

SPECIFICATION No. 56- BD- 07
(Supersedes 56-BD-97)

INDIAN RAILWAYS
SCHEDULE OF TECHNICAL REQUIREMENT
No. 56-BD-07

FOR

TRANSITION CENTRE BUFFER COUPLER

FOR

B.G. WAGONS

&

B.G. LOCOMOTIVES

(Amendment No. 2 of Sept 2010)



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Amendment No.2 of September 2016, to specification 56-BD-07 for SPECIFICATION TRANSITION CENTRE BUFFER COUPLER FOR B.G. WAGONS & LOCOMOTIVE..

.Add the following paragraph after clause 1.2 of Scope

“All the provisions contained in RDSO’s ISO procedures laid down in document No. QO-D-7.1-11 dated 19/07/2016 (Titled “Vendor – Changes in approved status”) and subsequent version/ amendments thereof, shall be binding and applicable on the successful vendor/ vendors in the contracts floated by Railways to maintain quality of products supplied to Railways”

**Amendment No.1 of September- 2010 to RDSO Specification No. 56-BD-2007 of
September 07 for TRANSITION Centre buffer Coupler for B.G. Wagons & B.G.
Locomotives**

The following changes may be incorporated in the specification No. 56-BD-2007.

**2. Page 19 - Clause 3.5.3.4.1 "ACCEPTANCE STANDARD FOR
RADIOGRAPHIC EXAMINATION"**

Replace existing clause with following

Radiographic examination shall be conducted on Knuckle, Coupler Body & Yoke to the extent of 5% of the casting produced and level of acceptance shall be as per ASTM E 446 Level-II. The location for radiographic test shall be as per Annexure-II (Sheet-1, 2 & 3).

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LIST OF DRAWINGS

(High Tensile Transition Centre Buffer Coupler for B.G. Wagons)

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2.	SK-62724	20	Details for Transition and Non-transition CBC.
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6.	WD-87004S-1	8	Markings on Knuckle.
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8.	WA/BD-403	5	Screw Coupling Lever & Weight (BG).
9.	W/BD-404	4	Screw Coupling Lever (BG).
10.	W/BD-433	6	Screw Coupling Lever Trunnion Washer.
11.	WA/BD-4461	4	Striker casting.
12.	WA/BD-4462	3	Yoke Pin Support.
13.	WA/BD-4464	2	Clevis (BG).

(High Tensile Transition Centre Buffer Coupler for B.G. Locomotive)

S. No.	Drawing No.	Alt. No. as on September'07	Description
1.	SK, DL-3430	7	Arrangement of High Tensile Transition C.B.C.with Un Coupling Gear.
2.	SK, DL-508	1	Fabricated Striker Block for Centre Buffer Coupler for B.G. Class Loco.
3.	SK, DL-890	3	Detail for Uncoupling Gear of Transition C.B.C.
4.	SK, DL-3491	1	Arrangement and Details of R.H.S. Uncoupling Gear for Transition C.B.C.
5.	SK, DL-2494	17	Revised Arrangement of Transition Screw Coupling for C.B.C.
6.	SK, DL-2495	12	Detail of Modified Transition Screw Coupling for C.B.C.
7.	SK, DL-2496	6	Clevis for Modified Transition Screw Coupling for C.B.C. OF B.G. Locos.
8.	SK-62724	20	Detail for Transition and Non Transition C.B.C.
9.	SK-69508	4	Clevis Pin With Washer.
10.	WD-87004-S-1	8	Markings on Knuckle.

**A -- SCHEDULE OF TECHNICAL REQUIREMENTS FOR HIGH TENSILE
TRANSITION CENTRE BUFFER COUPLER FOR BG WAGONS**

0. FOREWORD

- 0.1 This specification is intended to cover the technical provisions relating to Material, construction and tests and does not include all the necessary provisions of the contract.
- 0.2 This Specification is issued under the fixed number 56-BD-07. The number after BD indicates year of revision.
- 0.3 This revision supersedes all previous revisions.
- 0.4 This specification draws reference to the following specifications: -
- (i) AAR M 118, M 201, M 205 & M 211.
 - (ii) AAR S 172 Section 'B' Part- II & AAR S 137 Section 'B'.
 - (iii) IS: 2010, 1875, 2004, 3885, 5517, 817 & 1181, 1030, 1148, & 2062.
 - (iv) ASTM A 255, A 370, E 208, E446 and E604.
 - (v) IRS R-6 & R-9.
- 0.5 Whenever there is a conflict among the stipulations in the present specification, drawings or any of the relevant specifications, the most stringent requirement will apply.

1 SCOPE

- 1.1 This specification covers the particular requirements for the supply of **High Tensile Transition Centre Buffer Coupler and its components for B.G. Wagons.**
- 1.2 The Tenderer shall submit his offer for **High Tensile Transition Centre Buffer Coupler for BG Wagons** consisting of the following Items:

S No.	Name of Part	Nos / Coupler
1.	Coupler Body with Shank wear Plate	1
2.	Knuckle	1
3.	Lock	1
4.	Knuckle thrower	1
5.	Top Lock lift hole cap	1
6.	Knuckle Pin with Washer	1
7.	Rotary Bottom Operated articulated locklift Assembly	1
8.	Coupler Yoke	1
9.	Yoke Pin	1

S No.	Name of Part	Nos / Coupler
10.	Clevis with handle	1
11.	Clevis pin with washer	1
12.	Transition Screw Coupling	1
13.	Yoke pin support with wear plate	1
14.	Striker Casting with wear plate	1

2 GENERAL REQUIREMENTS

- 2.1 The manufacturer shall set aside one set of gauges for exclusive use of Inspecting authorities. The accuracy of gauges shall be checked by Inspecting authorities before the commencement of manufacture. Recalibration shall subsequently be made at the frequency stipulated in internal **Quality Assurance Programme**. Gauge drawings in original, shall also be made available for checking the tolerances of these gauges.
- 2.2 All components of coupler shall be interchangeable. Manufacture and inspection shall be carried out as per **"REQUIREMENTS FOR ACCEPTANCE OF COUPLER AND ITS COMPONENTS FOR BG WAGONS ON INDIAN RAILWAYS"** and as per other clauses of this specification.
- 2.3 Any deviation from inspection in respect of test details shall be worked to with prior concurrence of the purchaser.
- 2.4 The manufacturer shall provide labour, appliances and other details necessary for the inspection of the coupler and its components in accordance with this specification at his own cost.
- 2.5 In case the offer does not correspond to this specification in any respect, the tenderer shall submit a **DEVIATION STATEMENT**. This statement shall give the deviations clausewise with technical reasons for the same. Change in drawings, if any, shall be explained and accompanied by **THREE** copies of revised drawings. In case the tenderer does not require any deviation from this specification, a **NIL DEVIATION** certificate shall be submitted.

2.6 MARKING

- 2.6.1 All coupler components should have clear and legible manufacturers' name in short code and batch No. etc., which shall remain legible through out the entire service period. The letter size and height of the raised letter shall be as specified in relevant RDSO drawing.

The coupler components found having illegible marking at the time of fitment in Railway Workshops, Maintenance depot or on Wagon Builders premises shall be treated as rejected and shall be replaced by the manufacturers free of cost. The cost of transportation shall be borne by the manufacturer.

- 2.6.2 The manufacturer code shall be provided as per table shown at Annexure-I.

2.7 GAUGES:

The manufacturer shall have the capacity to manufacture and supply the gauges required for inspection and maintenance of Coupler and its components. The manufacturer should supply these gauges to Zonal Railways against the requirement of zonal railways.

2.8 Manufacturer shall supply Installation and Maintenance Manuals for proper installation and maintenance of coupler to RDSO. The number of manuals to be supplied shall be 25 per contract and shall be free of cost. The manual shall contain following information:

- i) Principal of operation and important design features.
- ii) Illustration explaining the working and maintenance practices.
- iii) Details of attention required during overhauling.
- iv) Special tools, capacity and specification.
- v) List of spares along with the specification and part No. etc.

2.9 FIELD PERFORMANCE:

The supplier shall regularly collect data and samples of previous supply from field to access the actual life obtained, nature of defects occurring in the service and should take necessary corrective action to improve quality. Half-yearly report should be submitted to RDSO on data, samples collected and action taken.

2.10 TRAINING OF RAILWAY STAFF:

The manufacturer shall also provide training to sufficient number of Railway Maintenance Supervisors/staff in consultation with purchaser, free of cost at his own premises or in Railway Workshops.

3 PARTICULAR REQUIREMENTS

3.1 GENERAL ARRANGEMENT

3.1.1 General arrangement of the coupler shall be to RDSO Drg. No. SK-62723, latest alteration.

3.2 MATERIAL

3.2.1 The material of High Tensile Transition Centre Buffer Coupler components shall be as indicated in RDSO Drg. No. SK-62724 latest alteration and this specification.

3.3 COUPLER

- 3.3.1 Coupler body and shank wear plate shall be to Drg. No. SK-62724 (Item 18 & Item 10 respectively) latest alteration. Shank wear plate shall be welded to the coupler shank as shown in the drawing.
- 3.3.2 Coupler components shall be in accordance with '**REQUIREMENTS FOR ACCEPTANCE OF COUPLER AND ITS COMPONENTS FOR BG WAGONS ON INDIAN RAILWAYS**' of this STR and shall meet the stipulations given below:
- a) knuckle shall be to Drg. No. SK-62724 (Item 2), latest alteration.
 - b) Lock shall be to Drg. No. SK-62724 (Item 8), latest alteration.
 - c) Knuckle thrower shall be to Drg. No. SK-62724 (Item 9), latest alteration.
 - d) Knuckle pivot pin with securing arrangement shall be to Drg. No. SK-62724 (Item 4), latest alteration.
 - e) Articulated Lock lift assembly consisting of Toggle, Universal Lock lift lever connector and lock lift lever hook shall be to Drg No. SK-62724 (Item 5, 6 & 7 respectively), latest alteration.
 - f) Top lift hole Cap shall be to Drg No. Sk-62724 (Item 11), latest alteration.

3.4 COUPLER, YOKE, YOKE PIN AND YOKE PIN SUPPORT

- 3.4.1 Coupler Yoke shall be to Drg. No. SK-62724 (Item 3) latest alteration.
- 3.4.2 Yoke pin shall be to Drg. No. SK-62724 (Item 12), latest alteration.
- 3.4.3 Yoke pin support shall be to Drg. No. WA/BD-4462 latest alteration. Yoke pin support shall be supplied complete with wear plate welded as shown in drawing.

3.5 STRIKER CASTING

- 3.5.1 Striker casting and Striker Casting Wear plate shall be to Drg. No. WA/BD - 4461 and WD-87056-S-01 respectively, latest alteration. Striker casting shall be supplied complete with wear plate bolted and tack welded as shown in drawing.

3.6 TRANSITION GEAR

(including clevis with handle, clevis pin with washer and screw coupling to couple with IRS draw gear)

- 3.6.1 Transition screw coupling shall be in accordance with IRS specification R-9-66, read with corr. Slip Nos. 1 & 2 of oct. 75 and Aug.,77 respectively and to

drg. No. SK-69503 and SK-69504, latest alteration. Screw coupling shall be of steel to specification No. IS: 1875 Cl. 4 & IS: 2004.

3.6.2 The material for clevis and clevis handle shall be to specification No. IS: 1030 Gr.27-54 and IS: 2062:2006 E 250 A respectively.

3.6.3 Clevis pin shall be to specification No. IS: 1875 Cl. 5 & IS: 2004 or AAR specification No. M118.

3.6.4 Clevis and Clevis pin shall be to Drg. No. WA/BD-4464 & SK-69508 respectively with latest alteration.

3.7 MAINTENANCE SPARES

3.7.1 Tenderer shall make recommendations suggesting scale of spares to be provided for holding each 100 couplers for a period of six years. 'Price proposal -for these spares shall also be submitted with the offer separately.

3.7.2 The Coupler Manufacturer shall supply all the spare parts required for maintenance of couplers supplied by them for use on Indian Railways against specific requirements of railways. In case of failure their registration is liable to be cancelled.

3.8 The supplier shall supply following items free of cost to Railways:

- (i) Two nos. of cut models per contract.
- (ii) 25 sets of colored wall charts per contract explaining working of Centre Buffer Coupler, component details of maintenance requirements.

4 DRAFT GEAR:

The coupler shall be suitable for fitment on freight stock along with **Draft gear and its follower to Indian Railway's Schedule of Technical Requirement No. 49-BD-02** latest revision.

5 DRAWINGS:

Drawing referred to in this schedule of requirement may be collected separately from RDSO, Lucknow on payment.

**B -- SCHEDULED OF TECHNICAL REQUIREMENTS FOR HIGH TENSILE
TRANSITION CENTRE BUFFER COUPLER FOR BG LOCOMOTIVES**

0.0 FOREWORD

- 0.1 This specification is intended to cover the technical provision relating to material, construction and tests and does not include all the necessary provisions of the contract.
- 0.2 This specification is issued under the fixed number 56-BD-07. The number after BD indicates year of revision.
- 0.3 This revision supersedes all previous revision.
- 0.4 This specification draws reference to the following specification: -
- (i) AAR M 118, M 201, M 205 & M 211
 - (ii) AAR S172 Section B Part –II & AAR S 137 Section B
 - (iii) IS:549,1364, 210,1875, 2004, 3885, 5517,81,118,1030, 1148, 2062, 2232 & 3063
 - (iv) BS: 970
 - (v) ASTM A 255, A 370, E 208, & E 604
- 0.5 Whenever there is a conflict among the stipulation in the present specification, drawings or any of the relevant specification, the most stringent requirement will apply. All specifications and drawings must be of latest revision / alteration.

1 SCOPE

- 1.1 This specification covers the particular requirements for the supply of **High Tensile Transition Centre Buffer Coupler and its components with screw coupling for B.G. Locomotives.**
- 1.2 The Tenderer shall submit his offer for High Tensile Transition Centre Buffer Coupler for B.G. Locomotives consisting of the following Items:

S.No	Name of Parts	No. off / coupler
1.	Coupler Body with Shank Wear Plate	1
2.	Knuckle	1
3.	Lock	1
4.	Knuckle Thrower	1
5.	Top Lock Lift Hole Cap	1
6.	Knuckle Pin with Washer	1
7.	Rotary Bottom Operated articulated locklift Assembly	1
8.	Coupler Yoke	1

9.	Yoke Pin	1
10	Clevis with handle	1
11.	Clevis pin with washer	1
12.	Transition Screw coupling	1
13.	Yoke Pin Support with Wear Plate	1
14.	Striker Casting with Wear Plate	1
15.	Draft Gear Assembly	1
16.	Draft Gear Follower Plate	1
17.	Uncoupling Gear R.H. side or Uncoupling Gear L.H. side	1

NOTE: -

Uncoupling Gear on L.H. side will be used when air brake twin pipe connection are located on the R.H. side (when facing the locomotive) as shown in Arrg. Drg. No. SK-DL-3430. For locomotives with twin pipe connections on L.H. side, the uncoupling gear shall be on R.H. side (When facing the locomotive) as shown in Drg. No. SK-DL-3491.

2 GENERAL REQUIREMENTS

- 2.1 The manufacturer shall set aside one set of gauges for exclusive use of Inspecting authorities. The accuracy of gauge shall be checked by Inspecting Authorities before the commencement of manufacture. Recalibration shall subsequently be made at the frequency stipulated in internal **Quality Assurance Programme**. Gauge Drawings in original, shall also be made available for Cheking the tolerances of these gauges. The General Arrangement drawings with controlling dimensions including gauging drawings shall be submitted to RDSO before commencement of supply. No change, there after be carried out without prior approval of RDSO.
- 2.2 All components of coupler shall be interchangeable. Manufacture and inspection shall be carried out as per **"REQUIREMENTS FOR ACCEPTANCE OF COUPLER AND ITS COMPONENTS FOR BG LOCOMOTIVES ON INDIAN RAILWAYS"** and as per other clauses of this specification.
- 2.3 Any deviation from inspection in respect of test details shall be worked to with prior concurrence of the purchaser.
- 2.4 The manufacturer shall provide labour, appliances and other details necessary for the inspection of the coupler and its components in accordance with the specification at his own cost.
- 2.5 In case the offer does not correspond to this specification in any respect, the tenderer shall submit a **DEVIATION STATEMENT**. This statement shall give the deviations clausewise with technical reasons for the same. Change in drawings, if any, shall be explained and accompanied by three copies of revised drawings. In case the tenderer does not require any deviation from this specification, a **NIL DEVIATION** certificate shall be submitted.

- 2.6 The coupler components found having illegible marking at the time of fitment in railways workshop , maintenance depot or at locomotive builders premises shall be replaced by the manufacturer free of cost. The cost of transportation also be borne by manufacturer.
- 2.7 The coupler manufacturer shall supply all the spare parts required for maintenance of coupler & draft gear supplied by them for use in Indian Railways against specific requirements of railways. In case of the failure, their registration is liable to be cancelled.

3 PARTICULAR REQUIREMENTS

3.1 GENERAL ARRANGEMENT:

- 3.1.1 General arrangement of the coupler shall be to RDSO Drg. No. SK-DL-3430, latest alteration.
- 3.1.2 The contractor shall submit requisite drawings with important controlling dimensions and tolerances thereon alongwith the surface and dimensions necessary to be gauged.

3.2 MATERIAL:

- 3.2.1 The material of High Tensile Transition Centre Buffer Coupler components shall be as indicated in RDSO Drg. No. SK-62724, latest alteration.

3.3 COUPLER:

- 3.3.1 Coupler body and shank wear plate shall be to Drg. No. SK-62724 (Item 18 & Item 10 respectively), latest alteration. Shank wear plate shall be welded to the coupler shank as shown in the drawing.
- 3.3.2 Coupler components shall be in accordance with '**REQUIREMENTS FOR ACCEPTANCE OF COUPLER AND ITS COMPONENTS FOR BG LOCOMOTIVES ON INDIAN RAILWAYS**' of this STR and shall meet the stipulations given below:
- a) Knuckle shall be to Drg. No. SK-62724 (Item 2), latest alteration.
 - b) Lock shall be to Drg. No. SK-62724 (Item 8), latest alteration.
 - c) Knuckle thrower shall be to Drg. No. SK-62724 (Item 9), latest alteration.
 - d) Knuckle pivot pin with securing arrangement shall be to Drg. No. SK-62724 (Item 4), latest alteration.
 - e) Articulated Lock lift assembly consisting of Toggle, Universal Lock lift lever connector and lock lift Lever Hook shall be to Drg No. SK-62724 (Item 5, 6 & 7 respectively), latest alteration.

f) Top lift hole Cap shall be to Drg No. SK-62724 (Item 11), latest alteration.

3.4 COUPLER YOKE, YOKE PIN AND YOKE PIN SUPPORT:

3.4.1 Coupler Yoke shall be to Drg. No. SK-62724 (Item 3) latest alteration.

3.4.2 Yoke pin shall be to Drg. No. SK-62724 (Item 12), latest alteration.

3.4.3 Yoke pin support shall be to Drg. No. SK-DL-890 (Item1&2) latest alteration. Yoke pin support shall be supplied complete with wear plate welded as shown in drawing.

3.5 STRIKER CASTING:

Striker casting shall be to Drg. No. SK-DL-508 latest alteration. Striker casting shall be supplied complete with wear plate bolted and tack welded as shown in drawing.

3.6 TRANSITION GEAR:

3.6.1 Screw coupling shall be to Drg. No. SK-DL-2494 (latest) and SK-DL- 2495.

3.6.2 Clevis with handle shall be to drg. No. SK-DL-2496 (latest).

3.6.3 Clevis pin with washer shall conform to drg. No. SK-69508 (latest) with HTEA marking stamped in 5mm. type.

3.7 FIELD PERFORMANCE:

The supplier shall regularly collect data and samples of previous supply from field to assess the actual life obtained, nature of defects occurring in the service and should take necessary corrective action to improve quality. Half-yearly report should be submitted to RDSO on data, samples collected and action taken.

3.8 TRAINING OF RAILWAY STAFF:

The manufacturer shall also provide training to sufficient number of Railway Maintenance Supervisors/staff in consultation with purchaser, free of cost at his own premises or in Railway Workshops.

3.9 MAINTENANCE SPARES

3.9.1 Tenderer shall make recommendations suggesting scale of spares to be provided for holding each 100 couplers for a period of six years. 'Price proposal -for these spares shall also be submitted with the offer separately.

3.9.2 The Coupler Manufacturer shall supply all the spare parts required for maintenance of couplers supplied by them for use on Indian Railways against specific requirements of railways. In case of failure their registration is liable to be cancelled.

4 DRAFT GEAR:

The coupler shall be suitable for fitment on freight stock along with **Draft gear and its follower to Indian Railway's Schedule of Technical Requirement No. 49-BD-02** latest revision.

5 DRAWINGS

Drawings referred to in this schedule of requirement may be collected separately from RDSO, Lucknow on payment.

**C-- REQUIREMENTS FOR ACCEPTANCE OF COUPLER AND ITS COMPONENTS
FOR BG WAGONS AND BG LOCOMOTIVES OF INDIAN RAILWAYS**

1. SCOPE

- 1.1 This specification covers purchase and acceptance requirements for coupler , its components and coupler Yoke used on Indian Railways. Material requirements for coupler body, knuckle, coupler lock and coupler yoke must meet various requirements of AAR specifications M-201 and M-205, if not stated in this specification.

2 GENERAL REQUIREMENTS

- 2.1 All manufacturer's foundries, material and boundary dimensions of the coupler and its components must be approved by RDSO. The basis for such approval shall be satisfactory compliance with the provision of AAR specifications M-201, M-205, M-211 and this specification.
- 2.2 All manufacturers seeking registration for supply of couplers, must submit an application to RDSO on proforma to be procured for this purpose. The application must include, inter alia, proof that the foundry satisfies the requirements for category "A" foundries specified and updated by the **Bureau of Indian Standards / RDSO** from time to time. Registration will be subjected to the foundry being able to produce prototype couplers/ components referred to here in para 2.2.1.
- 2.2.1 Five (5) numbers of coupler and components shall be selected and tested as per the requirement of this specification including tests to be carried out during manufacturing process by Inspecting Authorities from a lot of not less than fifty (50) couplers.
- 2.3 **Manufacturers will not be permitted to sublet any steel castings.** Re-registration will be required for any change in manufacturing process, place and material of coupler and its components.
- 2.4 Application shall be submitted in three copies in accordance with the prescribed proforma and be accompanied by three copies of the drawings, full information with respect to grade of material with well documented internal **Quality Assurance Programme** and the name of foundry or foundries that will produce the items.
- 2.5 The internal QUALITY ASSURANCE PROGRAMME (QAP) must also cover the following.
- (a) Gauging scheme to ensure dimensional accuracy of the components. System to ensure that gauges are recalibrated from time to time are accurate.
 - (b) Stagewise manufacturing quality checks/test of coupler components and their frequency.
These tests and checks must be in conformity to all the requirements

covered in para 3.0, 4.0 to 5.0 and 6.0.

If frequency of tests/checks is not specified, the manufacturer shall decide it and clearly indicate in QAP.

- (c) System to ensure use of correct raw material.
 - (d) Stagewise details of heat treatment and control checks to ensure proper heat treatment. The heat treatment should meet the requirement of para 3.7.
 - (e) Proper system to ensure quality of component manufactured other than casting. Proper tests/inspection procedures in conformity with the requirement of this specification for such components shall be developed and maintained. If these components are being purchased from sub-let vendors, the coupler manufacturer shall have facilities and system for their testing and inspection.
 - (f) System for disposal of defective components identified during various stages of manufacture and implementation of QAP, so that such components are not mixed up with lot being offered for inspection.
 - (g) List of testing and inspection facilities with their calibration status.
- 2.5.1 The manufacturer shall keep the records of Internal Quality Programme properly for future references/investigations. The manufacturer shall present these records as and when asked by the purchaser /inspecting official or RDSO Lucknow.
- 2.5.2 It should be possible from the QAP records to identify the manufacturing details/tests of components with serial Number marked on the components from QAP records. There must be relation between Serial Number marked on the components with heat number, batch number, date of manufacture and various test results.
- 2.5.3 In addition to above clause of para 2.5 the manufacturer shall submit QAP as per the guidelines indicated for preparation of QAP in RDSO Document No. IL:03:2000 with latest revision. The complete QAP shall be got periodically re-approved from RDSO as and when it becomes due.

3 MATERIAL AND MANUFACTURE OF STEEL CASTINGS

3.1 Chemical Composition and Tests.

3.2 Chemical Composition

The steel analysis shall not exceed the following:

	Grade E	Grade B
Carbon percent	0.28 - 0.33	0.32(MAX.)
Manganese percent	0.8 – 1.1	0.90(MAX.)

Phosphorus, maximum percent	0.03	0.03
Sulphur, maximum percent	0.03	0.03
Silicon percent	0.40 – 0.60	0.60(MAX.)
Chromium, percent	0.50 – 0.80	----
Nickel, percent	0.50 – 0.60	----
Molybdenum, percent	0.15 – 0.25	----

3.2.1 GRADE B STEEL

For each reduction of 0.01 percent of carbon below the maximum specified, an increase of 0.04 percent manganese above the maximum specified will be permitted to a maximum of 1.2 percent.

The content of elements other than those specified above shall be selected by manufacturer to obtain the physical properties specified in this specification.

- 3.2.2 The manufacturer shall ensure that all physical properties, as specified in the specification, are achieved by using proper chemical composition and heat treatment process. To achieve the properties he may add / change alloying element with prior approval of RDSO / Lucknow. The chemical composition shall be specified by the manufacturer in the QAP and checked at the time of adding the alloying elements at melting stage as well as at the time of chemical analysis of specimen / sample for verification of chemical properties. Records for each heat lot be maintained for 100% traceability.

3.3 HARDENABILITY

- 3.3.1 Composition of Grade E steel, except for coupler locks, shall produce in the standard jominy test the minimum hardness at 11 mm from the quench end for the carbon composition as follows, based on the initial composition :

Carbon percent	Minimum Hardness, RC
Up to 0.25	30
0.25 to 0.30	33
0.31 to 0.32	35

3.3.2 FREQUENCY OF TESTING

The manufacturer shall carry out jominy tests at the following frequency:

- On every heat till ten (10) consecutive heats gives satisfactory test results.
- On satisfactory Jominy test results for ten (10) consecutive heats, at least one test every month.
- On unsatisfactory Jominy test results during monthly tests, tests on every heat till ten (10) consecutive satisfactory tests.

3.3.3 HARDENABILITY CALCULATIONS

The ideal critical Diameter (D1) shall be calculated for each heat of quenched and tempered steel in accordance with ASTM Designation A 255 latest revision, Appendix III. The calculated dia. shall be indicated in test records and QAP.

3.4 CHEMICAL ANALYSIS

3.4.1 LADLE ANALYSIS

The manufacturer shall carry out test of samples taken during the initial 25 percent of the castings poured from each ladle to determine the percentage of carbon, manganese, phosphorous, sulphur, silicon and of the other intentional alloying elements. The results of analysis shall be reported to Inspecting Authority and shall conform to the requirements of para 3.1. If drillings are used, they must be taken at least 6.5 mm beneath the surface of the test ingot.

3.4.2 END OF HEAT ANALYSIS

A sample found with last acceptable castings of each heat must be used by manufacturer to determine the percentage of manganese. The results of this analysis must be reported to Inspecting Authority and shall conform to the requirements of para 3.1. If drillings are used, they must be taken at least 6.5 mm beneath the surface of the test ingot.

3.4.3 TEST LUGS

For all castings at least two and not more than four test lugs shall be cast. The location of test lugs shall be such that when removed, they shall indicate whether steel castings have been subjected to heat treatment. The standard test lug shall 25mm in height by 25 mm in width and 13 mm or 16 mm in thickness where it joins with castings.

If in the opinion of the inspector, a casting, if not heat treated, will be heat-treated.

3.5 MECHANICAL PROPERTIES AND TESTS

Each melt shall be tested for mechanical properties after heat treatment. The coupons from each melt shall be heat treated with castings of the same grade, in the same manner as the casting they represent.

3.5.1 TENSILE TEST SPECIMEN COUPONS

The coupons shall either be cast attached to the castings or the gating system or produced from keel blocks and prepared in accordance with ASTM Designation A 370, latest revision.

3.5.1.1 TENSION TEST

- 3.5.1.1.1 Test shall be conducted in accordance with standard Methods and Definition for mechanical testing of steel products, ASTM standard A 370, latest revision, using 13 mm round, 51 mm gauge length specimens as illustrated in that specification. Specimens are to be removed from coupons produced as per para 3.4.1 and shall meet the following requirements:

	Grade E	Grade B
Tensile strength N/sq. mm. (Minimum)	827.473	482.652
Yield strength N/sq. mm. (Minimum)	689.643	261.927
Elongation in 51mm (minimum %)	14	24
Reduction in area %	30	36

- 3.5.1.1.2 One specimen per heat for each grade of steel shall be tested. If test specimen shows a defect during machining or exhibits flaws before or after testing, it should be discarded and another specimen substituted.
- 3.5.1.1.3 Specimens from castings shall at least 80% of tensile and yield strengths required by clause 3.5.1.1.1.

3.5.2 IMPACT TEST

- 3.5.2.1 The manufacturer shall carry out test to determine impact properties by Standard Charpy-V-Notch type "A" specimen prepared as shown in ASTM Standard A370. Specimen to be removed from coupons prepared as per para 3.5.1. A test consists of determining the average energy absorbed from three-impact specimen from the same heat. The results should meet the following minimum requirements at the following temperatures.

Cast steel	Temp. Deg.C	Energy Kg.m.
Grade E	-40	2.77
Grade B	-7	2.07

- 3.5.2.2 The manufacture shall test specimen and record results including chemistry of that heat, excluding flawed specimen. Frequency of such test shall be one heat per week per grade of steel during pouring of the last 25 percent of the heat. Specimen to be removed from coupons as per para 3.5.1 and test shall be conducted in accordance with standard Methods and Definitions of ASTM Standard A 370, latest revision.

3.5.3 HARDNESS

- 3.5.3.1 The cast steel components must meet the following Brinell hardness range:

Grade	BHN Range
Grade E steel castings (except knuckle)	241-311
Grade E, Knuckles	261-291
Grade B, castings	137-208

- 3.5.3.2 Testing shall be done on a surface that has been ground to remove decarburization in accordance with ASTM A 370. The hardness shall be checked on the location as shown in Fig-1. Hardness of the components not shown in figure shall be checked at suitable location.

3.5.3.3 ACCEPTANCE LEVEL OF CASTING DEFECTS

- 3.5.3.3.1 2% of the castings shall be subjected to destruction to examine the presence of casting defects. Defects such as blow holes, slag inclusions, shrinkage, etc. are not acceptable. Porosity to a level of 2% of the cross section may be considered acceptable.

- 3.5.3.3.2 Knuckle, coupler body and yoke shall be subjected to destructive test. The location for the test shall be as per Annexure-II (Sheet-1 , 2 , & 3).

3.5.3.4 ACCEPTANCE STANDARD FOR RADIOGRAPHIC EXAMINATION

- 3.5.3.4.1 Radiographic examination shall be conducted on Knuckle Coupler Body & Yoke to the extent of 5% of the casting product and level of acceptance shall be as per ASTM E – 446 Level-II. The sampling rate for radiographic examination may be reduced to 2%, if no rejection during examination are observed in five successive lots. The sampling rate will also be increased to 5% if rejection is observed consistently. The procedure and detailed sampling plan to be reduced from 5% to 2% shall be incorporated in the Quality Assurance Plan of the manufacturer as approved by RDSO. The location for Radiographic test shall be as per Annexure-II (Sheet-1 , 2 , & 3).

3.6 FRACTURE TOUGHNESS

Fracture Toughness test shall be conducted on specimens from castings in accordance with either ASTM E604 or E208 except that Nil –Ductility Transition Temperature (NDTT) shall be -57° C or lower for grade E.

3.7 HEAT TREATMENT

- 3.7.1 After pouring castings shall be allowed to cool to a temperature below 500° C prior to heat treatment at a rate that will not be injurious to the castings.

- 3.7.2 Grade E steel castings shall be furnished quenched and tempered. Grade B steel castings shall be furnished normalized or normalized and tempered.

3.7.3 Normalized steel castings shall be processed in the following order:

- 3.7.3.1 Heat to a proper uniform temperature above the transformation range and

hold for the proper time to achieve complete austenization and to refine the grain structure.

3.7.3.2 Withdraw from the furnace & cool in still air until temperature is below 350° C.

3.7.4 Normalized and tempered steel castings shall be processed in the following order:

3.7.4.1 Heat to the proper uniform temperature above the transformation range and hold for the proper time to achieve complete austenization and to refine the grain structure.

3.7.4.2 Withdraw from the furnace and cool in still air until casting in their entirety are at least 50° C below tempering temperature.

3.7.4.3 Temper by reheating to the proper uniform temperature below the transformation range, but not less than 300° C and hold for the required time. Remove from the furnace and allow cooling at any desired rate.

3.7.5 Quenched and tempered steel castings shall be processed in the following order:

3.7.5.1 Heat to the proper uniform temperature above the transformation range and hold for the proper time to achieve complete austenization and to refine the grain structure.

3.7.5.2 Withdraw from furnace while castings are above the transformation range, subject to rapid cooling by suitable liquid medium to a temperature substantially below the transformation range.

3.7.5.3 Temper by reheating to proper uniform temperature below the transformation range, but not less than 400° C, Hold for the required time, remove from the furnace and allow to cool at any desired rate. All castings prone to cracking after quenching shall be tempered as soon as necessary to prevent cracking, but in no case shall the time between quenching and tempering exceed eight hours.

3.7.6 All the stages of heat treatment with various temperature ranges of processes shall be clearly brought out in QAP. Inspecting Authority may examine it with actual heat treatment process being followed as and when required.

3.7.7 MICRO-STRUCTURE

3.7.7.1 With a view to ensure the homogeneity of the steel and the quality of heat treatment, it is essential to examine the microstructure of the knuckles at the time of acceptance inspection.

3.7.7.2 The samples should be taken from the actual castings produced and not

from the separately cast test bars. Microstructure achieved shall be fine tempered martensite.

3.8 WELD REPAIR OF DEFECTS IN CASTING

- 3.8.1 The entire defect must be removed prior to weld repair. The area to be welded must have the sides contoured to provide for the application of a sound weld. Maximum depth of repaired area must allow at least 3.2mm sound metal remaining between the bottom of the weld groove and the opposite side of the casting wall in areas where welding cannot be accomplished from both sides of the casting wall. Where a defect continues through the casting wall and both sides of the wall are accessible for welding, the casting shall be welded from both sides using a double 'V' or a "U" contour weld. Where a defect continues through the casting and is inaccessible from both sides and unless prohibited by specific component specification (para 3.9 of this specification), defect may be weld repaired by using a copper backup plate provided the surface is smooth and clean.
- 3.8.2 Welders shall be qualified and use procedures under the welder qualification procedure contained in IS: 817 and IS: 1181 latest revision, or equivalent in the position welding is to be performed.
- 3.8.3 Defects may be repaired by using a metal-electrode arc welding process, which will result in sound weld deposit having, in the heat-treated condition, minimum mechanical properties equal to the requirements for the parent metal. Welding may be performed in either the non-heat treated or heat treated condition. Post weld heat treatment requirements are outlined in para 3.9 of this specification.
- 3.8.4 Grade B or E castings shall not be welded while the temperature of the casting is below 4.5° C. Localized pre-heating is acceptable.

3.8.5 FOR WELDING GRADE B STEEL CASTINGS

If shielded metal arc process is used, the electrode shall be a low hydrogen coated type, AWS/ASTM Class E7015, E7016, E7018, E8015, E8016, E8018 or equivalent, approved by M & C Directorate of RDSO.

3.8.6 FOR WELDING GRADE E STEEL CASTINGS.

The welding materials used for the repair of defects in Grade E steel castings shall be AWS/ASTM Class electrode E12015, E12016, E12018, E13015, E13016, E13018 or equivalent approved by M & C Directorate of RDSO.

3.9 WELDING ON COUPLERS, KNUCKLES AND YOKES:

- 3.9.1 Any welding in shaded areas as defined in Fig-2 will be considered structural repair and must be in accordance with Paragraph 3.9.2. Welds outside the critical area must be in accordance with the requirements of para 3.8 of this

specification.

- 3.9.2 The defect area to be welded must be prepared by contouring sides for a sound weld with a minimum 6mm weld relief at the root.
- 3.9.3 Maximum depth of repaired area must not exceed 25 mm with a minimum of 3.2 mm sound metal between edge of repair weld and the nearest casting wall.
- 3.9.4 After weld repair, a casting shall be heat treated as required by Fig-2 using the applicable process of para 3.7 of this specification.

4 COMPONENTS PERFORMANCE AND TEST REQUIREMENTS

- 4.1 The purpose of the below listed test requirements is to qualify and monitor the manufacturing process. Results obtained from a flawed specimen shall be discarded and another specimen shall be selected. Failure of an individual test should not be considered indicative of any product. Each failure shall be investigated and corrective action taken as determined by the manufacturer. If corrective action is not completed within four weeks, the RDSO Lucknow shall be notified and given a schedule for corrective action to be completed. Retests are permitted.

4.2 CASTING INTEGRITY

- 4.2.1 Manufacturer's Internal Process Specification and Quality Assurance Programme control casting integrity. As a periodic check, a laboratory static test will be conducted on one (1) specimen of every 5,000 couplers, knuckles and yokes being produced or once every three (3) or six months according to the following tabulation, whichever occurs first. If production is less than 1,000 in the frequency period, no test is required for that period. However, in any case, at least one (1) test is required per year. The specimen shall represent current production practices.

Component	Frequency Period
Coupler Body	6 months
Knuckle	3 months
Yoke	6 months
Lock	3 months

- 4.2.1.1 Following ten (10) successful consecutive laboratory static tests, the manufacturer may reduce frequency of testing to one (1) laboratory static test per year. If a test fails for other than a flawed specimen, the manufacturer will be required to re-establish the base ten (10) successful tests before going to reduced frequency of testing.

4.2.2 PROOF TESTS

- 4.2.2.1 Coupler bodies and knuckles must meet permanent set and ultimate strength requirements shown in paragraph 4.2.2.1.3. The dimensions shown in Fig-3 shall be used for determining permanent set and result

shall be recorded. Special test knuckles for testing coupler bodies shall have a load capacity in excess of 408 tonnes.

4.2.2.1.1 When testing coupler bodies, if test knuckle breaks before required loading is attained, the test shall be terminated and the load recorded as the "maximum applied load."

4.2.2.1.2 Test machines shall have a minimum capacity to meet specified loads and be calibrated to ASTM standards.

4.2.2.1.3 STATIC TENSION TEST REQUIREMENTS:

	Maximum Permanent Set - mm Grade E Steel		
	At 181.5 t	At 317.5 t	Minimum Ultimate
* Knuckle	0.76	-	295 t.
Coupler body	-	0.76	408 t.

*Based on testing with dummy knuckle fixture.

4.2.2.2 PROOF TEST OF YOKE

4.2.2.2.1 METHOD OF TESTING

The method of testing coupler yokes and measuring permanent set is shown in Fig-4. The support and loading of the yokes for these tests shall be equivalent to service application.

In making deflection measurements, the measuring instruments shall be set at zero, after a load of 9 tonnes has been applied and released to datum load of 2.27 tonnes.

The minimum ultimate load shall be considered the load at which distortion shall not exceed 6 mm over all, measured vertically or laterally.

4.2.2.2.2 TEST REQUIREMENT

The maximum permanent set, measured from the point of load application to the point of support, and the minimum ultimate load, shall be as shown below:

Maximum permanent set - - - mm

Material of Yoke	At 340.20 t.	Minimum Ultimate
Grade E steel	0.76	408 t.

4.2.3 INTERNAL SOLIDITY

4.2.3.1 Capability of meeting Internal solidity requirements shall be established at the beginning of production and every six (6) months thereafter by sectioning three (3) specimens listed in Paragraph 4.2.1. Each specimen

shall be from a different heat. However, if the production is less than 1,000 during this frequency period, no test is required. In any case, one (1) test is required per year. After two (2) years of successful sectioning results, the manufacturer may reduce the frequency of sectioning to one (1) casting each year. Castings will also be sectioned whenever significant changes are made in foundry practices. If a test fails, the manufacturer will be required to re-establish the base of two (2) years of successful tests before going to the reduced frequency of testing.

4.2.3.2 Castings are to be sectioned in accordance with Fig-5.

4.2.3.3 Areas to be rated for discontinuity severity level are illustrated in Fig-6 and Fig-7.

4.2.3.4 Casting areas for evaluation shall be rated as to level of severity by comparing them with "Standard Reference Photographs for Casting Solidity" included as Appendix C, of this specification and results shall be recorded.

4.2.3.5 The rated level of severity for each section must not exceed those listed in the following table:

Component Type	Maximum severity Levels					
	Sectional area					
	A	B	C	D	E	F
Coupler Head	3	5	4	4	4	2
Knuckle	4	4	2	-	-	-
Coupler Shank	3	4	4	4	-	-
Yoke	2	4	4	4	-	-

4.3 PERIODIC PRODUCTION TESTS

4.3.1 At least every two (2) months, one (1) coupler and one (1) yoke, with their respective test coupons, or keel block specimens in each grade of steel produced during that period, regardless of design, shall be sectioned and the following tests shall be performed on specimens from these castings and coupons or keel block specimens. If desired, a foundry may alternate couplers and yokes, month by month, to maintain a continuing record. Coupler and yoke in each grade of steel produced shall be tested at least once per year. After two (2) years of successful testing, the manufacturer may reduce the frequency of testing to one (1) coupler and one (1) yoke tested per year, in each grade of steel produced, from a randomly selected design group. Properties to be tested are as follows:

Fracture Toughness	- Para 3.6
Impact Properties	- Para 3.5.2
Tensile Properties	- Para 3.5.1.1
Chemistry	- Para 3.4
Hardness	- Para 3.5.3

4.4 COUPLER OPERATION

- 4.4.1 Assembled couplers must be free of any foreign material that will prevent proper operations described in Paragraph 4.4.1.1 through Paragraph 4.4.1.5. A coupler inspection-operating rod is illustrated in Fig-8.
- 4.4.1.1 The Coupler knuckle must rotate to the open position by a continuous rotary force applied by hand through the inspection-operating rod from the rod handle.
- 4.4.1.2 The coupler knuckle must rotate to fully closed position to permit drop of the lock to the locked position by a continuous steady force applied by hand on the knuckle nose.
- 4.4.1.3 The coupler lock must automatically drop to the locked position when the knuckle is closed as described in Paragraph 4.4.1.2. The coupler knuckle is locked shut when the lock drops to seat on or within 6mm of the knuckle tail lock shelf.
- 4.4.1.4 The coupler is put on lock set when the knuckle is restrained from opening while force is applied through the inspection-operating rod while trying to raise the lock above the knuckle tail. When the rod is eased back and released, the lock must rest on the forward top edge of the knuckle thrower lock leg. The knuckle then must be free to rotate open by hand force applied on the inside face of the knuckle nose. The coupler then must perform the function of knuckle closure and lock drop as described in Paragraph 4.4.1.2 and 4.4.1.3.
- 4.4.1.5 Coupler must provide anti-creep protection to prevent accidental unlocking as specified in Section B, Part II, of AAR Standard S-172, Paragraph 4.2.8.
- 4.4.2 Couplers furnished complete must be fitted with knuckles of the same grade of steel as the coupler body. Couplers must be fitted with grade E locks. The assembled coupler must operate as described in Section 4.4.

4.5 CASTING FINISH

- 4.5.1 Riser pads and gate stubs shall not project more than 6mm above the surrounding surface at any location, where interference would exist in the operation or application or where serviceability would be affected, the riser pads and gate stubs shall be contoured to surrounding areas.
- 4.5.2 Castings shall be blasted sufficiently clean to permit thorough, visual inspection. Prior to shipment, castings shall be free of dirt, rust, or loose material that would affect operation. Couplers must not be sand or shot blasted when completely assembled.
- 4.5.3 The castings shall not be painted or covered with any substance that will hide defects. However, manufacturer's and / or purchaser's paint identification marks are acceptable.

4.6 LUBRICATION

- 4.6.1 Only dry lubricant shall be applied to the coupler head or the coupler head fittings. This lubricant may be applied using water, alcohol, or other non-petroleum based carrier.

4.7 MARKINGS

- 4.7.1 All coupler/components shall have legible markings, as specified in RDSO Drawing No.SK-62724 (latest alteration). Knuckle shall have the markings "for manufacturer's name, serial number, month & year of manufacture etc. as shown in RDSO Drg. No.WD-87004-S-I (latest alteration):-
- 4.7.2 As already mentioned in clause 2.6 of Page 5, the manufacturer shall ensure that marking details are legible and are of good quality which shall remain legible through out the entire service life of coupler and its components. The marking shall be done at the casting stage itself so that the marking shall remain legible during entire service life of the components. The manufacturer will not be permitted to provide manufacturer's code and marking by electric arc welding in case these are not visible at casting stage.
- 4.7.3 Grade E Steel casting shall be indicated by raised letter HTEA.

4.8 PAINTING

- 4.8.1 Only exposed surfaces of Coupler and Yoke shall be painted with Black quick drying paint in accordance with IRS R 6. Paint must not be applied to the inside of the Coupler or internal fittings. Painting shall be done after the completion of inspection on Coupler & Yoke of acceptable casting lot.

4.9 GENERAL REQUIREMENT FOR CASTING ACCEPTANCE

This section defines and classifies casting defects and is to be used for visual inspection and gauging of coupler bodies, knuckles, locks, and Yokes by the manufacturer before offering for Purchase Inspection.

4.9.1 WALL THICKNESS

Wall thickness tolerances except where controlled by gauges or RDSO's drawings, are:

6 mm up to, not including 11mm wall,	+ 3mm	- 0.8mm
11 mm up to, not including 19mm wall,	+ 3mm	- 2.4mm
19 mm up to, not including 32mm wall,	+ 3mm	- 3mm
32 mm and over,	+ 4.8mm	- 4mm

If grinding makes walls thinner then minus limits above, Castings must be restored by welding to within tolerances specified in paragraph 4.9.1.

- 4.9.1.1 In local areas dictated by individual manufacturing practices, padding or additional metal thickness is done for casting solidity. This practice is not

violation of the plus tolerance of the metal section.

4.9.2 SURFACE ACCEPTANCE LEVEL

The minimum acceptable surface conditions for the defects described below shall govern. Acceptable surfaces shall be defined utilizing Steel Castings Research and Trade Association (SCRATA) Comparators for the Definition of Surface Quality of Steel Castings (1981). The listed defect classification does not apply to inaccessible areas. Surface defects described herein do not preclude the requirements of proper gauge application as defined elsewhere in this specification.

4.9.2.1 Surface conditions evaluated with SCRATA comparators:

		Critical Area Fig-9	Non Critical Area Fig-9
A	Surface Roughness	A3	A3
B	Surface Inclusion	B2	B4
C	Gas Porosity	C2	C3
D	Laps	D1	D4
E	Scabs	E2	E2
F	Chaplets	F2	F4
G	Thermal Dressing	G2	G3
H	Mechanical Dressing	H3	H4
J	Welds	J2	J3

Surface conditions B and C are acceptable if the depth of the defect does not exceed ten (10) percent of the section thickness at critical areas and twenty-five (25) percent of the section thickness in non-critical areas.

4.9.2.2 Surface conditions not evaluated with SCRATA comparators.

4.9.2.2.1 Offsets greater than ten (10) percent of the casting wall thickness are not permitted.

(Offsets: An offset is an abrupt, unintentional change in the casting surface.)

4.9.2.2.2 Cracks, hot tears, cold shuts, and weld cracks, which are visually apparent, are not permitted.

4.9.2.2.3 Zone 1 areas must be prepared in accordance with Fig-10.

4.9.3 ILLEGIBLE MARKINGS

Illegible markings are markings that do not conform to Paragraph 4.7 and Coupler components with illegible markings shall be repaired or rejected.

4.9.4 EVIDENCE OF IMPROPER HEAT TREATMENT

Evidence of Improper Heat Treatment as shown from manufacturer's records shall not be accepted. Heat treatment lugs may be used by Inspecting Authority to assist in the determination of improper heat treatment.

4.9.5 IMPROPER WELD REPAIR

Following weld defects shall not be acceptable:

- 4.9.5.1 Any crack in a repair weld.
- 4.9.5.2 Weld more than 1.5 mm below surrounding surface in shaded areas of Fig-9. Minimum wall thickness must be maintained.
- 4.9.5.3 Slag inclusion or in complete fusion in shaded areas as well as out side the shaded areas of Figure- 9.
- 4.9.5.4 Arc strike in shaded areas of Fig-9.
- 4.9.5.5 Weld below surrounding surface to depth greater than ten (10) percent of wall thickness. Minimum wall thickness must be maintained.

4.9.6 IMPROPER APPLICATION OF WEAR PLATES

- 4.9.6.1 Application of wear plates not performed in accordance with standard S-137 shall not be acceptable.

4.9.7 IMPROPER CLEANING

- 4.9.7.1 Cleaning not meeting the conditions of paragraph 4.5.2 shall not be acceptable.

4.9.8 MECHANICAL AND THERMAL DRESSING

Stress Risers (including chisel marks, handling notches and gouges in excess of 1.5mm deep) shall not be acceptable.

- 4.9.8.1 Any notches caused by flame cut, grinding, or chisel; cut, etc. in shaded areas of Fig-9 shall not be acceptable.
- 4.9.8.2 Any notches caused by flame cut, grinding, or chisel cut etc. greater than ten (10) percent of wall thickness outside the shaded areas of Fig-9 shall not be acceptable.

4.9.9 IMPROPER LUBRICANTS

Lubrication not conforming to Paragraph 4.6 shall not be acceptable.

4.9.10 RISER AND GATE PROJECTION

Riser pads and gate stubs projecting more than 6mm above surrounding surface at any location shall not be acceptable. Where interference would exist in the operation or application or where the serviceability would be affected, the riser pads and gate stubs shall be contoured to the surrounding surfaces.

4.9.11 SHARP OR JAGGED EDGES

Sharp or jagged edges that could be injurious to workers shall not be acceptable.

4.9.12 ACCEPTANCE CRITERIA

Before offering for the inspection, the manufacturer shall examine all steel castings for the defect listed in Paragraph 4.9 and defective castings shall be repaired or replaced. Detailed record of inspection shall be maintained.

4.9.13 WEIGHT VARIATION:

Variation in weight of coupler body, yoke and other components, viz. knuckle, lock, rotary parts, shall not vary more than FIVE percent above or THREE percent below what has been determined as the average weight, ascertained from the actual weight of 20 nos. of each of the coupler components verified for dimensional accuracy in presence of Inspecting Authority in the beginning of the contract.

Those coupler components, which do not fall within the prescribed limits of weight variation, shall be rejected by manufacturer during QAP.

5 REQUIREMENTS FOR KNUCKLE PIN AND YOKE PIN

5.1 MATERIAL

Steel 42Cr4Mo2 to IS: 5517-1993 or steel having minimum yield strength of 61 kgf. / mm² shall be used for the manufacture of knuckle pin. Steel class 5 to IS: 1875 -93 or steel having minimum yield strength of 43 kgf./mm² shall be used for manufacture of yoke pin.

5.2 HEAT TREATMENT

The pins shall be heat treated if required, to meet the requirements specified in Para 5.3

5.3 MECHANICAL PROPERTIES REQUIREMENTS:

5.3.1 KNUCKLE PIN

5.3.1.1 The material shall have minimum yield strength of 61 Kgf/Sq.mm

5.3.1.2 Hardness value shall be within the range of 229 to 428 BHN. Two or more hardness determinations shall be made at locations approximately midway between the center and end of the pin on opposite sides from each other. Hardness shall also be taken at centre of the diameter of, the pin at mid length. Hardness shall be taken after a sufficient amount of decarburization has been done from the surface.

5.3.2 YOKE PIN

5.3.2.1 The material shall have minimum yield strength of 43 kgf/Sq.mm.

5.3.2.2 Hardness shall be within the range of 262 to 302 BHN. Two or more determinations shall be made on cylindrical surface at location approximately at the centre and 25 mm from each end of the pin.

5.4 GAUGING:

All-important dimensions of the pin as shown in RDSO Drawings shall be within the limits when gauged.

5.5 FINISH:

The finished pin shall be straight, have a smooth surface and be free of scale. It shall not be painted. There should not be any injurious defects on surface of the pin.

5.6 MARKING:

Manufacturer's name & year of manufacture shall be stamped on the head of each knuckle pin and on the end of Yoke pin.

6 REQUIREMENT FOR OTHER COMPONENTS MANUFACTURED BY STEEL CASTINGS:

6.1 The components shall be manufactured and tested as per the requirement of respective component specification given in component drawings. Dimensions shall be checked as per their drawings.

6.2 Surface finish requirement shall be as per the standards specified in drawings/Specifications.

6.3 Chemical and Mechanical Properties of these components shall be as per the requirement of specification given in drawings.

6.4 Marking on these components shall be as per the requirement of RDSO drawings.

7 GUARANTEE:

The coupler supplied shall be accompanied by a guarantee for a period of 48 months from the date of supply or 36 months from the date of fitment whichever is earlier.

8 PURCHASE INSPECTION:

8.1 The Inspecting Authority shall have free access at all times, while performing the work on the contract of the purchaser, to all parts of the manufacturer's works which concerns the manufacture of the ordered material. The inspector shall comply with all applicable safety rules and local regulations. The manufacturer shall afford the inspector, free of charge, all reasonable facilities and necessary assistance to satisfy the Inspector that the material is being furnished in accordance with this specification. Tests and inspection shall be made prior to dispatch at the place of manufacture to ensure that provisions of this specification are being met. Any additional tests must be negotiated prior to placement of order. All inspections shall be conducted while not interfering with manufacturing operations.

8.1.1 Manufacturer shall set aside one set of gauges for the exclusive use of inspector. All the drawings in original shall also be made available for checking the tolerances of these gauges.

8.1.2 The cost of all tests and inspection shall be borne by the manufacturer.

8.2 The purchase inspection shall be carried out as follows: -

8.2.1 The Inspecting Authority shall first check the records of the manufacturer to ensure that the steel casting offered for inspection have been manufactured strictly to the requirement of this specification and QAP of the manufacturer in the manufacturer's premises. It shall also be examined and ensured that QAP of manufacturer meets the requirement of Para 2.5 of this specification.

8.2.2 It shall be verified from the records that the following as tested/examined during manufacture meets the requirements of this specification. Serial No. marked on components shall be used to identify the records.

1. Chemical composition
2. Mechanical properties
3. Fracture toughness
4. Hardness tests
5. Impact test
6. General requirements of casting acceptance
7. Interchangeability of components and dimensional accuracy.
8. All requirements of components other than steel castings.
9. Coupler operation.

8.2.3 Inspecting Authority should also do at least one ON PROCESS inspection for small quantity purchase order and at least two process inspection per month for large quantity purchase order during manufacture of casting for the followings:-

1. Chemical composition
2. Mechanical properties
3. Impact test
4. Hardness test
5. General requirement of casting acceptance.
6. Requirements of components manufactured other than steel castings.

Records of these inspections shall be verified at the time of inspection against para 8.2.2.

8.2.4 After having been satisfied about offered inspection lot that the components are strictly manufactured to all the requirement of this specification, the Inspection Authority shall carry out the inspection as per, procedure given below: -

8.2.4.1 The manufacturer shall submit test results of Coupler/Coupler component offered for inspection with Heat No., Batch No. marking details and internal test details to Inspecting Authority. From a lot of 200 Couplers or a part there of following inspection shall be done.

a) 5 (Five) percent Coupler shall be dismantled and each casting shall be checked for the following:-

- (1) Gauging of all components with calibrated gauges.
- (2) General requirement of casting acceptance.
- (3) Marking.
- (4) Weight variations.

On identification of a single defect on any of the components, the whole lot shall be rejected. However the manufacturer can re-offer the lot after carrying out internal inspection for identification of all defective components. Such defective component can be repaired or replaced by the manufacturer. In the re-offered lot 10 (Ten) percent coupler shall be checked for the above requirement and whole lot shall be rejected if a single defect is identified in the re-offered lot.

b) Components other than steel castings shall be checked as per requirement of this specification for the followings.

- (a) Dimensional accuracy
- (b) Surface finish requirements
- (c) Hardness testing *

*Note:- The frequency for hardness test shall be 1 per 100 Nos.

The dismantled components if meet the requirement of the paragraph 8.2.4.1 (a) and (b), they shall be assembled arbitrarily and following shall be checked.

- (1) Interchangeability of component.
- (2) Easy assembly of component*
- (3) Coupler operation.

8.2.4.2 The lot shall be rejected on failure of coupler or coupler components on any of the above requirements.

However, the manufacturer can re-offer the lot, after carrying out internal inspection and replacement or repair of all defective components.

8.2.4.3 In re-offered lot, double sample will be drawn and all requirements of paragraph 8.2.4.1 (a) and 8.2.4.1 (b) above shall be checked.

8.2.4.4 One coupler body, knuckle and yoke from the remaining lot shall be

selected at random and tested for proof test requirements and other casting shall be tested for hardness. On failure of proof test and / or hardness requirements, the whole lot shall be rejected. However the manufacturer can re-offer the lot after removing all the defective components manufactured in that particular heat and batch in which failed component was cast.

8.2.4.5 In re-offered lot double the sample shall be tested for proof and hardness test provided re-offered lot meets the requirement of paragraph 8.2.4.1 (a) and (b).

8.2.4.6 There should not be any failure on re-offered lot.

8.2.4.7 The coupler components with illegible marking shall be identified and rejected from the lot.

8.2.4.8 On completion of inspection and accepted by inspection authority, the coupler shall be painted as per paragraph 4.8 of this specification before inspector approval stamping & dispatch to consignee.

8.2.4.9 The components used for hardness/proof test etc. from the lot during purchase inspection shall be replaced free of cost by manufacturer.

SPECIFICATION No. 56-BD-07

MANUFACTURERS NAME IN SHORT

S.No.	MANUFACTURER'S NAME	NAME IN SHORT
1.	Burn Standard Co. Limited	BURN
2.	Bhartiya Electric Steel Co. Ltd.	BESCO
3.	Hindustan Engineering Industries Ltd.	HEI
4.	Orient Steel Industries Ltd.	OSIL
5.	Titagarh Industries Ltd.	TITA
6.	Texmaco Ltd.	TEX
7.	Raneka Industries Ltd.	RIL
8.	Jupiter Alloys & Steel (India) Ltd.	JASIL
9.	Frontier Alloy & Steel Ltd.	FAS
10.	Titagarh Wagon Ltd.	TWL
11.	Siena Engineering Pvt. Ltd.	SN

Note:

1. Manufacturer not named above shall put name in short as approved by RDSO.
2. Marking Scheme for Batch Sl. No., manufacturer code shall be as per relevant drawing of each component.

APPENDIX- A

GAUGES TO ENSURE INTERCHANGEABILITY OF COUPLER PARTS

	GAUGE NO.	DESCRIPTION
COUPLER HEAD	WD-84073-S-1-RC	10A Contour Gauge
	WD-84073-S-2-RC	Bottom Anticreep-Vertical Location
	WD-84073-S-3-RC	Bottom Anticreep-Horizontal Location
	WD-84073-S-4-RC	Top Anticreep-Vertical location
	WD-84073-S-5-RC	Pivot Lug
	WD-84073-S-6-RC	Pin Protector
	WD-84073-S-7-RC	Pulling Lug Gauge - Knuckle side
	WD-84073-S-8-RC	Pivot Pin
	WD-84073-S-9-RC	Lock Chamber
	WD-84073-S-10-RC	Lock Hole
	WD-84073-S-11-RC	Rotary Lug
	WD-84073-S-12-RC	Shank End Pin Hole
COUPLER PARTS	WD-84073-S-41-RC	Knuckle Bottom Pulling Lug
	WD-84073-S-42-RC	Knuckle Movable Point
	WD-84073-S-43-RC	Knuckle Hub
	WD-84073-S-44-RC	Knuckle Tail Height
	WD-84073-S-45-RC	Knuckle Top Pulling Lug
	WD-84073-S-46-RC	Knuckle Tail Shelf
	WD-84073-S-47-RC	Knuckle Pin Hole
	WD-84073-S-48-RC	Knuckle Length
	WD-00041-S-01	Gauges for Knuckle
	WD-84073-S-56-RC	Lock Contour Guard-Arm Side
	WD-84073-S-57-RC	Lock Contour - Knuckle Side
	WD-84073-S-58-RC	Lock Toggle
	WD-84073-S-59-RC	Lock Parallel and thickness
	WD-84073-S-60-RC	Lock Slot
	WD-84073-S-61-RC	Lock Toggle Arm Width-Go & No Go
	WD-84073-S-66-RC	Knuckle Thrower Contour
	WD-84073-S-67-RC	Knuckle Thrower Trunion
	WD-84073-S-76-RC	Lock Lift Assembly
	WD-84073-S-77-RC	Composite Gauge for Connector
	WD-84073-S-78-RC	Composite Gauge for Hook
	WD-84073-S-79-RC	Composite Gauge for Toggle
	WD-84073-S-96-RC	Knuckle pivot Pin Dia. & Length GO&NO GO
COUPLER SHANK	WD-84073-S-15-RC	Shank Height
	WD-84073-S-17-RC	Shank Butt Width
	WD-84073-S-18-RC	Pin Hole Shank Vail Thickness
	WD-84073-S-19-RC	Butt Rear Wall Thickness
	WD-84073-S-20-RC	Pivot Pin Hole
	WD-84073-S-21-RC	Shank Height with Wear Plate
	WD-84073-S-22-RC	Shank Length (Non-Transition)
	WD-84073-S-23-RC	Shank Butt End Contour
	WD-84073-S-24-RC	Spherical Butt and Pin Hole
	WD-84073-S-25-RC	Shank Butt Height

RDSO PROCEDURE FOR THE INSPECTION OF FOUNDRIES

The RDSO inspection programme is designed to qualify and evaluate each foundry and manufacturer's capability of producing castings to RDSO specification. This programme is directed towards establishing a minimum acceptable level of performance and capability with respect to experience, procedures, ability and equipment to produce castings of the required quality. Each foundry inspection will include the followings:

1. Entire plant operation, with emphasis on procedure that affect quality and uniformity of product.
2. Confirmation of values in certification test reports by following data gathering and storage throughout the foundry process.
3. Inspection of production and quality control equipment and facilities to determine ability to meet production requirements.
4. Interviews of supervisors with respect to procedures and methods used in production.
5. A review of the results of inspection with plant management and advise if any deficiencies are noted.

The following areas will be evaluated by the RDSO inspector:

A. Procedure

1. Moulding Operations

- a) Check pattern facilities and procedures for assuring proper pattern size control.
- b) Check sand conditioning and test procedures.
- c) Evaluate core-making facilities.
- d) Observe core-setting procedures. Proper quality control procedures must be in effect to assure cores are set properly. Care must be taken to avoid core shifts during movement and pouring.

2. Melting Practices

- a) Chemical Control of raw material.
- b) Temperature control on melting material.
- c) Proper time and quantity control over additions.

3. Pouring Practices

- a) Time records on pouring.
- b) Temperature record during pouring.
- c) Proper chemical and physical tests on representative castings.
- d) Positive method of determining last casting.

4. Cleaning Room Operations

- a) Cleaning equipment should be adequate to provide clean casting for proper inspection.
- b) Observe welding operations to assure quality workmanship. Welding equipment must be well maintained and evidence of periodic checking for correct Amperage and Voltage readings. Welding rods and wires must be properly identified and stored according to RDSO Standards.
- c) Workmanship of grinding operations should be evaluated.

- d) Facilities for performing welding according to temperature requirements of RDSO specification should be available. It is desirable that all weld repairs be made in the green condition prior to heat treat. If proper foundry practices are enforced, weld repair requirements will be minor.
- e) Inspection should be made of facilities and procedures for installing wear plates and other fixtures to castings.

5. Heat Treating Practices

- a) Proper temperature control of furnace with adequate recording capabilities.
- b) Furnaces should be adequate to assure uniform temperature throughout.
- c) Proper records must be kept to positively identify castings which have received heat treatment.
- d) Quench tanks must have circulating capability with facility to assure proper temperature of coolant. Tanks should be kept clean and free of scrap material which is likely to impair operation.

6. Casting Quality

- a) A random casting should be selected from the inspection area and run through the sample room. Object of this should be to evaluate over all quality of the finished casting. Pattern quality, core setting, and dimensional control should be evaluated.
- b) Availability and accuracy of gauges should be determined and calibration system for gauges should be evaluated.
- c) All physical test apparatus should be inspected for general operating condition and calibration. All equipments requiring calibration should have current certification.

B. ORGANISATION POLICY WITH RESPECT TO

- 1. Proper separation between production responsibility and quality control responsibility.
- 2. Procedure for resolving controversy between operations and quality control on non-conforming items.
- 3. Disposition of non-conforming items.
- 4. Knowledge of supervisory personnel with regard to Quality Assurance requirements.

C. PERSONNEL

1. Procedure for qualifying workmen for particular Jobs. Training provided for new employees.
2. Procedure for qualifying supervisors and methods of training and determining performance.
3. Determine if there are proper welding procedures and competent expertise in plant to perform welding tests and solve welding problems. Determine how and when welders are qualified.

APPENDIX-C

STANDARD REFERENCE PHOTOGRAPHS FOR CASTING SOLIDITY

1.0 SCOPE

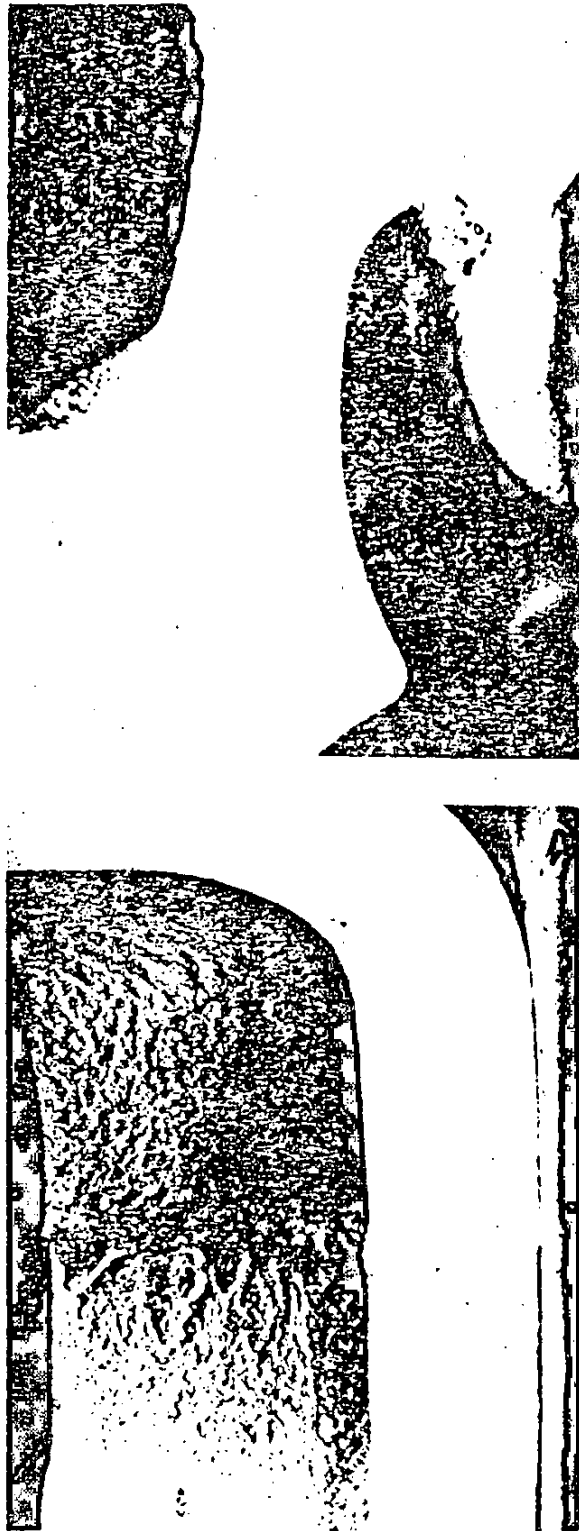
- 1.1 The reference photographs illustrates various types and degrees of shrinkage occurring in coupler, knuckle and yoke sections. They are full scale and provide the following: -
 - 1.1.1 A guide enabling recognition of shrinkage and its differentiation as to severity level.
 - 1.1.2 Serve as standard for evaluating minimum acceptability as specified for the product.
- 1.2 The reference photographs show graded shrinkage in six levels of increasing severity.

2.0 PREFACE

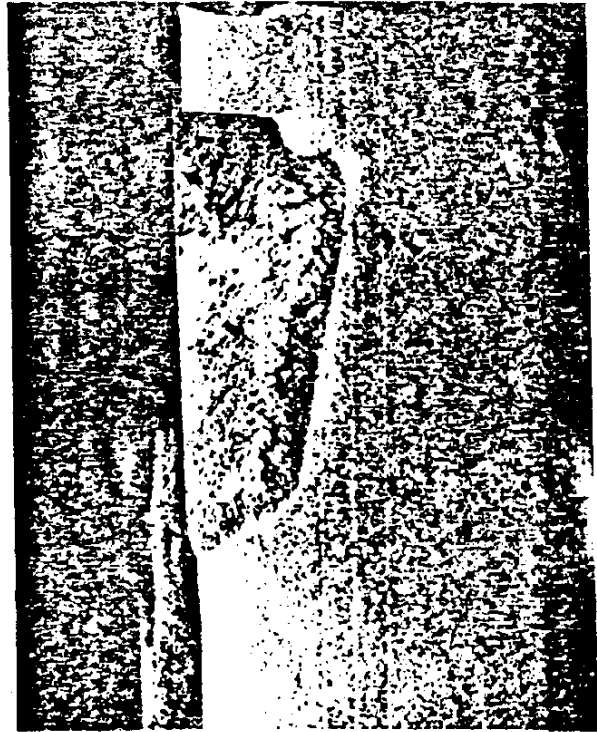
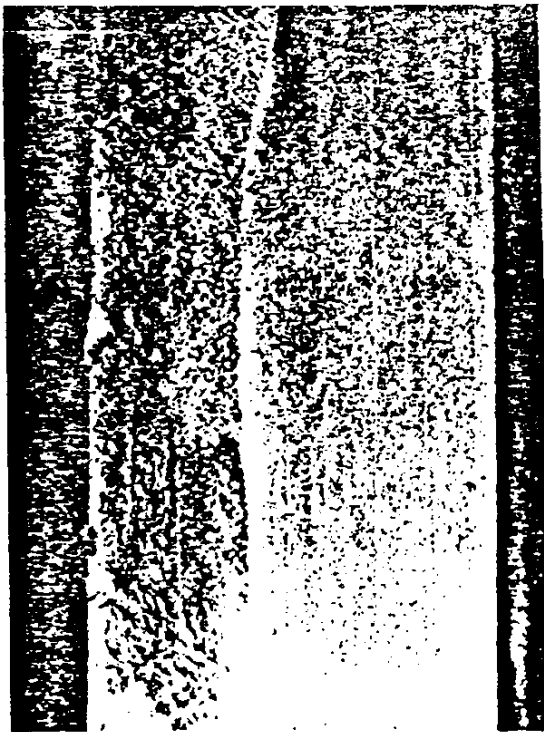
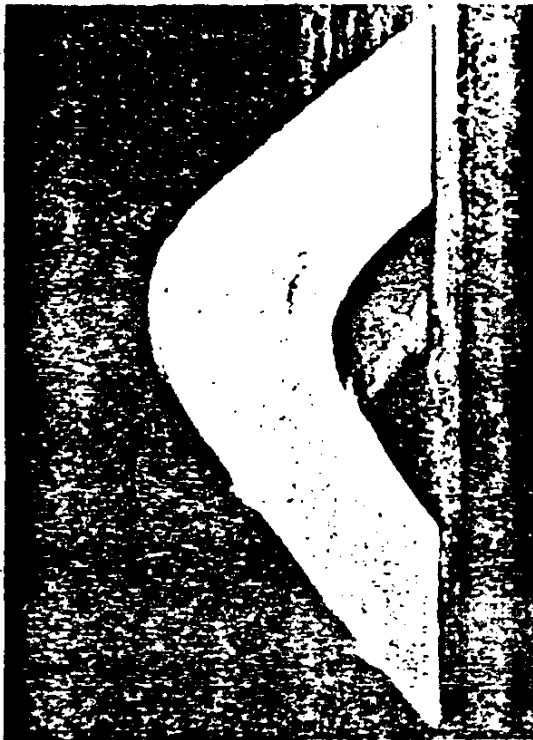
- 2.1 The reference photographs were prepared from actual production castings, which were first radio graphed. The radiographs were evaluated and rated as to shrinkage severity level by comparison with the standard reference radiographs in ASTM B-446-72. A saw cut was made through the rated shrinkage area of the casting at 90 degrees to the plane of radiograph. The casting section was then ground smooth and sand blasted to delineate shrinkage for photographs. The exposed shrinkage in section were then ranked visually according to severity and divided into levels corresponding to those found in ASTM E 446.
- 2.2 Radiographic evaluation of shrinkage is based on the greatest severity found in any 127mm x 178mm area of the section being examined. In a similar manner, evaluation of saw cut sections is predicated on the greatest shrinkage severity encountered in a 127mm length of the casting section. The difference and the judgment of an individual in determining the severity level of the radiographs combine to produce a possible variation in the severity level rating of the reference photographs that can amount to one level above or below the ASTM E446 reference radiograph rating.

3. EVALUATION

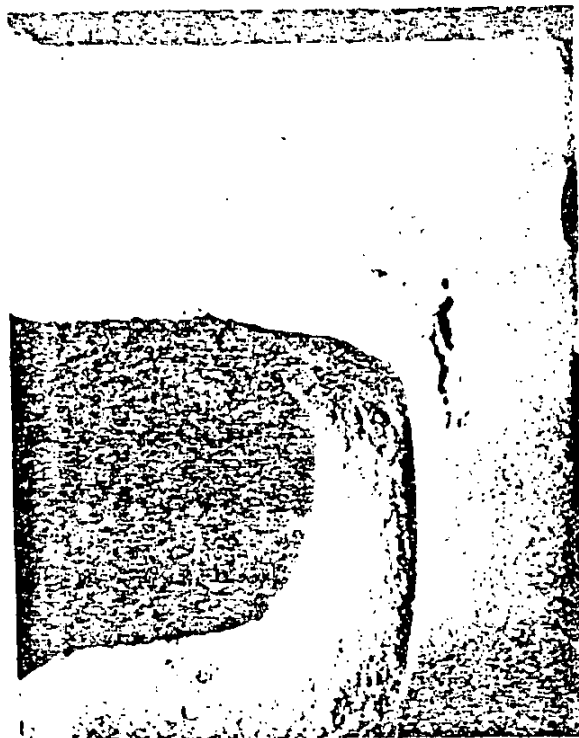
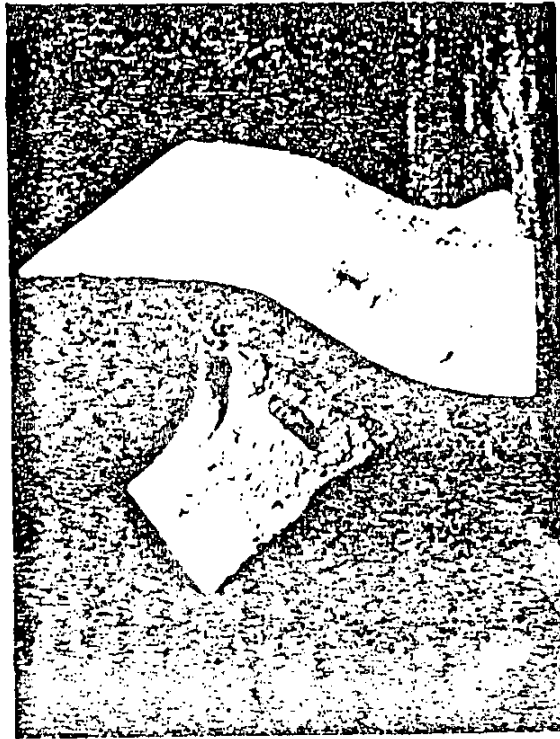
- 3.1 Severity level is established by determining which photograph of discontinuities most closely resembles the discontinuities present in the sectional area being investigated as illustrated in the attached photographs.



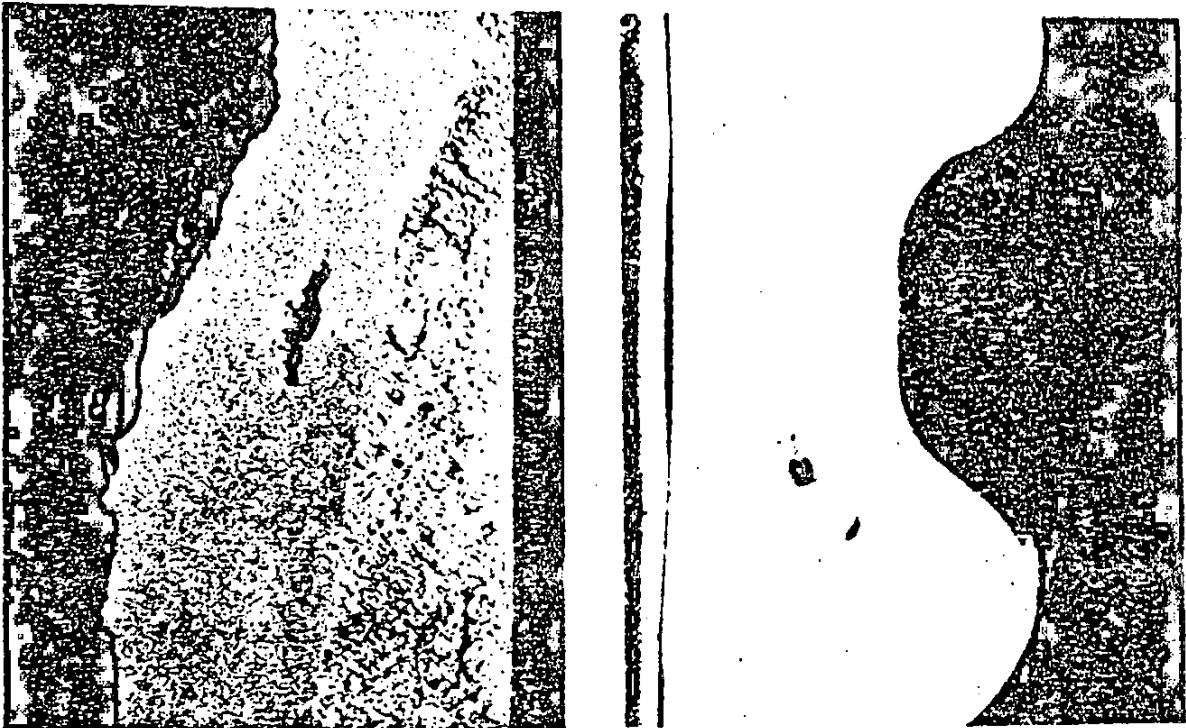
SHRINKAGE OF VISUAL SEVERITY 1



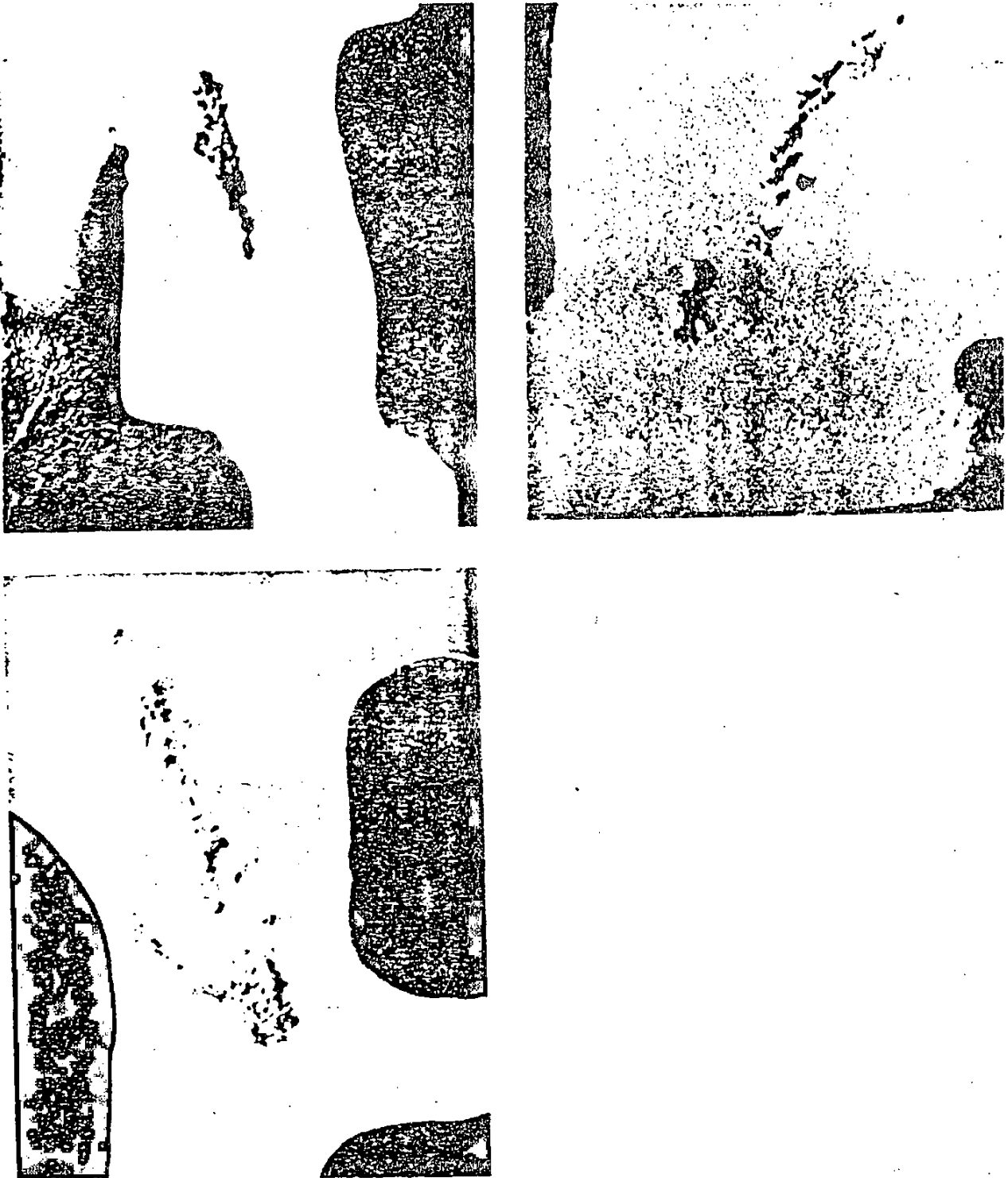
SHRINKAGE OF VISUAL SEVERITY 2



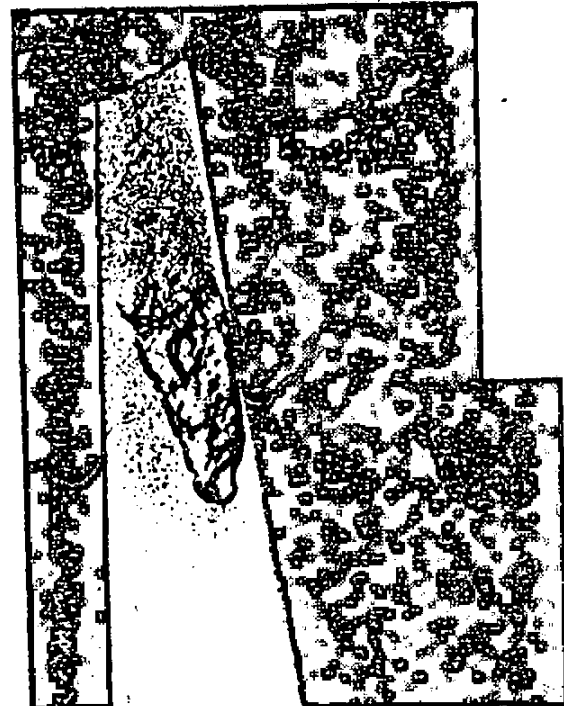
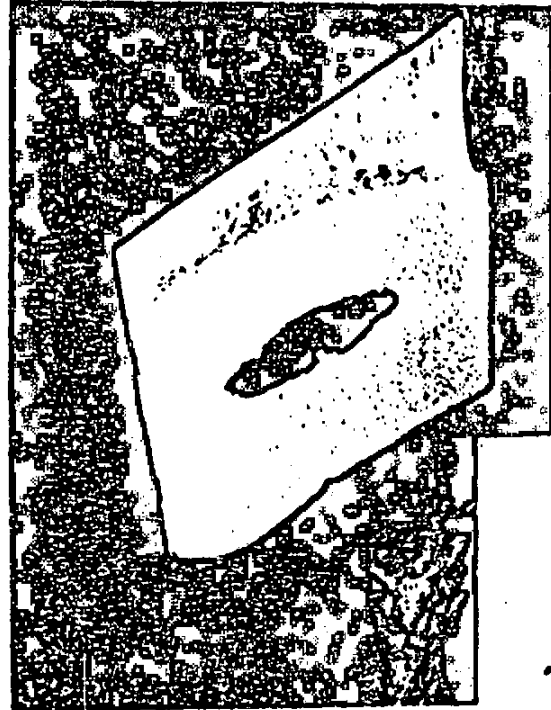
SHRINKAGE OF VISUAL SEVERITY 3



SHRINKAGE OF VISUAL SEVERITY 4

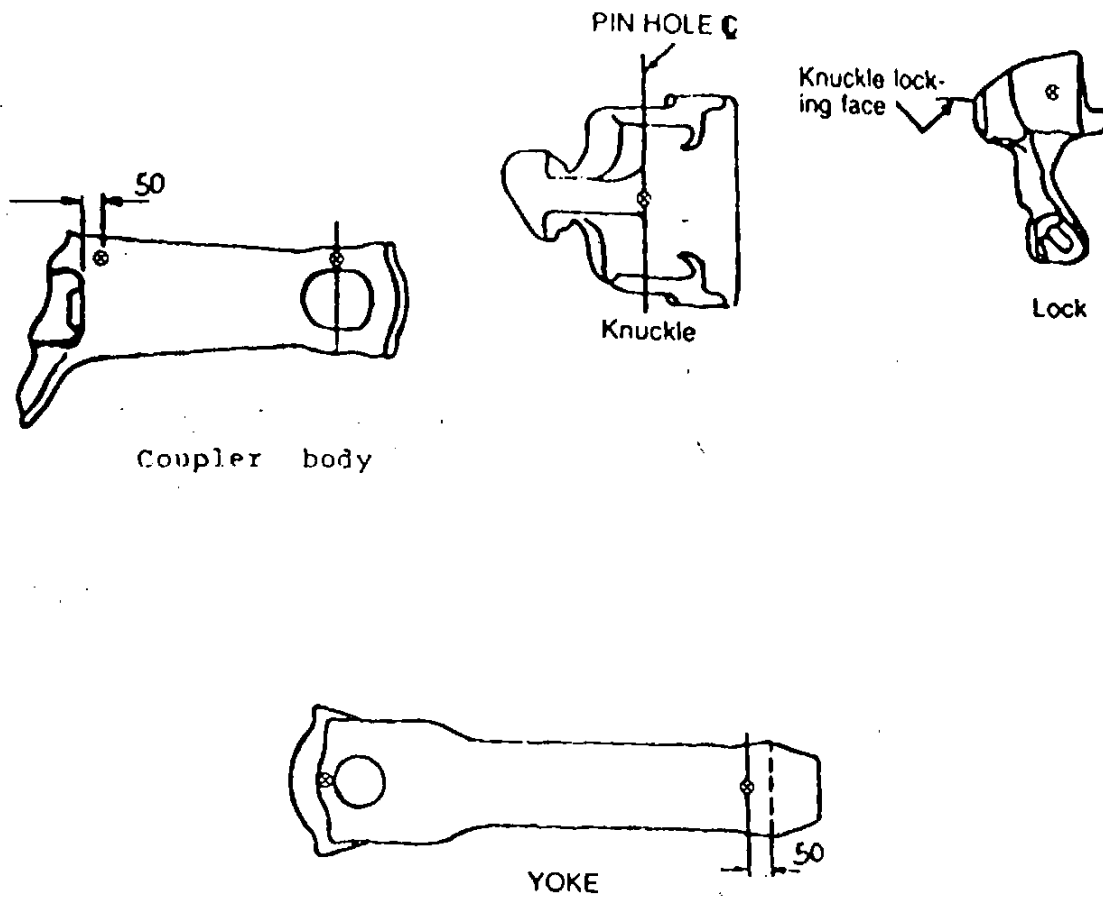


SHRINKAGE OF VISUAL SEVERITY 5



SHRINKAGE OF VISUAL SEVERITY 6

LOCATION FOR BRINELL HARDNESS READINGS

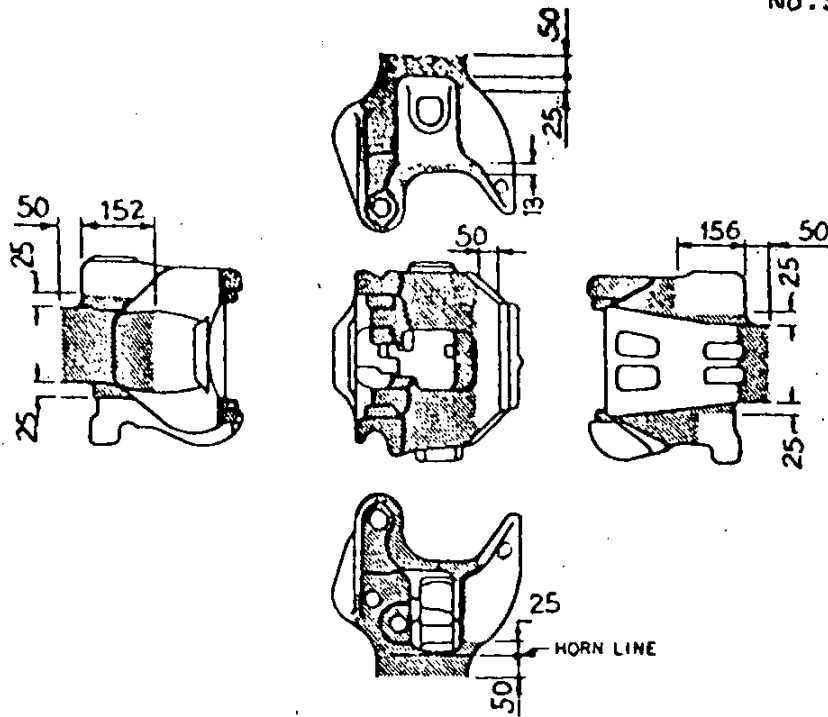


NOTE: Hardness reading required at two locations on coupler body & yokes as indicated by ⊗.

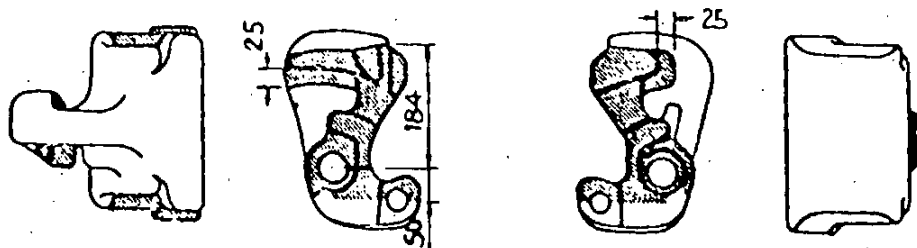
Figure 1

HEAT TREATMENT REQUIREMENTS AFTER WELD REPAIR

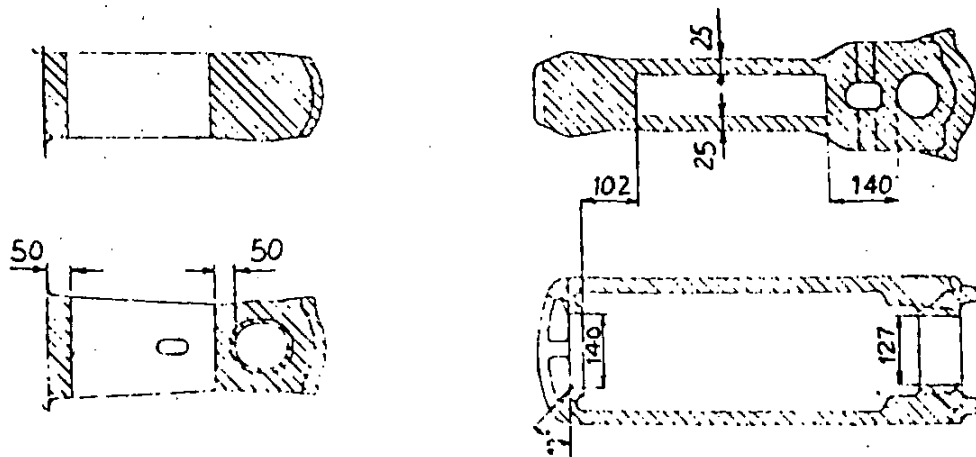
SPECIFICATION
No. 56-BD-07



COUPLER HEAD



COUPLER KNUCKLE



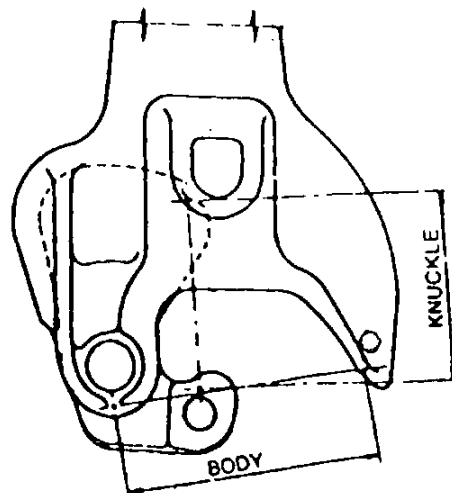
COUPLER SHANK

YOK

WELDS IN SHADED AREA	QUENCH AND TEMPER
WELDS IN NON-SHADED AREA	TEMPER

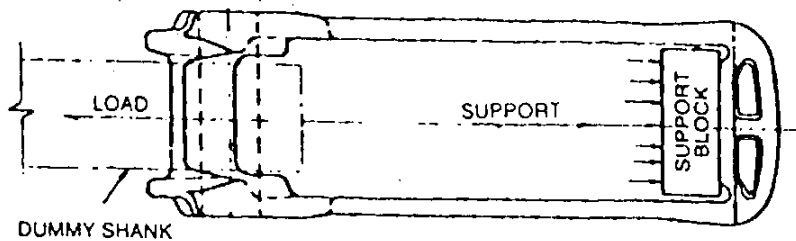
Figure 2

LOCATION OF PERMANENT SET MEASUREMENTS FOR
COUPLER BODIES, KNUCKLES & YOKE



COUPLER HEAD

Figure 3 ✓



DUMMY SHANK

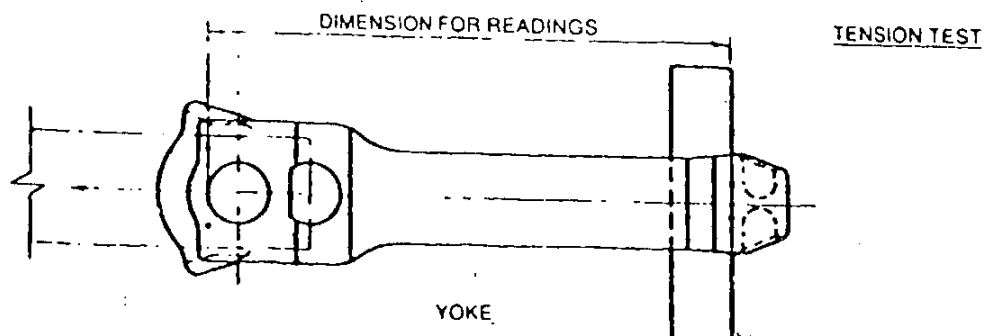
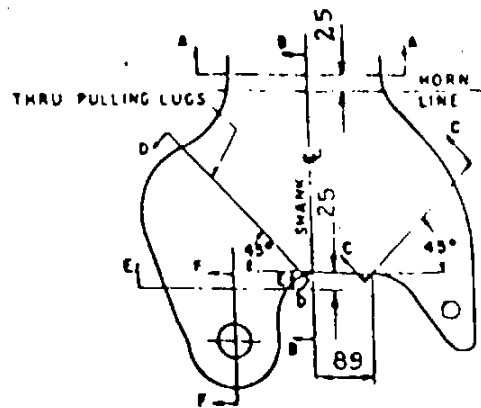
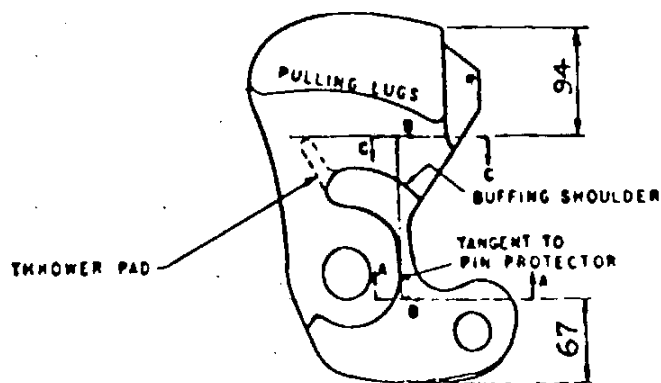


Figure 4

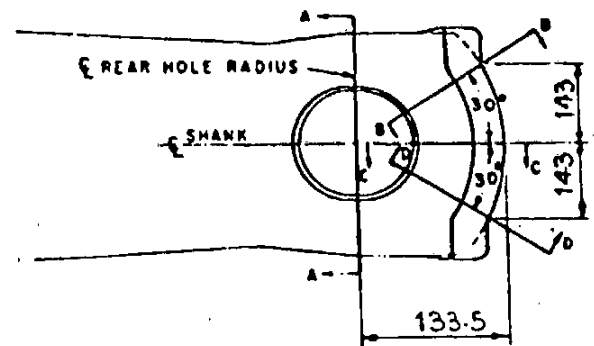
INTERNAL SOLIDITY SECTION CUT LOCATIONS



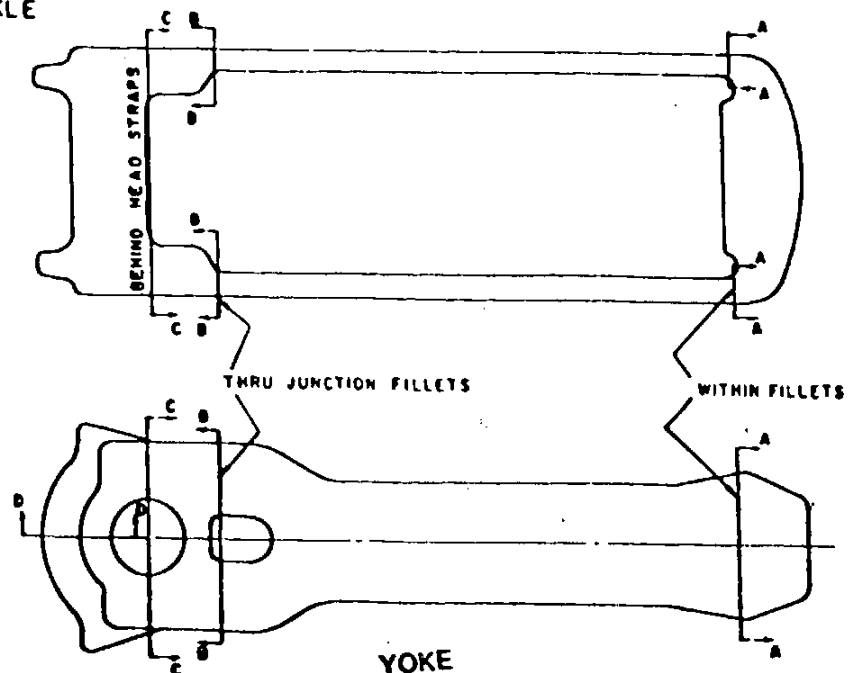
COUPLER HEAD



KNUCKLE

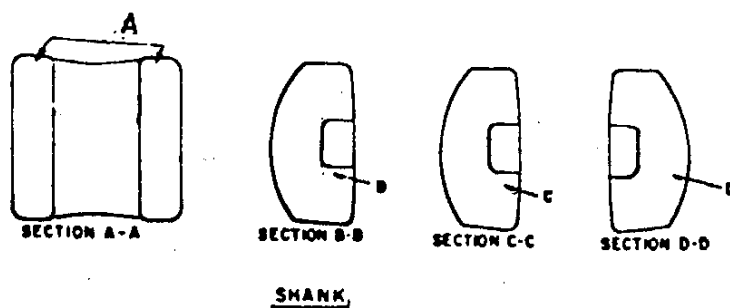
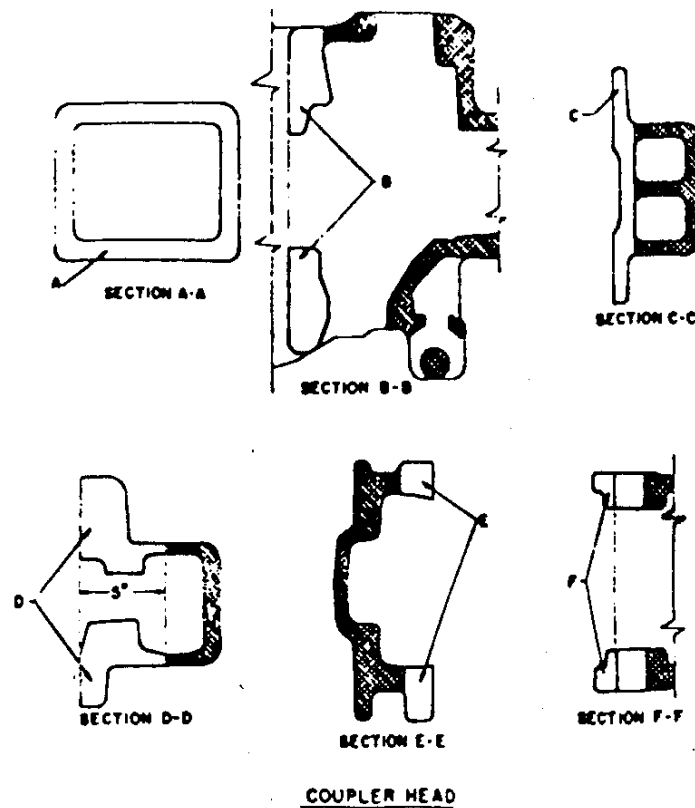


COUPLER SHANK



YOKE

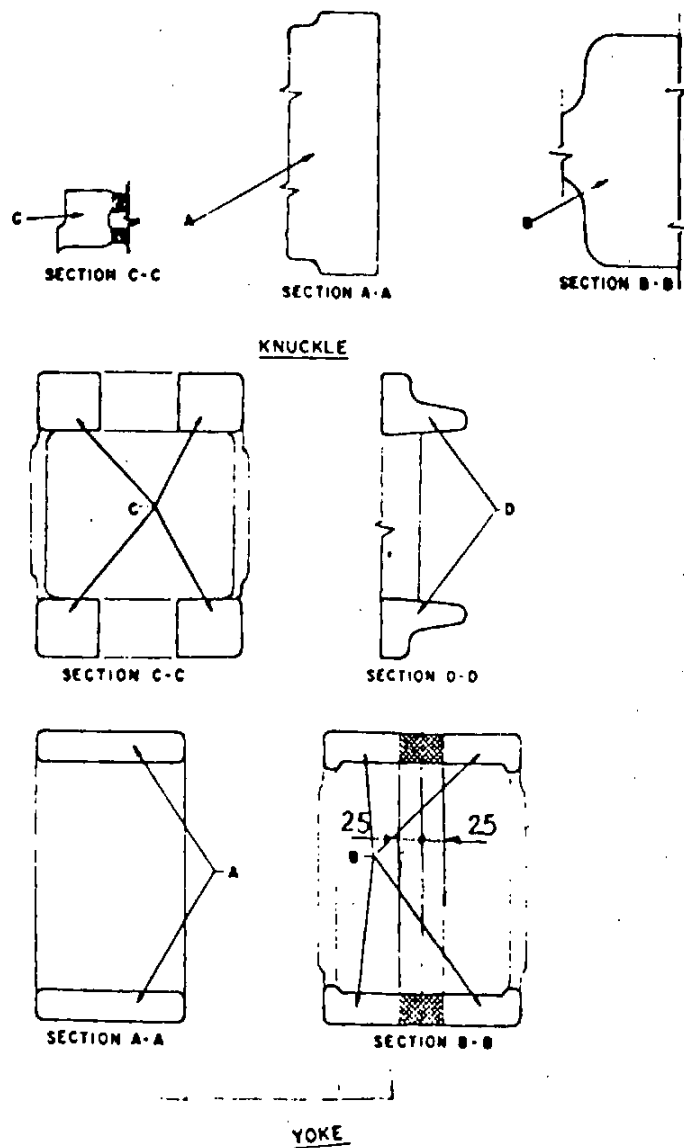
AREAS TO BE EVALUATED FOR DISCONTINUITY LEVELS



NOTE: SECTION CUT AREAS TO BE
RATED FOR SOLIDITY ARE
UNSHADED.

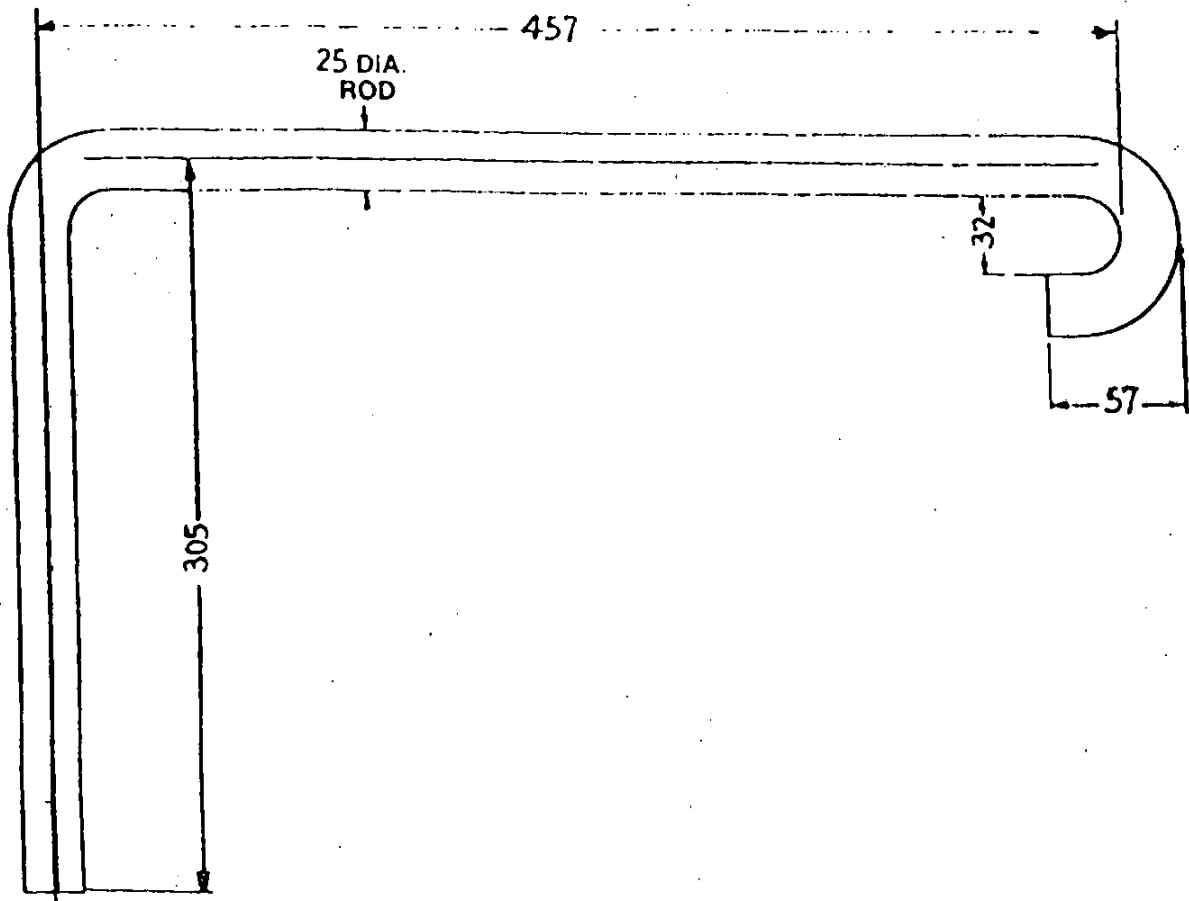
Figure 6

AREAS TO BE EVALUATED FOR DISCONTINUITY LEVELS



NOTE: SECTION CUT AREAS TO BE
RATED FOR SOLIDITY ARE
UNSHADED.

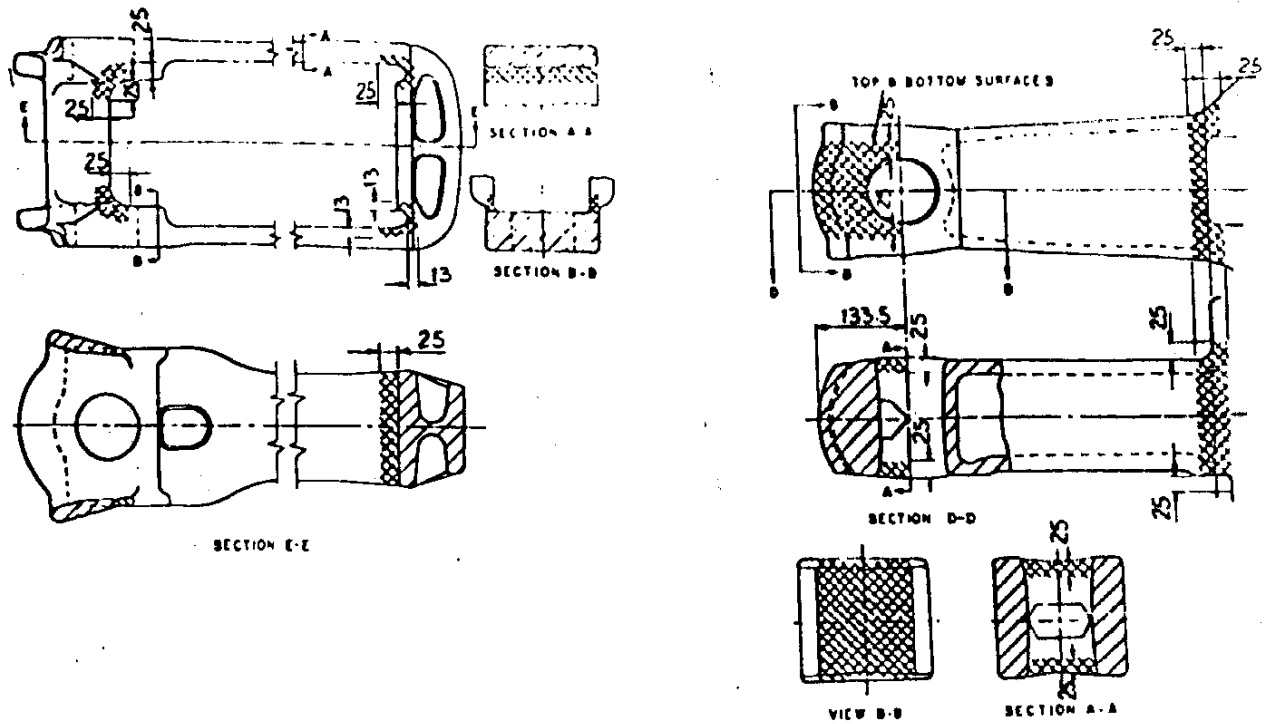
Figure 7



COUPLER INSPECTION
OPERATING ROD

Figure 8

INSPECTION ZONES FOR CRITICAL AREAS



NOTE: CRITICAL AREAS ARE SHOWN CROSSHATCHED

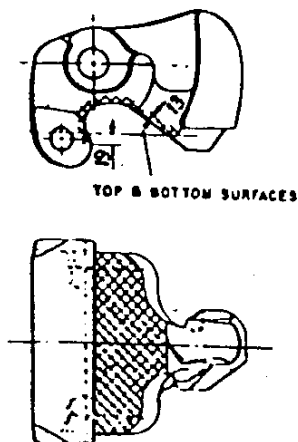
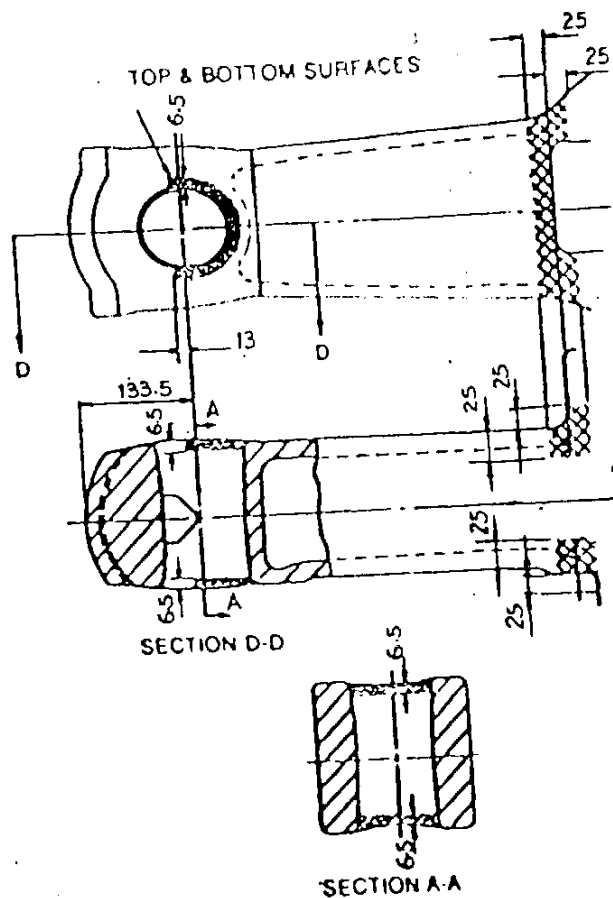


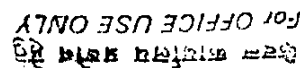
Figure 9

SPECIFICATION
No. 56-BD-07



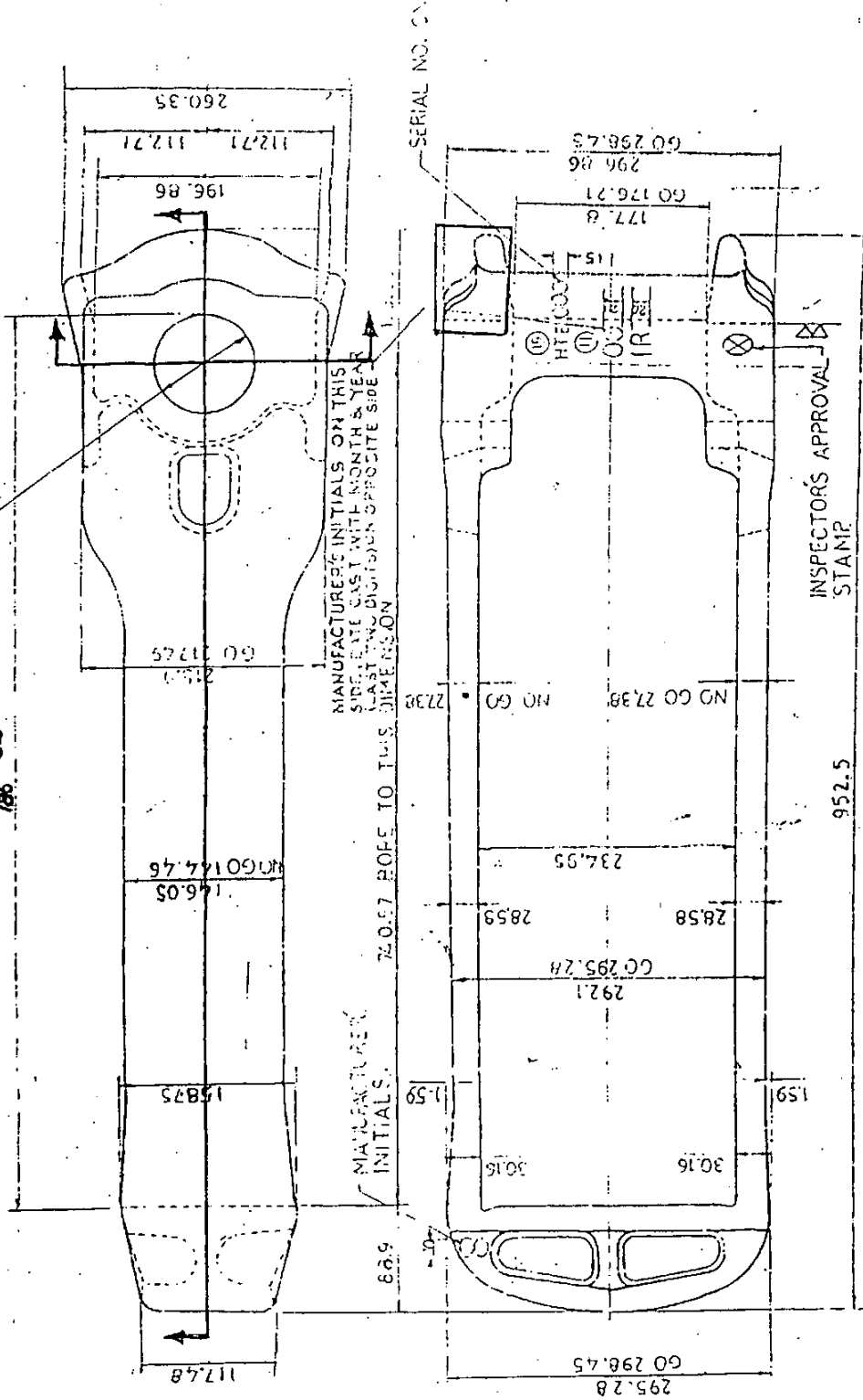
- NOTES: 1. ZONE 1 IS SHOWN CROSSHATCHED. ~~XXXXXXXXXX~~
2. BREAK SHARP CORNERS IN ZONE 1.
3. NO STRESS RISERS IN ZONE 1. SEE PARAGRAPH 4.2.2.3.

Figure 10



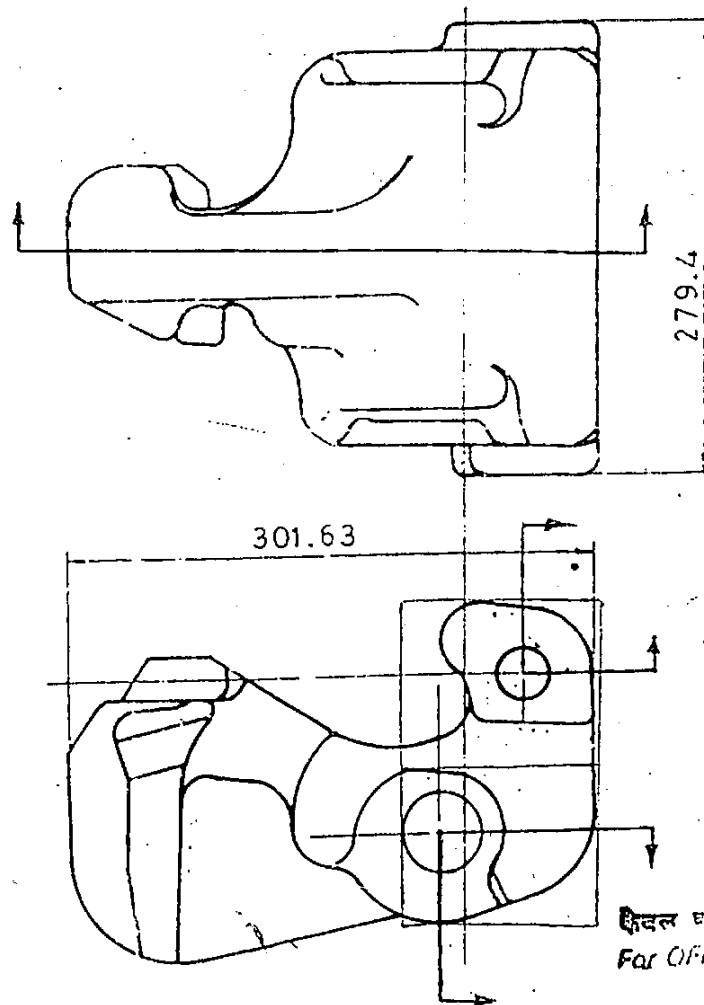
BORE 22.5 MAX.
91.6 MIN.

786
+0.4

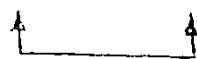


LOCATION TO BE
RADIOGRAPHED.
CLAUSE - 3.5.3.4

LOCATION OF SECTIONING.
CLAUSE - 3.5.3.3



केवल कार्यालय प्रयोग हेतु
For OFFICE USE ONLY



LOCATION OF SECTIONING.
CLAUSE - 3.5.3.3



LOCATION TO BE RADIOGRAPHED.
CLAUSE - 3.5.3.4