

# CIRCULAR NO. 38-1-3

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## COMPLIANCE MARK APPROVALS FOR BRAKE SYSTEM SUB-ASSEMBLIES

### INTRODUCTION

1. ADR 38 makes provision for trailer manufacturers to perform calculations as a means of demonstrating that a trailer complies with ADR 38. These calculations must use data from approved sub-assemblies, that is, from sub-assemblies which have a Compliance Mark Approval. Compliance Mark Approvals will be issued to sub-assemblies which have been shown to comply with the requirements of ADR 38.
2. The sub-assemblies for which approval will be granted are:
  - (i) The control system (i.e. a combination of the air lines, valves, tanks etc).
  - (ii) The suspension system (i.e. a combination of springs, hangers, radius rods, equaliser beams etc).
  - (iii) The foundation brakes (i.e. a combination of drums, linings, S-cam, back plate, etc.)
  - (iv) The total trailer brake system (a combination of either the previous 3 sub-assemblies or the equivalent components).
3. Because sub-assembly approvals are based on tests conducted by the sub-assembly manufacturer, which are basically the same as the physical tests conducted for the trailer road test procedures, these tests will not need repeating by trailer manufacturers demonstrating compliance using the calculation procedures.

### MAKE, MODEL AND VARIANT DESIGNATIONS

4. The Make designation is the general name by which a range of sub-assemblies or equivalent parts made by a particular manufacturer is popularly known. It can but need not also be the name of the manufacturer.
5. The Model designation will be a particular name and/or code number by which the sub-assembly, any Variants of that base Model and alternatives to a Variant or base Model are to be identified for compliance purposes at least. It can but need not be the Model designation used for the manufacturer's internal reference. A change in Model designation will be required whenever there is a change which affects the characteristics of the sub-assembly with respect to compliance with ADR38 or which changes the relationship between "input" and "output" when the sub-assembly is considered as a "black box". Changes to service brake booster size, slack adjuster length, over slung or under-slung suspension may not change the Model or Variant. See Attachment 1.
6. Any change to a base Model whose nature is likely to affect compliance would require the creation of a Variant. In particular, any change of component or configuration of components, whose performance normally affects compliance, included in the parts list and installation instructions for a base Model will bring about a Variant. Changes to the

brake lining make, grade or size would require a change in Variant at least and possibly in Model as outlined above. The Variant Code will be a particular name and/or code number by which sub-assemblies of that Variant are to be identified for compliance purposes at least. It can but need not be used by the manufacturer for internal use. Components whose performances do not affect performance maybe changed without creating either a new Model or Variant. Changes of this sort are called alternatives to a Variant or base Model.

7. A new Model designation will be required for a Total Trailer Brake System Sub-assembly for any change in the range of values of GTMR, Total Trailer Axle Load, static axle load and wheelbase or centre of mass height (if applicable).

### **APPLICATION PROCEDURES**

8. An application for Compliance Mark Approval for trailer brake system sub-assemblies should be made, using Form VSB72, to the AMVCB. A submission of evidence of compliance with ADR38, using the appropriate annexes of Form CB 38, must accompany the application together with a copy of the documents to be issued with each sub-assembly. These documents are parts lists, a set of installation instructions and a list of the approved data. If the parts lists or installation instructions for a Variant and its alternatives are in any way different from those for the base Model, the documents provided with the application must clearly indicate the differences. See paragraph 17.

9. The AMVCB will use that submission of evidence to determine if the sub-assembly complies with the requirements of ADR 38. Form CB38 requires details of the sub-assembly and the results of the tests performed.

10. Form VSB72 (and Form CB38) requires a Manufacturer's reference number. Each application by a manufacturer must have a number which is different from that of any other application by that manufacturer and a different\* number must be used on each document or form relating to an application. A separate application must be made for each Make or Model of sub-assembly for which a Compliance Mark is required. Variants of a Model can be included in one application for that Model, or made separately at a later date by referring to the original base Model's application. The same provisions apply to application for approval of parts list alternatives.

11. When demonstrating compliance for a Variant it is permissible to refer to results of the tests conducted on the base Model in certain circumstances. If all the information in an Annex of CB 38 is common to the Variant and base Model then that Annex need not be resubmitted. Instead the manufacturer's reference number for that Annex and the VSB 72 to which it was originally attached shall be quoted in the second column of annex A of Form VSB 72.

12. A summary of the forms required in making an application for Compliance Mark Approval is at Attachment 1.

13. All correspondence and submissions of evidence to the Board in support of an application for Compliance Mark Approval is treated by the Board as confidential between the manufacturer concerned and the Board. However, the manufacturer may give written permission for the Board to release specific items of information to certain other named parties.

## **USE OF COMPLIANCE MARKS**

14. A Compliance Mark Approval will be issued for a sub-assembly Make-Model for which a satisfactory application has been made to the AMVCB. It will also cover Variants (to the base Model) for which the sub-assembly manufacturer has demonstrated that the Variant has exactly the same “input” to “output” characteristics, when considered as “a black box”, as the base Model does. The Approval will also cover parts list alternatives to Variants and base Models.
15. A Compliance Mark Approval issued by the AMVCB allows the sub-assembly manufacturer to distribute the sub-assembly Make-Model (and Variants) for which the Approval is issued, and its approved data, for use by trailer manufacturers. There will be a different Compliance Mark Number for each Make-Model.
16. The approved sub-assembly should be used only in its entirely complete form as described in the Application for Compliance Mark Approval and identified by the approved parts list. Each sub-assembly shall be made available with a copy of the approved data, installation instructions and a parts list. The Compliance Mark Approval is valid only if the sub-assembly is in its entirely complete form installed according to the sub-assembly manufacturer's instructions and all the conditions of Compliance Mark Approval are complied with.
17. It is important that the sub-assembly manufacturer identifies which Variant of the Make-Model and which alternative parts list is being supplied to the trailer manufacturer and provides the parts list and installation instructions appropriate to that Variant and alternative.
18. The sub assembly manufacturer will be responsible for ensuring that all the parts comprising the sub-assembly are supplied exactly as per the Compliance Mark Approval Application. The trailer manufacturer will be responsible for ensuring that the sub-assembly is installed exactly as per the sub-assembly manufacturer’s instructions.
19. The trailer manufacturer will use the approved data when completing the submission of evidence of compliance by calculation (Form CB38 Annex C).
20. An example of a set of Compliance Mark Approval documents is at Attachment 2.

## **38-1-3 ATTACHMENT 1**

### **SUMMARY OF FORMS REQUIRED TO APPLY FOR A COMPLIANCE MARK APPROVAL FOR ADR 38 BRAKING SYSTEM SUB-ASSEMBLIES**

VSB 72 -Application for Compliance Mark Approval for sub-assemblies of trailer brake systems.

This form is a formal application for Compliance Mark Approval for a sub-assembly Make-Model and Variants of that Model. The sub-assembly manufacturer must ensure that all sub-assemblies of that Make and Model comply with the requirements of ADR 38. This can be done by adequate control during manufacture to ensure that all sub-assemblies are as described in the application (including the submission of evidence).

Annex A to VSB 72 requires all documents for each ADR to be listed, quoting the manufacturer's reference number for each document or form. A separate list is required for each Variant. The document description in many cases will be such as 'CB38 Annex J' or similar. The second column in Annex A is for such cases as when a document submitted with a previous application is to be used for this application as well. Rather than send the document again it is necessary only to quote the manufacturer's reference number for that document and for the VSB 72 to which that document was originally attached.

CB 38 - Submission of evidence of compliance with ADR38.

This form is split into Annexes A to M. Only those Annexes applicable to the particular application require completing and returning. The table on sheet 2 of CB38 shows which Annexes are required for each case.

CB 38

Annex E. This lists results of water performance tests. Annex E is used for Foundation Brake System sub-assembly approvals. The Foundation Brakes shall be tested at the claimed GALR. Physical tests are not required where the foundation brakes are the same as used by the manufacturer on a previously approved sub-assembly. In this case the results for that approval are used.

It is important to note that any change in friction materials requires an additional physical test.

The results from one physical test may be referred to in several applications providing that either the results have been submitted previously; or that all the applications, including the one containing those results, are submitted together.

If a water performance laboratory test is to be it must be approved by the Administrator prior to submitting test results. Refer to Circular No. 38-1-6 for details on water performance laboratory test approvals.

### 38-1-3 ATTACHMENT 1

CB 38

Annex F. This lists results of time response tests. Annex F is used for Control System sub-assembly approvals. The Control System shall be tested at the maximum actuator volumes. Time response tests are not required for hydraulic brake systems. Physical tests are not required where the control system (either as a sub-assembly or as part of a trailer) to be approved is considered to be the same as a previously approved control system (either as a sub-assembly or as part of a trailer). Refer to Annex E, Part B. In this case test results for the approved control system are referred to in the same manner as described for Annex E above.

Where the control system is of a modular construction it is permissible (for time response purposes) to remove a complete module providing all the questions in Annex F Part B can still be answered 'Yes'. However it is important to bear in mind the other design requirements for the control system which are covered in other Annexes. In certain circumstances an answer of 'No' to a question in Part 8 may not require additional tests to be performed providing it is still possible to demonstrate that the modified system complies with respect to time response. For example, an answer of 'No' to question (ii) and an answer of 'Yes' to question (iii) indicate that the time response is unaltered or improved. In these cases a new Variant, at least, will be required.

CB 38

Annex G. This lists data and descriptions of the Suspension System Sub-assembly and results of skid limit tests.

Board Circular 38-2-2 details the test procedures for skid limit tests. Skid limits are required to ensure that the calculations performed in Annex C are not invalidated by conditions which would result in wheel lock-up in a road test.

It is fundamental to the use of skid limits that the foundation brakes used for the skid limit tests are calibrated (i.e., the relationship between the output torque and input Control Signal to the brake actuator is known).

Any change to the Suspension system which would result in changes to the skid limits requires the creation of a new sub-assembly Model.

CB 38

Annex H. This lists data and descriptions of the Control System Sub-assembly and the results of physical tests. Design requirements are also checked.

### 38-1-3 ATTACHMENT 1

The design maximum actuator volume requested is the maximum actuator volume for which the Control System is designed. The service brake actuators do not necessarily form part of the Control System. Where they do, a range of sizes may be shown on the circuit details and parts list providing the time response tests were conducted using the design maximum actuator volumes. Spring brake chambers; or other emergency or parking brake actuators, will always form part of the Control System and only one size or part number may be used unless the value of 'A' (the input to the Emergency and/or Parking Brakes) is the same for all these actuators.

The value of 'A' shall be stated as the equivalent Control Signal, in E, for a stated brake actuator area (or equivalent). For example a pushrod output of 4000 Newtons could be stated as 0.32E for a 193 cm<sup>2</sup> (type 30) actuator.

Where the value of 'A' is dependant on stroke, in spring brakes for example, the value of A shall be stated as an expression in terms of the stroke, S, of the actuator pushrod in millimetres.

For example  $A = (0.32 - 0.004 \times S) E$  for a 193 cm<sup>2</sup> actuator.

Similarly, where the Supply Line energy level at which the Emergency brakes start to apply (Emergency brakes cut-in level, L), required in Annex H, is dependant on stroke this value shall also be given as an expression in terms of the stroke S. For example, Emergency brakes cut in level,  $L = (0.58 - 0.0062 \times S) E$ . Note that this energy level is the Supply Line energy level. The effects of any valves between the Supply Line and the actuator must be taken into account.

If the relationship between the value of 'A', or the Emergency brakes cut-in level, L, and stroke is not linear it may be acceptable to ignore minor variations from linear. In this case a graph of the relationship shall be provided as an attachment. It shall also show the assumed linear relationship.

It is expected that Annex F be completed and returned in support of the time response measurement in Section 5.

Any changes which alter the type of actuation, the Control System ratio (C), the input to the Emergency/Parking Brakes (A) or the Emergency Brake Cut-in level (L) will require a new sub-assembly Model.

Any other changes, except a decrease in service brake actuator volume may require a new Variant to be created. After any changes it will be necessary to demonstrate the effect of these changes and that all the questions in Part B can still be answered "Yes".

### 38-1-3 ATTACHMENT 1

CB 38

Annex I. This lists data and descriptions of the Foundation Brake System Sub-assembly and results of the physical tests performed. The figure for GALR is the maximum axle loading at which the foundation brakes can comply with all the performance requirements of ADR38. Tests for output torque and brake fade may be conducted either by using a dynamometer or by road test. The applicable Annexes must be completed and returned.

Annex E is always to be returned.

Any changes which decrease the GALR or which alter the output torque per unit Control Signal (T), or the ability to pass the fade or water performance tests will require a new sub-assembly Model. Brake actuators and actuating arm lengths are not part of the Foundation Brakes, but their sizes will form part of the approved data.

Other changes may require a new Variant to be created. Any change in friction materials will require a new Variant (or a new Model as outlined above) and retesting.

CB 38

Annex J. This lists results of dynamometer testing used in providing results for Annex I. It is permissible to conduct tests for only service brake effectiveness, or for only brake fade, using the applicable sections of Annex J. Whenever Annex J is used Section 3 must be completed.

CB 38

Annex L. This lists data and descriptions of the Total Trailer Brake System Sub-assembly. If approved sub-assemblies are being used then compliance may be demonstrated using Annex C. If approved sub-assemblies are not being used then the appropriate physical tests must be performed. It is permissible to either conduct the tests appropriate to each constituent sub-assembly (and then perform calculations using Annex C) or to conduct a series of road tests. Whenever a range of values (e.g. GTMR) is claimed for the Total Trailer Brake System Sub-assembly, tests or calculations must be carried out for each extreme (worst case) combination of values in the range(s). For example, on Dog Trailers with a range of centre of mass heights and wheelbases, the extremes would be: high height/short wheelbase; low height/long wheelbase.

Any change that requires a new Model or Variant for any one of the constituent sub-assemblies also requires a new Variant of Total Trailer Brake System Sub-assembly. It is necessary to demonstrate that the Variant has the same range of values as the base Model. However, any change in the range of values listed in Annex L, the number of axles or trailer category will require a new sub-assembly Model.

### **38-1-3 ATTACHMENT 1**

CB 38

Annex M. This lists details and calibration procedures for all test equipment used to perform tests. Laboratory includes test tracks.

Only one Annex M is required for several applications which are submitted at the same time if that Annex M covers all the test equipment used in conducting the tests described in the applications.

## **38 1-3 ATTACHMENT 2**

### ATTACHMENT 2 TO CIRCULAR NO. 38-1-3

#### Compliance Mark Approval - A Typical Document

### **38-1-3 ATTACHMENT 2**

AUSTRALIAN MOTOR VEHICLE CERTIFICATION BOARD Comprising Commonwealth, State and Territory

Authorities

Secretariat  
AMVCB  
P.O Box 293  
CIVIC SQUARE ACT 2608

### **COMPLIANCE MARK APPROVAL**

The Australian Motor Vehicle Certification Board (hereinafter called the Board) hereby approves the use by the Company named and described in Schedule 2 hereto (herein after called the Company) of a Compliance Mark Approval Number for the Sub-assembly described in Schedule 3 hereto (hereinafter called a specified Sub-assembly).

In this Approval, a reference to an Australian Design Rule is a reference to a Rule endorsed by the Australian Transport Advisory Council as set out in 'Australian Design Rules for Motor Vehicle Safety' issued by the Commonwealth Department of Transport.

This Approval may at the discretion of the Board be cancelled or suspended at any time.

This Approval is issued subject to the following conditions:

1. The Company shall not use the approved Compliance Mark Approval Number for a Sub-assembly that is not the specified Sub-assembly.
2. The Company shall not use for a specified Sub-assembly a number purporting to be a Compliance Mark Approval Number that is not the approved Compliance Mark Number.
3. The Company shall not without the prior approval of the Board use the approved Compliance Mark Approval Number for a Sub-assembly which is in any way different from the specified Sub-assembly as described in the final format of the application for this Approval. 'The application' includes reports and other documents relating to the application.
4. The Company shall by detailed quality control and test ensure continuing compliance of the specified Sub-assembly with such of the Australian Design Rules mentioned in Schedule 1 hereto.
5. The Company shall maintain records of detailed quality control and test documentation.
6. The Company shall permit the Board or its agent to have reasonable access to its plant for inspection of manufacture, assembly and test, and for examination of records.

7. The Company shall carry out, to the satisfaction of the Board, any additional tests required by the Board for the purposes of demonstrating compliance with such Australian Design Rules mentioned in Schedule 1 hereto.
8. The Company shall not use the approved Compliance Mark Approval Number for the specified Sub-assembly on or after the implementation date for a new Australian Design Rule applicable to the specified Sub-assembly.
9. The Company shall pay to the Department of Transport the prescribed charges for Compliance Mark Approvals.

SCHEDULE 1

Date of Issue

No. 38 - Heavy Trailer Braking Systems.

**38-1-3 ATTACHMENT 2**  
**COMPLIANCE MARK APPROVAL**  
 No. 123 SS2/50000  
 Make and Model: DELTA ZS-350

Schedule 2

Beta Transport Parts Pty Ltd. P.O. Box 14Bx2, Melbourne, VIC 3001.

Schedule 3

Delta ZS-350, Tandem Axle Suspension System.

Signed for and on behalf of the

Australian Motor Vehicle Certification Board

.....*Signed*.....  
 (Chairman)

Date: *30th Aug*..... 19 *83*

DATA SHEET - SUSPENSION SYSTEM SUB-ASSEMBLY

Complete CB 38 and its appropriate annexes before proceeding.

Complete the following tables, indicating with a 'X' where appropriate.

Make .DELTA.....  
 Model .ZS-350.....  
 Variant Code(s) .-----  
 .....  
 .....  
 .....  
 .....

Suspension System Compliance mark Approval Number (to be inserted by the Board).....123SS2/50000.....

State whether the suspension is:

Brake reactive  Non-brake reactive

SKID LIMITS (for brake reactive suspensions only)

1. For Suspension installed on other than Piggy Back Trailer with hinged drawbar.

Emergency or Parking Skid Limit Values

	AXLE							
	3		4		3		4	
	10.30	10.30	---	---	---	---	---	---
	9.84	9.84	---	---	---	---	---	---
			---	---	---	---	---	---
			---	---	---	---	---	---
Service Skid Limit Values								
	From	To	From	To	From	to	From	to
Skid Limits	0.85	1.0	1.0	1.0	---	---	---	---

APPROVED  
 DATE 30/9/83  
 APPROVAL NO. 123SS2/50000  
 AMVCB

2. For Suspension installed on Pig Trailer with hinged drawbar

Emergency or Parking Skid Limit Values

	AXLE							
	2		3		4			
Service Skid Limit Values								
	From	To	From	To	From	to	From	to
Skid Limits								

AMVGB APPROVED  
 APPROVAL NO. 123554 / 5000  
 DATE 3/9/87

38-1-3 ATTACHMENT 2

Beta Transport Parts Pty Ltd  
 Compliance Mark Approval No: 123 SS2/50000  
 Make and Model: Delta Z5-350

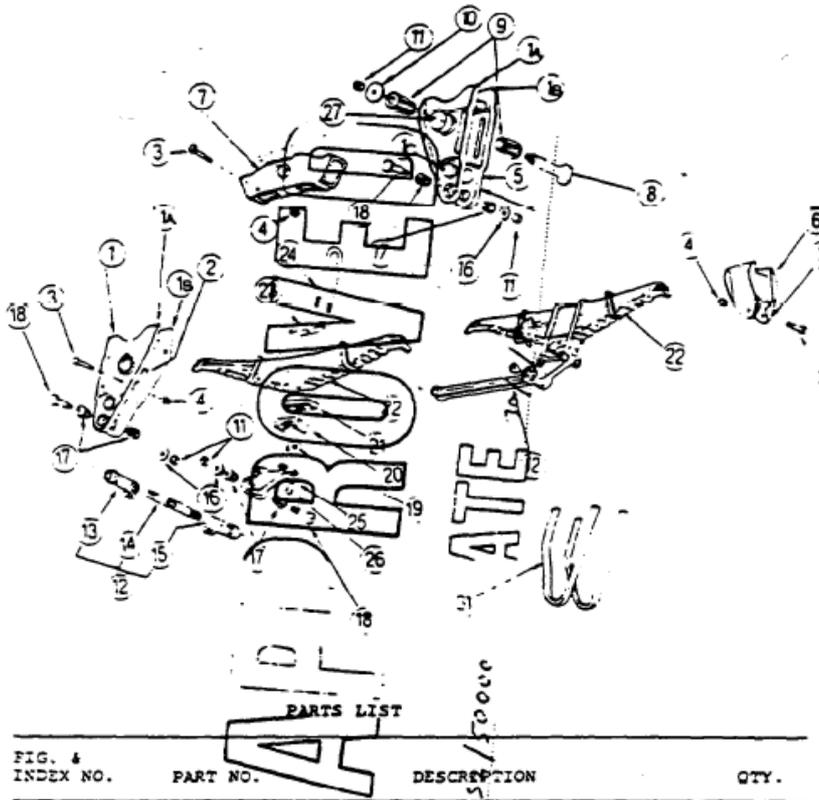


FIG. & INDEX NO.	PART NO.	DESCRIPTION	QTY.
- 1	134089	Hanger, Front	2
- 1A	129143	Sideplate	4
- 1B	156820	Sideplate	4
- 1C	329740	Boss	8
- 2	177234	Web Plate	4
- 3	186605	Bolt	4
- 4	149721	Nut	4
- 5	154512	Hanger, Equaliser	2
- 6	186605	Hanger, Rear	2
- 7	148129	Equaliser	2
- 8	152332	Bolt, Equaliser	4
- 9	172141	Bush, Equaliser	4
- 10	138226	Washer, Equaliser	2
- 11	328789	Nut	10
- 12	138222	Radius Rod, Fixed	2
-	142188	Radius Rod, Adjustable	2
- 13	156987	Radius Rod End	2
- 14	117912	Rad. Adjustable	2
- 15	184171	Radius Rod End	2
- 16	175567	Washer, Radius Rod	8
- 17	127689	Bush, Radius Rod	16
- 18	144599	Bolt, Radius Rod	8
- 19	158111	Spring Saddle Reinforcement	8
- 20	117288	Chair Spring	4
- 22	118922	Spring Coil Leaf	4
- 23	421899	Saddle	4
- 24	321445	'U' Bolt	8
- 25	219001	Washer, 'U' Bolt	16
- 26	200100	Nut, 'U' Bolt	16
- 27	406980	Boss	4
- 28	149222	Hanger Bands	8
- 29	186001	Axle Brake	4

38-1-3 ATTACHMENT 2

Beta Transport Parts Pty. Ltd.  
Compliance Mark Approval No. 123 SS2/50000  
Make and Model : Delta ZS- 350

INSTALLATION INSTRUCTIONS

(1) GENERAL.

All multi point (torque rod) trailer suspensions are designed to have the hangers mounted in a horizontal plane. When the hangers are being fitted, compensation must be made for any slope in the trailer, otherwise incorrect geometry of the torque rods or rockers will result in unequal load distribution on the axles [See diagram 'A'.]

Diagram 'A'.



(2) FITTING HANGERS TO THE TRAILER FRAME.

Accurate location of the spring hangers in any suspension is essential as this determines the correct tracking of the trailer. All location measurements must be taken from the centre of the quick release king pin or from the centre of the turntable. When laying out the suspension, measure from the king pin or turntable centre to the desired point of the axle or bogie centre and ensure that both main members are marked at an equal measurement from the king pin or turntable. [See diagram 'B'.]

All spring hangers are designed to be welded to the trailer or sub-frame. The material is cast steel. Welding should be carried out using low hydrogen electrodes.

It is essential that two, approx. 1/2" wide backing strips (thickness to suit) be inserted between each suspension bracket and trailer frame [See diagram 'B'], so that sufficient weld can be obtained along each side of the bracket.

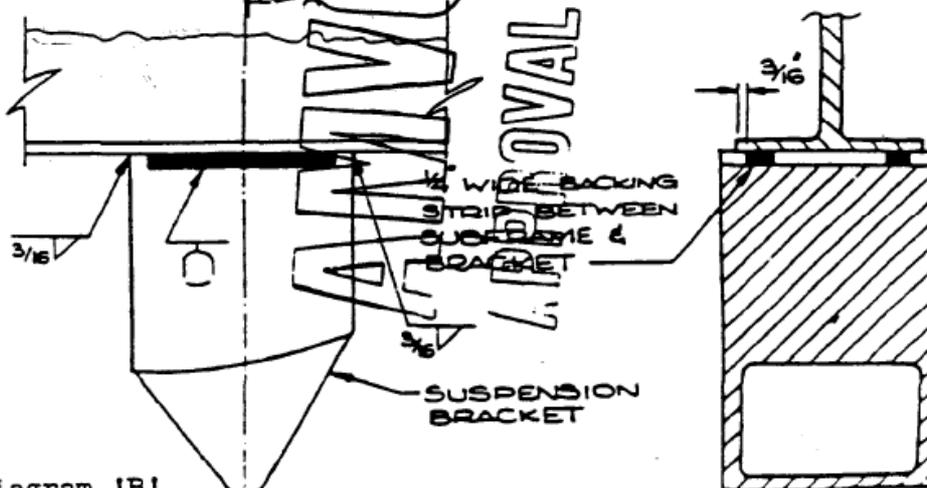
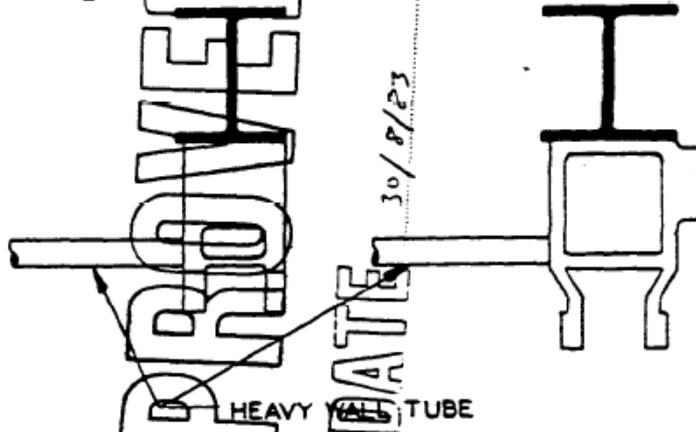


Diagram 'B'.

38-1-3 ATTACHMENT 2

The brackets should be tacked to the frame and then checked again before the final welding is carried out. If suspensions are mounted on a separate sub-frame, ensure that the sub-frame is correctly aligned by measurement from king pin or turntable centre to centre of suspension - not to front edge of sub-frame. For trailers with torsionally stiff frames, e.g. lowloaders, pantechinons and special purpose trailers, it is essential that a bracing tube or channel be welded between the front spring hangers of all suspensions and between the equaliser brackets of all multi-axle suspensions. [See diagram 'C-1'.]

Diagram 'C-1'.



30/8/23

HEAVY WALL TUBE

3" x 1-1/2" M.S. channel is also suitable in lieu of the heavy wall tube.

For flat-top semi-trailers it is recommended that the cross tubes be replaced with gussets. [See diagram 'C-2'.]

Diagram 'C-2'.



APPROVAL NO. 123552/5000

NO X-MEMBER IN POSITION OF HANGER

X-MEMBER AVAILABLE AT HANGER

(3) SUSPENSIONS.

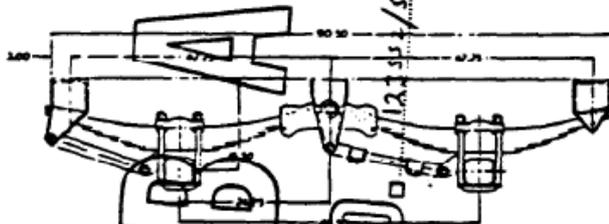
i. Overslung Suspensions.

Positioning of the hangers in relation to the marked centreline of the single axle or the bogie is carried out as follows:-

TANDEM AXLE: Locate the equaliser bracket with its centre at the bogie centre you have marked on the trailer main members. Then mount the front and rear spring hangers with their centres  $42\frac{1}{4}$ " ahead and  $42\frac{1}{4}$ " behind the equaliser bracket centreline respectively. [See diagram 'E'.]

TANDEM AXLE TRAILER SUSPENSIONS

Diagram 'E'.

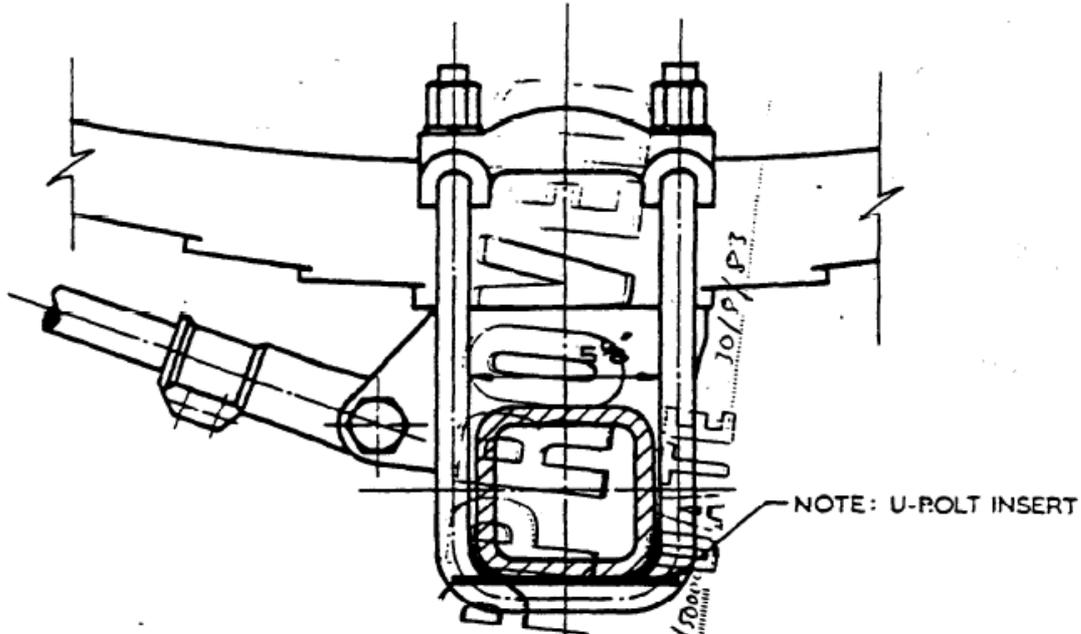


(4) CORRECT FITTING OF AXLES.

axles with square section beams are cambered in the stubs and therefore have straight ~~to~~ beams. Thus it is not necessary to shim the spring seats to ensure that the upper seat surface is horizontal. These axles must always be fitted with the cam shaft below the axle centreline and with the brass name plate on either the front or rear face of the axle beam with the ~~spring~~ fitting the correct way up.

axles with round section beams are not cambered and can therefore be mounted in the suspension with the cam shafts in any position.

Diagram 'K'.



(5) ASSEMBLY.

Assemble the springs loosely to the axles (use U-bolt insert if required) and the torque rods to the axle saddles. At this stage do not tighten any nuts. Assemble the springs/axles/torque rods to the hangers and ensure that the correct operating height of the suspension is achieved by allowing the weight of the trailer to rest on the suspension. This is most important as, by setting up in this manner, the torque rod bushings will be tightened without any "built-in" wear loading. This will avoid any premature rubber bush failure.

When the suspension has been fully assembled the U-bolts should be lightly tightened and the torque rod bolts fully tightened to 175-200 ft. lb. Torque rod end clamping bolts should be tightened to 25-30 ft. lb.

NOTE:- The torque rod on the kerbside of the first axle should be the fixed (non-adjustable) rod. If a tandem or tri-axle suspension is used, the fixed torque rods should be alternated from one side of the axle to the other in relation to adjacent axles.

(6) FINAL ALIGNMENT CHECK.

Ensure that all axles are centrally spaced across frame. Carry out a final check of axle alignment by measuring from king pin or turntable centre to machined edge of brake drums (on single axle units and on the front axle of tandems) and then measure from machined edge of drums on front axle to similar point on rear axle to ensure that multi axles are aligned with each other. (For details see diagram 'L'.) If tyre carriers make direct measurement from king pin difficult, drop a plumb line from the king pin or turntable centre to a point on the floor and measure from there. Adjust alignment with adjustable torque rods and then make sure that clamp bolts on adjustable ends are tightened.

