

MATERIAL STANDARDS DIESEL COMPONENT WORKS, PATIALA	NUMBER	FG-S.0010
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Scope

- i) This standard covers all types of ordinary forgings used in the construction of diesel engines and locomotives. This standard covers drop, upset, press and hammer forgings.
- ii) This standard specifies the general requirements of forgings for different applications and as such covers all aspects of manufacture and testing. The particular requirements shall be specified on the material standards /material treatment notes/special requirements, applicable to each forging and this standard shall be read in conjunction with the particular standards.

Material for manufacture

All forgings shall be manufactured from material as specified in material standards & heat treatment notes applicable to the components.

Forging practice

- i) The material shall be hot worked at an appropriate range of temperature under a press, a forging machine or a power hammer of adequate power, and the amount of hot work must be such as to ensure complete soundness and adequate uniformity of structure and mechanical properties.
- ii) The forgings shall be brought as close as practicable to the finished shape and size by hot working and shall be so worked as to cause metal flow in the directions most favourable for resisting the stresses encountered in service.
- iii) Unless otherwise specified, the sectional area of the body of the forging (as forged) shall not exceed 1/5 of the sectional area of the original ingot and no part of the forgings shall have more than 2/3 of the sectional area of the original ingot.
- iv) Where specified in the enquiry/order, the manufacturer shall submit the details of sequence of forging operations for prior approval.

Heat Treatment

- i) Each forging shall be heat treated as specified in the relevant material standards/material treatment notes after completion of the forging operations. If a forging is subsequently heated for any purpose, it shall be re-heat treated. After forging and before re-heating for heat treatment, the forgings shall be allowed to cool in a manner to prevent injury and to accomplish transformation.

BASED ON DLW SPECN. FG-S-010

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ii) Except where special heat-treatment is in the enquiry/order, all forgings supplied by the manufacturer shall be normalized/annealed after forging, as required by the material standards/heat treatment notes.

iii) The manufacturer shall submit full details of the heat treatment to DEW and obtain approval.

Freedom from defects:

i) The forgings shall be sound, smooth, well cleaned and free from scale, nicks, pipe, flakes, hammer bursts, laps, seams, cracks, segregations, undesirable inclusions, mismatch, shrinkage, distortion and any other defects detrimental to heat-treatment, machinability, appearance or service performance, and shall be finished to the prescribed dimensions on the drawings, as interpreted by DEW.

ii) The surfaces including parting lines of forgings shall be smooth. Any sharp edges or tear marks at the parting lines, as a result of trimming, shall be ground smooth and rounded off. When flash occurs at die partings due to wear, the excess metal shall not be forced back into the forging in subsequent blows, by turning the forgings in the die.

iii) Decarburized zones shall be kept to the minimum and shall, in any case, not exceed the machining allowances indicated.

iv) No repairs of any kind shall be done on the forgings.

Drawings.

i) Forging drawings may be furnished to the manufacturer wherever available in addition to the machining drawings. The parting line in all cases of die forgings shall be as indicated in the drawings.

ii) The tolerances on the drop & upset forgings shall conform to those referred to in the drawings and wherever not specified, shall conform to standards mentioned in the enquiry. In all cases, the manufacturer shall confirm the tolerance limits as given in the drawings and where the deviation is required, the manufacturer shall submit details at the time of enquiry.

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iii) In the case of hammer and other forgings, the tolerances as indicated in the drawings shall apply. Where tolerances are not mentioned in the drawings, the manufacturer shall furnish details of proposed tolerances when quoting against enquiries.

iv) In all cases, the manufacturer shall submit details of length and width, die wear, die closure, mismatch, radii, flash extension, straightness, draft angles, etc., tolerances and any other relevant data and get approval prior to manufacture.

i) Unless otherwise indicated, the test specimen shall be taken out of the finished forgings at midradius. The manufacturer shall submit as specified in the order:

- a) One extra forging per heat treatment lot, or
- b) Two percent of the number representing a test lot.

ii) In the case of forgings where it is possible to provide prolongation (test coupons), the manufacturer shall submit details for prior approval.

iii) All the test samples prior to preparation of test pieces shall receive the same heat treatment as those of the forgings they represent.

Test Specimen

The following tests shall be made:-

- a) Check chemical analysis on drillings taken from forgings.
- b) Longitudinal tensile test on the test specimen.
- c) Impact test shall be conducted on test specimens where indicated.
- d) Hardness test shall be conducted on cent percent of the forgings.
- e) Magnetic particle/liquid penetrant inspection shall be conducted at DCW before and/or after machining as called for in the drawings enquiry.

Tests

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- f) Macroscopic test shall be conducted to find the orientation of flow lines wherever called for.
- g) Microscopic test shall be conducted to ascertain the grain size, inclusions etc., wherever called for.

Inspection:

- i) Four sample forgings shall be submitted for approval to check conformity to drawing sizes, machining allowances, etc., and for metallurgical inspection, in the first instance and also on subsequent occasions when either dies are resurfaced or repaired, or when there is a change in the forging process, before undertaking bulk manufacture.
- ii) If any forging is found on inspection to have been over-heated or burnt, the whole lot represented by the sample shall stand rejected.
- iii) Where heat treated forgings are ordered, if the results of the mechanical tests of any lot do not conform to the requirements specified, the manufacturer may be allowed to re-heat treat the material and offer for retest. However, in no case, will forgings be allowed to be re-heat treated more than twice.
- iv) Any forging showing defects during subsequent manufacturing operations shall stand rejected notwithstanding any previous certificate of satisfactory testing or acceptance of rough forging, and the rejected forgings must be replaced by the manufacturer.
- v) Final inspection and acceptance shall be made only at DCW.
- vi) The manufacturer shall afford all facilities to DCW representative to satisfy that the material is furnished in accordance with this standard.

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Markings:

Identification marks catalogue numbers and Serial numbers shall be legibly stamped on each forging on the location shown on the drawings. Where not indicated, the manufacturer shall obtain the details from DCW.

Standard & Practices:

All other conditions not specifically mentioned here must meet the relevant ASTM standards. When specially authorised, BS or IS standards would apply.

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