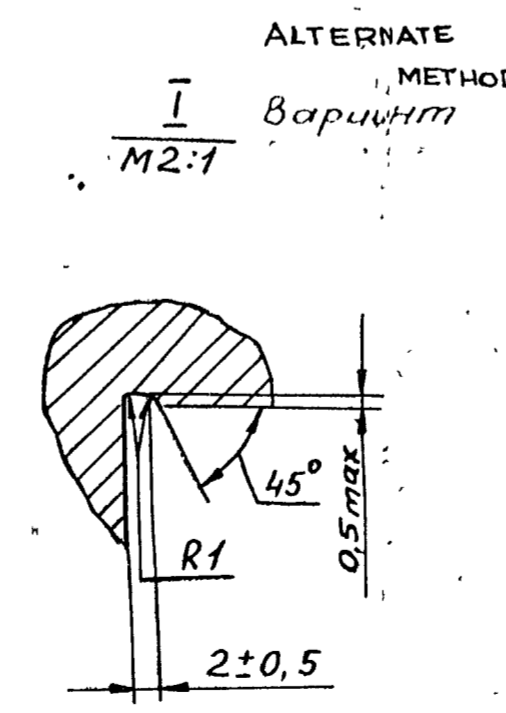


1. BHN 341-285 (DIA OF INDENTATION 3.3-3.6).
2. POSITION OF HOLES Ø7 RELATIVE TO THE TEETH ARE OPTIONAL.
3. A 0.2mm INCREASE OF PITCH DIMENSION BEYOND TOLERANCE ON 10 TEETH MAXIMUM IS ALLOWED.
4. DIFFERENCE OF MEASUREMENT OF DEPTH OF ANY PAIR OF TEETH APART FROM THE 10 PITCH INCREASED SHOULD NOT EXCEED 0.4mm.
5. LONGITUDINAL MARKS OF A DEPTH OF 0.2 mm MAX. ARE ALLOWED ON PROFILE OF TOOTH.
6. COATING: CHEMICAL OXIDIZING OIL FINISHED.
7. TO BE MARKED
8. INSTEAD OF CHECKING THE RUNOUTS SPECIFIED IN THE DRAWING IT IS ALLOWED TO PERFORM A CHECK OF THICKNESS OF DIFFERENCE BETWEEN SURFACES Ø460/ Ø512, AND 'δ' / 'B' PERMISSIBLE DIFFERENCE IS 0.15 mm MAX.
9. WELD UP THE 2 TOOTH SPACE SURFACES TO MAKE THEM SHALLOWER BY 3 TO 4 mm. FOR WELDING USE SHIELDING GAS MIDST WHILE WELDING, SEE THAT THE DIA 7 HOLES DO NOT OVER LAP AND THE WELD DOES NOT EXTEND ONTO END-FACE 'B' AND THE SURFACE OF DIA 507 C4. UP TO 1mm OF THE WELD MAY PROJECT OVER THE 4mm WIDE END FACE ON THE SIDE THE GROOVE THE WELDED SPACE SURFACE SHOULD NOT DEVIATE FROM THE TRUE POSITION BY MORE THAN 4.5 mm. THERE SHOULD BE 6 PITCHES OVER THE
10. INSTEAD CHECKING RUN-OUT OF Ø507 IT IS ALLOWED TO CHECK THE THICKNESS DIFFERENCE BETWEEN SURFACES Ø460 AND Ø507 MAXIMUM TOLERABLE VARIATION IS 0.25mm.

| | | |
|--------------------------------------|----------------|----------------------|
| Module | m | 3 |
| No of teeth | Z | 168 |
| Profile angle | α | 20° |
| Pressure angle | β | 0.7 |
| Pressure angle | β | 0.9 |
| Fillet radius | r _f | 0.3 max |
| Coefficient of addendum modification | ε _γ | 0 |
| Reference circle diameter | A | 504 |
| Addendum | A' | 15 (4.0000) TO PITCH |
| DEDENDUM | A'' | 2.7 |
| ADDENDUM | A''' | 170.89 - 0.7 |
| BASE TANGENT LENGTH | L | |

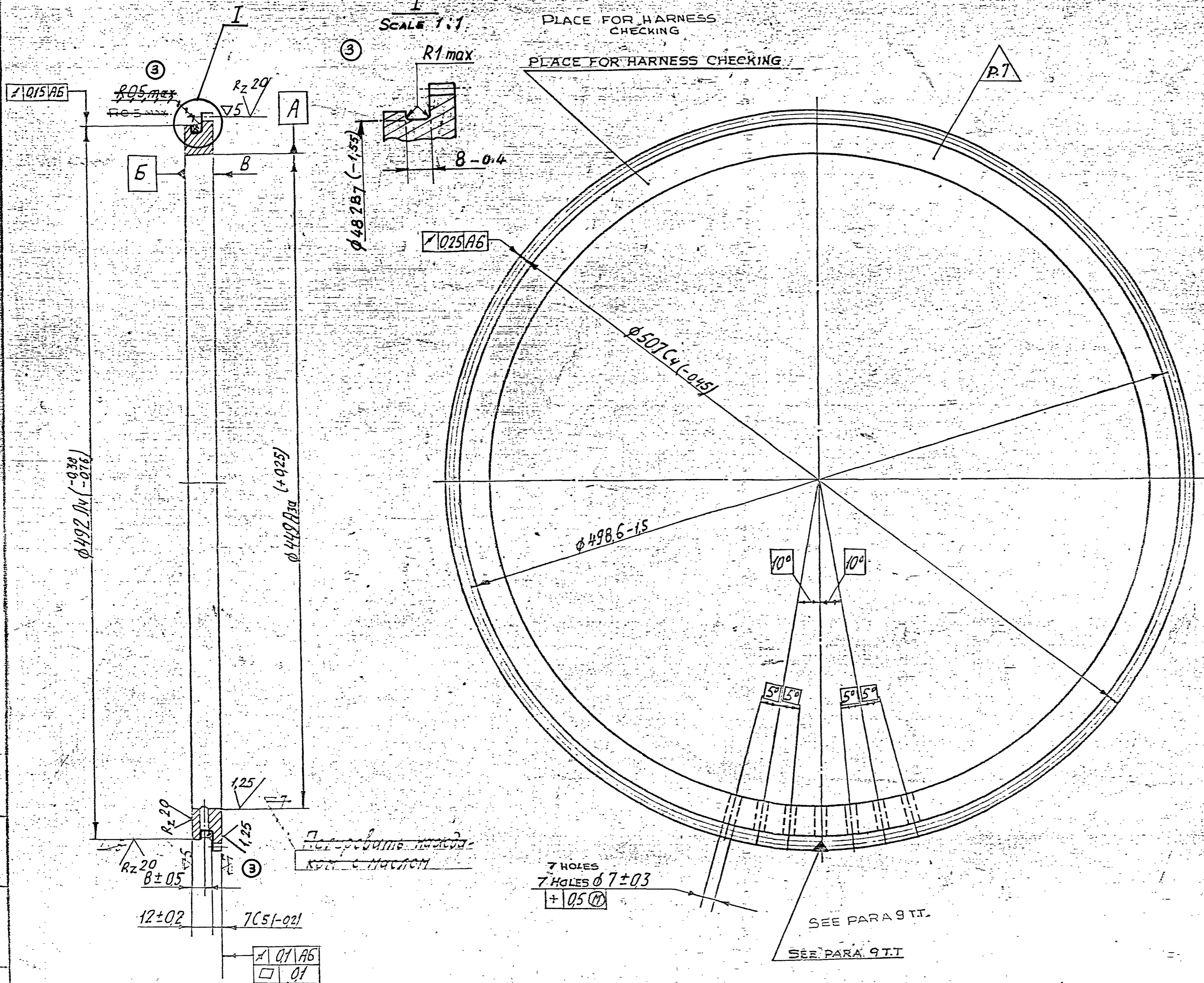


| | | | |
|------------|---|---|--|
| EST. MASS | 4.532 | TO BE STAMPED OR MARKED WHERE INDICATED THUS # | LETTERS) |
| ISSUE DATE | 02.11.84 | NATURE OF AMENDMENTS | ALL SHARP EDGES AND CORNERS TO BE REMOVED UNLESS OTHERWISE STATED MACHINED CORNERS TO HAVE R OUTSIDE R INSIDE EQUIVALENT CHAMFERS ARE PERMISSIBLE. |
| DWN | SCALE - 1:2 | MATERIAL: STEEL 38X | USED ON: 175.40.C6-5C0 |
| CHD | DIMENSIONS IN mm. | GOST 4543-71 | 175.40.C6-6C0 |
| TCD | TOLERANCE ON DIMS UNLESS OTHERWISE STATED | CONTROLLERATE OF INSPECTION (HEAVY VEHICLES) AVAD | TITLE: BOOSTER |
| APPD | ALL THREADS CONFORM | D S CAT NUMBER | DRAWING NUMBER 172 40 232 |
| DATE | 12.12.84 | | |

COMMON TO BLT

F 76





1. EN 341-285 (DIA OF INDENTATION 3.3 TO 3.8).
2. POSITION OF HOLES Ø7 RELATIVE TO TEETH IS OPTIONAL.
3. INCREASE OF PITCH BY 0.2mm BEYOND TOLERANCE IS ALLOWED ON NOT MORE THAN 10 TEETH.
4. DEPTH VARIATION FOR ANY PAIR OF TEETH EXCEPT 10 WITH INCREASED PITCH SHOULD NOT BE MORE THAN 0.4mm.
5. LONGITUDINAL MARKS OF A DEPTH OF MAXIMUM 0.2mm ARE ALLOWED OVER TOOTH PROFILE.
6. COATING : CHEMICAL OXIDATION WITH OIL FINISH.
7. TO BE MARKED.
8. INSTEAD OF CHECKING THE RUN-OUT SPECIFIED IN DRAWING IT IS ALLOWED CHECK THE THICKNESS DIFFERENCE BETWEEN DATUM SURFACE Ø449 AND SURFACE Ø492, THE MAXIMUM TOLERANCE DIFFERENCE BEING 0.15mm AND ALSO BETWEEN END-FACE '5' AND 'B' FOR WHICH CASE THE MAXIMUM TOLERABLE DIFFERENCE IS 0.15 mm MAXIMUM.
9. NEAR THE 4th HOLE OF Ø7 WELD UP THE TOOTH SPACE SURFACE TO MAKE IT SHALLOWER BY 3 TO 4mm IN THE MIST OF SHIELDING GAS. PROJECTION OF WELDED PORTION OVER FACE OF 7C5 AND OVER SURFACE Ø507C4 IS NOT ALLOWED.

| MODULE | | |
|--------------------------------------|----------|---------------|
| m | | 3 |
| NUMBER OF TEETH | | |
| Z | | 168 |
| PROFILE ANGLE | | |
| β | | 20° |
| COEFF. OF | ADDENDUM | f' |
| | DEDENDUM | f'' |
| | | 0.7 |
| | | 0.9 |
| FILLET RADIUS | | |
| Zi | | 0.3 MAX |
| COEFFICIENT OF ADDENDUM MODIFICATION | | |
| ε | | 0 |
| REFERENCE CIRCLE DIAMETER | | |
| A | | 504 |
| ADDENDUM | | |
| h' | | 1.5 (TOPPING) |
| DEDENDUM | | |
| h'' | | 2.7 |
| BASE TANGENT LENGTH | | |
| L | | 170.89 |

EXPLANATORY NOTE

10. REFERENCE MATERIAL QUOTED: STEEL 38XC GOST 4543-71
STRUCTURAL CHROMIUM SILICON ALLOY STEEL GOOD QUALITY
GRADE 38XC GOST 4543-71
- a) CHEMICAL COMPOSITION: AS PER STEEL GRADE 38XC GOST 4543-71

| GRADE OF STEEL | CONTENT OF ELEMENTS % | | | | |
|----------------|-----------------------|---------|-----------|-----------|--------------|
| | C | Si | Mn | Cr | S P |
| 38XC | 0.34-0.42 | 1.0-1.4 | 0.30-0.60 | 1.30-1.60 | 0.035; 0.035 |

RESIDUAL CONTENT OF COPPER AND NICKEL SHOULD NOT EXCEED 0.30% EACH

- b) MECHANICAL PROPERTIES: AS PER STEEL GRADE 38XC GOST 4543-71

| GRADE OF STEEL | TENSILE STRENGTH kgf/mm ² | YIELD POINT kgf/mm ² | ELONGATION % | REDUCTION IN AREA % | IMPACT STRENGTH kgm/cm ² |
|----------------|---|------------------------------------|-----------------|------------------------|--|
| 38XC | 95 min | 75 min | 12 min | 50 min | T min |

PLOT SAMPLE SHOULD BE APPROVED BY A H S P BEFORE BULK PRODUCTION.

EST. MASS 4.63 kg TO BE STAMPED OR MARKED WHERE INDICATED, THUS (IN LETTERS)
ALL SHARP EDGES AND CORNERS TO BE REMOVED UNLESS OTHERWISE STATED MACHINED CORNERS TO HAVE R OUTSIDE R INSIDE EQUIVALENT CHAMFERS ARE PERMISSIBLE.

| | | | | | |
|--|----------|------------------------|-------------------------|----------------------|---|
| DRN | 2.70 | MATERIAL | STEEL 38XC GOST 4543-71 | USED ON | 172 40 021cb 172 40 022cb |
| CHD | 18.11.88 | APPD | | CONTROLLER | DATE OF QUALITY ASSURANCE (HEAVY VEHICLES) A V A D I |
| TCD | | DATE | 27-07-88 | TITLE | BOOSTER |
| SCALE | 1:2 | DIMENSIONS IN mm. | | D S CAT NUMBER | |
| TOLERANCE ON DIMS UNLESS OTHERWISE STATED. | | ALL THREADS CONFORM TO | | DRAWING NUMBER | 172 40 231 |
| ISSUE | 3 | DATE | 18.11.88 | NATURE OF AMENDMENTS | Amdt. List 6/4, Book 7. |

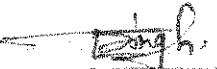


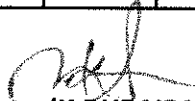


MACHINED COMPONENTS (GROUP -IV)

| Sl no. | Nomenclature & drawing No. | Manufacturing technology & Testing / Inspection Facilities required to produce the item | | Must be possessed by the vendor in his premises (P&M list and testing / inspection equipment list to be submitted) | May be possessed by the vendor in his premises or out sourced (Self declaration to be submitted) | FIRM Compliance (Y/N) | Remarks |
|--------|--|---|-----------------------|--|---|-----------------------|---------|
| 1 | Components as per enclosed list of Machined Components (Group IV) <i>Total items = 47 Nos</i> | TECHNOLOGY-1 | Turning | CNC Turning dia 600mm suitable to accommodate component of diameter in the range of dia 250 to 600mm with 0.010mm accuracy | | | |
| | | | Milling & Drilling | HMC and/or VMC suitable to the components upto the size 630mm diameter with 0.010 accuracy | | | |
| | | | Gear Hobbing | | Gear Hobbing of Mod 3 x cutting ϕ 400 with gear cutting accuracy of class of Din 7 or better accuracy | | |
| | | TECHNOLOGY-3 | Gear Shaping | | Gear Shaping of Mod 5 with gear cutting accuracy of class of Din 7 or better accuracy. | | |
| | | | Hardening & Tempering | | Hardening & Tempering furnace with Oil quenching facility | | |
| | | | Protection coating | | Oxidising Plant | | |
| | | TECHNOLOGY-4 | Raw material | | Firm should be capable to arrange the raw material like Forging, Casting, Bar material etc as per drawing specification and standard. | | |


(D.SATHISH KUMAR)
WM/QA(NF& QMSC)


(LUXMAN SINGH)
WM/TRG-II, HT & EP

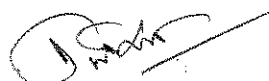

(K.DURAIRAJ)
JWM/Trans -II

We have studied and confirmed the VQC.

Firm's seal and signature


| Sl no. | Nomenclature & drawing No. | Manufacturing technology & Testing / Inspection Facilities required to produce the item | | Must be possessed by the vendor in his premises (P&M list and testing / inspection equipment list to be submitted) | May be possessed by the vendor in his premises or out sourced (Self declaration to be submitted) | FIRM Compliance (Y/N) | Remarks | |
|--------|---|---|--------------------------|---|--|------------------------------------|---------|--|
| 1 | Components as per enclosed list of Machined Components (Group IV) | TEST / INSPECTION-1 | 3D CMM | 3D CMM 500 x 500mm. | | | | |
| | | | Gear Profile Tester | | | Gear Profile Tester (Max module 5) | | |
| | | | Surface Roughness Tester | Surface Roughness Tester for Ra & Rz values | | | | |
| | | | Gauges | Standard Gauges for checking Holes and threads suitable to the requirement of the components. Firm should submit the undertaking in this regard that they will create the facilities within 6 months from the date of receipt of order. | | | | |
| | | | Measuring Instruments | Gear Teeth Micrometer, Vernier Caliper, Groove Vernier, Radius gauge, Feeler Gauge etc. suitable to the requirement of the components | | | | |
| | | TEST / INSPECTION-2 | Hardness measurement | | | Brinell / Rockwell Hardness Tester | | |

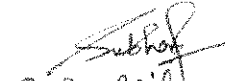
Note : Justification for alternate facilities may be shared to prove that alternate facilities can be utilised to manufacture the item wherever the facilities are mentioned above are not available, but vendor has alternate facilities.


(D.SATHISH KUMAR)
WM/QA(NF& QMSC)


(LUXMAN SINGH)
WM/TRG-II,HT & EP


(K.DURAIRAJ)
JWM/Trans -II


(J.P.SINGH)
GM-OPERATIONS I


Subham Brijlalan
Alt to (NEERAJ KUMAR)
QA-RIG(OE)


(ANIMESH PAIK)
DGM/CA,TRG & RG

We have studied and confirmed the VQC

Firm's seal & signature

**RESTRICTED
(DRAFT/PROVISIONAL)
QUALITY ASSURANCE PLAN**

FOR

(BOOSTER)

DRG.NO. 172.40.321

(LF NO: 6201040054)

No HVF/T-72C/QAP/40/BOOSTER/242664 - 00

ISSUE No: 00

DATE: OCT- 2021

QUALITY ASSURANCE (RIG-SUB ASSEMBLY)

HEAVY VEHICLES FACTORY

AVADI CHENNAI – 600 054

QUALITY ASSURANCE PLAN (QAP)

FOR


BOOSTER

DRG. NO. 172.40.321

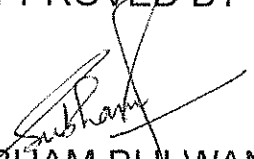
PREPARED BY


(C.NANDA KUMAR)
JWM/QA (RIG-SA)

REVIEWED BY


(HANUMANTHA RAO GOLLA)
JWM/QA (RIG-SA / TA)

APPROVED BY


(SUBHAM BIJLWAN)
AWM/QA-RIG-(SA)

ISSUED BY

QUALITY ASSURANCE (RIG- SUB ASSEMBLY)
HEAVY VEHICLES FACTORY
AVADI CHENNAI – 600 054

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1.IMPORTANT NOTE

Note-1

This is only a provisional and will be amended from time to time according to the requirement. No addition, deletion and reproduction will be done without permission of The Sr. General Manager, Heavy Vehicles Factory, Avadi, Chennai – 54.

Note –2

Any instruction contained in this does not prejudice the terms and conditions of the contract what so ever. In case of any contradiction between the contents of this QAP and the clause in the contract, the latter will prevail.

Note-3

The stores should be manufactured strictly only as per the drawings supplied by the Inspection Authority and not as per the samples, if any received by the manufacturer for guidance purpose.

Note-4

Any amendment issued by the Inspection Authority shall be incorporated in the QAP and the records for the amendments carried out should be maintained as per the Performa at Appendix-“A”.

Note-5

In case of any contradiction between the contents of this QAP and drawings issued along with the contract, the latter will prevail.

2.INTRODUCTION

1. This quality plan lays down the inspection and testing procedure to be carried out on the component **BOOSTER TO DRG.NO 172.40.321** being procured indigenously. This is prepared, based on the acceptance standards and inspection parameters laid down in collaborators documents and on the inspection test standards followed in respect of similar indigenous items.
2. This QAP is the property of Government of India and is liable for amendments as and when required. The Sr. General Manager, Heavy Vehicles Factory, Avadi, Chennai – 600 054, is the inspecting Authority for this assembly. Any query / clarification on the content of this QAP shall be referred to this Factory. Any departure from these instructions is allowed only after written approval from the above authority. Notwithstanding the tests indicated in this QAP, the inspecting Officer has the right to carry out any test to check conformance to the paper particulars quoted in the Supply Order, which he may consider necessary to satisfy himself about the stores which he has to accept.

3.AIM

The QAP is aimed at standardizing the Inspection procedure and acceptance norm for **BOOSTER TO DRG.NO:172.40.321**.

It also aims at giving adequate information to the manufacturer on the quality requirements so that the required quality control methods are established. This is also meant to guide authorized Inspection Officer in his routine inspection and to set out main points to which his attention must be drawn to ensure that the accepted stores meet the stipulated standards.

4. SCOPE:

This QAP outlines in general terms, the checks and methods to be used during inspection of **BOOSTER TO DRG. NO. 172.40.321** including the technical requirements of the drawings. The recommended Quality Plan stipulated herein is mandatory and should be strictly adhered to.

For inspection purpose, only the latest issue of this QAP will be made applicable and copies of this QAP can be obtained from the issuing authority i.e. The Sr. General Manager, Heavy Vehicles Factory, Avadi, and Chennai.

NOTE-I:

- i. Tender enquiry (TE) and supply order (S.O) will be issued with QAP stating that inspection will be done as per QAP.
- ii. In case of TE, It is responsibility of the vendor to obtain the copy of QAP and give the statement of compliance that vendor will abide by the QAP in case supply order is placed.
- iii. In case of S.O, it is the responsible of the vendor to obtained copy of QAP and give the statement of compliance that the vendor will follow QAP. However, GM/HVF reserves the right to revise/update the QAP from time to time.

5. DOCUMENTS:

- a) On placement of firm supply order, One set of relevant specification and technical instructions on the subject item can be obtained by the contractor from AHSP through DDO/HVF
- b) Any clarification required on these documents should be obtained from the Inspecting Authority i.e. The Sr. General Manager, Heavy Vehicles Factory, Avadi, Chennai – 600 054. Equivalentents to the collaborators specifications and standards will be decided only by the Inspecting Authority and should not be unilaterally decided. For any change in the specifications, standards or written approval, any alterations in specification can be affected and not otherwise.
- c) The process instruction sheets supplied by the collaborators are available with the Authority Holding Sealed Particulars, i.e. The Controllerate of Quality Assurance (Heavy Vehicles), Avadi, Chennai for the reference. The relevant process sheets may be studied at the premises of the AHSP after obtaining necessary permission.
- d) The supplier after scrutiny of the concerned process sheets and connected paper particulars should establish the necessary production and inspection facilities. Particularly the inspection test rigs, stands, fixtures, template, gauges

etc should be provided as recommended in these process sheets. If process sheet / Process Book is not available the details particulars/parameters available in the drawings to be strictly adhered.

6. ITEM USED ON:

- 1. 172.40CB-1CB -
- 2. 172.40CB-2CB -

7. LIST OF DRAWINGS:

| SI. NO. | DRG. NO | NOMENCLATURE | REMARKS |
|---------|------------|--------------|---------|
| 1 | 172.40.321 | BOOSTER | - |

8. BILL OF MATERIALS: (Individual items as mentioned in table to Para 7)

| SI. NO | DRG. NO | NOMENCLATURE | MATERIAL SPECIFICATIONS | Qty |
|--------|------------|--------------|-------------------------|-----|
| 1 | 172.40.321 | BOOSTER | STEEL 38XC GOST 4543-71 | 1 |

Note: Vendor / Contractor may use approved alternate material if any specified in drawing/ specification.* Also refer Para no.13.

9. CONDITIONS OF USE/STORAGE INSTRUCTIONS

This assembly/item should be properly packed to protect from transit / handling damage and influence of atmospheric precipitations. In addition, the following parameters should be ensured:

- (a) The threaded parts if any should be covered with suitable plastic caps to prevent damages.
- (b) If the item consists of assemblies, each assembly should be packed separately.
- (c) The stores are to be suitably covered for preventing ingress of dust and Dirt/entry of sunlight / moisture.
- (d) The packaging slip shall contains
 - (i) Certificate of testing- NABL Certificate.
 - (ii) Guarantee/ Warranty Certificate
 - (iii) Service and maintenance instructions
 - (iv) Delivery Slip with Inspector's Acceptance Mark
 - (v) Undertaking letter / certificate of conformance(as applicable).
- (e) The stores are not permitted to be stored together with oils. Petrol, acids, alkaline and other substances to avoid damage to the metal / rubber components.

10. SAMPLING PLAN:

| Sl. No. | Sampling Plan | Pilot | Bulk |
|---------|---|---------|--|
| (i) | Visual Inspection | 100% | 100% |
| (ii) | Dimensional Inspection | 100% | General Inspection level III, single sampling, Normal Inspection, AQL 2.5 of IS 2500 (Part-I)-2000 |
| (iii) | Material Inspection | 1 No | 1 No. for each batch of raw material or heat treatment lot as required by specifications. |
| (iv) | Acceptance test | 100 % | 100 % |
| (v) | Pressure testing | ----- | ----- |
| (vi) | Machining/Fitment/ Performance trial on higher assembly / Tank | 01 Nos. | 01 Nos. per batch/As required. |
| vii) | Interchangeability Test | 02 Nos. | 02 Nos. per batch on randomly basis, except selective assembly. |
| viii) | Test stand/Jigs/ Fixtures/Gauges/Man drels/etc. | 100 % | 100 % |
| ix) | Marking/Identification | 100% | 100% |
| x) | Packing/ Preservation | 100% | 100% |

Note:-

A New (First time supplier of this item) supplier should obtain clearance from HVF for bulk production which will be issued only after inspection/evaluation of pilot samples by HVF.

11. VISUAL INSPECTION[Sampling plan as per Para- 10 (i)]

The stores are to be visually examined on 100 % of pilot /bulk and same should be free from any defects and all the finishing requirements shall satisfy as indicated in technical conditions of the assembly / component drawing.

The components shall be checked for the following and should be free from the defects:

- Defects in construction
- Cracks/Dents/Scratches
- Fitment of all components
- Presence of foreign particles
- Moisture and dust
- Corrosion of metal parts

- Mechanical imperfections & distortion
- Any form of deterioration of material and finishing.

Packing and preservation should be ensured as per drawings/relevant TY specification (To be ensured on receipt at consignee end).

12. DIMENSIONAL CHECK [Sampling plan as per Para- 10(ii)]

The dimensions of individual component, sub assembly and major assembly shall be checked and ensured as per respective drawing. Dimensional check should be carried out as per sampling plan. However, the inspecting authority/rep. may at his discretion, tighten the inspection level and acceptance quality level on the critical items and adopt check point during manufacture.

12.1 BOOSTER TO DRG.NO 172.40.321

1. All dimensions should be confirmed as per drawing.
2. Surface finish/Roughness should be confirmed as per drawing and specification.
3. Place for testing hardness (Refer Drawing).
4. Refer drawing / specification for admissible alternate manufacture in dimensions/material if any specified for the component.

13) MATERIAL CHECKS [SAMPLING PLAN AS PARA – 10 (iii)]

Material specimen /test bars of the components shall be in conformity as per the material mentioned in the relevant documents/drawing. NABL test reports for all the parameters as per relevant specifications to be submitted. Test samples to be submitted by the vendor to HVF, if required. The material check will be carried out as per sampling plan.* However, if the manufacturer proposes any alternative material at the stage of tender enquiry, the same has to be approved and a written concurrence should be obtained from AHSP through DDO/HVF, before usage of such materials.

13.1 BOOSTER TO DRG.NO.172.40.321

a) The component should be manufactured from STEEL 38XC GOST 4543-71.

b) **Chemical properties:** As per STEEL 38XC GOST 4543-71.

| Grade | CONTENT OF ELEMENTS% | | | | | | | |
|-------|----------------------|--------------------|--------------------|--------------------|-------|-------|------|------|
| | C | Si | Mn | Cr | S | P | Cu | Ni |
| | | | | | MAX | | | |
| 38XC | 0.34 to 0.42 | 1.00 to 1.40 | 0.30 to 0.60 | 1.30 to 1.60 | 0.035 | 0.035 | 0.30 | 0.30 |

Note: For mass fraction of other elements refer GOST 4543-71.

c) Mechanical properties: As per STEEL 38XC GOST 4543-71.

| Grade | Yield point, N/mm ² / (kgf/mm ²) | Ultimate strength, N/mm ² (Kgf/mm ²) | Elongation % | Relative reduction of area % | Impact strength KCU / (Kgm/cm ²) |
|---------------|---|---|-----------------|---------------------------------|--|
| Not less than | | | | | |
| 38XC | 75 | 95 | 12 | 50 | 7 |

Note: For other properties refer GOST 4543-71

14) PERFORMANCES / ACCEPTANCE TEST: BOOSTER TO
DRG.NO:172.40.321

- 1 BHN 285 341
- 2 Location of hole E relative to teeth is arbitrary.
- 3 Base tangent length may be decreased up to 169 69mm not more than in 10 teeth
- 4 Along profile of teeth longitudinal marks with depth $0^{+0,2}$ mm are allowed
- 5 Difference in depth of teeth should be checked In this case difference in measurement of depth of any pair of teeth should be $0^{+0,4}$ mm
- 6 Instead of checking runout of surfaces Γ and Π , difference in thickness along dimension Δ and H correspondingly may be checked In this case difference in measurements should be $0^{+0,15}$ mm
- 7 Two tooth spaces should be welded to a depth 3^{+1} mm In this case following is not allowed

Overlapping with build up metal in the section of hole E and projection of build up metal over surface Γ and \mathcal{K}

Projection of build up metal over surface \mathcal{M} 0^{+1} mm is allowed

Gas shielded welding should be done.

Shifting of tooth space \mathcal{M} from nominal position $0^{+4,5}$ mm is allowed Length of arc \mathcal{K} to corresponding to 6 pitches

- 8 Coating Chemical oxidizing, oil finish
- 9 Other requirements are as per specification 520 TY1

GEAR DETAILS:

| | | | |
|--|---|-----------------------------------|--|
| Module | | m | 3 |
| Number of tooth | | Z | 168 |
| BASIC CONTOUR | Profile angle | α | 20° |
| | Co-efficient of addendum | h_a^* | 0.7 |
| | Co-efficient of bottom clearance | C^* | 0.2 |
| | Fillet radius | ρ_f | 0.3 |
| Addendum modification coefficient | | X | 0 |
| Base tangent length | | W | 170.89 ^{-0.7}_{-1.0} |
| Drawing no of mated components | | 172 40. 302 172.40 303 | |

15) FITMENT AND PERFORMANCE TEST:

- a. Pilot samples should be checked for fitment and Performance test to ascertain the efficacy of the system under different operating conditions by fitting in higher assembly and repeating it for functional checks, wherever required.
- b. Items of Bulk supplies may be subjected to performance trial in tank in case of repeated failure/defects during exploitation.

EXPLANATORY NOTE:

- 1) Stage wise process and inspection of the component as specified in TD Book/ Process Book/ illustration book/specification is to be confirmed by the supplier during manufacturing the components.
- 2) Firm shall submit details of manufacturing process, inspection process and also reports for the same to HVF.
- 3) If required/applicable HVF shall witness/verify stage wise inspection /process details during manufacturing of the components.
- 4) The component may be subject to endurance test, when fitted in higher assembly as specified in process / illustration /TD book.

16) INTERCHANGEABILITY:

The assemblies/component should be interchangeable component wise and assembly wise, except the Component are to be supplied as a set and to be assembled selectively as per sampling plan.

17) CALIBRATION CHECKS

(TEST STANDS/JIGS/FIXTUERS/GAUGES/INSTRUMENTS):

The supplier / Contractor should have suitable Instruments, Test Stand, jigs, fixture, mandrels and gauges to carry out quality checks, to ensure conformance of components/assembly as per drawing and Specification /T.R points.

The supplier/contractor should submit calibration reports for instruments/fixtures/gauges/mandrels etc., which are used during process of inspection activities.

18) MARKING/IDENTIFICATION

Marking of the items is to be carried out as called for in the relevant drawing, drawing/T.R points.

Inscription if any on the components is to be carried out as called for in the drawing/T.R points. Unless otherwise specified in the drawing/ specification, marking should not be carried out over the components.

For traceability, marking of part No., Manufacturer name, supply order No, Serial No/Qty, batch No. and manufacture date & year are to be carried out. Suitable method can be adopted, provided that the above parameters are legible and considering the parameters mentioned in the drawing and specification.

19) PRESERVATION CHECK

- a) Preservative coatings are to be strictly adhered to as called for in the drawing. However, equivalent BIS Standards can also be followed, subject to the thickness of the coating/preservative is maintained as per the drawing/specification.
- b) Other preservations as necessary to prevent damages due to moisture and dust during process, storage and transit are to be carried out. Conventional Methods can also be resorted to.

20) PACKING CHECK

Components / Assemblies are to be packed separately to avoid damages during transit / handling of the same. Part No. and No. of sets are to be marked on the packing.

Packing and preservation should be ensured as per drawings/relevant TY specification (To be ensured on receipt at consignee end).

Finished products shall be wrapped / packed using black and opaque polyethylene sheet or bags.

21) DOCUMENTATION

- i. Firm has to maintain all the documents as per QAP with respect to the SI.No.to have traceability.
- ii. Vendor has to submit Bill of materials, Material test reports, Class 'C' /Endurance test reports (wherever specified in drawing/TY specification/QAP) and Complete PIR (pre-inspection report)at the time of offering the item for inspection. HVF will commence inspection only after scrutiny of these documents.
- iii. The testing/inspection responsibility to test all the parameters as per QAP and drawing specifications as mentioned in Annexure -A (enclosed).
- iv. Pre inspection reports (PIR) of firm like, 1. Chemical analysis (NABL Certificate), 2.Mechanical properties (NABL Certificate), 3. Pre-forming process, 4. Coating certification. 5. Calibration reports of instruments and 6. 100 % Dimensional inspection reports.

22) REFERENCE:

- a) Drawing No: 172.40.321
- b) Material specification as per drawing:
STEEL 38XC GOST 4543-71.
- c) GOST 4543-71.
- d) Specification: 520.TY1.

| SL. NO. | CATEGORY | ASSEMBLY/SU B ASSEMBLY | TESTS/INSPECTION PARAMETERS | STANDARDS TO BE REFERRED | ACCEPTANCE CRITERIA | INSPECTION RESPONSIBILITY | | | REMARKS | |
|---------|-------------------------------|--------------------------------------|---|--------------------------------------|--|-------------------------------|-----|------|--|---------------------|
| | | | | | | Firm | HVF | DGOA | | |
| 1 | BOOSTER TO DRG. NO 172.40.321 | Pre inspection reports (PIR) of firm | Firm has to produced all the document as per Para 21 (iv) | As per the relevant drawing and QAP. | Confirm to drawing and QAP as per bill of material | P | V | R | 100% by firm/ vendor. | |
| 2 | | Bill of material (BOM) | Firm has to prepare the BOM as per QAP | Refer QAP Para no: 8 or item list. | Confirm to QAP. | P | V | R | 100% by firm/ vendor. | |
| 3 | | Material tests | Chemical composition & Mechanical / Physical Properties | As per-GOST 4543-71. | All the values to confirm with QAP (Para no.13.1 (a), (b) & (c)) | P | W/V | R | SP followed by HVF. | |
| 4 | | Hardness checks | Hardness | 341...285 BHN | Refer QAP Para no: 14(1) | Confirm to QAP Para no: 14(1) | P | W/V | R | SP followed by HVF. |
| 5 | | Coating checks | Chemical Oxidizing, Oil finish. | Refer QAP Para no: 14(8) | Confirm to QAP Para no: 14(8) | P | W/V | R | SP followed by HVF. | |
| 6 | | Dimensional checks | Dimensions as per the drawing | Refer drawing /QAP Para no: 12.1 | Confirm to drawing and QAP | P | W/P | R | 100% by firm/ vendor SP followed by HVF. | |
| 7 | | Marking / traceability | Firm has to make marking / traceability records. | Refer QAP Para no: 18 | Confirm to QAP Para no: 18 | P | V | R | 100% by firm/ vendor. | |
| 8 | | Preservation & packing | Firm has to make Preservation & packing records | Refer QAP Para no: 19 & 20 | Confirm to QAP Para no: 19 & 20 | P | V | R | 100% by firm/ vendor. | |

Note:
For conformity of the items (Chemical/Physical/Mechanical properties).

1. One sample per heat / batch shall be tested under NABL Lab/Govt. Approved lab by firm. In case of non-compliance to standards entire lot shall be rejected or not to use in production further.

2. For cross conformation of material, manufacturer has to submit test sample pieces for the items used / test slab and button for rubber items / HVF will draw samples from supplied lot for Witnessing (W) at HVF premises. In case of non-compliance to standards entire lot will be rejected.

P- Perform W- Witness V-Verify R-Review

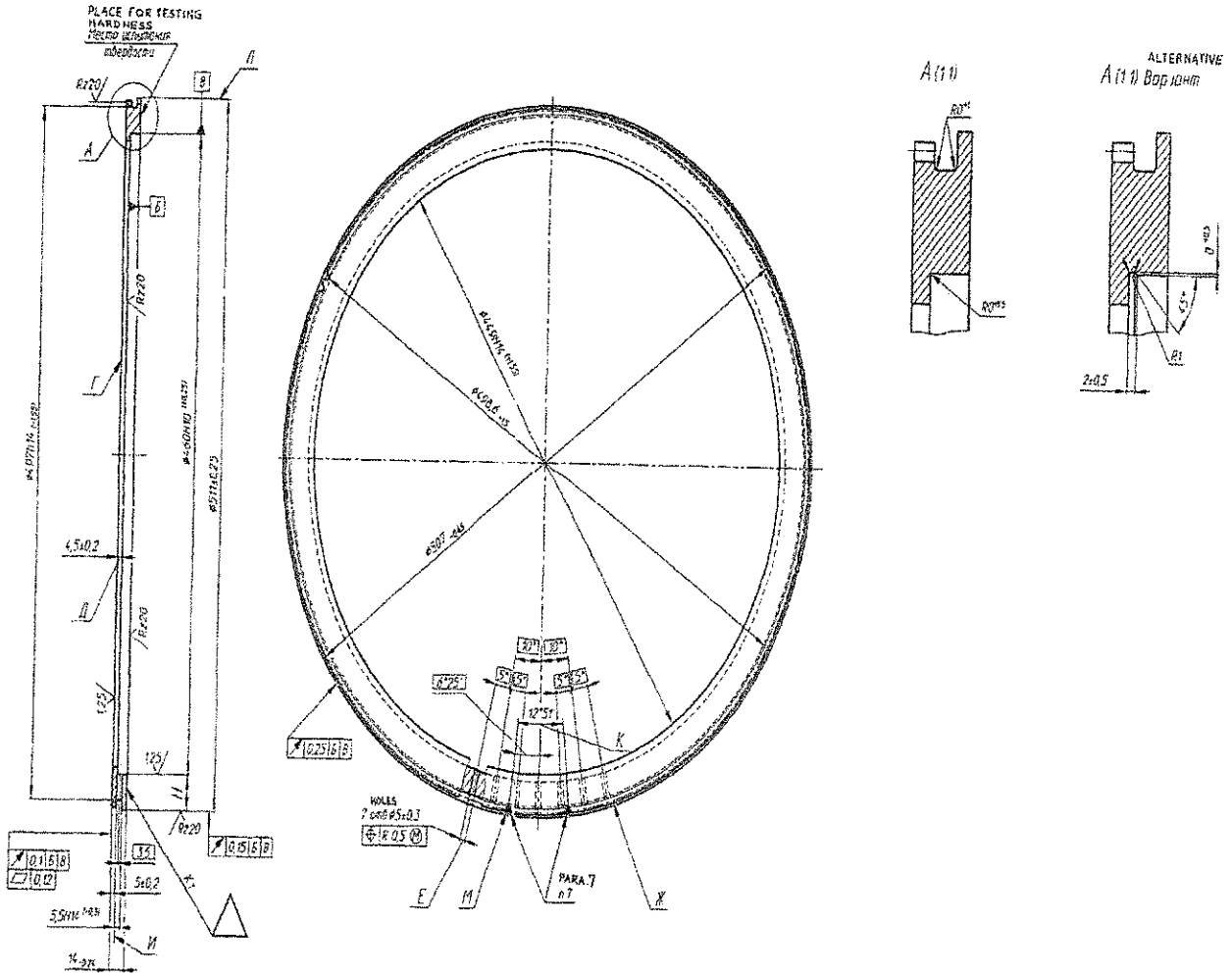


FIG: BOOSTER TO DRG. NO 172.40.321
(For reference only)

RECORD OF AMENDMENTS

| Sl. No | Amendment No. & date | Amended by | Date of Insertion | Initial |
|--------|----------------------|------------|-------------------|---------|
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We have studied and confirmed the QAP.

Firm's seal and signature

**RESTRICTED
(DRAFT/PROVISIONAL)
QUALITY ASSURANCE PLAN**

FOR

(BOOSTER)

DRG.NO.172.40.232

(LF NO: 6206401071)

No HVF/T-72/QAP/40/BOOSTER/244025 - 00

ISSUE No: 00

DATE: JUNE-2022

QUALITY ASSURANCE (RIG-(OE))

HEAVY VEHICLES FACTORY

AVADI CHENNAI – 600 054


QUALITY ASSURANCE PLAN (QAP)

FOR

BOOSTER

DRG. NO. 172.40.232

PREPARED BY


(C.NANDA KUMAR)
JWM/QA (RIG-OE)

REVIEWED BY


(AWNEESH YADAV)
JWM/QA (RIG-OE / TA)

APPROVED BY


(NEERAJ KUMAR)
DGM/QA-RIG-(OE)

ISSUED BY

QUALITY ASSURANCE (RIG-(OE))
HEAVY VEHICLES FACTORY
AVADI CHENNAI – 600 054

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1. IMPORTANT NOTES

Note-1

This is only a provisional and will be amended from time to time according to the requirement. No addition, deletion and reproduction will be done without permission of The Chief General Manager, Heavy Vehicles Factory, Avadi, Chennai – 54.

Note –2

Any instruction contained in this does not prejudice the terms and conditions of the contract what so ever. In case of any contradiction between the contents of this QAP and the clause in the contract, the latter will prevail.

Note-3

The stores should be manufactured strictly only as per the drawings supplied by the Inspection Authority and not as per the samples, if any received by the manufacturer for guidance purpose.

Note-4

Any amendment issued by the Inspection Authority shall be incorporated in the QAP and the records for the amendments carried out should be maintained as per the Performa at Appendix-“A”.

Note-5

In case of any contradiction between the contents of this QAP and drawings/Specifications/GOST issued along with the contract, the latter only will prevail.

2. INTRODUCTION

1. This quality plan lays down the inspection and testing procedure to be carried out on the component **BOOSTER TO DRG.NO 172.40.232** being procured indigenously. This is prepared, based on the acceptance standards and inspection parameters laid down in collaborators documents and on the inspection test standards followed in respect of similar indigenous items.
2. This QAP is the property of Government of India and is liable for amendments as and when required. The Chief. General Manager, Heavy Vehicles Factory, Avadi, Chennai – 600 054, is the inspecting Authority for this assembly. Any query / clarification on the content of this QAP shall be referred to this Factory. Any departure from these instructions is allowed only after written approval from the above authority. Notwithstanding the tests indicated in this QAP, the inspecting Officer has the right to carry out any test to check conformance to the paper particulars quoted in the Supply Order, which he may consider necessary to satisfy himself about the stores which he has to accept.

3. AIM

The QAP is aimed at standardizing the Inspection procedure and acceptance norm for **BOOSTER TO DRG.NO:172.40.232**.

It also aims at giving adequate information to the manufacturer on the quality requirements so that the required quality control methods are established. This is also meant to guide authorized Inspection Officer in his routine inspection and to set out main points to which his attention must be drawn to ensure that the accepted stores meet the stipulated standards.

4. SCOPE:

This QAP outlines in general terms, the checks and methods to be used during inspection of **BOOSTER TO DRG. NO. 172.40.232** including the technical requirements of the drawings. The recommended Quality Plan stipulated herein is mandatory and should be strictly adhered to.

For inspection purpose, only the latest issue of this QAP will be made applicable and copies of this QAP can be obtained from the issuing authority i.e. The Chief. General Manager, Heavy Vehicles Factory, Avadi, and Chennai.

NOTE-I:

i. Tender enquiry (TE) and supply order (S.O) will be issued with QAP stating that inspection will be done as per QAP.

ii. In case of TE, It is responsibility of the vendor to obtain the copy of QAP and give the statement of compliance that vendor will abide by the QAP in case supply order is placed.

iii. In case of S.O, it is the responsible of the vendor to obtained copy of QAP and give the statement of compliance that the vendor will follow QAP. However, GM/HVF reserves the right to revise/update the QAP from time to time.

5. DOCUMENTS:

- a) On placement of firm supply order, one set of relevant technical documents like GOST/drawing/specification, technical data book, process sheet etc and technical instructions on the subject item to be obtained by the contractor from AHSP through DDO/HVF.
- b) Any clarification required on these documents to be obtained from the Inspecting Authority i.e. The Chief. General Manager, Heavy Vehicles Factory, Avadi, Chennai – 600 054. Equivalent to the collaborators specifications and standards will be decided only by the Inspecting Authority and should not be unilaterally decided. For any change in the specifications, standards or written approval, any alterations in specification can be affected and not otherwise.
- c) The process instruction sheets supplied by the collaborators are available with the Authority Holding Sealed Particulars, i.e. The Controller ate of Quality Assurance (Heavy Vehicles), Avadi, Chennai for the reference. The relevant process sheets may be studied at the premises of the AHSP after obtaining necessary permission.
- d) The supplier after scrutiny of the concerned process sheets and connected paper particulars should establish the necessary production and inspection facilities. Particularly the inspection test rigs, stands, fixtures, template, gauges etc should be provided as recommended in these process sheets. If process

sheet / Process Book is not available the details particulars/parameters available in the drawings to be strictly adhered.

6. ITEM USED ON:

- 1. 175.40CB-5CB -
- 2. 175.40CB-6CB -

7. LIST OF DRAWINGS:

| SI. NO. | DRG. NO | NOMENCLATURE | REMARKS |
|---------|------------|--------------|---------|
| 1 | 172.40.232 | BOOSTER | --- |

8. BILL OF MATERIALS: (Individual items as mentioned in table to Para 7)

| SI. NO | DRG. NO | NOMENCLATURE | MATERIAL SPECIFICATIONS | Qty |
|--------|------------|--------------|-------------------------|-----|
| 1 | 172.40.232 | BOOSTER | STEEL 38XC GOST 4543-71 | 1 |

Note: Vendor/Contractor may use approved alternate material, if any specified in drawing/specification.* Also refer Para no: 13.

9. CONDITIONS OF USE/STORAGE INSTRUCTIONS

This assembly/item should be properly packed to protect from transit / handling damage and influence of atmospheric precipitations. In addition, the following parameters should be ensured:

- (a) The threaded parts if any should be covered with suitable plastic caps to prevent damages.
- (b) If the item consists of assemblies, each assembly should be packed separately.
- (c) The stores are to be suitably covered for preventing ingress of dust and Dirt/entry of sunlight / moisture.
- (d) The packaging slip shall contains
 - (i) Certificate of testing- NABL Certificate.
 - (ii) Guarantee/ Warranty Certificate
 - (iii) Service and maintenance instructions
 - (iv) Delivery Slip with Inspector's Acceptance Mark
 - (v) Undertaking letter / certificate of conformance (As applicable).
- (e) The stores are not permitted to be stored together with oils. Petrol, acids, alkaline and other substances to avoid damage to the metal / rubber components.

10. SAMPLING PLAN:

| Sl. No. | Sampling Plan | Pilot | Bulk |
|-----------------------------------|---|--------|---|
| Acceptance test (as below) | | | |
| (i) | Visual Inspection | 100% | 100% |
| (ii) | Dimensional Inspection (Including hardness) | 100% | General Inspection level III, single sampling, Normal Inspection, AQL 2.5 of IS 2500 (Part-I)-2000 |
| (iii) | Material Inspection (Including Mechanical, Chemical and Physical properties) | 1 No | 1 No. or qty as specified in specification, GOST for each batch of raw material or heat treatment lot / As required for confirmation of material. |
| (iv) | Pressure testing | ----- | ----- |
| (v) | Machining/Fitment/ Performance trial on higher assembly / Tank | 01 No. | 01 No. per batch/As required. |
| (vi) | Interchangeability Test | 01 No. | 01 No. per batch on randomly basis, except selective assembly. |
| (vii) | Calibration reports/certificates of Test stand/Jigs/Equipment/ Fixtures/Gauges/ Mandrels/etc. | 100 % | 100 % |
| (viii) | Marking/Identification | 100% | 100% |
| (ix) | Packing/ Preservation | 100% | 100% |

Note:-

A New (First time supplier of this item) supplier should obtain clearance from HVF for bulk production which will be issued only after inspection/evaluation of pilot samples by HVF.

11. VISUAL INSPECTION [Sampling plan as per Para- 10 (i)]

The stores are to be visually examined on 100 % of pilot /bulk and same should be free from any defects and all the finishing requirements shall satisfy as indicated in technical conditions of the assembly / component drawing.

The components shall be checked for the following and should be free from the defects:

- Defects in construction
- Cracks/Dents/Scratches
- Fitment of all components

- Presence of foreign particles
- Moisture and dust
- Corrosion of metal parts
- Mechanical imperfections & distortion
- Any form of deterioration of material and finishing.

Packing and preservation should be ensured as per drawings/relevant TY specification (To be ensured on receipt at consignee end).

12. DIMENSIONAL CHECK [Sampling plan as per Para- 10(ii)]

The dimensions of individual component, sub assembly and major assembly shall be checked and ensured as per respective drawing. Dimensional check should be carried out as per sampling plan. However, the inspecting authority/rep. may at his discretion, tighten the inspection level and acceptance quality level on the critical items and adopt check point during manufacture.

12.1 BOOSTER TO DRG.NO 172.40.232

1. All dimensions shall be confirmed as per drawing/specification
2. Place for checking the hardness refer drawing
3. Surface finish/Roughness should be confirmed as per drawing and specification.
4. Spline/ gear details dimensions including profile is to be confirmed as per drawing.
5. For admissible alternate method for manufacture in dimensions/material if any, refer drawing/specification.
6. Welding/Solder/Brazing parameters to be confirmed as per Drawing/ Specification / GOST specified against relevant component/assemblies.

13) MATERIAL CHECKS [SAMPLING PLAN AS PARA – 10 (iii)]

Material specimen /test bars of the components shall be in conformity as per the material mentioned in the relevant documents/drawing. NABL test reports for all the parameters as per relevant specifications to be submitted. Test samples to be submitted by the vendor to HVF, if required. The material check will be carried out as per sampling plan.* However, if the manufacturer proposes any alternative material at the stage of tender enquiry, the same has to be approved and a written concurrence should be obtained from AHSP through DDO/HVF, before usage of such materials.

13.1 BOOSTER TO DRG.NO.172.40.232

a) The component should be manufactured from

STEEL 38XC GOST: 4543-71

b) Chemical properties: As per STEEL 38XCGOST 4543-71.

| Grade | CONTENT OF ELEMENTS% | | | | | | | |
|-------|----------------------|--------------------|--------------------|--------------------|-------|-------|------|------|
| | C | Si | Mn | Cr | S | P | Cu | Ni |
| | | | | | MAX | | | |
| 38XC | 0.34 to 0.42 | 1.00 to 1.40 | 0.30 to 0.60 | 1.30 to 1.60 | 0.035 | 0.035 | 0.30 | 0.30 |

Note: For mass fraction of other elements refer GOST 4543-71.

c) Mechanical properties: As per STEEL 38XC GOST 4543-71.

| Grade | Yield point, (kgf/mm ²) | Ultimate strength, (Kgf/mm ²) | Elongation % | Relative reduction of area % | Impact strength (Kgm/cm ²) |
|-------|--|--|-----------------|---------------------------------|---|
| | Not less than | | | | |
| 38XC | 75 | 95 | 12 | 50 | 7 |

Note: For other parameters refer GOST 4543-71.

14) PERFORMANCES / ACCEPTANCE TEST: BOOSTER TO DRG.NO:172.40.232

1. BHN 341-285 (DIA OF INDENTATION 3.3-3.6).
2. POSITION OF HOLES $\phi 7$ RELATIVE TO THE TEETH ARE OPTIONAL.
3. A 0.2mm INCREASE OF PITCH DIMENSION BEYOND TOLERANCE ON 10 TEETH MAXIMUM IS ALLOWED.
4. DIFFERENCE OF MEASUREMENT OF DEPTH OF ANY PAIR OF TEETH APART FROM THE 10 PITCH INCREASED SHOULD NOT EXCEED 0.4mm.
5. LONGITUDINAL MARKS OF A DEPTH OF 0.2 mm MAX. ARE ALLOWED ON PROFILE OF TOOTH.
6. COATING: CHEMICAL OXIDIZING OIL FINISHED.
7. TO BE MARKED
8. INSTEAD OF CHECKING THE RUNOUTS SPECIFIED IN THE DRAWING IT IS ALLOWED TO PERFORM A CHECK OF THICKNESS OF DIFFERENCE BETWEEN SURFACES $\phi 460 / \phi 512$, AND 'D' 'B' PERMISSIBLE DIFFERENCE IS 0.15 mm MAX.
9. WELD UP THE 2 TOOTH SPACE SURFACES TO MAKE THEM SHALLOWER BY 3 TO 4 mm. FOR WELDING USE SHIELDING GAS MIDST WHILE WELDING, SEE THAT THE DIA 7 HOLES DO NOT OVER LAP AND THE WELD DOES NOT EXTEND ONTO END-FACE 'B' AND THE SURFACE OF DIA 507 C4. UP TO 1mm OF THE WELD MAY PROJECT OVER THE 4mm WIDE END FACE ON THE SIDE THE GROOVE THE WELDED SPACE SURFACE SHOULD NOT DEVIATE FROM THE TRUE POSITION BY MORE THAN 4,5 mm. THERE SHOULD BE 6 PITCHES OVER THE ^{12° 40' - ARC}
10. INSTEAD CHECKING RUN-OUT OF $\phi 507$ IT IS ALLOWED TO CHECK THE THICKNESS DIFFERENCE BETWEEN SURFACES $\phi 460$ AND $\phi 507$ MAXIMUM TOLERABLE VARIATION IS 0.25mm.

GEAR / SPLINE DETAILS

For Gear / Spline details refer drawing.

15) FITMENT AND PERFORMANCE TEST:

- a. Pilot samples should be checked for fitment and Performance test to ascertain the efficacy of the system under different operating conditions by fitting in higher assembly and repeating it for functional checks, wherever required.
- b. Items of Bulk supplies may be subjected to performance trial in tank in case of repeated failure/defects during exploitation.

EXPLANATORY NOTE:

- 1) Stage wise process and inspection of the component as specified in TD Book/ Process Book/ illustration book/specification is to be confirmed by the supplier during manufacturing the components. (Refer QAP Para no: 5(a)).
- 2) Firm shall submit details of manufacturing process, inspection process and also reports for the same to HVF.
- 3) If required/applicable HVF shall witness/verify stage wise inspection /process details during manufacturing of the components.
- 4) The component may be subject to endurance test, when fitted in higher assembly as specified in process / illustration /TD book.
- 5) Apart from above, all other relevant test for acceptance of the item as specified in GOST / Specification / drawing shall be carried out by the firm and the report/ certificates shall be submitted to HVF

16) INTERCHANGEABILITY:

The assemblies/component should be interchangeable component wise and assembly wise, except the Component are to be supplied as a set and to be assembled selectively as per sampling plan.

17) CALIBRATION CHECKS (TEST STANDS/JIGS/FIXTUERS/GAUGES/INSTRUMENTS):

The supplier / Contractor should have suitable Instruments, Test Stand, jigs, fixture, mandrels and gauges to carry out quality checks, to ensure conformance of components/assembly as per drawing and Specification /T.R points.

The supplier/contractor should submit calibration reports for instruments/fixtures/gauges/mandrels etc., which are used during process of inspection activities.

18) MARKING/IDENTIFICATION

Marking of the items is to be carried out as called for in the relevant drawing, drawing/T.R points.

Inscription if any on the components is to be carried out as called for in the drawing/T.R points. Unless otherwise specified in the drawing/ specification, marking should not be carried out over the components.

For traceability, marking of part No., Manufacturer name, supply order No, Serial No/Qty, batch No. and manufacture date & year are to be carried out.

Suitable method can be adopted, provided that the above parameters are legible and considering the parameters mentioned in the drawing and specification (Refer QAP Para no: 14(7)).

19) PRESERVATION CHECK

- a) Preservative coatings are to be strictly adhered to as called for in the drawing. However, equivalent BIS Standards can also be followed, subject to the thickness of the coating/preservative is maintained as per the drawing/specification.
- b) Other preservations as necessary to prevent damages due to moisture and dust during process, storage and transit are to be carried out. Conventional Methods can also be resorted to.

20) PACKING CHECK

Components / Assemblies are to be packed separately to avoid damages during transit / handling of the same. Part No. and No. of sets are to be marked on the packing.

Packing and preservation should be ensured as per drawings/relevant TY specification (To be ensured on receipt at consignee end).

Finished products shall be wrapped / packed using black and opaque polyethylene sheet or bags.

21) DOCUMENTATION

- i. Firm has to maintain all the documents as per QAP with respect to the Sl.No.to have traceability.
- ii. Vendor has to submit Bill of materials, Material test reports, Class 'C' /Endurance test reports (wherever specified in drawing/TY specification/QAP) and Complete PIR (pre-inspection report)at the time of offering the item for inspection. HVF will commence inspection only after scrutiny of these documents.
- iii. The testing/inspection responsibility to test all the parameters as per QAP and drawing specifications as mentioned in Annexure -A (enclosed).
- iv. Pre inspection reports (PIR) of firm like, 1. Chemical analysis (NABL Certificate), 2.Mechanical properties (NABL Certificate), 3. Pre-forming process, 4. Coating certification. 5. Calibration reports of instruments and 6. 100 % Dimensional inspection reports including reports of spline and gear profiles and other relevant reports for acceptance of the item as specified in GOST/ Specification / drawings etc.

22) REFERENCE:

1. Drawing No: 172.40.232.
2. Material specification as per drawing:
STEEL 38XC GOST 4543-71
3. GOST 4543-71.

ANNEXURE-A

| SL. NO. | CATEGORY | ASSEMBLY/SUB ASSEMBLY | TESTS/INSPECTION PARAMETERS | STANDARDS TO BE REFERRED | ACCEPTANCE CRITERIA | INSPECTION RESPONSIBILITY | | | REMARKS |
|---------|-------------------------------|--------------------------------------|---|--------------------------------------|--|---------------------------|-----|------|--|
| | | | | | | Firm | HVF | DGQA | |
| 1 | BOOSTER TO DRG. NO 172.40.232 | Pre inspection reports (PIR) of firm | Firm has to produced all the document as per Para 21 (iv) | As per the relevant drawing and QAP. | Confirm to drawing and QAP as per bill of material | P | V | R | 100% by firm/ vendor. |
| 2 | | Bill of material (BOM) | Firm has to prepare the BOM as per QAP | Refer QAP Para no: 8 or item list. | Confirm to QAP para no 8 | P | V | R | 100% by firm/ vendor. |
| 3 | | Dimensional checks | Dimensions as per the drawing | Refer drawing /QAP Para no: 12.1 | Confirm to drawing and QAP para no 12.1 | P | W/P | R | 100% by firm/ vendor SP followed by HVF. |
| 4 | | Material tests | Chemical composition & Mechanical / Physical Properties | As per- GOST 4543-71 | All the values to confirm with QAP Para no:13.1 (a), (b),(c) | P | W/V | R | SP followed by HVF. |
| 5 | | Hardness check | Hardness BHN 341-285 (Dia of INDN 3.3 – 3.6) | Refer QAP Para no: 14(1) | Confirm to QAP Para no: 14(1) | P | W/V | R | 100% by firm/ vendor SP followed by HVF. |
| 6 | | Coating checks | Coating | Refer QAP Para no: 14(6) | Confirm to QAP Para no: 14(6) | P | W/P | R | 100% by firm/ vendor SP followed by HVF. |
| 7 | | Marking / traceability | Firm has to make marking / traceability records. | Refer QAP Para no: 18 & 14(7) | Confirm to QAP Para no: 18 & 14(7) | P | V | R | 100% by firm/ vendor. |
| 8 | | Preservation & packing | Firm has to make Preservation & packing records | Refer QAP Para no: 19 & 20 | Confirm to QAP Para no: 19 & 20 | P | V | R | 100% by firm/ vendor. |

Note:

For conformity of the items (Chemical/Physical/Mechanical properties).

- One sample per heat / batch shall be tested under NABL Lab/Govt. Approved lab by firm. In case of non-compliance to standards entire lot shall be rejected or not to use in production further.
- For cross conformation of material, manufacturer has to submit test sample pieces for the items used / test slab and button for rubber items / HVF will draw samples from supplied lot for Witnessing (W) at HVF premises. In case of non-compliance to standards entire lot will be rejected.
- All other relevant tests as specified in GOST/ Specification / Drawing is to be carried out by firm and to be confirmed

P- Perform W- Witness V-Verify R-Review SP-Sampling Plan

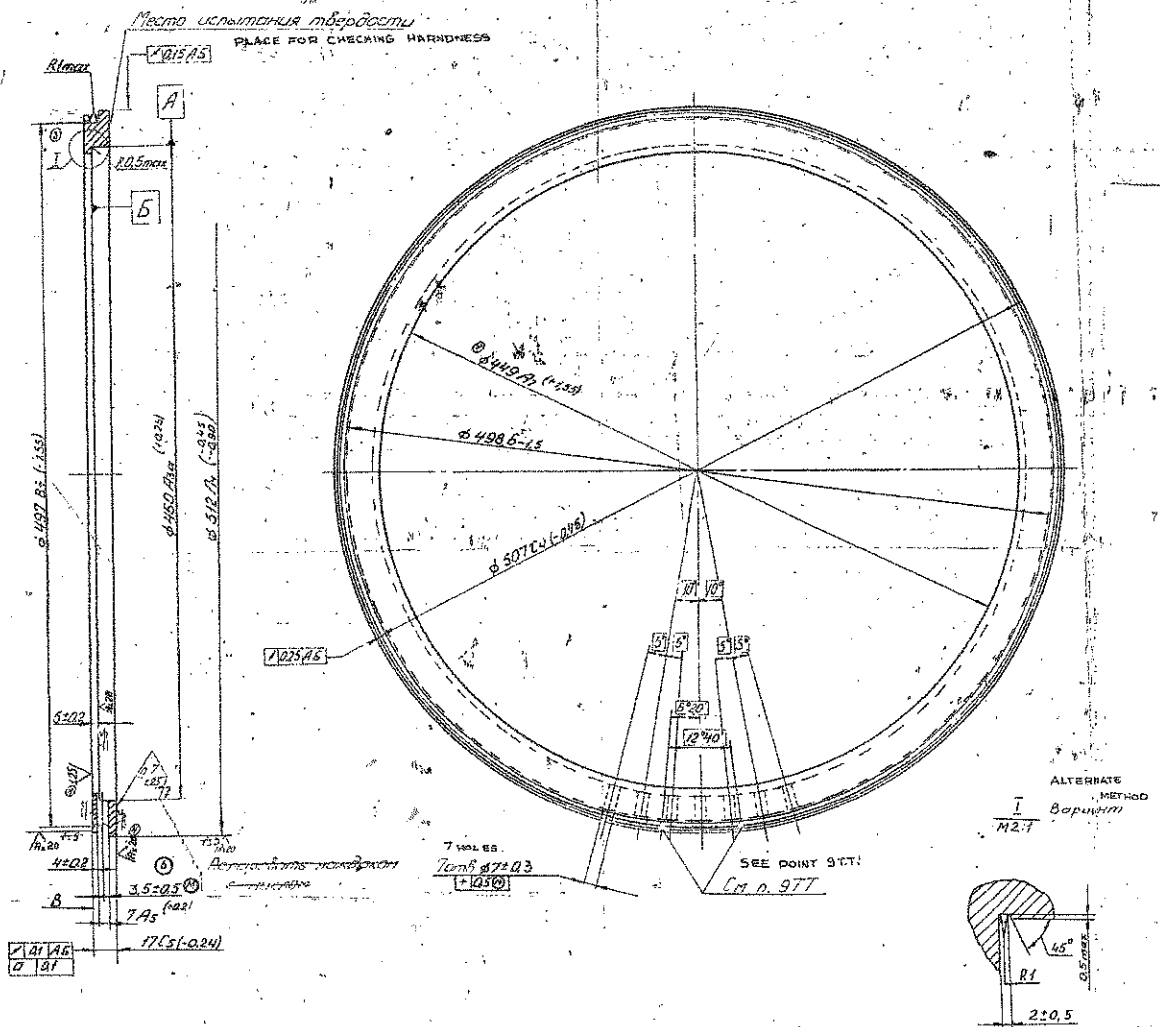


FIGURE: BOOSTER TO DRG. NO 172.40.232
 (For Reference Only)

**RESTRICTED
(DRAFT/PROVISIONAL)
QUALITY ASSURANCE PLAN**

FOR

(BOOSTER)

DRG.NO.172.40.231

(LF NO:6206401070)

No.HVF/T-72/QAP/40/BOOSTER/241573-00

ISSUE No:00

DATE:AUG-2021

QUALITY ASSURANCE (RIG-SUB ASSEMBLY)

HEAVY VEHICLES FACTORY

AVADI CHENNAI – 600 054


QUALITY ASSURANCE PLAN (QAP)

FOR

BOOSTER

DRG. NO. 172.40.231


PREPARED BY


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ISSUED BY

QUALITY ASSURANCE (RIG- SUB ASSEMBLY)
HEAVY VEHICLES FACTORY
AVADI CHENNAI – 600 054

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1.IMPORTANT NOTE

Note-1

This is only a provisional and will be amended from time to time according to the requirement. No addition, deletion and reproduction will be done without permission of The Sr. General Manager, Heavy Vehicles Factory, Avadi, Chennai – 54.

Note –2

Any instruction contained in this does not prejudice the terms and conditions of the contract what so ever. In case of any contradiction between the contents of this QAP and the clause in the contract, the latter will prevail.

Note-3

The stores should be manufactured strictly only as per the drawings supplied by the Inspection Authority and not as per the samples, if any received by the manufacturer for guidance purpose.

Note-4

Any amendment issued by the Inspection Authority shall be incorporated in the QAP and the records for the amendments carried out should be maintained as per the Performa at Appendix-“A”.

Note-5

In case of any contradiction between the contents of this QAP and drawings issued along with the contract, the latter will prevail.

2.INTRODUCTION

1. This quality plan lays down the inspection and testing procedure to be carried out on the component **BOOSTER - 172.40.231** being procured indigenously. This is prepared, based on the acceptance standards and inspection parameters laid down in collaborators documents and on the inspection test standards followed in respect of similar indigenous items.
2. This QAP is the property of Government of India and is liable for amendments as and when required. The Sr. General Manager, Heavy Vehicles Factory, Avadi, Chennai – 600 054, is the inspecting Authority for this assembly. Any query / clarification on the content of this QAP shall be referred to this Factory. Any departure from these instructions is allowed only after written approval from the above authority. Notwithstanding the tests indicated in this QAP, the inspecting Officer has the right to carry out any test to check conformance to

the paper particulars quoted in the Supply Order, which he may consider necessary to satisfy himself about the stores which he has to accept.

3.AIM

The QAP is aimed at standardizing the Inspection procedure and acceptance norm for **BOOSTER- to Drg no. 172.40.231**.

It also aims at giving adequate information to the manufacturer on the quality requirements so that the required quality control methods are established. This is also meant to guide authorized Inspection Officer in his routine inspection and to set out main points to which his attention must be drawn to ensure that the accepted stores meet the stipulated standards.

4. SCOPE:

This QAP outlines in general terms, the checks and methods to be used during inspection of **BOOSTER to Drg. no- 172.40.231** including the technical requirements of the drawings. The recommended Quality Plan stipulated herein is mandatory and should be strictly adhered to.

For inspection purpose, only the latest issue of this QAP will be made applicable and copies of this QAP can be obtained from the issuing authority i.e. The Sr. General Manager, Heavy Vehicles Factory, Avadi, Chennai.

Note:

- i. Tender enquiry (TE) and supply order (S.O) will be issued with QAP stating that inspection will be done as per QAP.
- ii. In case of TE, It is responsibility of the vendor to obtain the copy of QAP and give the statement of compliance that vendor will abide by the QAP in case supply order is placed.
- iii. In case of S.O, it is the responsible of the vendor to obtained copy of QAP and give the statement of compliance that the vendor will follow QAP. However, GM/HVF reserves the right to revise/update the QAP from time to time.

5. DOCUMENTS:

- a) On placement of firm supply order, One set of relevant specification and technical instructions on the subject item can be obtained by the contractor from AHSP through DDO/HVF
- b) Any clarification required on these documents should be obtained from the Inspecting Authority i.e. The Sr. General Manager, Heavy Vehicles Factory, Avadi, Chennai – 600 054. Equivalent to the collaborators specifications and standards will be decided only by the Inspecting Authority and should not be unilaterally decided. For any change in the specifications, standards or written approval, any alterations in specification can be affected and not otherwise.
- c) The process instruction sheets supplied by the collaborators are available with the Authority Holding Sealed Particulars, i.e. The Controllerate of Quality

Assurance (Heavy Vehicles), Avadi, Chennai for the reference. The relevant process sheets may be studied at the premises of the AHSP after obtaining necessary permission.

- d) The supplier after scrutiny of the concerned process sheets and connected paper particulars should establish the necessary production and inspection facilities. Particularly the inspection test rigs, stands, fixtures, template, gauges etc should be provided as recommended in these process sheets. If process sheet / Process Book is not available the details particulars/parameters available in the drawings to be strictly adhered.

6. ITEM USED ON:

1. 172.40.021CB.
2. 172.40.022CB

7. LIST OF DRAWINGS:

Single (individual) item

| SI. NO. | DRG. NO | NOMENCLATURE | REMARKS |
|---------|------------|--------------|---------|
| 1 | 172.40.231 | BOOSTER | - |

8. BILL OF MATERIALS:

Single (individual) item, details as below,

| SI. NO | DRG. NO | NOMENCLATURE | MATERIAL SPECIFICATIONS | Qty |
|--------|------------|--------------|----------------------------|-----|
| 1 | 172.40.231 | BOOSTER | Steel 38XC To GOST 4543-71 | 1 |

Note: Vendor/Contractor may use approved alternate material as per drawing. Refer Para 13.

9. CONDITIONS OF USE/STORAGE INSTRUCTIONS

This assembly/item should be properly packed to protect from transit / handling damage and influence of atmospheric precipitations. In addition, the following parameters should be ensured:

- (a) The threaded parts if any should be covered with suitable plastic caps to prevent damages.
- (b) If the item consists of assemblies, each assembly should be packed separately.

- (c) The stores are to be suitably covered for preventing ingress of dust and Dirt/entry of sunlight / moisture.
- (d) The packaging slip shall contains
- (i) Certificate of testing (NABL)
 - (ii) Guarantee/ Warranty Certificate
 - (iii) Service and maintenance instructions
 - (iv) Delivery Slip with Inspector's Acceptance Mark
- (e) The stores are not permitted to be stored together with oils. Petrol, acids, alkaline and other substances to avoid damage to the metal / rubber components.

10. SAMPLING PLAN:

| Sl. No. | Sampling Plan | Pilot* | Bulk |
|---------|--|---------|--|
| (i) | Visual Inspection | 100% | 100% |
| (ii) | Dimensional Inspection | 100% | General Inspection level III, single sampling, Normal Inspection, AQL 2.5 of IS 2500 (Part-I)-2000 |
| (iii) | Material Inspection | 1 No | 1 No. for each batch of raw material or heat treatment lot as required by specifications. |
| (iv) | Acceptance test | --- | ----- |
| (v) | Pressure testing | --- | ----- |
| (vi) | Machining/Fitment/ Performance trial on higher assembly / Tank | 01 no | 1 no. |
| (vii) | Interchangeability Test | 02 Nos. | 02Nos.per batch on randomly basis, except selective assembly. |
| (viii) | Test stand/Jigs/ Fixtures/Gauges/Mandrels/etc. | 100% | 100% |
| (ix) | Marking/Identification | 100% | 100% |
| (x) | Packing/ Preservation | 100% | 100% |

Note:-

* This clause is applicable if mentioned in supply order or project sanction order.

A New (First time supplier of this item) supplier should obtain clearance from HVF for bulk production which will be issued only after inspection/evaluation of pilot samples by HVF.

11. VISUAL INSPECTION[Sampling plan as per Para- 10 (i)]

The stores are to be visually examined on 100 % of pilot /bulk and same should be free from any defects and all the finishing requirements shall satisfy as indicated in technical conditions of the assembly / component drawing.

The components shall be checked for the following and should be free from the defects:

- Defects in construction
- Cracks/Dents/Scratches
- Fitment of all components
- Presence of foreign particles
- Moisture and dust
- Corrosion of metal parts
- Mechanical imperfections & distortion
- Any form of deterioration of material and finishing.

Packing and preservation should be ensured as per drawings/relevant TY specification (To be ensured on receipt at consignee end).

12. DIMENSIONAL CHECK[Sampling plan as per Para- 10(ii)]

The dimensions of individual component, sub assembly and major assembly shall be checked and ensured as per respective drawing. Dimensional check should be carried out as per sampling plan. However, the inspecting authority/rep. may at his discretion, tighten the inspection level and acceptance quality level on the critical items and adopt check point during manufacture.

12.1 BOOSTER(172.40.231)

All dimensions shall be confirmed as per drawing/Specification.

| Sl. No. | Drawing Dimensions |
|---------|--------------------|
| (i) | Ø507C4(-0.45) mm |
| (ii) | Ø498.6(-1.5) mm |
| (iii) | 10° |
| (iv) | 10° |
| (v) | 5° |
| (vi) | 5° |
| (vii) | 5° |
| (viii) | 5° |
| (ix) | □ 0.1 |
| (x) | 7holes Ø7±(0.3) mm |
| (xi) | + 0.5 |
| (xii) | 1/0.25/1.6 |
| (xiii) | R1 max |
| (xiv) | 8(-0.4) mm |

| | |
|---------|---|
| (xv) | Ø482B7(-1.55) mm |
| (xvi) | √1015A5 |
| (xvii) | Ø492Π4(-0.38/-0.76)mm |
| (xviii) | Ø449A3a (+0.25)mm |
| (xix) | 8±0.5mm |
| (xx) | 12±0.2mm |
| (xxi) | 7C5(-0.2)mm |
| (xxii) | √1015A5 |
| (xxiii) | Place for hardness checking refer drg |
| (xxiv) | Surface Finish/ roughness should be confirmed as per the drawing / specification. |

For admissible alternate manufacture if any in dimensions/material, refer drawing/specification.

| | | | |
|--------------------------------------|--------------------|-----|---------------|
| MODULE | | m | 3 |
| NUMBER OF TEETH | | Z | 168 |
| BASIC RACK | PROFILE ANGLE | α | 20° |
| | COEFF. OF ADDENDUM | f' | 0.7 |
| | | f'' | 0.9 |
| | FILLET RADIUS | Zr | 0.3 MAX |
| COEFFICIENT OF ADDENDUM MODIFICATION | | ε | 0 |
| REFERENCE CIRCLE DIAMETER | | A | 504 |
| ADDENDUM | | h' | 1.5 (TOPPING) |
| DEDENDUM | | h'' | 2.7 |
| BASE TANGENT LENGTH | | L | 170.89 |

13) MATERIAL CHECKS [SAMPLING PLAN AS PARA – 10 (iii)]

Material specimen /test bars of the components shall be in conformity as per the material mentioned in the relevant documents/drawing. The material check will be carried out as per sampling plan. However, if the manufacturer proposes any alternative/equivalent material at the stage of tender enquiry, the same has to be approved and a written concurrence should be obtained from AHSP through DDO/HVF, before usage of such materials.

13.1 BOOSTER to Drg. No. 172.40.231

- The component should be manufactured from STEEL 38XC GOST 4543-71.
- Chemical properties:** As per STEEL 38XC GOST 4543-71.

| CONTENT OF ELEMENTS % | | | | | | | |
|-----------------------|------|------|------|------|-------|-------|------|
| C | Si | Mn | Cr | Ni | S | P | Cu |
| 0.34 | 1.00 | 0.30 | 1.30 | 0.30 | 0.035 | 0.035 | 0.30 |
| to | to | to | to | | | | |
| 0.42 | 1.40 | 0.60 | 1.60 | MAX | | | |

Note: For mass fraction of other elements refer GOST4543-71

c) Mechanical properties: As per STEEL 38XC GOST4543-71

| Yield point, N/mm ² /kgf/ mm ² | Ultimate strength N/mm ² (kgf/mm ²) | Elongation % | Relative reduction of area % | Impact strength KCU/ (Kgm/cm ²) |
|--|---|-----------------|---------------------------------------|--|
| Not Less than | | | | |
| 735 (75) | 930 (95) | 12 | 50 | 69 (7) |

For other details/parameters refer GOST 4543-71.

14) PERFORMANCES/ACCEPTANCE TEST: BOOSTER 172.40.231.

The following technical requirements shall be confirmed for acceptance of the component.

1. BHN 341-285(DIA OF INDENTATION 3.5 TO 3.8).
2. Position of holes Ø7 relative to teeth is optional.
3. Increase of pitch by 0.2mm beyond tolerance is allowed on not more than 10 teeth.
4. Depth variation for any pair of teeth except 10 with increased pitch should not be more than 0.4mm.
5. Longitudinal marks of a depth of maximum 2mm are allowed over tooth profile.
6. Coating: chemical oxidation with oil finish.
7. To be marked.
8. Instead of checking the run out specified in drawing is allowed check the thickness difference between datum surface Ø449 and Ø492, the maximum tolerance difference being 0.15mm and also between end face 'B' and 'B' for which case the maximum tolerable difference is 0.15mm maximum.
9. Near the 4th hole of Ø7 weld up the tooth space surface to make it shallower by 3 to 4mm in the mist of shielding gas. Projection of welded portion over face of 7C5 and over surface Ø507C4 is not allowed.

EXPLANATORY NOTE:

10. Reference material quoted steel 38XC GOST 4543-71

Structural chromium silicon alloy steel good quality grade 38XC GOST 4543-71.

15) FITMENT AND PERFORMANCE TEST:

a) Pilot samples should be checked for fitment and Performance test to ascertain the efficacy of the system under different operating conditions by fitting in higher assembly and repeating it for functional checks, wherever required.

b) Items of Bulk supplies may be subjected to performance trial in tank in case of repeated failure/defects during exploitation.

16) INTERCHANGEABILITY:

The assemblies/component should be interchangeable component wise and assembly wise, except the Component are to be supplied as a set and to be assembled selectively as per sampling plan.

17) CALIBRATION CHECKS

(TEST STANDS/JIGS/FIXTUERS/GAUGES/INSTRUMENTS):

i)The supplier / Contractor should have suitable Instruments, Test Stand, jigs, fixture, mandrels and gauges to carry out quality checks, to ensure conformance of components/assembly as per drawing and Specification /T.R points.

ii)The supplier/contractor should submit calibration reports/certificates for instruments/fixtures/gauges/mandrels etc., which are used during process of inspection activities.

18) MARKING/IDENTIFICATION

Marking of the items is to be carried out as called for in the relevant drawing, drawing/T.R points.

Inscription if any on the components is to be carried out as called for in the drawing/T.R points. Unless otherwise specified in the drawing/ specification, marking should not be carried out over the components.

For traceability, marking of part No., Manufacturer name, supply order No, Serial No/Qty, batch No. and manufacture date & year are to be carried out. Suitable method can be adopted, provided that the above parameters are legible and considering the parameters mentioned in the drawing and specification.(refer para 14(7))

19) PRESERVATION CHECK

a) Preservative coatings are to be strictly adhered to as called for in the drawing. However, equivalent BIS Standards can also be followed, subject to the thickness of the coating/preservative is maintained as per the drawing/specification.

b)Other preservations as necessary to prevent damages due to moisture and dust during process, storage and transit are to be carried out. Conventional Methods can also be resorted to.

20) PACKING CHECK

Components / Assemblies are to be packed separately to avoid damages during transit / handling of the same. Part No. and No. of sets are to be marked on the packing.

Packing and preservation should be ensured as per drawings/relevant TY specification (To be ensured on receipt at consignee end).

Finished products shall be wrapped / packed using black and opaque polyethylene sheet or bags.

21) DOCUMENTATION

- i. Firm has to maintain all the documents as per QAP with respect to the SI.No.to have traceability.
- ii. Vendor has to submit Bill of materials, Material test reports, Class 'C' /Endurance test reports (wherever specified in drawing/TY specification/QAP) and Complete PIR (pre-inspection report)at the time of offering the item for inspection. HVF will commence inspection only after scrutiny of these documents.
- iii. The testing/inspection responsibility to test all the parameters as per QAP and drawing specifications as mentioned in Annexure -A (enclosed).
- iv. Pre inspection reports (PIR) of firm like, 1. Chemical analysis, 2.Mechanical properties, 3. Pre-forming process, 4. Coating certification(whenever applicable), 5. Calibration reports of instruments and 6. 100% Dimensional inspection reports. 7. Pressure test (leakage test) (whenever applicable) reports, etc.,

22) REFERENCE:

- a) Drawing No: 172.40.231
- b) Material specification Steel 38XC to GOST 4543-71

| SL. NO. | CATEGORY | ASSEMBLY/SU B ASSEMBLY | TESTS/INSPECTION PARAMETERS | STANDARDS TO BE REFERRED | ACCEPTANCE CRITERIA | INSPECTION RESPONSIBILITY | | | REMARKS |
|---------|-------------------------------|--------------------------------------|---|--|---|---------------------------|-----|------|-----------------------------------|
| | | | | | | Firm | HVF | DGQA | |
| 1 | BOOSTER TO DRG. NO 172.40.231 | Pre inspection reports (PIR) of firm | Firm has to produced all the document as per Para 21 (iv) | As per the relevant drawing and QAP. | Confirm to drawing and QAP as per bill of material | P | V | R | 100% by firm/ vendor. |
| 2 | | Bill of material (BOM) | Firm has to prepare the BOM as per QAP | Refer QAP Para no: 8 or item list. | Confirm to QAP. | P | V | R | 100% by firm/ vendor. |
| 3 | | Dimensional checks | Dimensions as per the specification | Refer Specifications & QAP Para no: 12.1 | Conform to Specifications and QAP | P | W/P | R | 100% by firm/ SP followed by HVF. |
| 4 | | Material tests | Chemical composition & Mechanical / Physical Properties | Refer GOST 4543-71 | All the values to confirm with QAP (Para no:13.1 (a), (b), (c) | P | W/V | R | SP followed by HVF. |
| 5 | | Hardness | Hardness 341-285 BHN | Refer QAP Para no: 14(1) | All the values to confirm with QAP Para no: 14(1) | P | W/V | R | SP followed by HVF. |
| 6 | | Coating Checks | chemical oxidation with oil finish | As per Para 14 (6) | All the values to confirm with QAP Para 14 (6) | P | W/V | R | SP followed by HVF. |
| 7 | | Marking / traceability | Firm has to make marking / traceability records. | Refer QAP Para no: 18&14(7) | Confirm to QAP Para no:1814(7) | P | V | R | 100% by firm/ vendor. |
| 8 | | Preservation & packing | Firm has to make Preservation & packing records | Refer QAP Para no: 19 & 20 | Confirm to QAP Para no: 19 & 20 | P | V | R | 100% by firm/ vendor. |

Note:
For conformity of the items (Chemical/Physical/Mechanical properties).
1. One sample per heat / batch shall be tested under NABL Lab/Govt. Approved lab by firm. In case of non-compliance to standards entire lot shall be rejected or not to use in production further.
2. For cross conformation of material, manufacturer has to submit test sample pieces for the items used / test slab and button for rubber items / HVF will draw samples from supplied lot for Witnessing (W) at HVF premises. In case of non-compliance to standards entire lot will be rejected.

P- Perform W- Witness V-Verify R-Review SP - Sampling Plan

