
2015-16 @	183	09	99	16	10	-	-
Total-	499	188	160	35	33	26	08

@ Release orders in respect of 49 BMPs are yet to be floated as of March 2016

In reply, MGO stated (July 2016) that there was no delay on their part to initiate release order, which was done within two weeks of receiving the list of available BMPs from CAFVD Kirkee. The reply is suggestive of the fact that delay has occurred at the level of CAFVD, Kirkee, which is a part of Ordnance Branch, functioning under MGO. Hence shifting of responsibility to the Depot was not in order.

(b) Delay in dispatch

Besides the delay in issue of release orders by DGOS, there was a further delay in dispatch of BMPs by CAFVD to units/formations even after the issue of release orders by AHQ as indicated in Table 14 below:

Table-14: Time taken in dispatch of overhauled BMPs collected by CAFVD

Year	No of overhauled BMPs collected by CAFVD	Time taken in dispatch of overhauled BMPs collected by CAFVD					
		0-60 days	61-120 days	121-180 days	181-365 days	366-730 days	More than 730 days.
2010-11	110	06	46	27	29	01	01
2011-12	51	15	08	01	02	22	03
2012-13	54	09	10	10	13	12	-
2013-14	24	-	-	04	-	20	-
2014-15	77	12	40	18	07	-	-
2015-16	183	65	33	03	-	-	-
Total	499	107	137	63	51	55	04

Note- 82 BMPs were yet to be issued as of March 2016

We observed that in 12 per cent cases (i.e. 51 out of 417), there was delay of more than six months to a year and in 14 per cent cases (i.e. 59 out of 417) the delay was more than one year (Maximum delay 1796 days), in dispatch of overhauled BMPs to concerned units after the receipt of the ROs from Army HQ.

2.5.4 Quality of overhauled BMPs

We observed that overhauled BMPs issued to users were also low in Quality Index due to use of poor quality material and poor workmanship. Even the ABW lacked adequate testing facilities as brought out below:-

(i) Low Quality Index

As per the directive, QI for overhauled BMP should be 95. We observed that the QI achieved was far below the limit prescribed in Technical Instruction and the equipment had been cleared for issue to the depots despite the shortfall. The quality Index achieved for BMP is shown in Table 15 below:

Table-15: Quality index of overhauled equipment.

Year	BMP	
	Minimum	Maximum
2010-11	31.44	65.83
2011-12	60.65	70.04
2012-13	57.10	75.37
2013-14*	-	-
2014-15	58.40	71.84
2015-16	70.28	77.40

*Inspection was not carried out by QA wing of BWG during the period.

We observed that defects were recurring over the years and the numbers of defects in the major sub systems of BMP showed increased trend. For the Automotive Portion while the types of defects were only 10 in 2010-11, the same increased to 126 in 2014-15. Similarly there was an increase in the type of defects in Armament Portion, Instrument Portion, TCM portion and Electric Portion by 480 to 1017 per cent. System wise defects during the last six years are summarized in Table 16 below:-

Table-16: Defect frequency of overhauled equipment

Year	Automotive Portion		Armament Portion		Instrument portion		TCM portion		Electric Portion	
	Type of defects	Total No. of defects	Type of defects	Total No. of defects	Type of defects	Total No. of defects	Type of defects	Total No. of defects	Type of defects	Total No. of defects
July 2010- June 2011	10	NA	4	NA	5	NA	6	NA	4	NA
July 2011- June 2012 ^c	19	419	4	87	21	537	8	123	8	157
July 2012- June 2013	35	836	8	180	41	1481	38	553	7	56
July 2013- June 2014	88	2945	19	273	14	284	21	483	27	187
July 2014-June 2015	126	3081	34	630	24	429	61	787	31	384
July 2015 –March 2016	NA	6334	NA	1769	NA	1913	NA	2645	NA	1236

NA= Not Available

In reply, MGO (May 2016) attributed low quality index to non-availability of spares and the shortfall was made from reclamation and self manufacture of spares. The reply was suggestive of the fact that purpose of overhaul to achieve 'Zero Hour Zero Kilometer' status was not achieved and the equipment were issued with compromised quality.

(ii) Issue of overhauled equipment without testing

We observed that due to non availability of certain vital test facilities at 512 ABW, the overhauled equipment were issued to the units without testing as detailed below:-

A. Ad-hoc testing of amphibious capabilities of overhauled BMPs

The counter weight of Hull is required for dip testing and checking the amphibious capabilities of overhauled BMP. This test is a pre requisite as per OEM recommendations.

We observed that in the absence of counter weight of Hull, test was carried out by making workers stand on the hull being tested.

In reply, MGO stated (May 2016) that the amphibious testing of overhauled BMPs is full proof. They further stated that in absence of counter weight as per dimensions given by OEM the equivalent weight is put on BMP under test to ascertain perfect floatation. However the fact remains that the mandatory test is being carried out without proper test facility as per the recommendation of the OEM.

B. Issue of BMPs without test firing

Due to lack of test firing facility and ammunition at 512 ABW, overhauled BMPs were issued without proof firing. The case has been discussed in the Paragraph 3.4 of Chapter III.

In reply MGO stated (May 2016) that teams from the ABW were associated during test firing at user firing ranges, hence 100 *per cent* proof firing was being done. The reply is not tenable as the equipment should have been issued to user units after complete testing.

C. Vital deficiency of Special Machine Tools (SMTs), Special Tools Equipment (STEs) and Tools/Jigs (TJs)

We observed that the ABW was deficient in Special Machine Tools/Special Test Equipment/ Test Jigs like universal gun pull back apparatus, Eye bolt for mounting and dismounting gear box and Guard disc for installation and removal of road wheels without disconnecting the tracks. The deficiency of vital SMTs/STEs/TJs was reported since 2011-12.

In reply HQ BWG stated (September 2015) that the digital tools were demanded to enhance efficiency and save time but these had not been received yet. In the absence of digital test equipment, QA/QC checking was done with conventional instruments.

The reply that QA/QC check was being done with conventional methods was indicative of the fact that the QA/QC checking in the absence of these test equipment was not only time consuming but also less efficient. This also has an impact on quality of overhaul.

(iii) Feedback of overhauled equipment from the Users

HQ BWG (January 2005) issued Technical Directive for obtaining feedback report on equipment overhauled by ABWs within six months after equipment reached the user. The feedback report has to rate the overhauled equipment in three categories viz. Excellent, Good and Satisfactory.

We observed that feedback reports on the quality of work carried out by ABW in overhaul consisted of barrel spring broken during firing, oil pump leaking, fly wheel leaking, deficient tools and accessories, unsatisfactory night vision *etc.* Non-supply of vital equipment like gun, vision sights, maintenance kits *etc.* with overhauled BMPs did not serve the purpose of 'Zero Hour Zero Kilometers'. Despite these shortcomings we observed that out of 295 feedback reports received during the period under review, 16 were graded as 'Excellent', 132 'Good' and 147 'Satisfactory'.

In reply MGO stated (May 2016) that the user perceives overhauled equipment as either 'fit' or 'unfit' for war and accordingly writes only good or satisfactory. Hence co-relation to overhaul performance in conjunction with categorization by users has no relevance. Reply is not tenable as 'fit' or 'unfit' are not the criteria on which quality of overhaul is assessed under feedback. The deficiency in supply of vital equipment coupled with the fact that only five *per cent* of the overhaul was termed "excellent" is a comment on the quality of the overhaul.

2.6 509 Army Base Workshop (ABW), Agra

509 ABW is responsible for repair and overhaul of communication systems, radars and other electronic equipment including diesel generators. User units directly deposit their equipment due for overhaul and collect the same after overhaul from the ABW.

The details of targets originally assigned, subsequently revised and achieved in overhaul of signal equipment are indicated below in Table-17:

Table17:- Non-achievement of Overhaul Targets for signal equipment

Equipment→	Rdr Fly Catcher			Rdr TC Reporter			BFSR (MR)			Gen set 30 KVA		
Year	O	R	A	O	R	A	O	R	A	O	R	A
2010-11	12	12	12	5	5	5	25	25	25	55	55	55
2011-12	24	18	18	10	5	5	25	19	19	65	44	44
2012-13	24	18	18	15	08	08	25	20	20	65	32	32
2013-14	24	12	12	15	07	07	25	25	25	30	24	24
2014-15	24	12	12	15	06	06	25	25	25	65	25	25
2015-16	30	30	24	15	15	14	-	-	-	55	55	40

As seen from the above table, there were shortfalls in achieving the targets *vis a vis* original targets up to 50 *per cent* in respect of Radar Fly Catcher, up to 60 *per cent* in respect of Radar TC Reporter and 62 *per cent* in respect of Gen Set 30 KVA. In case of BFSR (MR) there was marginal shortfall during 2011-13.

MGO in reply stated (May 2016) that the targets could not be achieved due to non-availability of spares from Ordnance Factories/ DPSUs and slow pace of indigenization. The other reasons for non-achievement of the targets was non-availability of repairable as equipment due for overhaul cannot be de-inducted at the same time from the operational area due to operational reasons. However, the fact remains that a major component of critical signal and surveillance equipment are yet to be overhauled thereby compromising communication and surveillance activities.

2.6.1 Delay in overhaul of Signal equipments

Time-frames for overhaul of radars / generator sets were also prefixed. We, however, observed that time taken for overhaul of these equipments during the review period has invariably exceeded the laid down time-frame. Out of 381 signal equipment overhauled during the six years, only nine equipments were overhauled in time. The delay ranged up to 921 days in case of Flycatcher radar. Delay in overhaul of these equipments during the period under review is indicated in Table 18 below:

Table-18: Delay in overhaul of equipment at 509 ABW

Equipment	Eqpt Overhauled (Nos.)	Time for overhaul as per norms (in days)	Equipment overhauled				Maximum time taken for overhaul (in days)	Average time taken for overhaul (in days)
			Within the prescribed time limit	within 100 days	Between 101 to 200 days	201 days and above		
Radar Flycatcher	96	70	09	13	40	34	921	200
TC Reporter	45	70	00	01	09	35	467	314
BFSR (MR)	109	07	00	39	44	26	664	146
Gen Set 30 KVA	131	21	00	12	45	74	544	241
Total	381	-	9	65	138	169	-	-

2.6.2 Delay in dispatch of signal equipments to the units

We observed that following equipment overhauled during 2010-11 to 2015-16 by 509 ABW were not issued (March 2016) to the user unit due to non-reporting of collection parties from units. The equipments were still held in the Workshop. Year wise details of such equipment are shown in Table 19 below:

Table-19: Overhauled equipment yet to be collected by units

Year	Type of equipment				Total Equipment
	Telecom	Instruments	Radar	Power	
2010-11	01	01	-	-	02
2011-12	-	-	05	-	05
2012-13	04	-	35	01	40
2013-14	09	20	09	03	41
2014-15	27	65	24	-	116
2015-16	-	-	10	16	26

2.7 510 Army Base Workshop (ABW), Meerut

510 ABW undertakes overhaul of various engineering equipment and specialist vehicles. The details of targets originally assigned, subsequently revised and achieved in overhaul of the equipment are indicated in Table-20 below:

Table-20: Status of Achievement of Overhaul Targets

Eqpt→	Fagot/ Konkur			Flame launcher I&II			Zil 131			KolosTatra			HRV AV 15		
	O	R	A	O	R	A	O	R	A	O	R	A	O	R	A
2010-11	300	200	200	25	25	25	35	38	38	80	50	52	-	-	-
2011-12	225	225	250	50	50	50	40	40	37	50	50	50	-	1	1
2012-13	250	250	250	100	65	66	40	42	42	60	60	60	5	5	5
2013-14	350	320	306	100	85	107	45	35	32	50	50	52	10	10	8
2014-15	380	380	380	70	70	71	40	38	38	20	25	27	10	9	1
2015-16	380	380	380	70	77	77	25	25	27	30	30	30	15	15	15

As seen from the above table, 510 ABW had generally achieved the targets of overhaul except for Fagot/ Konkur in 2013-14, Zil 131 in 2011-12 & 2013-14 and HRV AV 15 in 2013-14 & 2014-15.

2.7.1 Non-Formulation of overhaul policy for Class “B” vehicles - Scania, Tatra and Kraz

MoD in Action Taken Note on Report No. 14 of 1992 on “Review of Army Base Workshops” had stated that an Equipment Management Policy Statement is issued by the MGO’s branch in consultation with Users, Ordnance and EME directorate before an equipment is inducted.

We however, observed that no overhaul policy for Scania, Kraz-255B/B1 and Tatra T-815 was available with HQ BWG and the concerned workshops. Presently, Base workshops are accepting these vehicles of eight years vintage and above for overhaul as per the direction of EME Directorate.

2.8 515 Army Base Workshop (ABW), Bengaluru

The primary role of 515 ABW is to undertake manufacture and indigenization of spares for various equipments held by Indian Army. Besides, the workshop also manufactures simulators for field army and overhaul of aviation rotables.

We analyzed the performance of the workshop to assess its effectiveness with reference to the role assigned and found that the workshop had not commenced the overhaul of aviation rotables. Further, the workshop was not able to adhere to the time schedule allotted for manufacture of spares. Our findings are discussed below.

2.8.1 Non-commencement of overhaul of aviation rotables

The overhaul of rotables of Chetak and Cheetah Helicopters in the Indian Army was being undertaken by Hindustan Aeronautics Ltd. In order to meet the future engineering support requirements, the ABW was assigned the responsibility to undertake the overhaul of aviation rotables by AHQ in 2005. We observed that MoD, in June 2011 accorded sanction for overhaul of 99 rotables. The target was subsequently reduced to 23 by MGO (Avn) in December 2014.

MoD in December 2006 sanctioned Civil Works for a Repair Shed at an estimated cost of ₹ 1.94 crore, later revised to ₹ 3.20 crore in April 2008. Construction of the Repair Shed was completed in April 2010. The ABW during the period September 2005 and October 2014 procured 76 Plant, Machinery and Special Equipments (PMSE) out of which cost of 56 PMSEs was ₹ 48.96 lakh. 47 personnel were also posted for the purpose of overhaul. However, no overhaul could commence (December 2015) as the ABW had not been put on the dependency list of Central Aviation Supply Depot (CASD) by MGO (Avn) for supply of rotables and spares for overhaul.

In reply to our query as to why overhaul of rotables was not commenced, it was informed (December 2015) that DGOS had expressed reservations to MGO (Avn) about repair and overhaul of rotables at the ABW, stating that presently HAL was providing comprehensive repair and overhaul facilities to meet urgent requirements and HAL located at the same station was able to meet the targets.

MGO stated (May 2016) that overhaul activities for 13 of 23 rotables has been commenced from the production year 2016-17. As an overhaul facility was already available at HAL and as only 23 out of 118 rotables will be overhauled, creation of infrastructure at a cost of ₹ 3.69 crore at 515 ABW was un-warranted.

2.8.2 Inordinate delay in execution of Work Orders

The Work Orders (WOs) for manufacture of spares are prioritized in three categories based on the urgency projected by the indenter as shown below in Table 21:

Table-21: Classification of Work Orders

Category	Period of completion
Operational Immediate (OPI)	To be completed within 12 months.
Priority (PTY)	To be completed within 24 months
Routine (RUT)	To be completed within 36 months

We observed that only 27 *per cent* work orders of 'OPI' category placed on the ABW by Ordnance Depots were completed within the time frame. In certain cases, the time taken was up to 93 months defeating the very purpose of processing under OPI category. In respect of 'Priority' and 'Routine' work orders, the percentage of completion within time frame was 65 *per cent* and 90 *per cent* respectively as indicated in Table 22 below:-

Table-22: Time taken for manufacture of spares.

OPI Category					
Year	Total number of WO completed	Within One year	One to Two years	Two years and above	Maximum period in months
2010-11	258	151	73	34	66 Months
2011-12	353	116	183	54	86 Months
2012-13	167	29	61	77	65 Months
2013-14	252	67	56	129	76 Months
2014-15	210	11	49	150	93 Months
2015-16	180	11	09	160	84 Months
Total	1420	385	431	604	
PTY Category					
Year	Total number of WO completed	Within Two years	Two to Three years	Three years and above	Maximum period in months
2010-11	175	136	29	10	47 Months
2011-12	167	112	36	19	57 Months
2012-13	149	109	18	22	75 Months
2013-14	238	163	12	63	79 Months
2014-15	217	119	26	72	80 Months
2015-16	155	78	30	47	79 Months
Total	1101	717	151	233	
RUT Category					
Year	Total number of WO completed	Within Three year	Three to Four years	Four years and above	Maximum period in months
2010-11	295	290	04	01	51 Months
2011-12	278	269	07	02	57 Months
2012-13	360	333	26	01	49 Months
2013-14	412	348	17	47	60 Months
2014-15	471	403	38	30	93 Months
2015-16	529	456	59	14	72 Months
Total	2345	2099	151	95	

From the above Table, it could be seen that maximum delay was in OPI category and the number of WOs completed within the time frame was decreasing over the years. Most of these WOs were placed on the ABW by various Ordnance depots for manufacture of spares required for overhaul of equipment.

We further observed that as of March 2016, 1348 Work orders were pending as against 1707 pending for execution as on 1 April 2010. Age-wise analysis of the outstanding work orders revealed that oldest outstanding work orders were of 2007-08.

MGO in reply (May 2016) attributed the delay in manufacture not only to non-receipt of samples, drawings and delay in procurement of material but also to delay in material testing and production failures.

Notwithstanding the reasons cited by the MGO, the fact of the matter is that delayed manufacturing is affecting the availability of spares required for overhaul. As the ABW was tasked with indigenization and manufacture of spares, it should have put a mechanism in place to tide over these constraints. Further, the workshop is fully equipped with drawing section and efforts should have been made to utilize the available facility. The testing infrastructure should have been created over the years.

2.8.3 Non-monitoring of Defect reports

515 ABW receives reports on manufacturing defects in respect of stores manufactured and issued by them. We however observed that documents related to the defect reports, their monitoring and replacement of defective stores were not maintained by ABW.

In reply MGO stated (May 2016) that it is possible that units/ Wksp /Depots had not raised the defect reports as spares get dissipated in the environment. It was further stated that they would be asked to raise defect reports in future and monitoring mechanism has been put in place at the ABW.

In the absence of any existing mechanism to monitor defects at the 515 ABW, no corrective steps could be taken to avoid recurrence of such defects.

2.9 Non-existence of Cost Accounting system

As per Ministry's Guidelines (March 1994) the cost of overhaul of vehicle and engine was not to exceed 30 *per cent* of the cost of new vehicle/engine. This was to be ensured by MGOs Branch/ DGEME. We noticed that at ABWs cost accounting system was not implemented. Hence cost effectiveness of overhaul process at ABWs could not be verified.

In reply MGO stated (May 2016) that the cost accounting procedure in ABW was introduced in 1995 to calculate cost of overhaul of equipment by taking into account the cost of labour and spares only. However the system was not fully implemented due to its limitation of not being able to consider other elements of cost viz MES assets and allied services being vintage. MGO brought out some of the inadequacies in the cost accounting system viz. no

access to the cost of all the spares provisioned through ordnance and assessment of cost of building.

The reply confirms the fact that Ministry's instructions of cost control are yet to be implemented and in the absence of this, efficiency and economy of ABWs cannot be ascertained. The point assumes significance in light of the fact that the initially assigned targets to the ABWs were with reference to designed capacity and these targets were invariably reduced every year. The designed capacity in turn is worked out with reference to Manpower posted to the ABWs. Since the expenditure on manpower is obligatory and the designed capacity of the ABWs remains underutilized, this is bound to result in increased cost of overhauls.

Conclusion:

Inordinate time taken for overhaul, reduction in targets due to lack of adequate spares and delay & non-creation of timely infrastructure for the overhaul had adversely affected the maintenance of the equipment. Consequently, there was a huge backlog of equipment for overhaul impacting the operational preparedness of the Army. The delayed overhaul, compounded by delay in issue of release orders and dispatch of the overhauled equipment to the unit was not desirable as a substantial part of the serviceable life of the equipment was spent in workshop/depots. One of the workshops, whose primary role was to undertake manufacture and indigenization of spares to meet the requirement of overhaul and maintenance of other ABWs and field Army had failed to meet its mandate as considerable delay was noticed in the manufacture/indigenization of spares under "OPI" category.

Quality Index of overhauled equipment was far below the prescribed norm due to poor workmanship and poor quality of material used. Due to lack of critical test facilities and test equipments, overhauled equipment was issued to user units without carrying out mandatory tests.

Recommendations:

1. Ministry should ensure strict implementation of the Maintenance Philosophy and intervention norms formulated at the time of induction of equipment and establish a monitoring & co-ordination mechanism at higher level by involving Department of Defence Production and the AHQ to remove the bottlenecks of timely availability of spares and the repairables.
2. In the absence of a policy on overhaul of Class 'B' vehicles in Army, these vehicles are overhauled by the workshops on case to case basis. Ministry may formulate the overhaul policy for Class 'B' vehicles.
3. Timeframe for issue of release orders by DGOS and dispatch of the overhauled equipment by the Depot should be prescribed.
4. Cost accounting system should be introduced in the workshop to ensure optimum utilization of resources viz. man-power, machines and materials and to assess the cost of overhaul.
5. OEM prescribed test facility should be installed at the time of setting up of infrastructure for overhaul. Since the release of T-72 Tanks and BMPs overhauled

by workshops to units without certain vital test such as proof firing and dip testing have serious operational and quality implications, facilities for these testing must be created at the concerned workshops.

6. Quality Index of overhauled BMPs despite improvement during 2015-16 still remains low and needs to be further improved.