

CHAPTER 9

DRAW & BUFFING GEAR

901 ENHANCED DRAW GEAR & SCREW COUPLINGS**901a Description & Guidelines****i) Description**

Enhanced draw gear and screw coupling components were earlier manufactured from Stc. 60.61 VSM10661 steel. The draw gear & screw couplings are designed for a proof load of **60t** (both) and a breaking load of **108t & 112t** respectively.

In 1998, the material for the draw gear and screw coupling components has been upgraded to IS:5517-93 Grade 35 Mn6M03 to enhance the proof load to 75t (both) and a breaking load of 130 t (both). Specifications C -9509 and C -9505 apply to these draw gear and screw coupling respectively. The dimensions of these draw gear & screw couplings are the same as earlier.

Relevant drawings are given below:

	VSM10661 Stc.60 -61	IS:5517-93 Gr.35Mn6M03
General Arrangement	SK-79061	SK-99003
Draw Hook	SK-79062	SK-99004
Draft Yoke	SK-79146	SK-99005
Draft Key	SK-79064	SK-99006
Draw bar and castle nut	SK-79063	SK-99007
Rubber buffer spring	SK-96002 Spec. C-9501(Rev.2)	
Screw coupling assly.	SK-79067	SK-99001
Details of screw coupling	SK-79068	SK-99002

ii) Guidelines

The components, except draft yoke, are specially heat treated to achieve the load bearing capacity. Hence these components should not be heated above **550°C**. The latest specified material for screw

coupling and draw gear is 35 Mn6Mo3 to IS 5517-1993. The material is required to be in hardened and tempered condition to achieve high tensile and yield strength. Stress relieving during maintenance acts as tempering treatment and there will be adverse effect on tensile properties every time stress relieving is done. For screw couplings and draw gear manufactured from steel to IS 5517 the practice of stress relieving in workshops should be dispensed with.

Due to poor weldability of these steels as well as inadequate infrastructure in Railway workshops for pre- & post-weld heat treatment, reclamation of these components (except draft yoke) by hot working / welding is prohibited.

The proof load testing machines should have a capacity of applying loads upto a maximum of 100t - 150t. The load should be increased on the component gradually. When the prescribed load is achieved, hold it for 2 minutes before gradually releasing the load and checking for permanent set.

Measure permanent set by checking the distance across 2 marks on the component, as far as possible, before and after application of load. It is preferable to have direct indication of permanent set, for higher productivity.

901b Inspection & Maintenance in POH

Periodicity : Every POH.

Record-keeping: Inspection records should be kept for each inspection stage, relating them to the coach from which stripped & also the coach on which fitted after maintenance. Reasons for rejection & repairs should be clearly mentioned.

Load testing and crack detection should be carried out even on newly procured draw gear components before fitting them on the coaches.

i) Draw Gear Maintenance

(Ref. Drawing : RDSO Sk. 79061 alt 4 & SK. 99003)

Pre-inspection

- Inspect all components visually for dimensional distortion and surface defects such as crack, dent marks, pitting etc. Mark components failing in this check for rejection.
- Special attention should be paid to the condition of the yoke & draw gear pins for signs of creep motion, loose or bent /cracked pins. Elongated or worn out yoke holes should be marked for repairs. Any welding cracks or distortion in the yoke should also be checked visually.

Dismantling

- Take out the draft key from the draw bars and the draw hook after straightening & pulling out the draft key cotters.
- Remove the draw hook along with the screw coupling.
- Detach the screw coupling assembly from the draw hook by cutting off the snap head rivet and removing the pin from the collar.
- Remove the split pins and the castle nuts from the draw bar rear ends.
- Remove the spring end plates, draft pads and parting plates and pull out both the draw bars.
- Dismantle the draw hook beam by un-bolting it from the underframe.
- Remove the draft yoke, if required in pre-inspection, by pulling out the draw gear pins, using a puller.
- Clean the components by any suitable method (Bosch tanks, hot water jets etc) before inspecting them for cracks, distortions, corrosion or wear. The detailed instructions for inspection & repair of individual components are given below :-

Draw Hook

(Ref. drg. RDSO Sketch - 79062 alt.5 & 99004)

- Remove the scale, rust, work hardened layers and surface cracks, if any, by light

grinding/filing. Take care so that no grinding cracks or sharp edges are generated which could act as stress raisers. Use dye-penetrant test for checking surface cracks in case of doubts.

- Inspect the draw hook for deformations & cracks. The neck, its pin hole, and the slot are vulnerable locations. Draw hooks worn beyond the maximum permissible wear laid down in the table below should be scrapped :-

Table 9.2

Location of wear	Wear limit	Suggested no go gauge
Root of hook near point of contact with bent link	13 mm	Profile gauge with 15 mm adjustable projection
62 mm dia pin hole	3 mm	65 mm flat
Bottom side of shank 56 mm height	15 mm	41 mm snap
Draft key slot(159 mm)	13 mm	173 mm flat
38 mm width	2 mm	40 mm flat
Hook opening 48 mm	5 mm	46 mm go 53 mm no go plug

- Stress relieve the draw hooks manufactured from steel to Stc. 60-61. Stress relieving should not be done for draw hooks manufactured from steel to IS:5517.
- Load Test draw hooks (Stc. 60-61) at 60 t and those of IS:5517 Gr. 35Mn6Mo3 at 75 t respectively. There should be no permanent set after release of load.

Draw Bar

Ref. Drawings :RDSO Sk. 79063 alt.4 & Sk. 99007

- Check the draw bar for dimensional distortions and damaged threads. Also check for wear on the following locations :-

Table 9.3

Location of wear	Wear limit	Suggested no go gauge
155mm draft key slot	9 mm	164 mm snap
39 mm shank body	3 mm	36 mm snap
Slot width 38 mm	2 mm	40 mm flat
Threads M39x3	1 mm	Thread profile

- Reject draw bars failing these standards. In acceptable draw bars, clean the threads and ease them. Round off the roots of threads at the slot.
- Check the castle nuts for damaged threads, worn nut faces and threads visually. Replace castle nuts if so.
- Stress relieve the draw hooks manufactured from steel to St. 60-61. Stress relieving should not be done for draw hooks manufactured from steel to IS:5517.
- Test all draw bars by magna-glow equipment for surface cracks.
- Load test draw bar (Stc. 60.61) at **39.5 t** and those of (IS 5517 Gr. 35Mn6Mo3) at 60t. There should not be any permanent deformation.

Draft Key

(Ref. Drawing : RDSO SK. 79064 alt.2 & Sk.99006)

- Check draft key for bending and for wear as given below :-

Table 9.4

Location of wear	Wear limit	Suggested no go gauge
Draw bar seating 139 mm	4 mm	Profile gauge with 5 mm adjustable projection
Draw hook seating 139 mm	4 mm	Profile gauge with 5 mm adjustable projection
Thickness 36 mm	4 mm	32 mm snap
Cotter hole 14 mm dia	2 mm	16 mm plug

- Renew worn, mis shaped draft keys. In acceptable draft keys, round off the contact area with the draw bars & draw hook to remove ridges, pitting, etc. if any.
- Stress relieve draft key manufactured from steel to Stc. 60-61. Stress relieving should not be done for draft key manufactured from steel to IS:5517.

Rubber draft pads

(Ref.drg. RDSO Sk.96002 alt.3 & spec.C- 9501 (Rev.2))

- The rubber pads should invariably be changed as a set every alternate POH. The sets should not be formed from supplies from different suppliers. Furthermore, the pads should be checked every POH for bulging, perishing or having got set to a length below **186 mm**. Replace the pads (as a set) if found defective.

Draft Yoke

(Ref. Drawing : RDSO Sk.79146 alt.2 & Sk.99005)

- Carry out detailed inspection, after removal and cleaning, for welding cracks, distortions and wear as given in the table below :

Table 9.5

Component	Wear location	Wear limit	Suggested no go gauges
Draft yoke	45 mm dia hole	3mm	48 mm flat
Bush	32mm dia hole	1mm	33 mm flat

- Rebuild the **45mm dia hole** by welding and drilling to the nominal size, if required. Ensure that the minimum distance between the inner edges of the 2 holes is **171^{+0.5}₋₀ mm**.
- Replace corroded, cracked or worn bushes.

Draw gear pin

(Ref. Drawing : ICF/Sk.-2-1-016)

- Replace pins, found damaged, bent or worn more than 1 mm anywhere on the nominal diameter (31 mm).

Draw hook beam

(Ref ICF drg. no. T-2-1-602 and Sk.99034)

- Check the following locations for wear :-

Table 9.6

Wear location	Wear limit	Suggested no go gauge
Wearing piece	6 mm	snap gauge 12 mm thick
Locating pins 25 mm dia	6 mm	19 mm snap

- The wearing piece on the draw hook beam should be replaced if worn or cracked.
- The locating pins provided to restrict side-ways movement of the draw hook, should be replaced if deficient , cracked or worn.

Screw Coupling Maintenance

(Ref. Drawings : 79067 alt. 7 & Sk. 99001 (Assembly),79068 alt.8 & SK 99002 (Details))

- Cut off rivets at both ends of screw and also rivets on trunnion for straight links and remove screw and straight links.
- Inspect the components for distortion, cracks or wear exceeding the limits below. In case of doubt, dye-penetrant tests may be used for confirming the presence/absence of cracks.

Table 9.7

Component	Wear location	Wear limit	Suggested no go gauge
Straight link	61 mm dia hole	2 mm	63 mm flat
Straight link	47 mm dia hole	2 mm	49 mm flat
Bent link	42 mm dia stem	3mm	39 mm snap

Component	Wear location	Wear limit	Suggested no go gauge
Bent link	47 mm dia hole	2 mm	49 mm flat
Bent link	78 mm 'U' gap	3 mm on each arm	77 mm to go 85 mm no go gauge
Pin on draw hook	60 mm dia	2mm	58 mm flat
Screw	55 x 6.35 mm k/thread	1 mm	K thread profile gauge
Trunnion LH/RH Knuckle	Thread 55.635x6 .35 K/thread	1 mm	K thread profile gauge
-do-	76 mm thickness	4 mm	72 mm snap
-do-	46 mm dia pin	2 mm	44 mm snap

- Replace the worn out components. Replace both the trunnions if required. Remove ridges, rust, notches etc. by grinding.
- Stress relieve the screw coupling manufactured from steel to Stc. 60-61. Stress relieving should not be done for draw hooks manufactured from steel to IS:5517.
- Assemble the screw coupling as shown in SK 79067 & 99001.
- Load test the screw coupling assembly under proof load of 60t (Stc. 60-61) and 75t (IS:5517) respectively. There should not be any permanent set.

Re-fitment of Draw Gear on coach

(Ref Drawing : RDSO Sk. 79061 alt. 4 & Sk.99003)

- Lubricate the wearing surfaces in the screw couplings, draw hooks and draw bars with graphite grease or used Roller Bearing grease.
- Place the draft yoke and secure it with draw gear pins. Place lock pins and splits pins in the bracket and secure lock pin with split pin. Do not re-use split pins.
- Position the draw hook beam on head stock and secure it with bolts and nuts as shown in ICF/SK T-2-1-602.

- Assemble the screw coupling with draw hook by inserting pin and rivet the pin.
- Position the draw bars in the draft yoke and insert draw hook. Insert the draft key in draw bars and draw hook. Fit cotters in the draft key and bend them. Do not re-use cotters.
- Place a rubber draft pad pack to STR No.C- 9501 (Rev.2), parting plates and spring end plate on each draw bar. The free height of rubber springs & parting plates should be 208 mm.
- Tighten the castle nuts **with 9.15 kg-m torque** so as to achieve a pre-compression of **196 mm** length of pack.
- Insert the split pins through the castle nuts and draw bars and open the split pins to **90 degrees**. Use new split pins always.
- Ensure that the projection of the shoulder on the draw hook from the head stock is within **92 mm – 120 mm**.
- Check for proper condition of the draw gear and screw couplings, after cleaning the accumulated dirt. Pay special attention to displaced draft key & it's cotters, draw bars and condition of draft pads.
- Lubricate the screw portion of the coupling and the area around the draw hook pin with graphite grease or used roller bearing grease.
- Always replace unused screw coupling on the suspension hook.

902 ICF TYPE BUFFER OF BG MAINLINE COACHES

902a Description and guidelines

i) Description

Presently enhanced capacity (**1030 kg.m**) buffer conforming to specification No. IRS-M 10 are fitted in all BG mainline coaches .

Relevant assembly and main component drawings are given in table 9.8.

Table 9.8

Components	Drawings
Buffer Assembly	SK 92090(existing) & Sk 98145(new)
Buffer casing (cast steel) (Forged)	W/BD –392 & Sk 94043 (with enlarged base) W/BD-393 & Sk 94044 (with enlarged base)
Buffer plunger-cast steel (Forged)	W/BD-359 & Sk 94255 (with flat face) W/BD-355 & S~94256(with flat face)
Rubber buffer pads Buffer spindle	SK 96002 and STR. no. C- 9501 (Rev . 2) W/BD- 353
Destruction tube	ICF drg. No. T-2-2-602
Recoil spring	W/BD-2252
Recoil spring parting plate	W/BD-2253
Recoil spring Washer	W/BD-350
Buffing spring parting plate	W/BD-2261
Face plate for buffer plunger M.24 Hex Head bolt	Sk 94254 ICF drawing No. F2-2-503

Earlier buffer had a plunger with curved face. During reclamation a wear plate with centre hole as per SK-81142 is fitted and plug is welded at centre to prevent rotation of buffer spindle. To avoid welding of centre plug, an integral face plate is to be provided and the new buffer assembly should be to SK 98145

Rubber buffer pads are to be procured and used as a pack from RDSO approved sources.

Buffer casing of earlier design are to IRS drawing no W/BD 392 & 393. In order to reduce the stress level on fixing bolts and prevent cracks in underframe headstock, the size of base of casing and location of fixing holes were increased and design of casing to RDSO SK 94043 and SK 94044 has been advised to PU's and Railways in 1994. Railways may use both existing and revised design of casings depending on the location of holes available in the underframe head stock.

902b **Inspection and Maintenance in workshops**

i) **Periodicity** – Every POH

ii) **Record keeping**

Record should be maintained related to the coach from which buffers are removed, the defects, repairs attended and the coach on which fitted after attention.

iii) **Dismantling**

- Take out split pin and unscrew nuts holding buffer casing with underframe head stock and remove buffer assembly from the coach .
- Remove split cotter and nut from buffer spindle and separate buffer plunger from casing and take out all components for inspection .

iv) **Inspections and Repair**

- Clean the components by any suitable method (Bosch tanks, hot water jet etc.) thoroughly before inspection and check for cracks, distortions, wear, corrosion & pitting.
- The instructions for inspection and repair of individual components are given below:

Buffer casing (Ref. drawing W/BD-392/393 AND Sk 94043 & 94044)

- Examine the buffer casing for cracks, damage, deformation & wear. The casing worn more than the wear limit and found cracked should be discarded. The elongated holes can be filled with weld metal and re drilled to **26 mm dia**. The location of 4 holes are **60.3 +/- 0.2 mm** from centre of casing along width & **174.5 ± 0.2 mm** along length in buffer casing to IRS W/BD – 3 9 2 / 3 9 3 . The respective dimensions in casing to SK 94043/94044 are **85 ± 0.2 mm** & **174.5 ± 0.2 mm**. These dimensions should be checked and restored ,if found different.
- The wear limits are given in table 9.9.

Table 9.9

Wear location	Wear limit	Suggested gauge
Buffer casing body wall thickness 11.5 mm	5.5 mm in wall thickness	Inside micrometer
Fixing hole in the base 26 mm dia	2 mm on dia	28mm flat

Buffer plunger (Ref. drg, W/BD- 355 & 359 and SK 94255 & SK 94256)

- Examine the plunger for wear, cracks & deformation. The plunger worn more than the wear limit on body and cracked should be discarded. Worn out face plates shall be replaced.
- The wear limits are as follows :

Table 9.10

Wear location	Wear limit	Suggested gauge
Buffer plunger tube wall thickness 9 mm	4mm	Micrometer
Plunger face/face plate 19 mm	11mm	1905 mm curvature gauge with depth measurement.

- Place buffer spindle in the plunger and rivet cast steel face plate to Sk 94254 with 6 Nos. of **16 mm dia** flat CSK rivets on buffer plunger from face plate side. No gap should exist. Circumferential welding of face plate with plunger is prohibited

Rubber buffer pads

(Ref. Drg. RDSO SK 96002 alt.3 & STR No. C- 9501(Rev.2)

- Rubber buffer pads should invariably be changed as a set at every alternate POH. The set should not be formed from different supplies. Further more, the pads should be checked every POH for perishing or permanent set to a length below **424 mm**.

Buffer spindle (Ref. drg. W/BD-353)

- Inspect the spindle for straightness, wear on body and threads. Straighten the spindle, if required.

The Wear permissible on body is :

Table 9.11

Wear location	Wear permitted	Suggested no go gauge
Buffer spindle body 40 mm dia	5 mm	35 mm snap
Threads M 39	0.5 mm	thread profile gauge

Destruction Tube

(Ref. ICF drg. No. T-2-2-602.)

- Check the destruction tube for bulging, corrosion. Replace the damaged/corroded destruction tube.

v) Assembly of Buffer

- Measure the free height of a set of rubber buffer pad pack (consisting of 16 pads) to STR No.9501 (Rev.2) and add parting plates, as required, to achieve a free height of **484 +/- 2 mm**.
- Place washer (ICF Drg . No . T-2-2-602), measured rubber pad pack with parting plates, destruction tube in the buffer plunger and insert the plunger inside the buffer casing.
- Assemble recoil springs (W/BD-2252) parting plate (W/BD-2253) and washer (W/BD-2261) on buffer spindle . Place the M39 nut over spindle and tighten the nut as to achieve a length of buffer of **635 +/- 2 mm**. The pre-compression of rubber pack with parting plate will be **439 +/- 2 mm**.
- Insert the split cotter in the spindle and split open to **90 degrees**. Use always new cotters. Use washer if needed, to eliminate gap between nut and split cotter.

vi) Mounting of Buffer on Coach

Before placing the buffer on the underframe head stock, check the condition of head stock for corrosion and damage and 4 nos. of **27 mm dia** holes for cracks and elongation. The corroded / damaged head stock behind buffer location should be replaced with new part head stock pressing for a length of **746 mm** as per RDSO Sk 76026 alt . 1 Annexure V of corrosion Manual C-7602 (Rev .-1) Deposit weld metal in elongated holes and re drill if needed. The distance of holes from centre of buffer is **60.3 +/- 0.2 mm** vertically & **174.5 +/- 0.2 mm** horizontally in earlier design of head stocks and this is suitable for fixing buffer casing to IRS drg No W/BD/392 &393. These dimensions should be checked and rectified if required for correct fitment of buffers. In the current design of headstock the distance is **85.5 ± 0.2 mm** vertically & **174 ± 0.2 mm** horizontally and is suitable for fixing buffer casing to RDSO SK94043 & 94044.

Place 4 nos. of Hex. Head bolts to ICF drg. No. T-2-2-503 through holes in head stock and buffer base and fully tight slotted nuts. Insert split pins through the slot in the slotted nut and hole in the bolts and split open to **90 degree**. Ensure the buffers remains horizontal.

vii) Maintenance in Depots

Check for tightness of buffer fixing bolts, drooping of buffers and slackness in buffer plunger to ensure destruction tubes are not damaged.

Buffer face should be scrubbed with a scrapper to remove dirt and muck and wiped clean using cleaning fluids After cleaning, the buffer face should be checked for the condition of CSK rivets holding face plate. Apply graphite grease on face plate after checking for cracks and wear.

viii) Pre-compression

The projection of buffer from head should be within **600 mm to 635 mm**.

903 **EXAMINATION AND REPAIR PRACTICE IN CARRIAGE MAINTENANCE DEPOT**

903a **Draw Gear**

i) **Primary & Secondary Maintenance**

- Check and replace damage/missing split pins/cotters/rivets.
- Examine draw hook, draw bars and rubber pads for damages.
- Check condition of the screw coupling and its components and replace if required.

ii) **Schedule A & Schedule B**

- Examine as per (i) above.
- Check condition of draw beam and locating pins on it.
- Examine visually draft key locking pins.

iii) **Schedule C**

- Follow the items given in (ii) above.
- Ensure that wear on screw coupling shackle pins, trunion pins shackle/link holes and draw hook holes should not exceed 3 mm.
- Ensure that wear at any section on draw hook should not exceed **10 mm**.

903b **Buffing gear**

i) **Primary & Secondary Maintenance, Schedule A and Schedule B**

- Buffing gear assembly should be externally examined for drooping, cracked and worn parts for proper securing.
- Buffer casing should be properly secured in the prescribed manner.
- Buffer face rivets when provided should be counter sunk and intact i.e. not missing.
- Destruction tube should be examined and coaches with collapsed destruction tube should be withdrawn from service at the first opportunity for sick line attention.
- Buffer alignment with head-stock should be true.

- Buffers should not be dead i.e. they should have sufficient buffing capacity.

- The buffer spindle should be in proper condition with the bolts and cotter intact.

ii) **Schedule C**

- Follow the items given in (i) above.
- Buffer projection should be not less than **600 mm** and not more than **635 mm**.
- Destruction tube should be examined and coaches with collapsed destruction tube should be attended.
- Inspect buffer plunger false plate for wear and profile.
