TRI-MOUNT BOGIE

WDM2, WDS5 & WDS6 Class broad gauge and YDM4 Class metre gauge locomotives supplied by Alco products Inc, U.S.A and the same classes of locomotives being built by the Diesel locomotive work are fitted with Alco’s TRIMOUNT Rigid bolster, Swivel type, three individually motored axle bogies. Requirements of WCG2 & WAM4A class loco / bogies which differ from the above mentioned loco / bogies are “Traction motors, driving gears, return shunts and earthing brushes. Each of the three driving axles is driven by a T/M 4939 AZ / TM 165 / m axle hung nose suspended traction motor”. The tri-mounts bogie (figure SK.DL-1473, In 2 sheets) consists of a single piece cast steel frame, which has a conventional bogie pivot (swivel bearing) carried in the cross member located between the leading and middle axles and two load bearers which are carried in cross member of the frame between the middle and trailing axles. The weight of the locomotive body is transferred to the bogie at the pivot and at the two load bearers to form a three-point support. The pivot carries approximately 60% of the vertical load and also receives and transmits traction and braking forces while the two load bearers share the remaining 40% of the vertical load. The load bearers are not designed to transmit any traction or braking forces. The effect of the off centre pivot and the concentric loading pads is virtually that a large diameter pivot (if a circle is drawn through the pivot centre and load bearers). This tends to minimise weight transfer due to tractive effort or braking force and maintain a higher factor of adhesion in service.

The construction of the pivot and loading pads is shown in SK.DL-2069. The cylindrical pivot liner which transmits traction and braking forces and the circular liner which receives the vertical load, are of medium carbon steel, the pivot bowl and loading pad oil pads are fitted with oil for lubrication of these liners. The oil pans are provided with dust shields. Resilient liners are provided between the foot of the loading pad and the bearing shoe. The lateral spacing of the pads affords stability against the tipping forces of the locomotive and the frictional resistance of the pads prevents nosing. Single stage suspension is used, consisting of long deflection helical springs, friction snubbers are fitted inside one nest of each group of springs. Location of snubbers in spring groups is shown in SK.DL-2211. The frame is supported by these springs on four sets of double equaliser beams as shown in SK.DL-1473. Full equalisation between adjacent wheels is obtained by suitably positioning the springs on the equaliser and controlling their working heights. Movable axle journal boxes are mounted in pedestals cast integral with the frame. Movement of the boxes in the pedestals obtains the lateral play for negotiating passage over curves and turnouts. Clasp brakes are provided on the broad gauge locomotives while single shoe brakes are provided on the meter gauge locomotives. A typical brake arrangement is shown in SK.DL-1478 for BG and SK.DL-3515 for MG.

Manually operated slack adjusters of palm type are fitted to take up wheel and brake shoe wear. The design features of this bogie oriented towards simplicity, the absence of the secondary suspension has resulted in a lowering of the centre of gravity while the 3 - point, widely spaced, loading helps to keep weight transfer to a minimum. Side equalisation is conducive to riding stability over indifferently maintained secondary tracks. This bogie is inherently suitable for freight and medium speed passenger operation. The bogies fitted on the YDM4A class of locomotives supplied by the Montreal Locomotive works differ as follows. "In addition to the swivel bearing about which the truck swings and which bears no vertical weight, there are three weight bearing pads, one on each side of swivel bearing and one larger one on the inboard transom carrying the balance of the cab load". The trucks are so positioned under the locomotive that the larger pad is located towards the centre of the locomotive. The pads thus form a three-point support, which carries the total load on each truck. The lateral spacing of the pads affords stability against the tipping forces of the locomotive on a curve, and the frictional resistance of the pads prevents nosing at high speed.
<table>
<thead>
<tr>
<th></th>
<th>Main data of Tri-Mount Bogie</th>
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<tbody>
<tr>
<td>1.</td>
<td>Length of locomotive</td>
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<tr>
<td>2.</td>
<td>Width of locomotive</td>
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<tr>
<td>3.</td>
<td>Height locomotive</td>
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<tr>
<td>4.</td>
<td>Weight of Dry Engine</td>
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<td>5.</td>
<td>Bogie Weight</td>
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<td>6.</td>
<td>Pivot pin load 60%</td>
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<td>7.</td>
<td>Side load bearer 40%</td>
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<td>8.</td>
<td>Axle load</td>
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<tr>
<td>10.</td>
<td>Wheel dia</td>
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<td>11.</td>
<td>Wheel dia</td>
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<td>12.</td>
<td>Axle journal dia</td>
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<tr>
<td>13.</td>
<td>Sus. Brg. Journal Clearance</td>
</tr>
<tr>
<td>14.</td>
<td>Axle box lateral play</td>
</tr>
<tr>
<td></td>
<td>a. End journal</td>
</tr>
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<td></td>
<td>b. Centre</td>
</tr>
<tr>
<td>15.</td>
<td>Piston travel</td>
</tr>
<tr>
<td>16.</td>
<td>Buffer Height</td>
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<tr>
<td>17.</td>
<td>Rail Guard Height</td>
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</tbody>
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Tri-Mount Bogie
Under-Carriage Divided In to three Major Divisions.


A - Main parts of the buffer beam

1. Both side Buffers.
2. C.B.C.(Centre Buffer Coupling)
3. Cattle Guards.
4. Foot Steps

B - Main parts of the Chassis

1. Fuel oil tank (Welded With Chassis)
2. Pivot Pin.
3. Side load bearer
4. Bolster Pin Clamps. 02 nos
5. Air duck boot base. 03 nos
6. Both sides fuel oil-filling cap. One nos each side
7. Both sides buffer beam. 02nos
8. Both sides stay rod-fitting base. 04 nos
9. Main reserve one no L/ Side and one no R/ Side
10 Add.C2 Relay Valve.
12. Air cut out cock both sides.
C - Main parts fitted on bogie frame (Front & Rear)

1. Three pair wheel fitted in each bogie
2. F/Bogie - 1, 2, 3  & R/Bogie - 4, 5, 6.
3. Gear case, three pair in each bogie.
4. T/M 3 nos. in each bogie.
5. In each bogie 08 no. Eq. beam fitted.
   i. Smalls Eq. beams on wheel no 1-2 & 5-6.
   ii. Big Eq. beam on wheel no 2-3 & 4-5.
6. Tie bar in each bogie 02 no.
7. Coil springs –
   i. Outer coil spring – 08 no.
   ii. Inner coil spring – 04 no.
   iii. Snubber coil spring- 04 no.
8. Brake cylinder base 02 no both Side
10. Both Side brake Hanger 02 nos each
11. Pull Rod "L" clamp – 08 nos. each Bogie

Load Distribution of WDM2 Locomotive

1. Locomotive Weight = 112.8 T
2. Bogie Weight = 23 T (Each)
3. Total weight of superstructure (Two bogies) = 112.8 - 46.00 = 66.80 T
4. Pivot pin 60% = 40.08 T
   = 20.04 T (Each)
5. Side Load Bearer 40% = 26.72 T
6. Axle Load = 18.8 T (Each) Axle
Safety fittings fitted in Tri-Bogie bogie

1. Dust guard for pivot pin & side of load bearer.
2. Buffer.
3. Cattle Guard.
4. Rail Guard.
5. Safety bracket for Air Main Reservoir.
6. "U" bracket for C B C.
7. Buffer lamp box.
8. Hand Brake Chain.
10. Equaliser beam safety bracket.
11. Pull Rod "L" clamp.
12. Gear case "L" clamp for Gear case M / Bolt
15. Bolster pin (Safety Lug).
17. Sealing of felt wick’s carrier plate bolt / screw.
18. Sealing of T / M cap’s dummy.
HIGH SPEED BOGIE, TWO-STAGE
FLEXI-COIL, MK-5, FARICATED BOX TYPE,
TWO-STAGE SUSPENSION, “H” TYPE BOLSTER, CO-CO TYPE

The bogie frame and bolster of flexi-coil MK-5 bogie are of fabricated box type, construction manufactured from steel plates to IS: 2062 Gr.- "C". The locomotive body weight is transferred to the bolster through a Centre pivot. The bolster rests on four pairs of helical coil- springs. The secondary spring seats are located outside bogie long beams to provide wider support base for bolster and reduce the bogie roll. The bogie frame is supported on the primary helical coil springs, which rest on either side of axle boxes. The Centre pivot is fitted with phenolic oil lubricated vertical and horizontal liners. Two lifting links, located diagonally opposite, engage or disengage bogie when installing or removing the bogie. The underarm and bolster are attached through safety interlock which is attached to the underside of the under frame and locked into the recesses of the bolster. The general arrangement of the bogie is shown in Fig.

Main Data of High Speed Bogie (WDP2)

1. Locomotive weight - 117 T
2. Complete Bogie weight - 25 T
3. Supersture weight - 67 T
4. Axle Load - 19.5 T
5. Primary Spring - 12 T
6. Secondary Spring - 08 nos
7. Primary Vertical Damper - 04 nos
8. Secondary Vertical Damper - 04 nos
9. Lateral Damper - 02 nos
11. Design Speed - 160 to 180 KMPH
12. Max. Adhesion - 29.25 %
HIGH ADHENSION, FARICATED BOX TYPE, 
TWO STAGE SUSPENSION, CO-CO TYPE BOGIE

This is a 3 - axle type bolster-less bogie with two-stage suspension, floating pivot and Uni.-Directional arrangement of axle huge nose suspended traction motors. Bogie frame is of straight and fabricated box type construction with three transoms to carry nose suspension. The general arrangement of bogie is shown in Fig.

The locomotive body weight is supported on bogie frame through four rubber side-bearers directly mounted on bogie side bears. Shims have been provided below outer side-bearers to distribute load on side bearers in a 60:40 ratio, 60% of the load being supported on side bearers adjacent to centre pivot and 40% of load at remaining two side bearers. Centre pivot does not take any vertical load and is used only for transfer of traction and braking forces.

The bogie frame in turn is supported on axles through helical coil spring mounted on equalizer beams. The equalizing mechanism consists of equalizers hung directly on end axle boxes and supported on middle axle box through a link and compensating beam arrangement. The equalizing mechanism enables achievement of equal axle loads on uneven track and reduces weight transfer at start.

**Main Data of High Adhesion Bogie (WDG2)**

1. Locomotive weight  
   - 123T

2. Complete Bogie weight  
   - 25T

3. Superstructure weight  
   - 73T

4. Axle Load  
   - 20.5T

5. Primary Outer Spring  
   - 08T

6. Secondary Rubber Spring  
   - 04 nos

7. Primary Inner Spring  
   - 08 nos

8. Primary Vertical Damper  
   - 04 nos

9. Secondary Lateral Damper  
   - 02 nos

10. Pinion & Bull Gear Ratio  
    - 18:74

11. Design Speed  
    - 100 to 110 KMPH

12. Max. Adhesion  
    - 40 %
Bogie of WDG2 Locomotive
INTRODUCTION OF HTSC BOGIE

The GT46 PAC locomotive is equipped with a modified HTSC (High Tensile Steel Cast) means for transmission of power to the rails. This bogie assembly supports the weight of the locomotive and provides the means for transmission of power to the rails. Unlike conventional rigid bogies, in which axles are held in parallel with each other, the HTSC bogie is designed as a powered “bolster less” unit. Although the bogie frame itself is rigid, the design allows the end axles to move or “Yaw” within the frame. This movement will allow the wheels to position themselves tangent to the rails on curves for reduced wheel and rail wear. Traction loads are transmitted from the bogie to the locomotive under frame though the carboy pivot pin assembly.

The bogie is designed for extended maintenance intervals with lateral thrust pads and plates at the journal bearings and brake rigging being the only friction wearing components on the bogie requiring periodic replacement. The bogie is equipped with two AC power traction motors and one unpowered idler axle. The traditional rubber suspension spring “nose packs” on the motors is replaced with nose link assemblies that increase ease of disassembly and lowering of traction motor/wheel srts for maintenance.

Main data of G/M Locomotive (WDG4) HTSC Bogie

1. High traction, High speed, three Axle, Independent driven Type Bogie.
2. Double Suspension
3. ‘U’ – cross section, Single Piece, Steel Cast bogie.
4. CO-CO type Wheel arrangement
5. Bolster less bogie
6. Total weight - 126T
7. Bogie weight - 21.47T (APP.)
8. Axle Load - 21.0T
9. Pinion & bull Gear ratio - 16:85
10. Starting adhesion - 42%
11. Designed speed - 100 to 110 KMPH
Main data of G M Locomotive (WDP4) HTSC Bogie

1. High traction, High speed, three Axle, Independent driven Type Bogie.

2. Double Suspension

3. ‘H’ Type Bolsterless bogie

4. ‘U’ – cross section, Single Piece, Steel Cast bogie.

5. Wheel arrangement (AO-AO-1, 1- AO-AO or BO – 1, 1 - BO)

6. Total weight - 117 T

7. Bogie weight - 25 T

8. Superstructure weight - 67 T

9. Axle Load - 21.0T

10. Pinion & Gear ratio - 17:90

11. Starting adhesion - 29.25 T

12. Designed speed - 160 to 180 KMPH
Top View of G/M Bogie Frame

Side View of G/M Bogie Frame
G/M Locomotive Bogie
The GT46PAC locomotive is equipped with cartridge type grease lubricated journal bearings. These cartridge type bearings are self-contained, pre-assembled, pre-adjusted, pre-lubricated, and completely sealed. The bearings are applied and/or removed without exposing the bearing elements, seats, or lubricant to contamination or damage.

The bearing element assembly is pressed on the axle as a completely sealed unit. It is retained on the axle by one end cap, which in turn is secured to the axle by three cap screws and a locking plate. A journal bearing adapter is used to locate the bearing assembly within the truck/bogie frame. The bearing adapter uses a full bore housing which must be clean and free of any dust, dirt, metal chips, and foreign material which could otherwise interfere with the proper seating of the bearing within the adapter.
The adapter serves to position the journal springs between the truck/bogie frame and the axle to transmit the vertical loads. It also provides the means to position and control the axle laterally within the frame, as well as longitudinal control through the attached traction rod.

Roller bearings should be given a visual inspection for the following;

- Signs of overheating
- Excessive lubricant leakage
- Broken, loose, or missing parts (such as loose cap screws, etc)
- Loose or defective seals
- Cracked or broken cups, end caps, or adapters, etc

If a seal can be removed with a suitable probe, the bearing must be removed from the axle for inspection and possible repair. Under normal operating conditions, running temperatures of approximately 56° C (100° F) may be expected. In this range simply placing a bare hand on the journal adapter can check the temperature. If the bare hand cannot be kept on the adapter for more than a few seconds, and if the bearing feels noticeably warmer than other bearings on the locomotive, the bearing should be checked further. This is accomplished by checking the outside face of the adapter with a temperature indicating crayon of 93° C (200° F) or with a direct reading pyrometer. If the bearing temperature is in excess of these figures, the bearing should be removed from service for closer examination.

In the event that one or more bearing end plate retaining cap screws are found loose or missing, the wheel, gear, axle and journal adapter should be removed from the truck/bogie assembly. The bearing should then be removed from the axle and a full inspection made to determine the cause and possible damage.

A small amount of bearing grease leakage around the seals may be expected during an initial run-in period. This leakage will eventually be reduced to a more normal "weeping". However, if a bearing appears to be leaking excessively, check for loose or damaged seals.

When locomotives equipped with cartridge type roller bearings are placed in storage, the hand brake should be set or the wheels should be chocked to prevent movement. It is not necessary to periodically move the locomotive to distribute the lubricant over the bearing surfaces as with older types.
# DIFFERENCE BETWEEN WDM2 & WDG4

<table>
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<tr>
<th>Sl. no</th>
<th>WDM2</th>
<th>WDG4</th>
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<tbody>
<tr>
<td>1.</td>
<td>WEIGHT</td>
<td>WEIGHT</td>
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<tr>
<td></td>
<td>- 112T</td>
<td>- 126T</td>
</tr>
<tr>
<td>2.</td>
<td>AXLE LOAD</td>
<td>AXLE LOAD</td>
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<tr>
<td></td>
<td>- 18.8T</td>
<td>- 21T</td>
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<tr>
<td>3.</td>
<td>PINION&amp;BULL GEAR RATIO</td>
<td>PINION &amp; BULL GEAR RATIO</td>
</tr>
<tr>
<td></td>
<td>- 18:65</td>
<td>- 16:85</td>
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<tr>
<td>4.</td>
<td>SPEED</td>
<td>SPEED</td>
</tr>
<tr>
<td></td>
<td>- 120KMPH</td>
<td>- 100KMPH/110KMPH</td>
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<tr>
<td>5.</td>
<td>ADHENSION</td>
<td>ADHENSION</td>
</tr>
<tr>
<td></td>
<td>- 27%</td>
<td>- 41%</td>
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<td>6.</td>
<td>SINGLE SUSPENSION</td>
<td>DOUBLE SUSPENSION</td>
</tr>
<tr>
<td>7.</td>
<td>CO-CO-TYPE-TRI MOUNT BOGIE</td>
<td>CO-CO TYPE BOLESTER - LESS BOGIE</td>
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<td>8.</td>
<td>SHOCK-ABSORBERS NOT FITTED</td>
<td>SHOCK-BSORBERS FITTED</td>
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<td>9.</td>
<td>TRACTION ROD NOT FITTED</td>
<td>TRACTION ROD FITTED</td>
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<tr>
<td>10.</td>
<td>RUBBER COMPRESSION SPRING NOT FITTED</td>
<td>RUBBER COMPRESSION SPRING FITTED</td>
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