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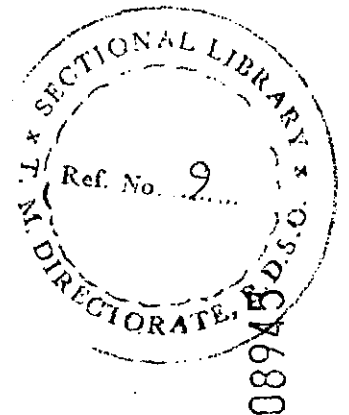


GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
RESEARCH DESIGNS AND STANDARDS ORGANISATION
LUCKNOW

**MANUAL OF INSTRUCTIONS FOR
MAINTENANCE OF MEASURING FRAMES
OF TRACK RECORDING CARS**

(BG)

REPORT NO. TM-9



TRACK MACHINES & MONITORING DIRECTORATE

MARCH 1997

This maintenance manual is based on experience gained in the day to day maintenance of Track Recording Cars under the Track Machines & Monitoring (T.M.M.) Directorate of RDSO. Although every care has been taken for incorporating all the necessary instructions and guidelines with supporting information for effective maintenance, these are subject to modification from time to time in the light of experience in future. Further the guidelines do not necessarily represent the views of Ministry of Railways (Railway Board), Government of India.

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Instructions for Maintenance of Measuring frame and Associated Equipments of Track Recording Cars (B.G.)

1. Introduction: The Track recording cars (TRCs) are equipped with a measuring frame mounted on the 3 measuring bogie. The sensors for sensing defects of gauge and alignment are mounted on the measuring frame. Measurement of track parameter is possible at speed upto 100 km/h on well maintained track. At higher speeds, the feelers are prone to loose contact with the rail resulting in inaccuracy in recording. This happens particularly at locations of sharp changes in the rail alignment (alignment kinks, point of entry in the turnouts etc) where spurious large peaks called "flicks" may be reported. Therefore the speed of recording should be reduced where running is rough. For recording, the TRC is generally coupled at the rear end of a special train.

2. Configuration of: The body of the measuring frame basically consists of two longitudinal beams held equidistant by two or three pairs of cross-beams. The frame is mounted on the primary spring base at the outer axle-boxes of the measuring bogie. The measuring frame provided in the Mechanical TRC has two sets of cross beams [Fig.1(a)]. Each set of cross-beams carries 2 spring loaded feeler plates, one for the left rail and one for the right rail.

2.2 For microprocessor based TRCs, only, one set of feeler blades is needed which are provided on the 3rd set of the cross-beams provided in the extended portion of the longitudinal beam. This facilitate calibration of the transducers as they can be easily accessed, being outside the bogie. However, it is found that due to greater dynamic effect, the lateral accelerometer mounted on the frame gets damaged and there is slight over reporting of defects due to the feeler dynamics. For this reason, the extended portion has been removed from TRC 225 & 2500. The feelers are provided on the pair of cross-beams between the outermost axle and the middle axle [Fig. 1(b)] The same shall be done for other two TRCs (TRC 803 & 7973).

2.3 For Microprocessor based TRCs, 3-axles bogie is not needed. Therefore, the 3-axle bogies may be

replaced with standard two-axle ICF bogie. Because of the difficulties in maintenance and repairs of this special bogie of the 3-axle bogies, the POH and major repairs can be taken up only at the nominated workshop (C&W Workshop, Lallaguda, S.C.Rly.).

- 2.4 A frame has been designed for the 2-axle bogies, details are shown in [Fig.1(c)]. It has 3 sets of cross beams with the feeler mounted on extended portion. The cross-beams falling in the bogie space are single beams whereas the outer one has a pair of beams which also carry the feeler blades. The extended portion is necessary because due to shortage of space between the wheels and the bolster, it is not possible to provide a pair of cross-beams there. All members of the frame are made of pressed steel channel (IS specification) of 125 mm x 50 mm. Middle portion of the Longitudinal beam is reduced in cross-section in order to provide a wide window for the free play of the bolster.
- 2.5 M.S.Lugs (made out of 12 mm thick plates) are welded on the primary spring base of axle boxes for holding the frame. The connection of the frame, with the lugs is through eccentric bolts (6 Nos.). The details of the eccentric bolt are shown in Fig.2. On the leading (towards the middle of the coach) eccentric bolts, the longitudinal beams are mounted with round bearings. This is the fixed end of longitudinal beams. The trailing end is mounted with rectangular bearings with sliding allowances of 15 mm in both leading and trailing directions. This is to allow longitudinal play of wheel sets caused by angular motion on curved track. The details of the bearings and bushes are shown in Fig.3.
- 2.6 The feelers placed opposite each other are supported by self-aligned ball-bearings in the cross beams. The ball bearings allow free lateral movement of feelers with the variations of lateral profile of the rail gauge faces. The application springs, one for each feeler, attach the upper arm of the L-frame (which carries the feelers) to the holding plates mounted on the cross-beams by steel wire cable, with LVDT in between. The springs are housed inside GI pipe casings. The springs help in keeping the feelers in contact with rail gauge face with specified load of 18 ± 2 Kg.
- 2.7 The contact surface of the feeler blades with rail gauge face is provided with four carbide tips brazed in a M.S.plate (Fig.4). The carbide

tip holder is fitted on the feeler blade with CSK bolts. The feeler are so designed that when the bottom level of the feelers blade is at 14mm below the rail top, the lower-half portion of the carbide tips will touch the rail gauge face and upper half will be above the rail head. This allow atmospheric cooling of the heat generated due to constant friction between rail and carbide tips during recording.

3. Important Bogie Clearances : Perfect mounting of Measuring frame and its stability depends upon good riding quality of the measuring bogie. The recommended dimensions (Ref. Sketch No.75055 of Technical Pamphlet No.C-7501 and IRCA Part-IV) which are generally considered good practice, the adoption of which will lead to good running of TRC and proper mounting of measuring frame are detailed below. A departure from these dimensions must not be allowed. These dimensions should be checked before taking out the TRC from the shop after every POH/IOH and during service and a record to be maintained.

i) wheel dia.	a) After POH	915 mm max.	
	b) During use	900 mm min.	
ii) Buffer Ht.	a) Unloaded coach	1105 mm	
	b) Loaded coach	1030 mm	
iii) Ht. of Bogie frame at 4 corners		652 mm	
iv) Ht. of pivot seat of 3 axle bogie		920 mm	
v) Ht. of axle box spring of 3 axle bogie (dia 218 mm)	a) Free height	315 mm	
	b) Loaded ht.	244 mm	
vi) - as above - for 2 axle bogie	a) Free ht.	360 mm	
	b) Loaded ht.	259 mm	
vii) Ht. of bolster spring of both bogies.(Dia 260 mm)	a) Free height	385 mm	
	b) Loaded "	263 mm	
viii) Clearance between axel box crown and bogie frame.	a) For 2 axle bogie(A)	36.00 mm	
		± 2.00 mm	
	b) For 3 axle bogie (C)	34.5 mm	
		± 2.00 mm	
ix) Clearance between bolster and bogie frame	a) For 2 axle bogie(B)	40.00 mm	
		± 3.00 mm	
	b) For 3 axle bogie(C)	25.00 mm	
		± 3.00 mm	

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Note: i) All heights are to be measured from rail level for item ii to iv above.

ii) Tare load of the coach is considered 42 tonnes.

4. POH of TRC : i) Before placement in C&W Depot/Shop :
coaches.

(a) TRC to be placed in S&T Shop, SC.Rly., Secunderabad for dismounting the Measuring frame and through inspection of all parts one by one by S&T staff for replacement if required.

Note : This will facilitate the S&T shop in manufacturing the parts during the period the coach will be in C&W shop.

(b) All the lugs welded with the axle box housings are to be numbered with paint after testing them (for wear and tear) in S&T Shop. Numbering of lugs to be done starting from leading end of TRC LHS 1, 3 & 5 and RHS 2, 4 & 6.

ii) During the POH in C&W Shop/Depot :

The RDSO staff taking over the TRC from the C&W workshop after POH should check that the following are complied.

(a) New wheels of 915 mm dia, fitted with new Direct Mounted bearings are provided.

(b) Slotted journal used for Tacho are fitted in proper location.

(c) Tilted axle-box is not allowed.

(d) All other measurements as mentioned in para 3 are fulfilled.

(e) Axle box housings welded with MS Lugs are fitted in correct positions for proper mounting of measuring frame.

(f) Before the TRC coach is turned out, the coach is placed on good track preferably pit line and the measurements of coach as stipulated para 3 are checked and rectified before sending the coach to the S&T Shop.

5. Mounting of : At the time of taking over the TRC from the S&T
measuring frame Workshop after POH, it should be checked that
after POH/repairs the following are completed.

i) On new wheel (dia. 915 mm) the centre of

measuring frame eccentric bolts (fitted with locating pins in bottom most hole of MS Lug) should be at a height of 257 mm from rail level.

The eccentricity of the eccentric bolt being 7.5 mm it can compensate a wheel wear of $(7.5+7.5)=15$ mm in radius, by adjusting the location of the pin from bottom hole (normal position) to top on MS Lug.

- ii) The Measuring Frame can be shifted both longitudinal and vertically by adjusting the position of all the locating pins at a time on the same holes of the MS lugs and maintaining 15 mm clearance at each sides of rectangular bearings.
 - (a) Maximum allowable Longitudinal shift from normal position towards leading/trailing end 7.5 mm
 - (b) Maximum allowable vertical shift from normal position of eccentric bolt. 15 mm
- iii) Eccentric bolt must be fitted face to face on the M.S. Lugs for its entire contact area.
- iv) Before mounting the long beams, the following dimensions of the eccentric bolts need to be verified:-
 - (a) Height of all bolts from Rail level must be 257.5 mm.
 - (b) LHS bolt must be perfectly opposit of RHS bolt.
 - (c) Lateral distance between bolts opposite side i.e. LHS & RHS must be equal.
 - (d) Longitudinal distance between the bolts of LHS must be equal to the bolts of RHS.
- v) All bolts used at any joint must pass straight through holes.
- vi) The leading end of feelers in working position must be at a min. distance of 70 mm from the wheel flange.
- vii) In no case the total length of feelers to be reduced from 1200 mm.

- viii) The fittings and fixtures provided for mounting of the frame accelerometer and LVDT and the vertical LVDTs are in good condition.

6. Daily Maintenance - Measuring Frame and other equipments must be checked every day before calibration and logbook to be maintained every day as per proforma given in Annexure-I.

- i) All bolts & nuts to be tested by tapping the heads of bolts with stroke of light hammer.
- ii) Condition of wire-rope, its alignment, tension along with tightness of wire-locks to be checked before checking the feeler tension. Feeler tension to be maintained within 18 kg \pm 2 kg.
- iii) Depth of feeler blade bottom edge from the railtop (14mm) and wear of carbide tips to be checked. After 6 mm wear of carbide tips, the holders should be turned upside down and can be re-used. The flared ends of feelers must be 10 mm from the rail. Except carbide tips no other part of feeler should touch the rail.
- iv) Before tensioning, the free movement of feelers must be checked to test the condition of feeler-bearings.
- v) Fittings of LVDTs and Accelerometers must be checked for proper holding so that the fittings do not get loosened during recording due to vibrations.

Base plates of vertical LVDTs to be cleaned and lubricated with grease for free lateral movement of the LVDT rod.

- vi) Lubrication of all bearings must be done from the nipples.
- vii) On the day of formation of TRC special, before beginning of a recording programme, detailed calibration check of the transducers should be carried out and record kept as per the proforma given in Annexure II(a) and II(b).

7. Half yearly check : i) The measuring frame should be dismounted. All parts are to be cleaned and checked for wear/cracks. M.S. Lugs to be checked by sound test.

- ii) Any fitting found defective must be replaced.

- iii) Before mounting the measuring frame the TRC must be placed on good track preferably on a pit line.
- iv) Eccentric bolts to be fitted in the M.S.Lugs to height of 257.5 mm from the rail top. Care to be taken to place the locating pins in the same hole of the same side of the eccentric bolt. This will allow equal clearances (15 mm at each side) for the rectangular bearings. Details are given in Fig.3(a) & (b).
- v) Fresh rubber packings are to be used at the joint of long beam and cross beam.
- vi) All nuts to be secured with split pins.
- vii) Alignment of wire-rope must be maintained adjusting the position of wire-pullies.
- viii) Depth of feeler(14mm below rail top) must be adjusted by shifting the position of locating pins of eccentric-bolts only.
- ix) Feeler tension springs must be placed perfectly in the alignment of casing pipe to avoid friction during function.

8. Precautions during idle movement of TRCs and recording runs

8.1 For idle movement :

- (i) Feeler tension to be released. The feelers should be lifted fully, clamped with double bolts and check nuts.
- (ii) Vertical LVDT rods are to be clamped to create a gap of minimum 50 mm from the base plates.
- (iii) All nuts and bolts are to be tested.

8.2 Due to vibration transmitted from the bogie, and the forces exerted by rubbing of feeler blades against the gauge face of the rail, the various fittings may get loosed during running and cracks may develop in the various members of the measuring frame particularly at the joints. It is, therefore, necessary that during recording run, as well as idle run whenever the TRC stops at any station during day time the staff shall conduct a check visually as well as by tapping with a light hammer the measuring frame whenever the time permits to see that the various components and fittings are in order and cracks have not occurred. If any unsafe condition is observed, it should be set right immediately. If the problem is serious and can not be

set right, the TRC should be detached.

**9. Spare parts:
for measuring
frame**

The following spare parts shall be kept in each TRC:

1. Axle box cover
2. Split pins for axle box bolts
3. Eccentric bolts with nut and split pin
4. Long beam brass (round and rectangular) complete with Bush and Sleeve.
5. Bolt and nuts of sizes with split pin.
6. Feeler frame
7. Feeler blade
8. Carbide tip holder
9. Ball bearing for feeler frame
10. Wire cable
11. Lock nuts
12. LVDT Fixing clamp
13. Vertical LVDT link
14. Vertical LVDT ball.
15. Hard rubber packing plates.

**Inspection of Measuring frame and Transducers
(To be inspected every day before recording)**

TRC No. : _____

Date of inspection : _____

Sr.No.:	Item	: Remarks with : date of inspection
---------	------	--

1. (A) Feeler Tension (18 ± 2 Kg):

(a) Left feeler

(i)

(ii)

(iii)

(b) Right feeler

(i)

(ii)

(iii)

(B) General condition of fittings of feeler-blades and brackets .

(C) Whether there are any signs of damage or crack in the long and cross beam joints of measuring frame and brackets of axle box (Checking by tapping with light hammer)

2. Fittings of transducers, LVDT links, locknuts and free movements of bearings.

(a) Lateral LVDT (L&R)

(b) Vertical LVDT (L&R)

(c) Acc. (UNR&UNL)

(d) Acc. VAC

(e) Acc. LAC

(f) Acc. (Frame)

3. Electrical cable connections:

- (a)FLYL & FLYR
- (b)CLZL & CLZR
- (c)CAYL & CAYR
- (d)CAZL & CAZR
- (e)CAV
- (f)CAL

4. Tacho cable connections:

Tacho I

Tacho II

5. Wear of the carbide tips of feelers:

(a) Left feeler

(b) Right feeler

6. Depth of the bottom edge of the feeler blade from the rail top

(a) Left feeler

(b) Right feeler

7. Any other remarks.

Signature of the
inspecting supervisor

**PROFORMA FOR CHECKING OF LVDTs BEFORE
EACH RECORDING PROGRAMME**

TRC NO.....

LVDT NO.....

DATE OF CHEKING.....

LVDT core movement in mm	LVDT OUT PUT IN MV					REMARKS
	POSTIVE VALUE			NEGATIVE VALUE		
	I	II	III	AV	MAX.	
	Variation			Variation		

0 mm

5 "

10 "

15 "

20 "

25 "

30 "

40 "

0 "

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SIGNATURE OF THE
INSPECTING SUPERVISOR

**PROFORMA FOR CHECKING OF ACCELEROMETER
BEFORE EVERY RECORDING PROGRAMME**

TRC NO.....

ACCL. NO.AND TYPE.....

DATE OF CHEKING.....

Acc. tilt in Degree	ACC. OUT PUT IN MV										REMARKS
	RINGHT TILT					LEFT TILT					
	I	II	III	AV	MAX.	I	II	III	AV	MAX.	

0

22.5

45.0

67.5

90.0

SIGNATURE OF THE
INSPECTING SUPERVISOR

MEMORANDA FOR HALF YEARLY CHECKING OF MEASURING FRAME

TRC No. _____

Date _____

- (1) Condition of eccentric bolt and eccentric pin and replacement, if necessary.
- (2) Condition of brass bushes and clearances :
 - (i) Left side
 - (ii) Right side
- (3) Condition of 1204 bearings
- (4) Condition of tension springs.
 - (i) Left side
 - (ii) Right side
- (5) Condition of wire ropes, pulleys, lock nuts tension bolts etc.
- (6) Condition of carbide tips, feeler blades and L-frame
 - (i) Left side
 - (ii) Right side
- (7) General condition of window bracket and window bracket Brass bush.
- (8) Checking of UN LVDT fittings
 - (i) LVDT Guide rod.
 - (ii) Cup and the condition of top sliding plate resting the LVDT rod/LVDT core.
 - (iii) Balls including small bolts.
 - (iv) Greasing etc.

Signature of the
Inspecting official

This manual has been prepared under the guidance of Shri
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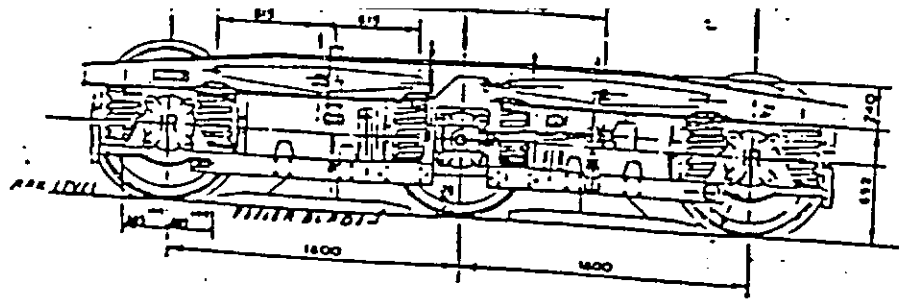
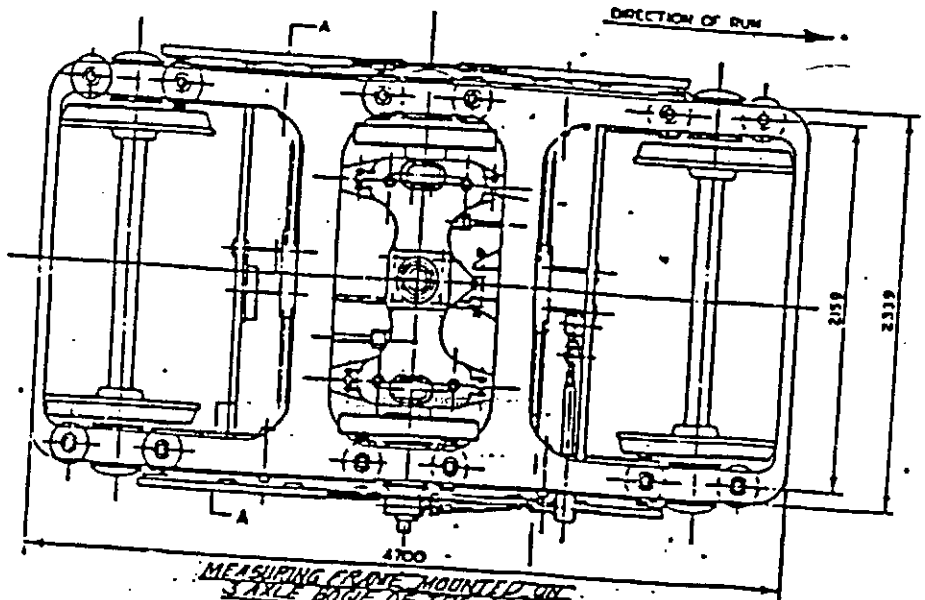


Fig. 1(a)



MEASURING FRAME MOUNTED ON 3-AXLE BOGIE OF TRCA (BG) (TWO SETS OF FEELERS)

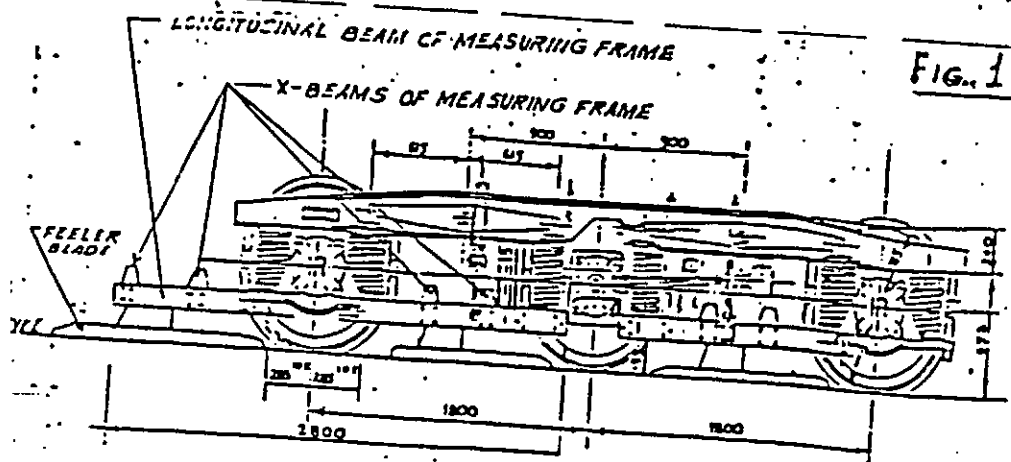
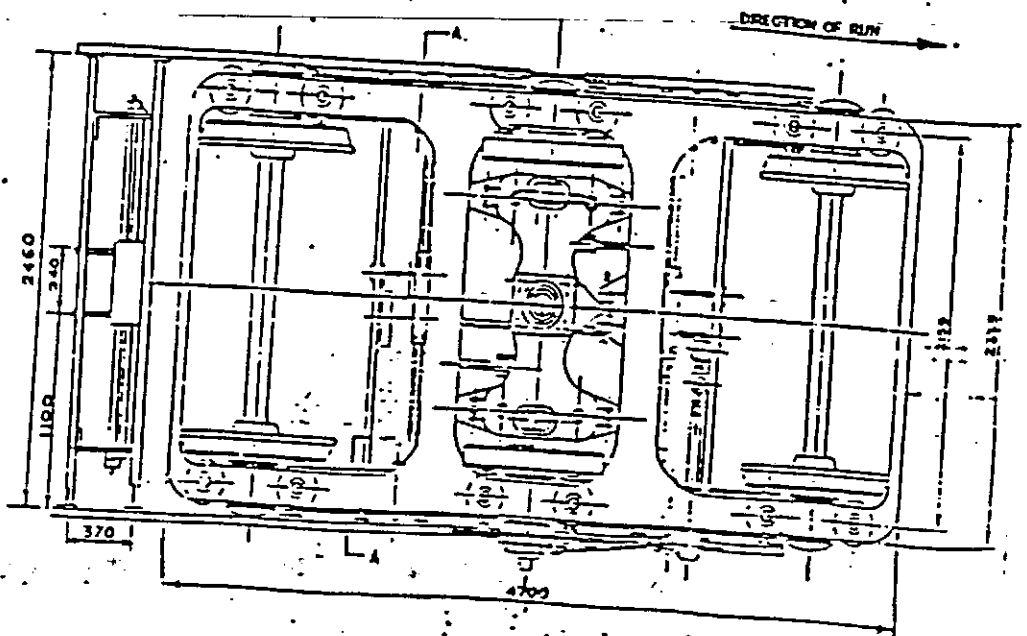


Fig. 1(b)



MEASURING FRAME MOUNTED ON 3-AXLE BOGIE OF TRCs (BG) (THREE SETS OF FEELERS)

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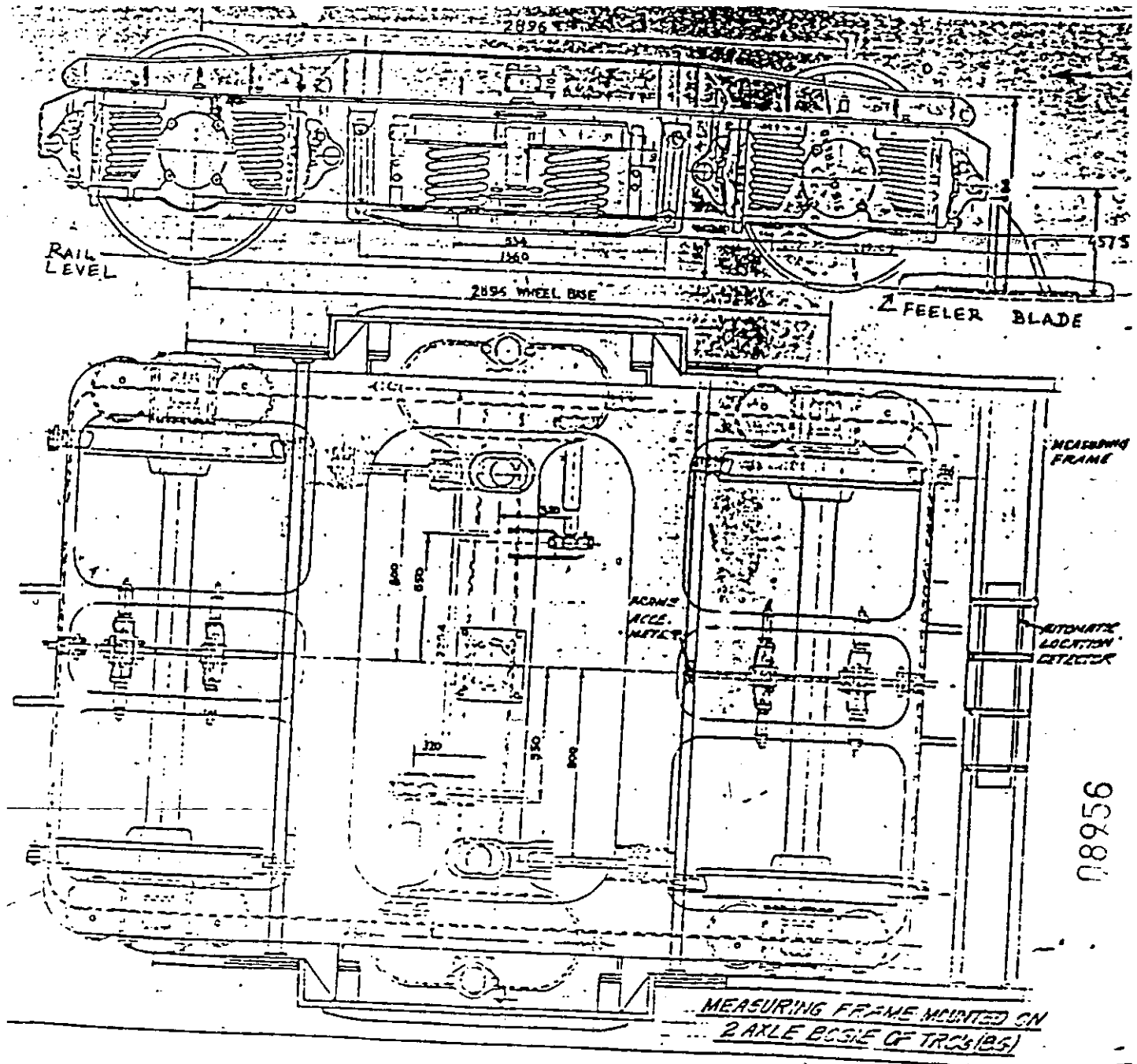
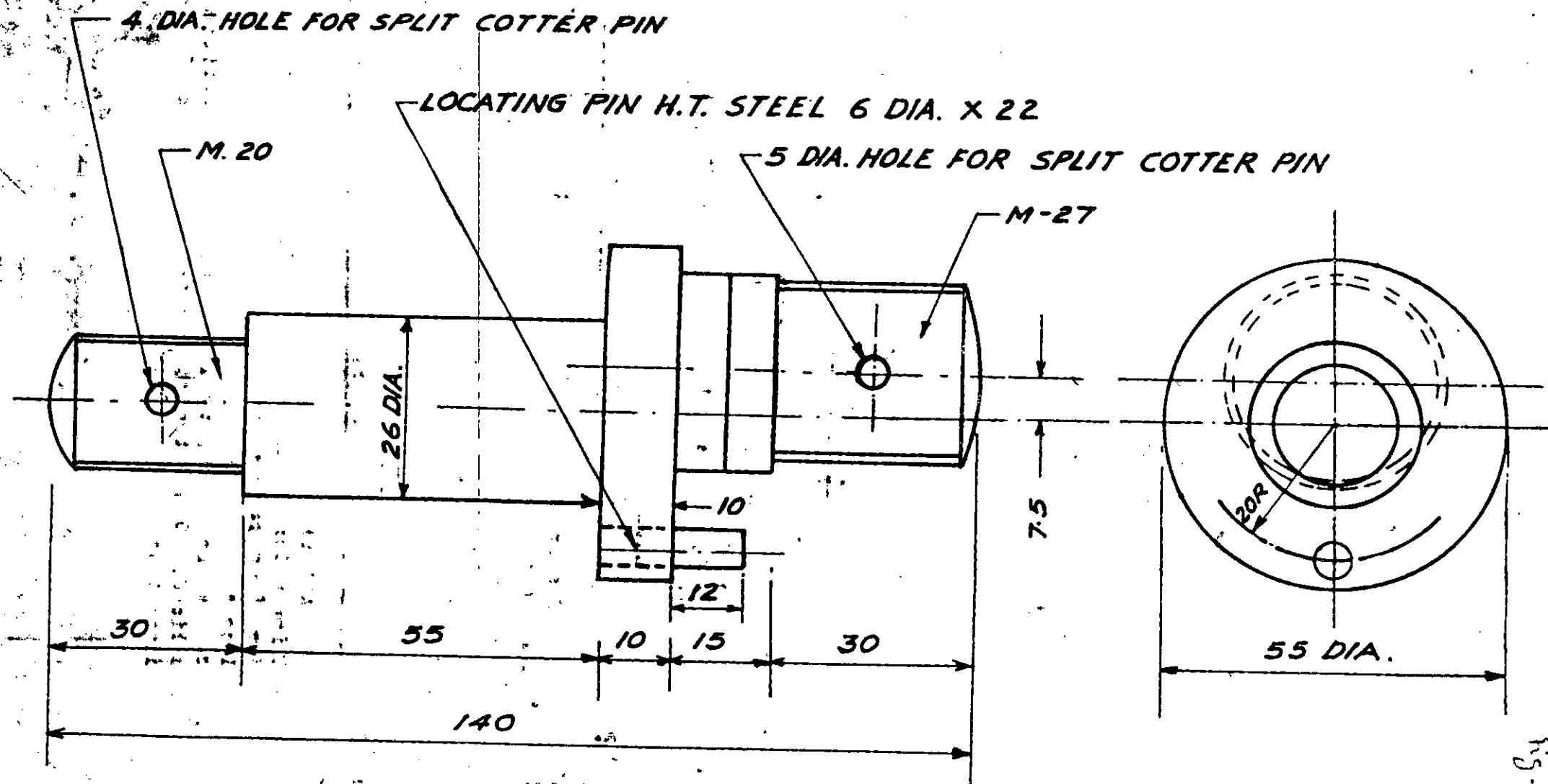
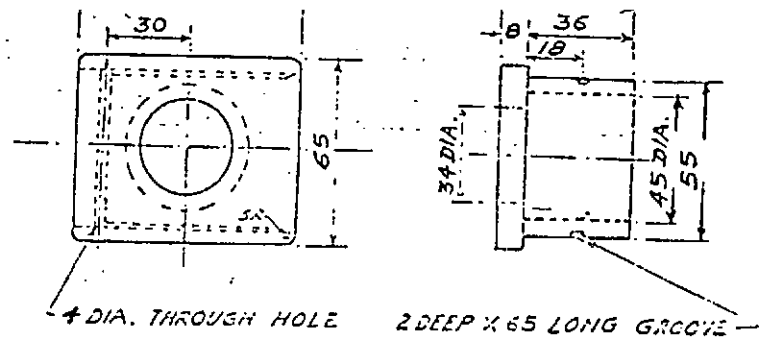


FIG. 1(c)

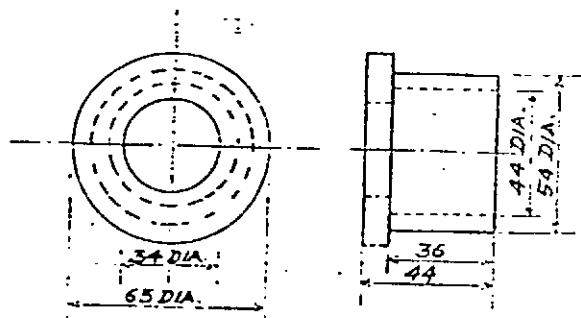


DETAILS OF ECCENTRIC BOLT

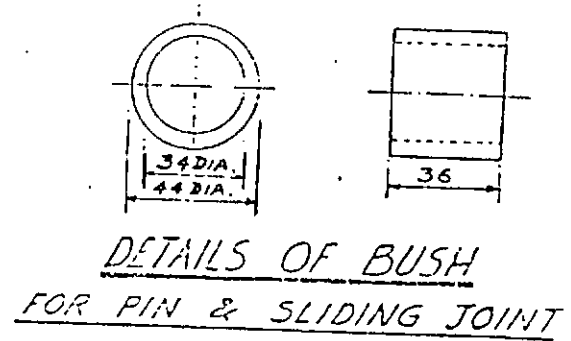
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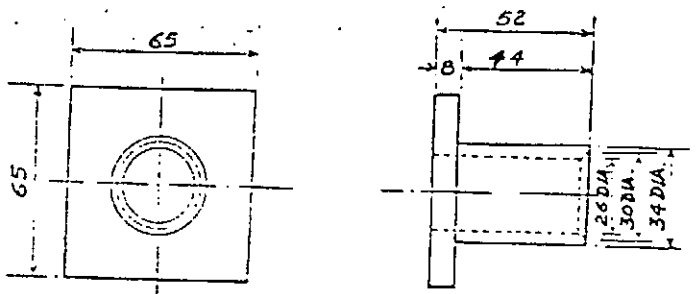
DETAILS OF BEARING FOR SLIDING JOINT



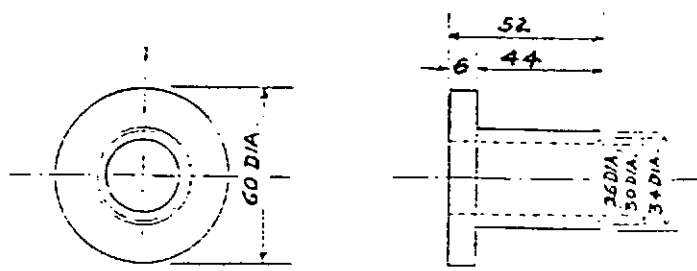
DETAILS OF BEARING FOR PIN JOINT



DETAILS OF BUSH FOR PIN & SLIDING JOINT

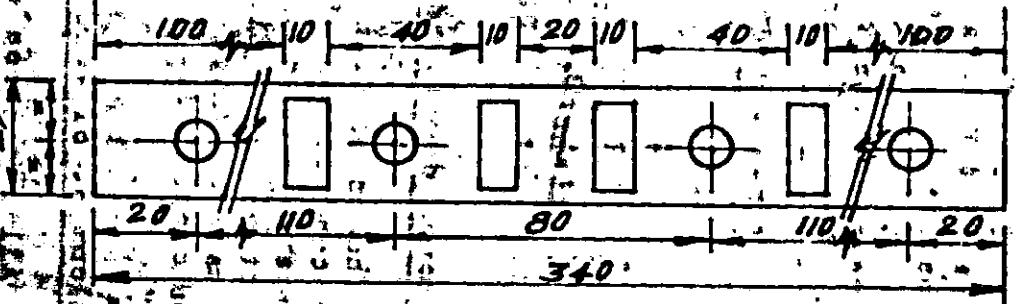
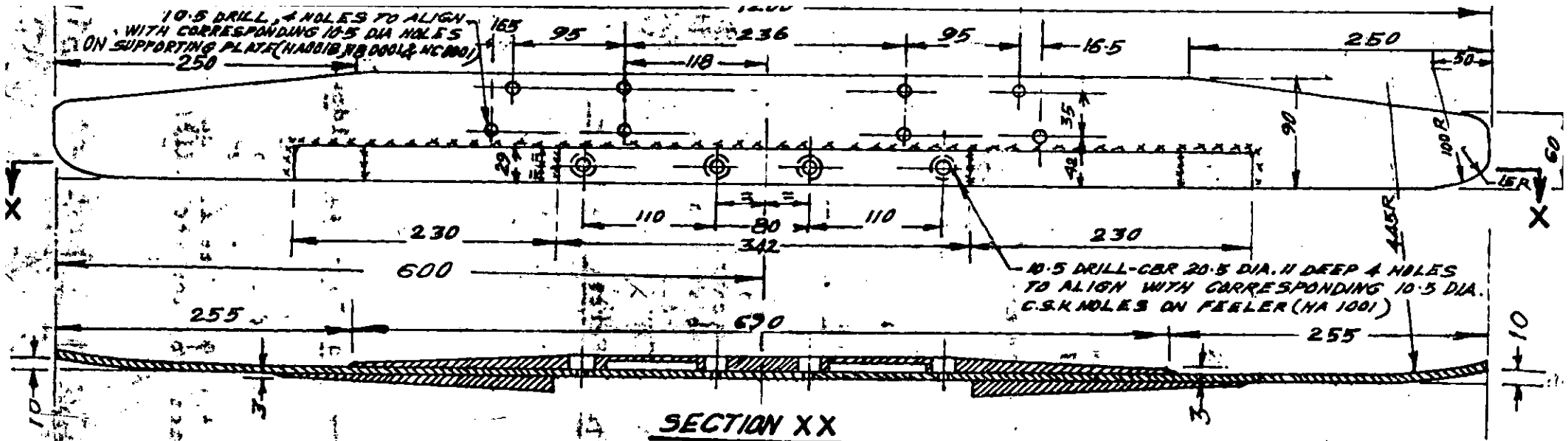


DETAILS OF SLEEVE FOR SLIDING JOINT

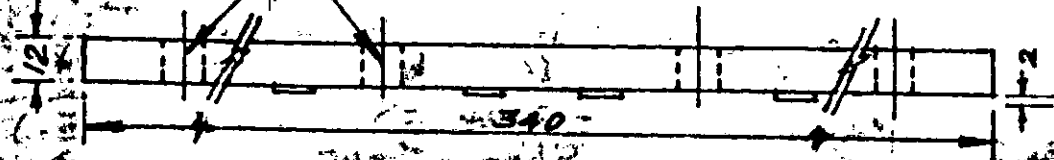


DETAILS OF SLEEVE FOR PIN JOINT

DETAILS OF BEARINGS AND BUSHES



10.5 DIA. HOLES FOR C.S.K BOLT



DETAILS OF CARBIDE TIP HOLDING PLATE

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8.8