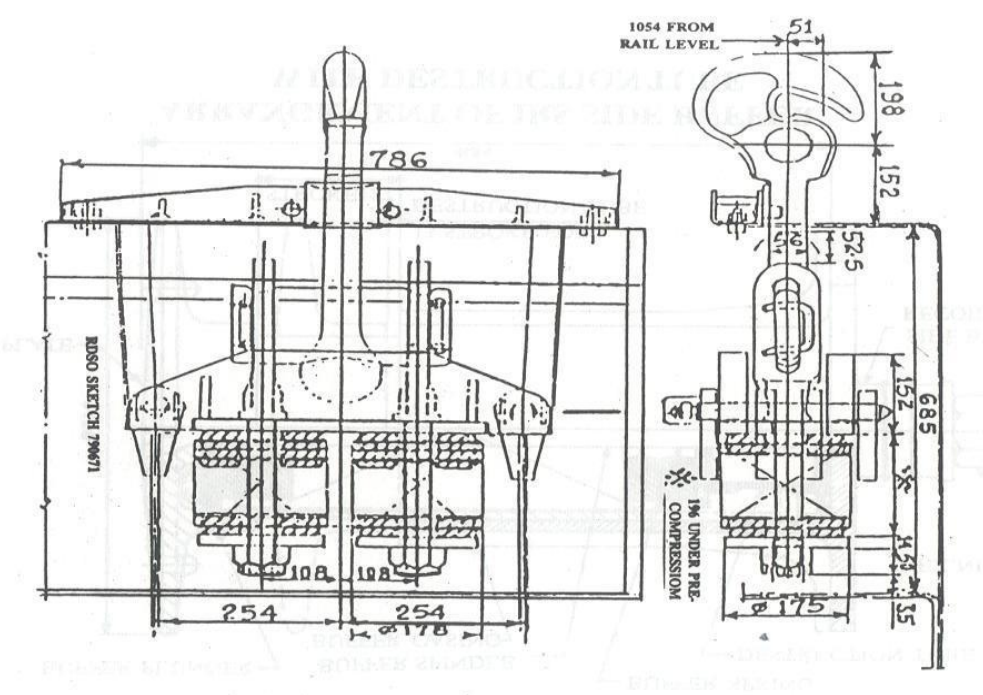
DRAW & BUFFING GEAR

Draw Gear:

It is a vital component of rolling stock, which is utilized to connect one rolling stock to the adjacent rolling stock to form a train & also to transmit draft forces from engine to last vehicle. It is provided in the centre of the body in the under frame head stock at both the ends. Mainly two types of draft gear are being utilized in Indian Railways.

1. Conventional Draft Gear
2. Centre Buffer Coupler

1. Conventional Draft Gear

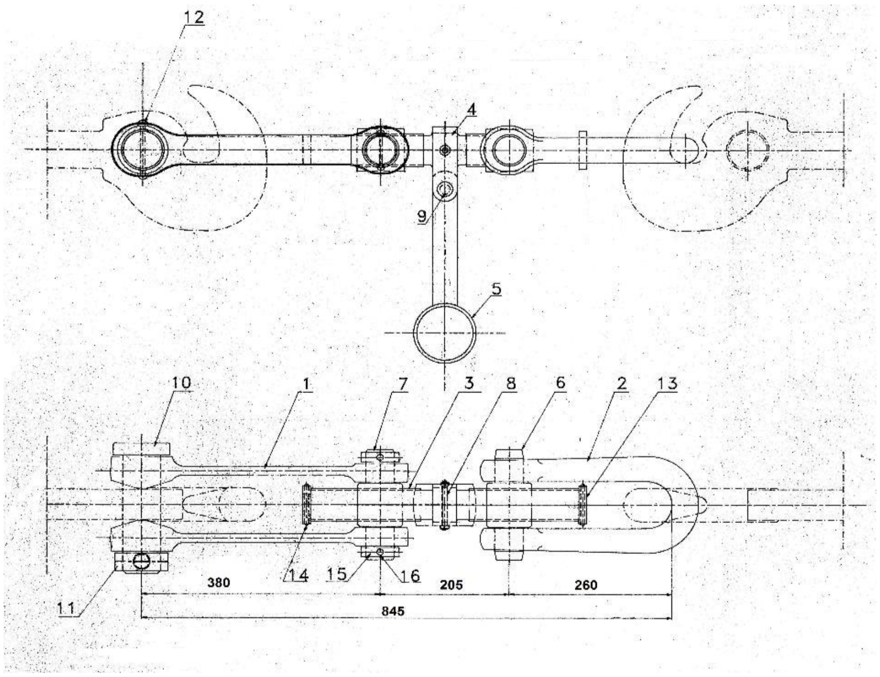


IRS DRAW GEAR WITH RUBBER PAD SPRING

Main components:

1. Draft Hook
2. Draft Links
3. Draft Key
4. Washer
5. Draft Spring/Draft Pad
6. Cotter
7. Bent Pin (U-Pin)
8. Hexagonal Nut
9. Screw Coupling

Screw Coupling:



Parts of Screw Coupling

1. Straight Link
2. Bent link
3. Screw
4. Dead weight clamp
5. Dead weight
6. Trunnion
7. Trunnion
8. Snap head rivet dia 8 x 85mm
9. Rivet
10. Pin 60 x 218mm
11. Collar
12. Snap head rivet 12 x 95mm
13. Ferrule
14. Ferrule
15. Collar
16. Snap head rivet 6 x 70mm

In 1984 use of Enhanced Screw Coupling was started, which was again modified in 1998. To identify this coupling a Dumble mark is stenciled at both the side of coach end body.

Length of coupling when fully opened – 997 mm

Length of coupling when fully Tight – 751 mm

Modifications:

S. N.	Description	Non Modified	Modified
1.	Working Capacity	36 Tonnes	36 Tonnes
2.	Proof Load Capacity	60 Tonnes	70 Tonnes *
3.	Breakage Capacity	Draw Bar – 108T S/Coupling – 112T	130T for both
4.	Stamping Mark	C – 60.61	IS – 5517

Note: *Proof Load Capacity of Enhanced Screw Coupling is increased from 70T to 75T. This must be used in all coaches including 24 coach trains.

Design features of screw coupling:

- The length is adjustable i.e. it can be lengthened to facilitate easy coupling with the adjoining draw bar hook and then tightened to take up the slack between buffers. This is achieved through the screws, which has right threads on one side and left threads on the other.
- The shackles make the connection flexible so as to avoid any undue strain on the drawbars due to variation in buffer heights between coupled vehicles, vertical oscillation and lateral displacement of the buffers.
- The screw coupling can be easily applied and handled by one person. It is easily replaceable in case of failure. Since either end of the vehicle is provided with a screw coupling, in case of failure, the screw coupling of the opposite end can be applied.

Limitations of screw coupling:

- The draft capacity of screw coupling is restricted by weight consideration because the coupling link has to be lifted manually and placed over the hook. The UIC Codex 520-R lays down a limit of 36 Kg for the weight of the shackle and has recommended that it should preferably by near 30 Kg.
- With the use of high tensile steel and with the restrictions mentioned above, an ultimate strength of approximately 130 t corresponding to a working load of 36 t has already been obtained in the enhanced screw coupling arrangement on IR. As such there is no further scope of increase its working load. However, it has been seen that in operation of long double-headed trains, in certain situations, the coupler forces are in excess of 36 t. Therefore, for operation of long double headed trains (26-30 coaches), screw coupling and side buffer arrangement has to be replaced by a suitable CBC which has a much higher capacity.
- In case of derailments, the couplings links slips off and does not offer restraining forces to coaches.
- Each vehicle has two coupling units and four Side Buffers units, thus increasing the maintenance cost.
- Inter coach distance cannot be reduced necessitating longer platform lengths and berthing facilities. This is also disadvantageous from aerodynamic considerations in high-speed trains.
- The possibility of the shunting porter getting injured during coupling/uncoupling is high.
- Coupling/uncoupling time is high.
- The possibility of providing air and electric connection through this arrangement does not exist.

Q. What are the various defects normally observed in draw gear and screw coupling?

Ans. Following are the various defects normally observed in Draw gear and Screw coupling:

- Draw bar, draw bar hook or draw link broken.
- Shoulder of draw bar hook-projecting more than 32mm.
- Draw bar spring deficient or broken unless both ends are properly tapered off.
- Draw bar spring broken in more than two pieces.
- Draw bar, which can be turned upside down.
- Draw bar or draw hooks worn more than 13mm through any section.
- Draw bar nut or washer deficient or incorrect size or not secured with a cotter as specified.
- Draft cotter/key/link pins free to work out.

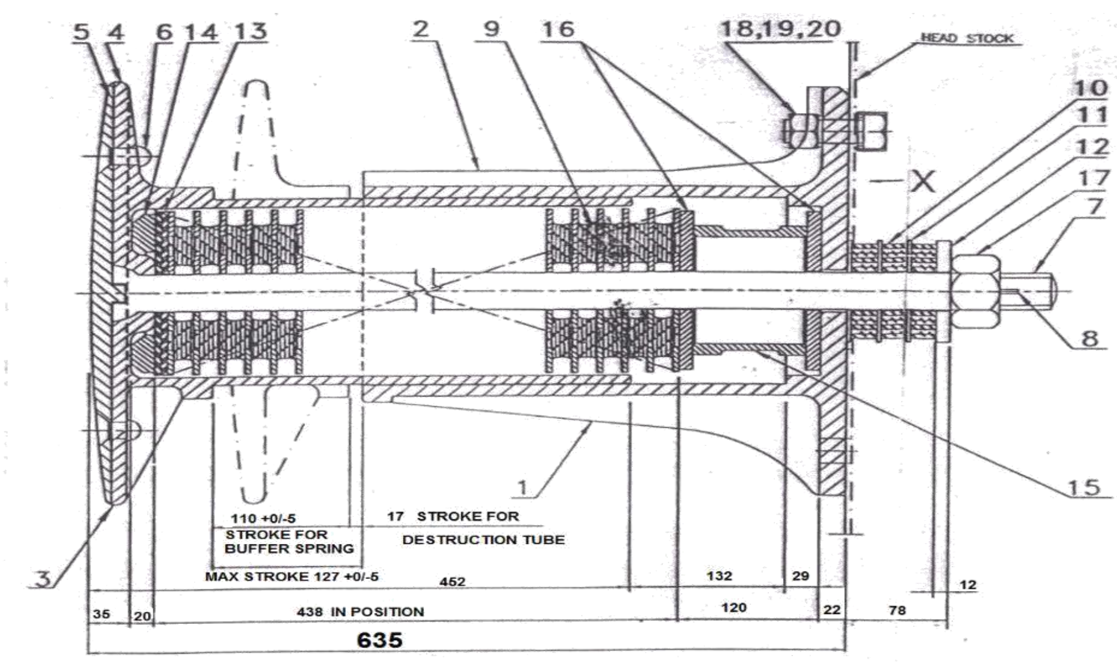
- Draw bar wearing plate with lug broken or deficient or any of its rivet deficient.
- Any part of a screw coupling or draw gear assembly deficient or broken.
- Suspension hook deficient or broken.
- Any screw coupling shackle pin free to work out.

BUFFING GEAR:

Two nos. of buffers are provided on body head stock on both ends to absorb the longitudinal impacts during run, these are fitted at a distance of 1956 mm. The buffers also transmit buffing forces during pushing to its trailing end stock

The main components of Buffing Gear are as under:-

1. Buffer Plunger
2. Buffer Socket with securing bolt
3. Buffer Spindle & Plug
4. Buffing Pad
5. Destruction Tube
6. Recoil rubber Washer
7. Washer
8. Nut & Cotter



Details components of Buffer Assembly:

1. Side Buffer Casing (Casting)
2. Side Buffer Casing (Forging)
3. Buffer Plunger (Casting)
4. Buffer Plunger (Forging)
5. Face plate for Buffer Plunger
6. Flat CSK HD Rivet (Forged)
7. Buffer spindle
8. Bulb cotter
9. Rubber buffer spring
10. Side buffer recoil spring
11. Recoil spring parting plate
12. Recoil spring washer
13. Buffing spring parting plate
14. Washer
15. Destruction tube
16. End plate M 12x170 dia
17. Hexagonal nut M 39x3
18. Hexagonal bolt M 24x90
19. Nylock Nut M24
20. Spring washer

Mainly Buffers are of two types:-

Long Case Buffer – Length from head stock – 635 mm

Short Case Buffer – Length from head stock – 458 mm (4 wheeler)

<u>Other data:</u>

Max. Height in Empty condition – 1105 mm

Min. Height in Loaded condition – 1030 mm

Minimum buffer height of coaching stock should not be less than 1090 mm at the time of releasing of coach from POH Workshop.

Allowed variation in height at same end – 64 mm

Allowed variation with adjacent vehicle – 75 mm Max.

Plunger Travel – 127 mm

Min. Plunger Travel – 51 mm

No. of Buffing Pads per Buffer – 14 to 16 Nos.

Capacity of Buffing Pads – 1030 kgm.

Q. What are the reasons for the buffer height being lower than the permissible limit? How is it adjusted in ICF Coaches to make it within limits?

Ans. The buffer height of the coach is lower than the permissible limit due to any of the following reasons:-

1. Wear on the wheel tread.
2. Wear on wearing piece and wearing plate of the side bearer.
3. Wear on hanger block and pin of secondary suspension.
4. Loss of height of primary and secondary springs, not being within permissible limits.
5. Loss of camber in sole bar during service.
6. Reduced height of side bearer.
7. Twist in the underframe and bolster body.
8. Uneven load distribution between side bearers due to thermal stresses caused during manufacturing.
9. Uneven loading of coach due to improper fitment of equipments.
10. Whenever headstock is changed, its location gets disturbed resulting in buffer drooping.
11. Elongated buffer fixing holes.
12. Measurement of buffer height taken on unleveled tracks.

To bring the buffer height within the specified limits, wooden packings of thickness as given below should be kept under the flanges of the lower spring seats, depending on the wheel diameters.

Average wheel diameter of the two wheel sets of the same bogie (mm)	**Total thickness of wooden packing ring (mm)**
889 to 863	13
863 to 839	26
839 to 825	38
825	48

1. Where a wooden packing of 48 mm thickness is provided, a ring should be welded at the bottom of the lower spring seat to increase the length of its projection below the flange of the spring seat or new lower spring with a longer projection should be provided.
2. Compensating ring/rings of suitable thickness should be placed over the flange of the lower spring seat ensuring that the combined thickness of the compensating rings does not exceed 12mm. The total thickness of the wooden packing and the compensating rings is approximately equal to tread wear.

3. While lowering the bogie frame and the bolster assembly on the wheels, it should be ensured that the bogie frame is set evenly on the four axle boxes.
4. The bogie assembled with wooden packings and compensating rings as requird, should now be loaded under the loading fixture and the height of its bolster top surface from rail level measured. This should be compared with predetermined dimensions to decide on further adjustment of buffer height.
5. If the buffer height requires further adjustment, the load on the axle box spring should be released and the packing rings in halves should be inserted below the axle box springs. The total combined thickness of all the compensating rings and the packing rings under each spring should not exceed 40mm and there should be a minimum clearance of 40mm between the axle box wing lugs and their safety straps. If necessary, modified axle box safety straps should be used.
6. The clearance between the axle box crown and the bogie frame should thereafter be adjusted as per the dimensions specified.

Q. When is buffer replaced? Describe briefly the procedure of replacing buffer on an ICF coach in the sick line.

Ans. Buffer in an ICF coach is normally replaced due to following reasons:-

i. Damage of spindle nut/spindle threads.
ii. Defective threads of nut-bolts of the buffer casing.
iii. Torn/worn rubber pads.

- ✓ Buffer height should be 1105 mm in unloading condition and 1030 mm minimum during loading condition.
- ✓ Buffer length should be between 600 mm and 635 mm and dead buffer will be considered if length reaches 584mm.

Wear limits of buffer components

Buffer casing

Wear location	Wear limits	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	28 mm flat

Buffer Plunger

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

Buffer Spindle

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

Procedure:

1. Put wheel skid on the coach, in which the defective buffer is being replaced.
2. Put buffer stand below the buffer being changed and lift it slightly with help of the screw.
3. Remove spindle cotter with the help of hand hammer & punch.
4. Remove spindle nut with help of a spanner.
5. If the threads of spindle/nut are worn out, cut it with the help of a gas cutter.
6. Open nut-bolts of the casing with the spanner. Cut with gas cutter, if worn out.
7. Remove the buffer from the buffer stand.
8. Check wear on buffer casing.
9. Check breakage and wear on buffer pads, destruction tube, spindle etc.
10. Replace the parts found defective.
11. Measure buffer length with measuring tape.
12. Check wear in buffer casing hole and headstock hole. If the wear is more than permissible, then put a plate with correct holes with the help of electric welding.
13. If the buffer case is excessively worn out and spindle key is moving out, then weld the round plate through electric welding.
14. Put the buffer on the stand carefully and tighten the buffer casing nut-bolt & spindle nut with the help of spanner.
15. Place spindle cotter and split it at 90^o angle.

Conclusion:

Screw coupling and side buffers are used in all conventional ICF design coaches whereas CBC couplers are used in LHB design coaches. Coupler is provided to connect coaches into a train. It also transmits draw force from loco to trailing coaches. Buffer avoids bumping of one coach into other during drawing of train or during braking operation.

Both the arrangements come into play in the following situation:

a) Pull action

b) Buffing action

a) Pull action:

The pull action commonly called draft is necessary for transmitting the draw bar pull exerted by the locomotive on the train. The value of draft does not remain constant. The peak draft is required for starting a train. This falls rapidly once the train has started moving, but again rises as the speed is raised. After attaining maximum speed the values of draft again falls and remains constant during cruising. Subsidiary draft action can also be caused during braking when certain portions of the train may be retarted more than others due to train composition and brake system characteristics etc.

The draft gear is interposed between the coupling mechanism and the underframe of the vehicle to transform a direct application of pull from the locomotive into a gradually increasing effort against the vehicle underframe.

The total pull exerted by the locomotive will pass through the draft gear of the vehicles, which are immediately following the power unit and it is therefore, necessary that such a draft gear should have sufficient strength to withstand the maximum pulling stress. The draft gears on the rear vehicle of the train is not subjected to as great a pull as vehicles at the head. But since no particular place can be nominated for the vehicle in train marshalling couplers and draft gears of all vehicles have to be designed to withstand maximum pull.

In case of passenger train, it has been noticed that maximum draw bar pull is not experienced at the time of starting of the train. But when there is application of brakes from the rear of the train i.e. by pulling of alarm chain from one of the rear coaches or by sudden application of the guard van valve.

b) Buffing action:

In railway operation vehicles may be subjected to buffing loads of varying intensities because of different operating conditions such as-

- Unequal retardation during emergency braking.
- Service application and release of brakes on long trains.
- Use of banking locomotives.
- Impacts during shunting and marshalling of vehicles particularly over humps.

The shocks in first three cases are normally of moderate intensity. The most severe type of buffing loads are encountered in the last mentioned case namely during hump shunting of Goods trains.

The purpose of the buffing gear interposed between the railway vehicles is to smoothen the shock during impact and to transmit a gradual load to the vehicle underframe.

Screw couplings have been used on coaches right since beginning. However they have limitations and so in future CBC couplers may replace Screw Couplings.

Letter No.97/M(C)/137/1 Vol.XI New Delhi dated 22.11.2016 has been issued by Railway Board to General Manager, Integral Coach Factory, Chennai and Rail Coach Factory, Kapurthala for Manufacturing of ICF Conventional Coaches with CBC.

And it has also been decided by Railway Board to Retro-fit all ICF coaches having Screw coupling with CBC with balanced draft gear vide Railway Board's letter No. 97/M(C)/137/1 Vol (XI) New Delhi, Dated. 20.01.17.

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