SERVICE BULLETIN QUA/03/001

(QUASAR AMUSEMENT RIDE)

SEPTEMBER 1988

In response to reports of cracking in the vicinity of weldments on the *Quasar lower lifting frame*, it has been deemed prudent in the interests of public safety to initiate remedial action.

After examination and assessment it has been concluded that the cracking is fatigue initiated due to the presence of geometrical discontinuities in the vicinity of the tensile fibres of the main side members and forward crossmember.

These discontinuities in the form of weldments and square profiled pipe slot produce local stress concentrations and initiate cracks in the tensile fibres.

To obviate and prevent further occurence of these phenomenon the following modifications to the lower lifting frame are to be carried out.

1. Bracing gussets to connect side members, crossmembers and lower plate. This will reduce moment arm on sidemembers and increase torsional stiffness, thus reducing stress levels and stress range in this vicinity.

2. Stiffening plate on underside to lower neutral axis and increase section modulus on tensile flange of sidemembers in the XX plane. This will also increase torsional stiffness and bending stiffness in the YY plane.

3. Modification to the profile of pipe slot in forward crossmember by radiusing the ends of slot, thus removing the local stress concentration present at the upper square corners of the original slot.

These modifications are designed to reduce the stress ranges incurred by the lower frame members when in bend and axial tension. This will greatly increase the number of loading events that may be sustained by the structure and thus increase its useful life in fatigue terms.

It was decided to position the stiffening plate on the underside of the structure, i.e. the compression zone because there is a zero risk of initiating any further cracks in the vicinity of its weldments. It is also bad practice to cover up existing cracks because of the risk of them propagating unseen below this plate. Also there is a risk of initiating further cracks in the vicinity of the new weldments, especially at the ends of intermittent welds.

For the above reasons it was deemed prudent to position the stiffening plate on the underside while recognising that it is less effective in the tensile zone than would be the case if it were positioned on top of the structure.

The above modifications are to be carried out on all rides not later than five years after commencement of operational use.

MODIFICATION PROCEDURE

1. Repair any existing cracks in the top of sidemembers by grinding out to full depth and butt welding with a full penetration single 'V' butt weld.

   These welds to have a root run by manual metal arc using a 5mm low hydrogen electrode. Remainder of weld may be by manual metal arc or M.I.G.

   After completion of weld, grind down flush with surface of member giving a smooth crack free surface.

2. Repair any existing cracks in crossmember located at the top corners of pipe slot by drilling a 10mm diameter hole at the upper end of cracks as depicted on page 6. No further action is required.

3. Modify shape of pipe slot as depicted on page 6. Remove any drag lines from flame cutting and grind smooth.

   Weld pipe slot flange part no. QUA/01/4 into position as depicted on pages 7 and 8.

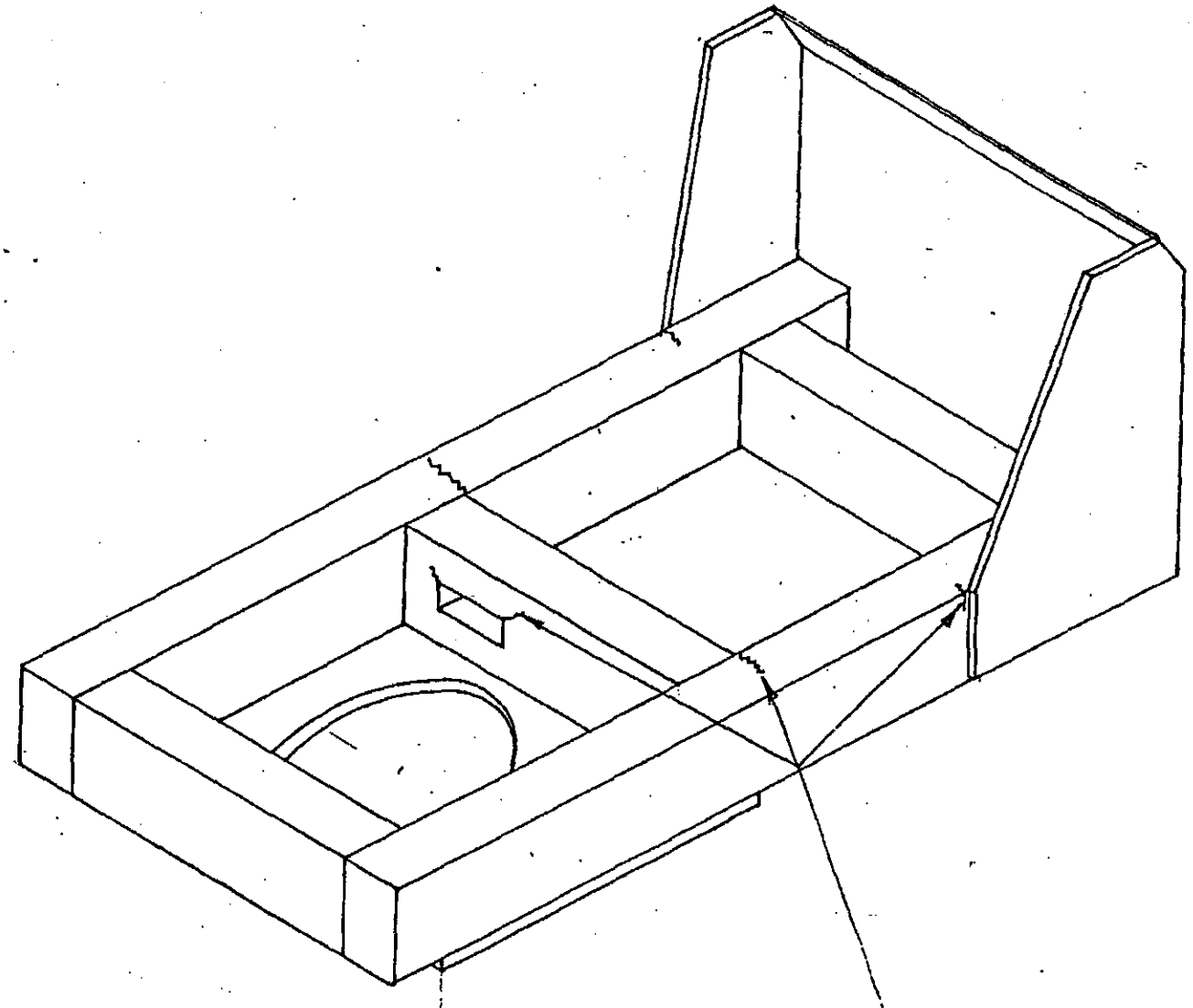
4. Weld lower stiffening plate into position. Weld type as depicted on pages 11 and 12.

5. Weld gussets in the vicinity of pipe slot into position, part no. QUA/01/2 and QUA/01/3. Weld joint type and corner detail as depicted on pages 5 and 12. Weld remainder of gussets in position. Part No. QUA/01/1.

6. The weld connecting the sideplates to the top of sidemembers is to be ground flush with top surface of sidemembers for the last 150mm of its length. See pages 10 and 12.

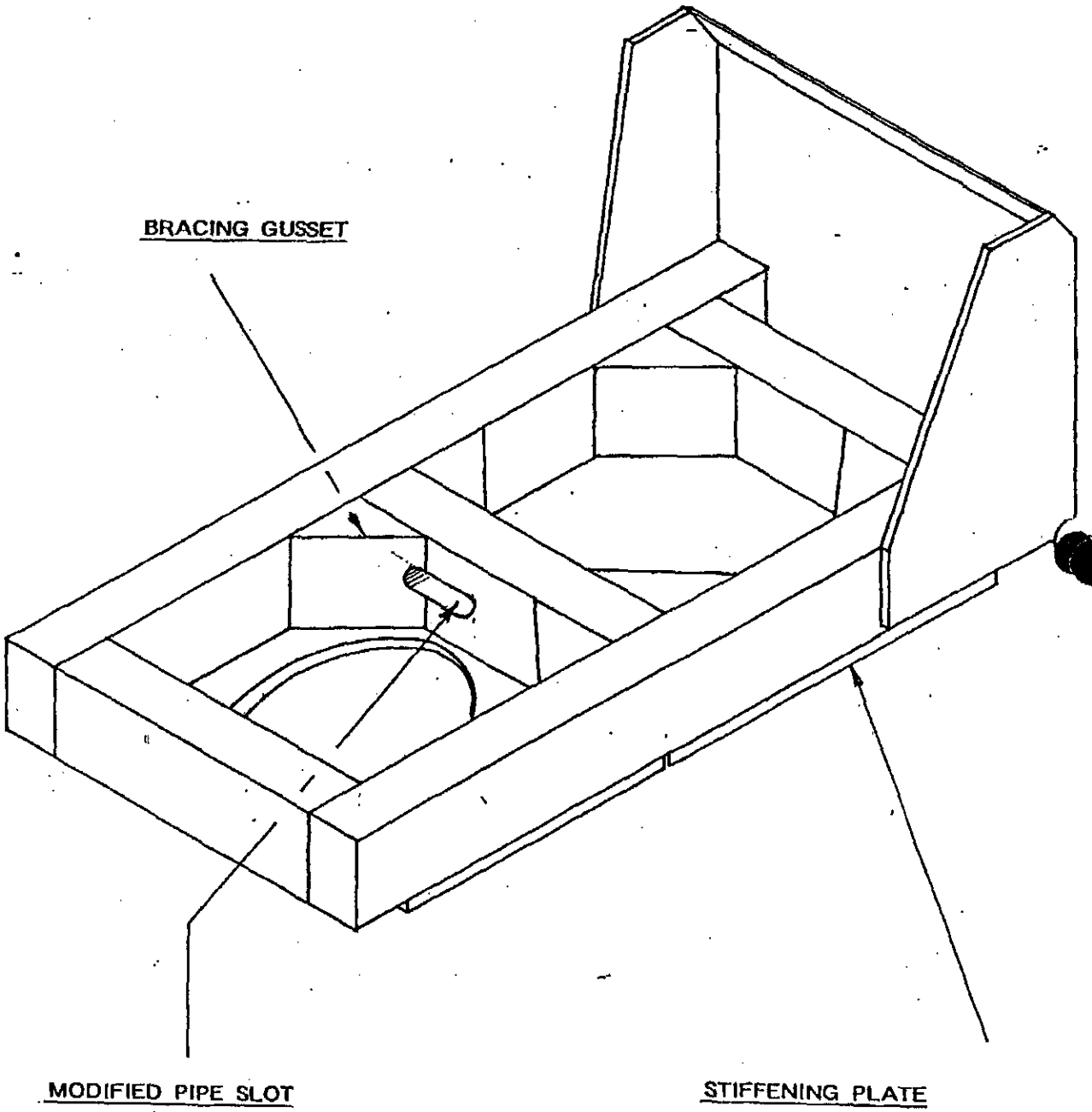
   The vertical weld connecting end of sideplates to side of sidemembers is to be ground out to give a weld prep for the first 150mm of its length. Weld type and corner detail as depicted on pages 10 and 12.

ORIGINAL CONSTRUCTION

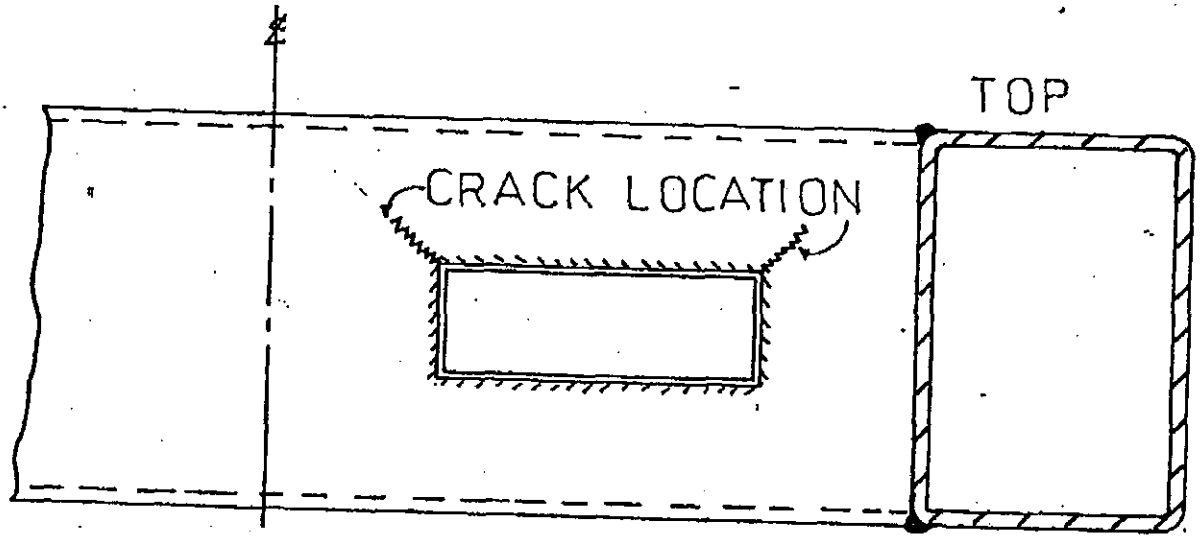


POTENTIAL CRACK LOCATION

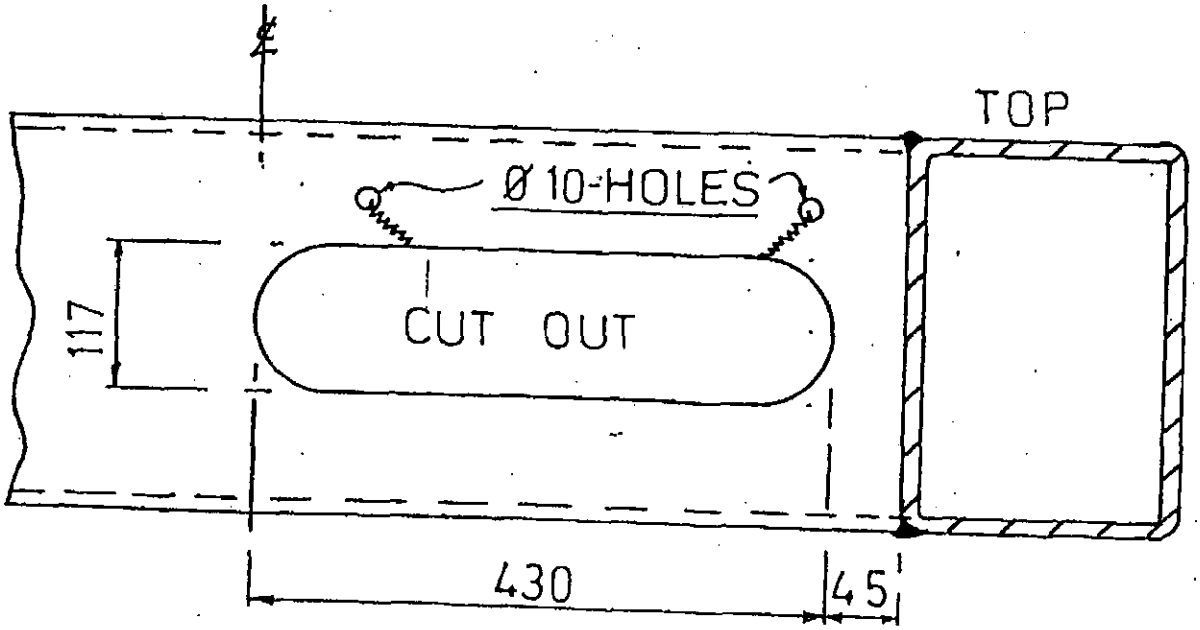
MODIFIED CONSTRUCTION



PIPE SLOT DETAIL

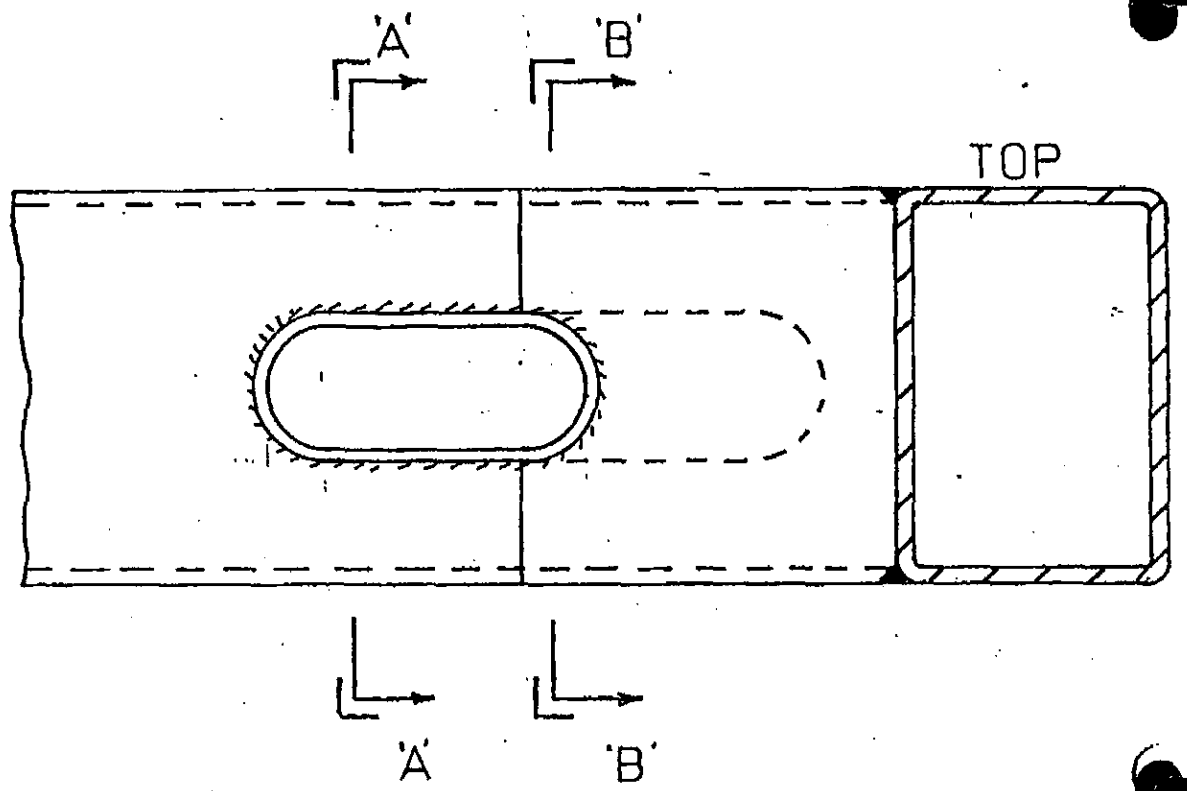


ORIGINAL PIPE SLOT

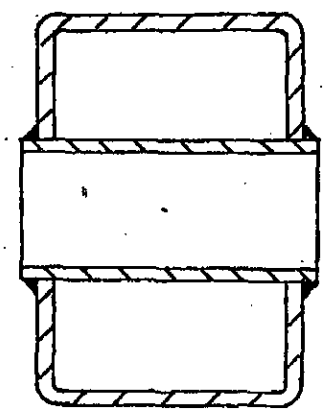


MODIFIED PIPE SLOT

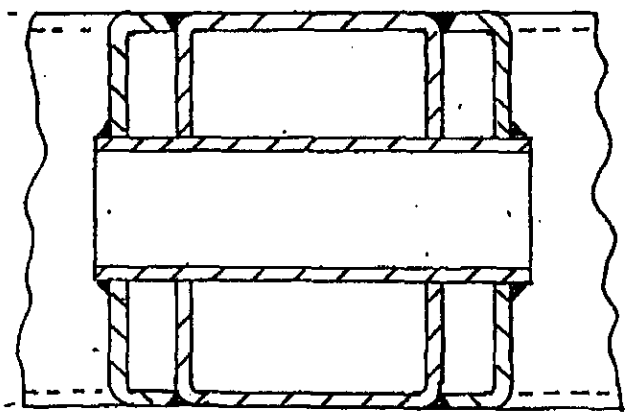
MODIFIED PIPE SLOT



FRONT ELEVATION

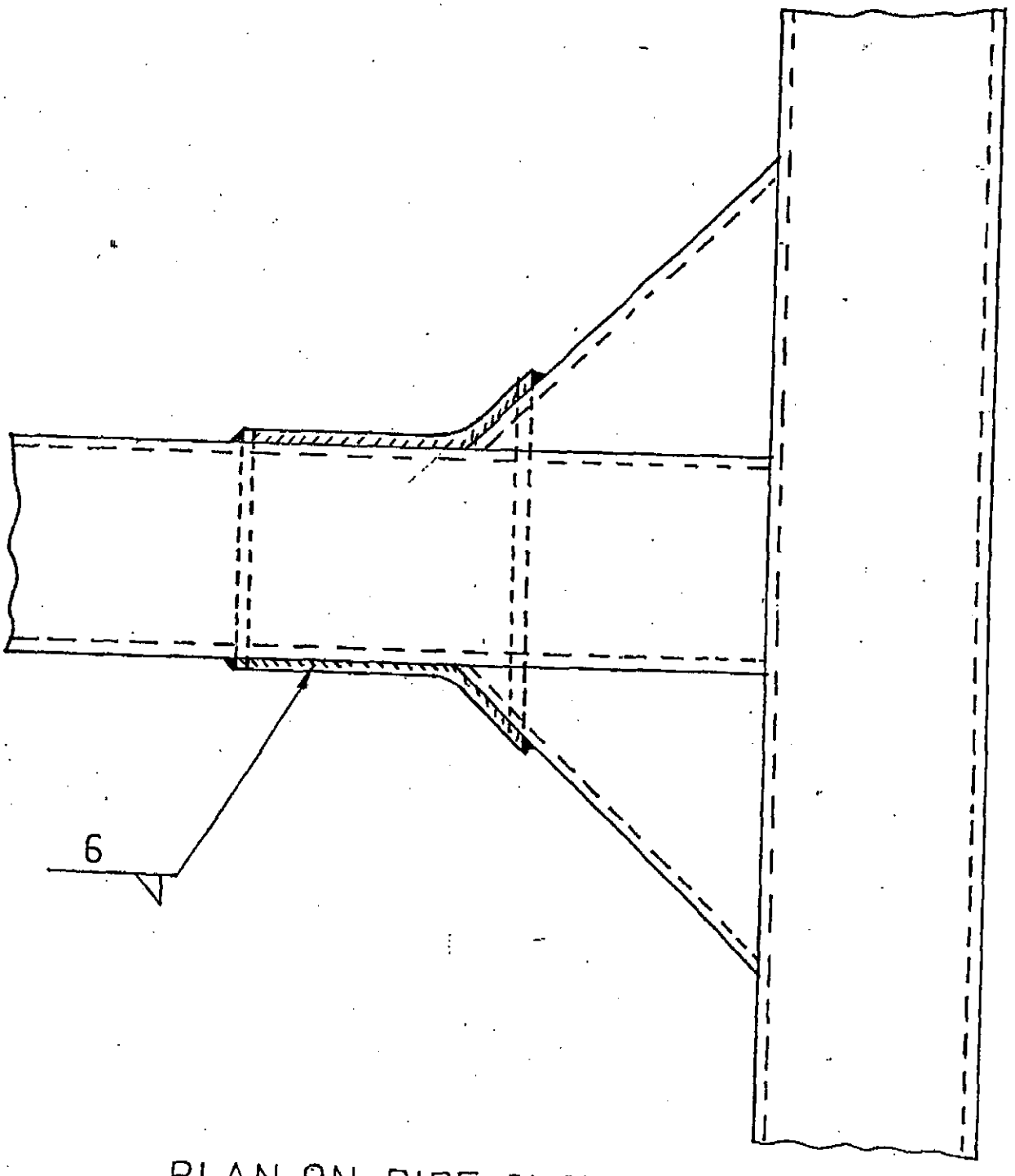


SECTION A-A



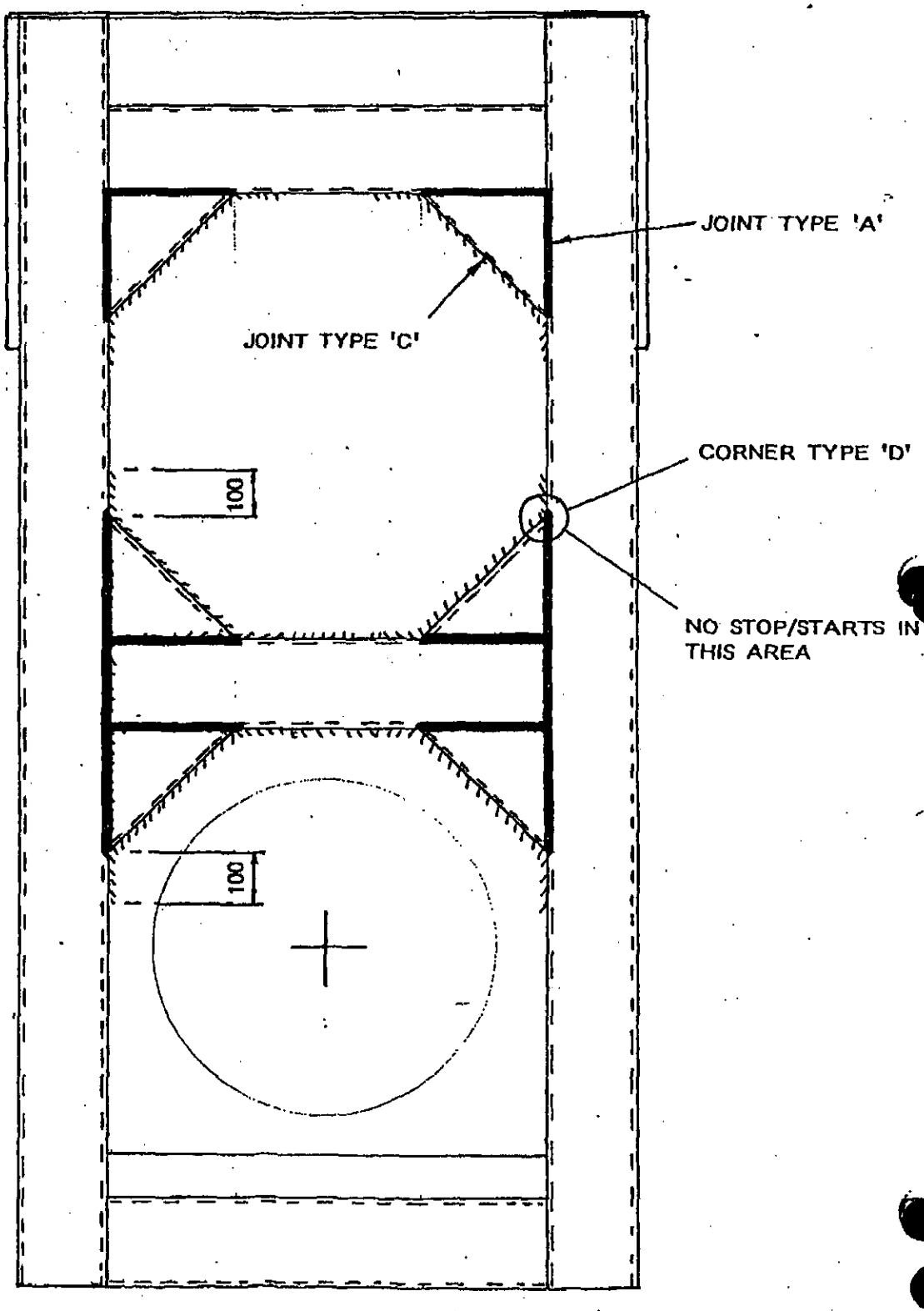
SECTION B-B

MODIFIED PIPE SLOT



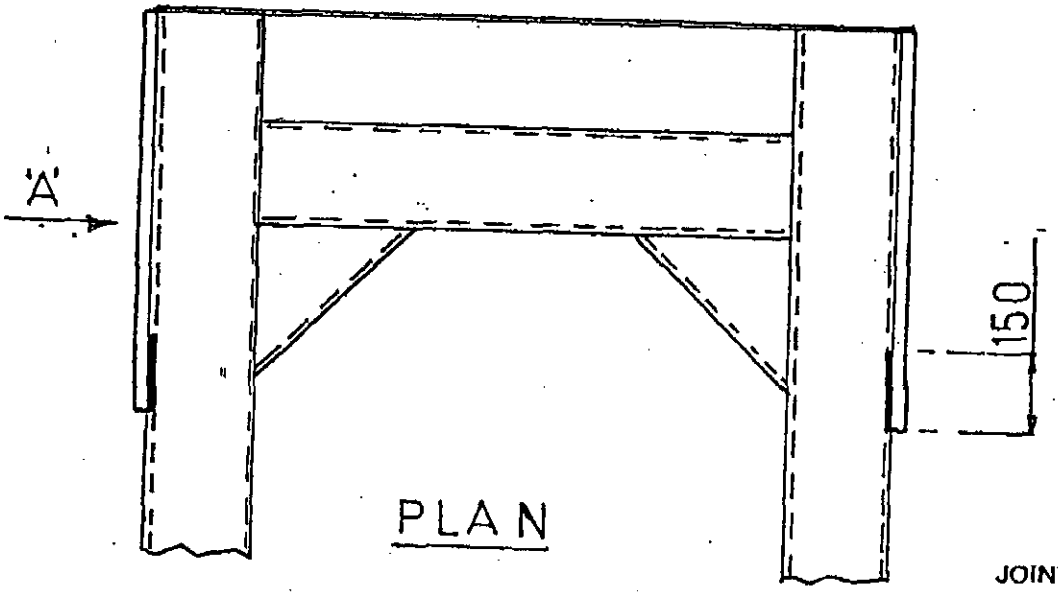
PLAN ON PIPE SLOT

WELDING DIAGRAM (LOWER FRAME)



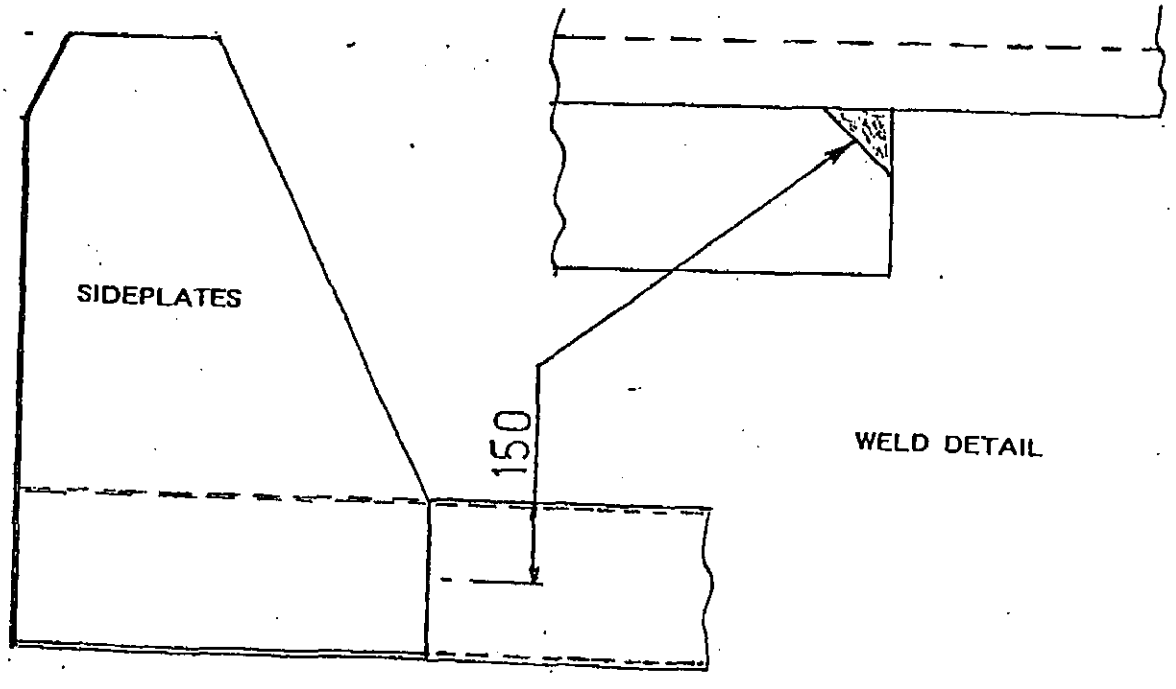
PLAN

WELDING DIAGRAM (SIDE PLATE)



PLAN

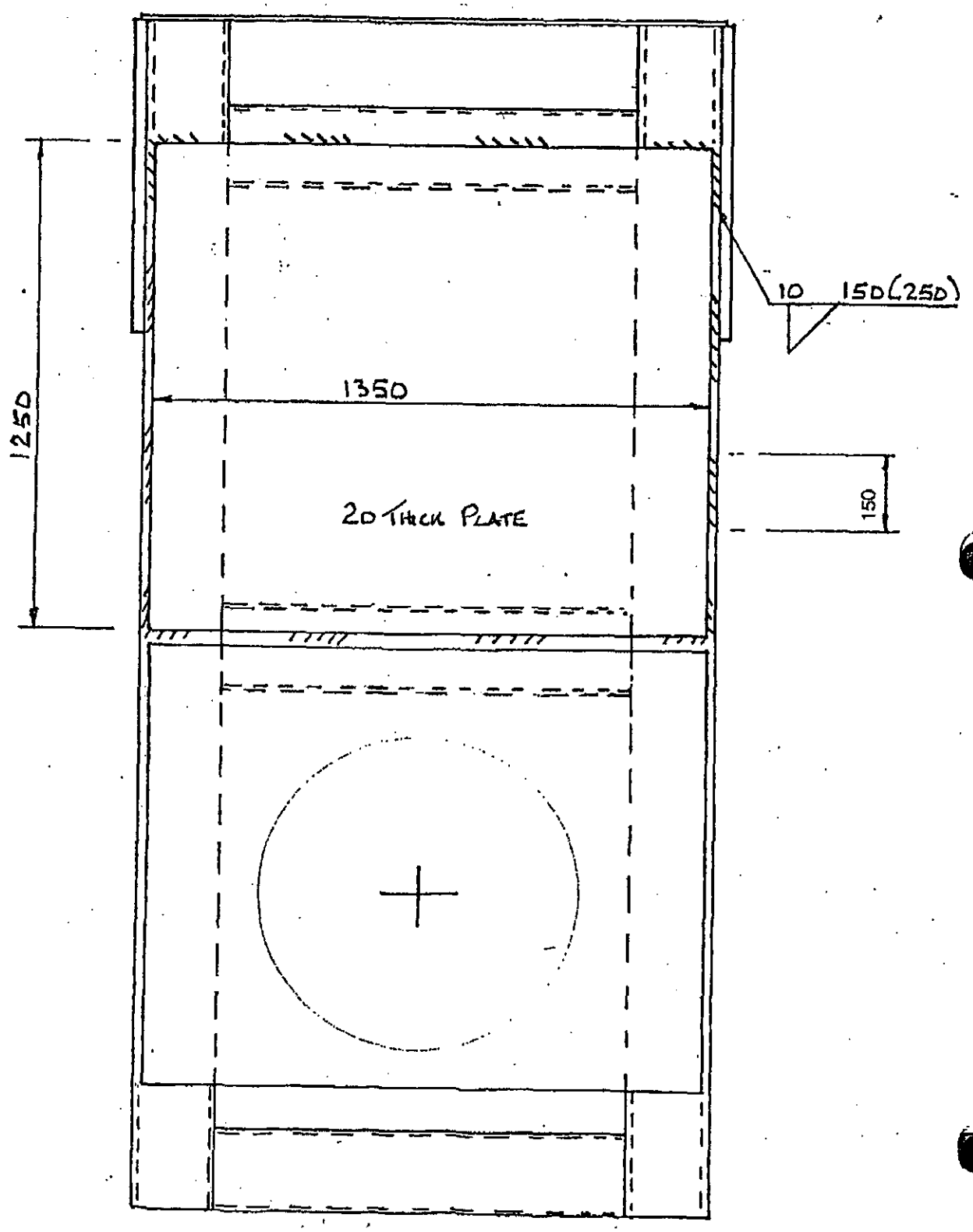
JOINT TYPE 'A'



WELD DETAIL

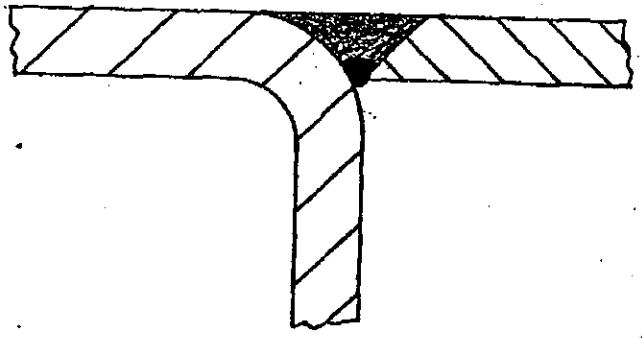
VIEW ON ARROW 'A'

WELDING DIAGRAM (LOWER FRAME)

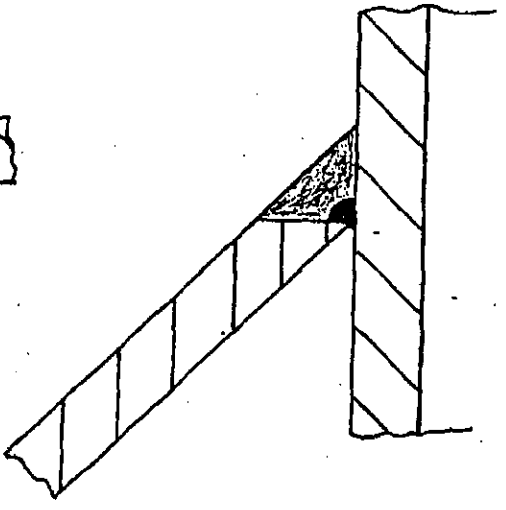


VIEW ON UNDERSIDE

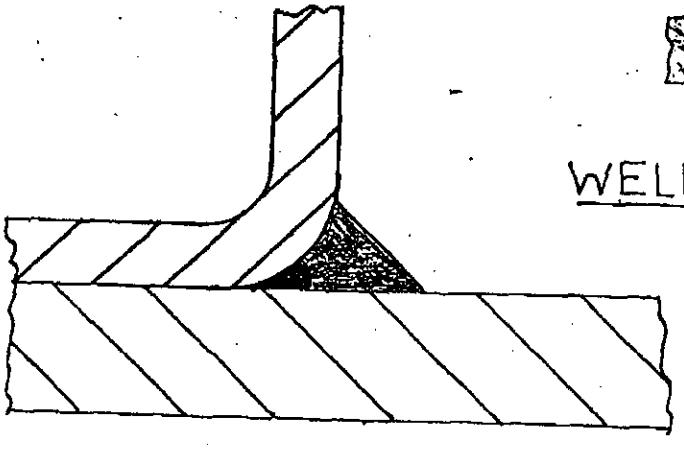
WELD TYPES



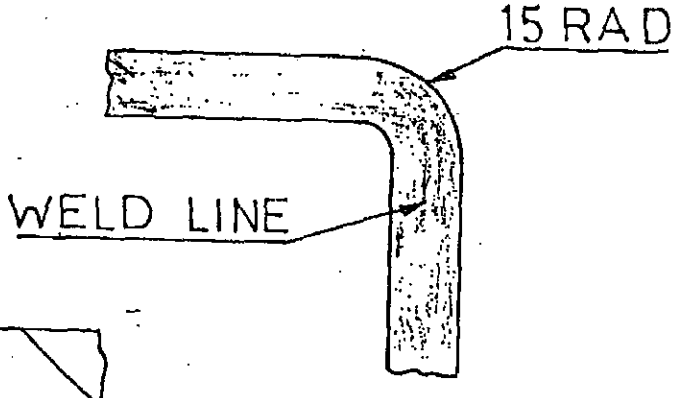
JOINT TYPE 'A'



JOINT TYPE 'B'



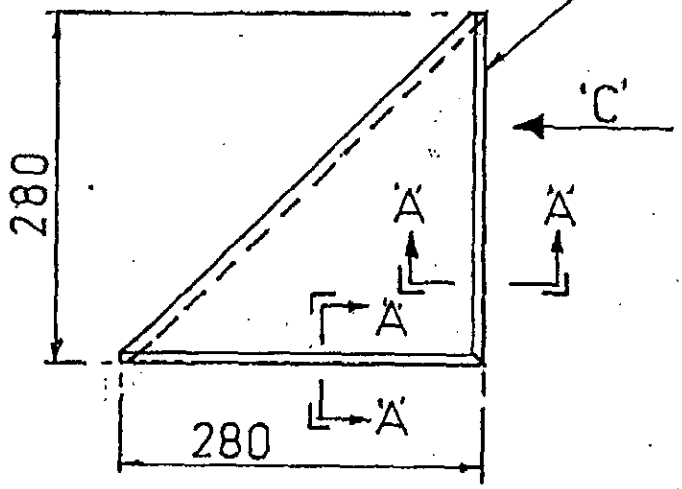
JOINT TYPE 'C'



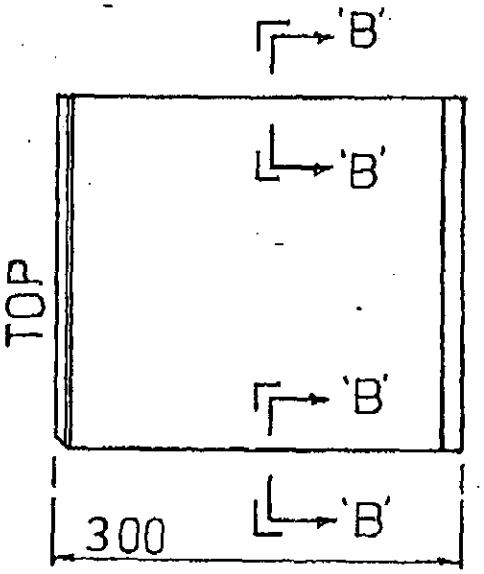
CORNER TYPE 'D'

MAKE FROM 300x200x10 R.H.S.

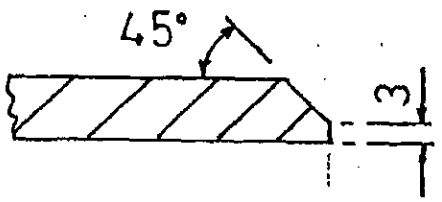
WELD PREP TOP ONLY



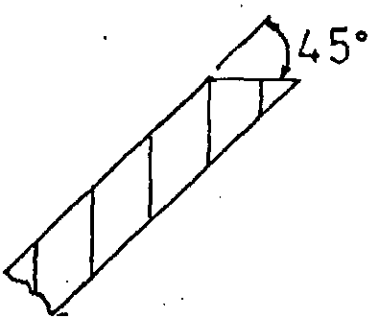
PLAN



VIEW ON ARROW 'C'



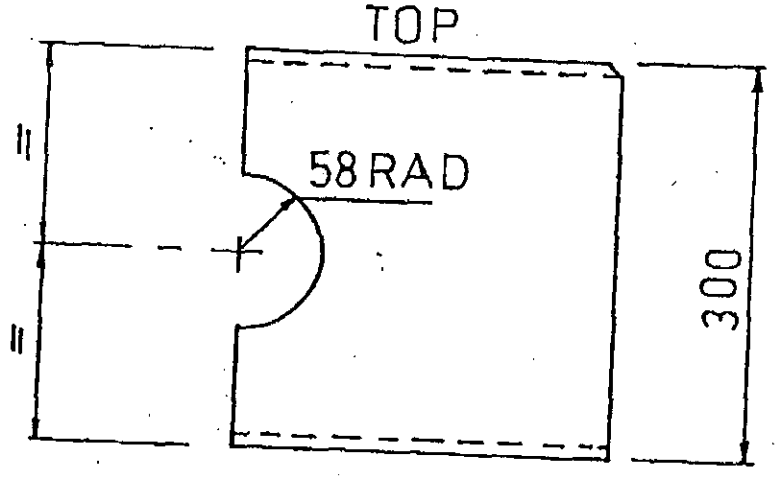
SECTION A-A



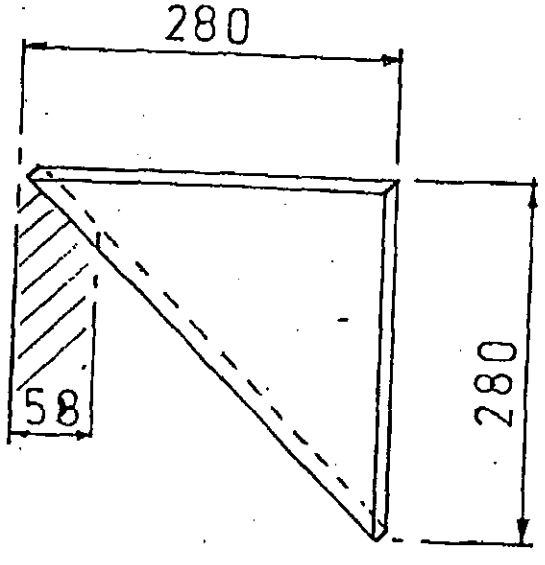
SECTION B-B

GUSSET. PART NO. QUA/01/1. 6 OFF.

MAKE FROM PART NO QUA/01/1



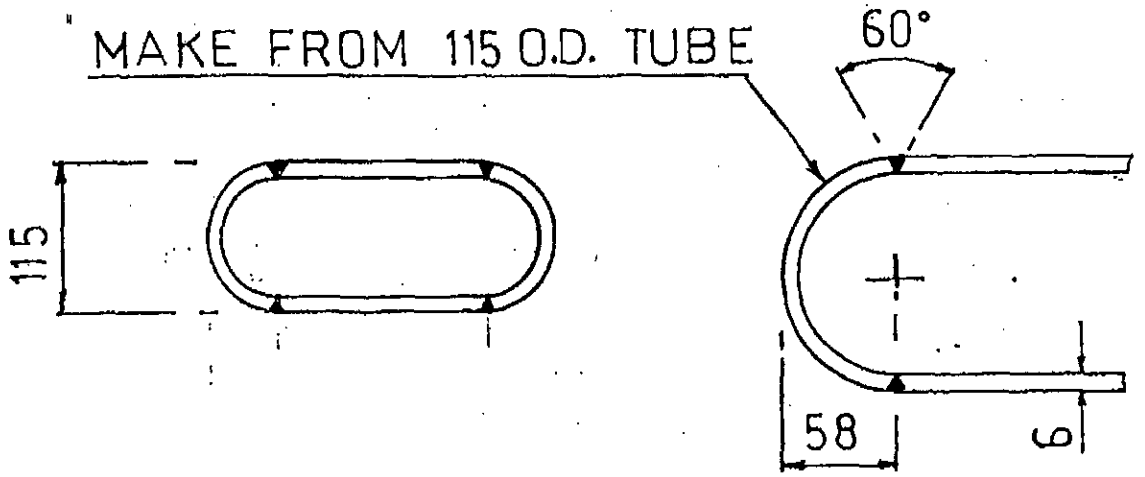
FRONT ELEVATION

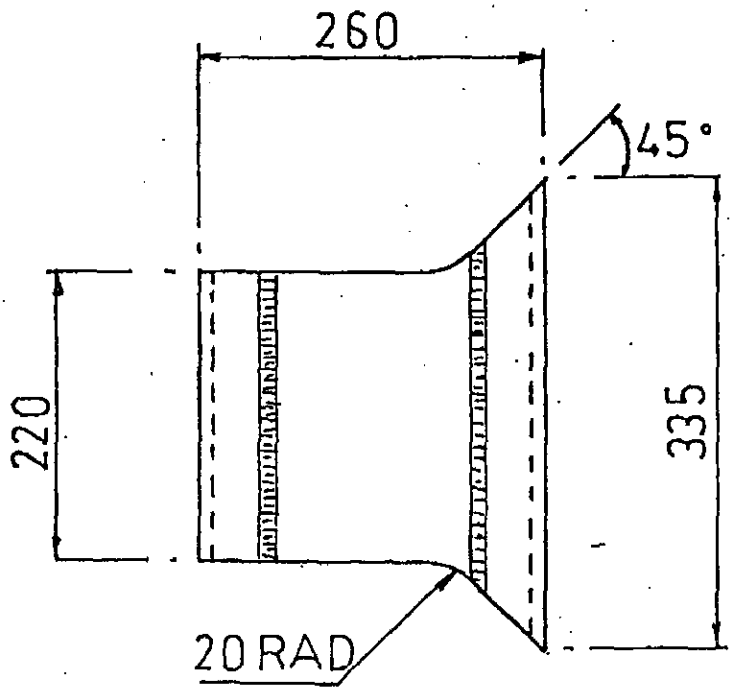


PLAN

GUSSET. PART NO. QUA/01/2. LH - 1 OFF

GUSSET. PART NO. QUA/01/3. RH - 1 OFF





PIPE SLOT FLANGE. PART NO. QUA/01/4 - 1 OFF

SERVICE BULLETIN QUA/03/002

(QUASAR AMUSEMENT RIDE)

SEPTEMBER 1988

In response to report of cracking in the vicinity of weldments on the trailer main longitudinal members and top mounting plate, it has been deemed prudent in the interests of public safety to initiate remedial action.

After examination and assessment it has been concluded that the cracking is fatigue initiated. The loading spectrum on the trailer is very complex because when in travelling mode the trailer will be subject to stress ranges of varying magnitude and quantity. This will depend on the road surface quality and the number of miles travelled per annum. The former is impossible to evaluate without resorting to strain guage analysis.

The loading spectrum when operational may be assessed with some accuracy and the loadings on the trailer imposed by the outrigger feet and pads appear to be significant in fatigue terms.

The picture is further complicated by their being two types of trailer construction, viz Type 1 with cranked main longitudinal members and Type 2, with straight members. The cranked version gives most cause for concern because the members are cut, bent and then welded which places a weldment at right angles to the stress lines in the tensile zone. This weldment then initiates cracks on the underside of the main members which propagate outwards and upwards.

To obviate and prevent further occurrence of these phenomenon the following modifications to the trailer are to be carried out.

1. Bracing strap to be fitted on underside of main members.

2. Bracing member fitted vertically between top and bottom plate and connected to side of main members.

These modifications are designed to reduce the stress ranges incurred by the trailer main longitudinal members and reduce the bending moment on the top plate in addition to providing a greater weld area.

On the cranked version of trailer the bracing strap will need to be cranked to follow the contour of the main longitudinal members.

The above modifications are to be carried out on all rides not later than five years after commencement of operational use.

MODIFICATION PROCEDURE

1. Repair any existing cracks by grinding out to full depth and butt welding with a full penetration single 'V' butt weld.

   These welds to have a root run by manual metal arc using a 3mm low hydrogen electrode. Remainder of weld may be manual metal arc or MIG.

   After completion of weld, grind down flush with surface to give a smooth crack free surface.

2. Cut out a 160mm wide section of bottom plate above both main members to allow bracing strap to pass along surface of main members - see Page 6 .

   Weld prep edges of bottom plate and bracing strap as depicted on Page 6 . Weld bracing strap to underside of main members then weld bottom plate to bracing strap as depicted on Page 6 .

3. Weld bracing member between top and bottom plates and side of main members as depicted on Page 6

MODIFICATION PROCEDURE

1. On cranked type trailer, remove all weld bridging plates positioned on underside of trailer. Repair any existing cracks by grinding out to full depth and butt welding with a full penetration single 'V' butt weld.

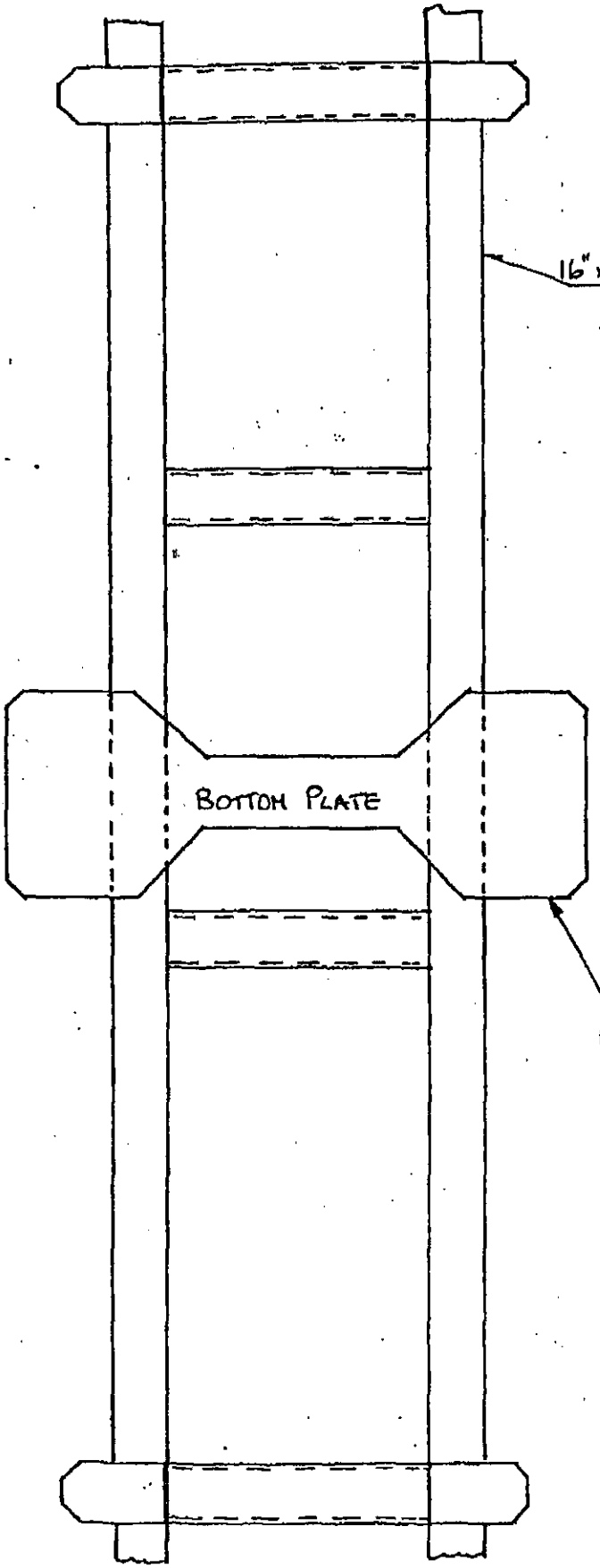
   These welds to have a root run by manual metal arc using a 3mm low hydrogen electrode. Remainder of weld may be manual metal arc or MIG.

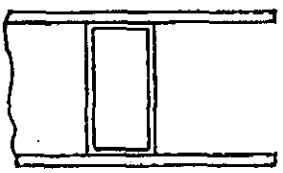
   After completion of weld, grind down flush with surface to give a smooth crack free surface.

2. Weld wedge plates to underside of main members butting angled end up to bottom plate and welding together.

3. Position bracing strap over bottom plate. Weld strap to bottom plate and bend down to follow contour of wedge plates. Weld strap to wedge plates and main members. See Pages 7 and 8.

ORIGINAL CONSTRUCTION (STRAIGHT TYPE)

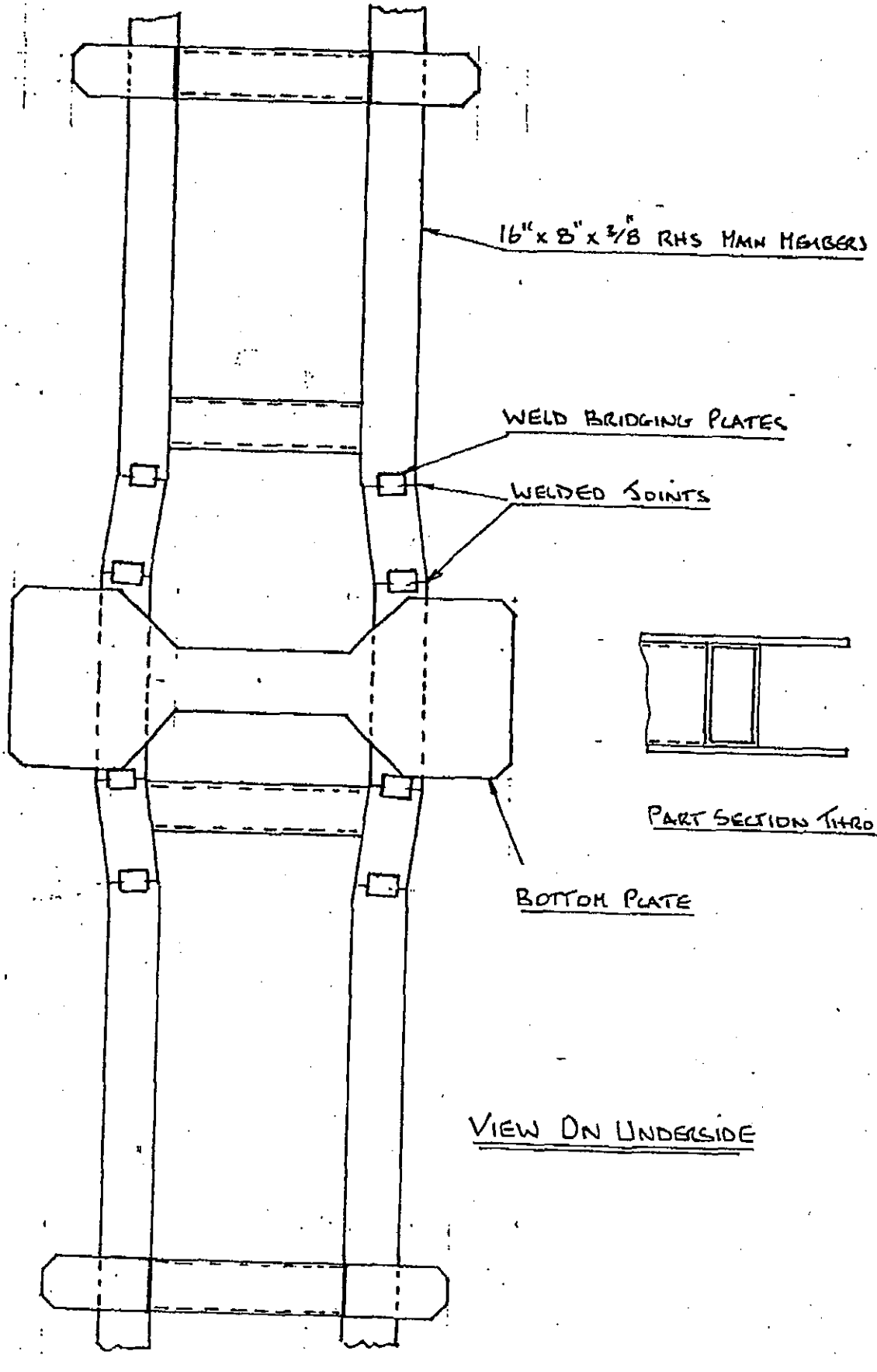




PART SECTION THRU CENTRE

VIEW ON UNDERSIDE

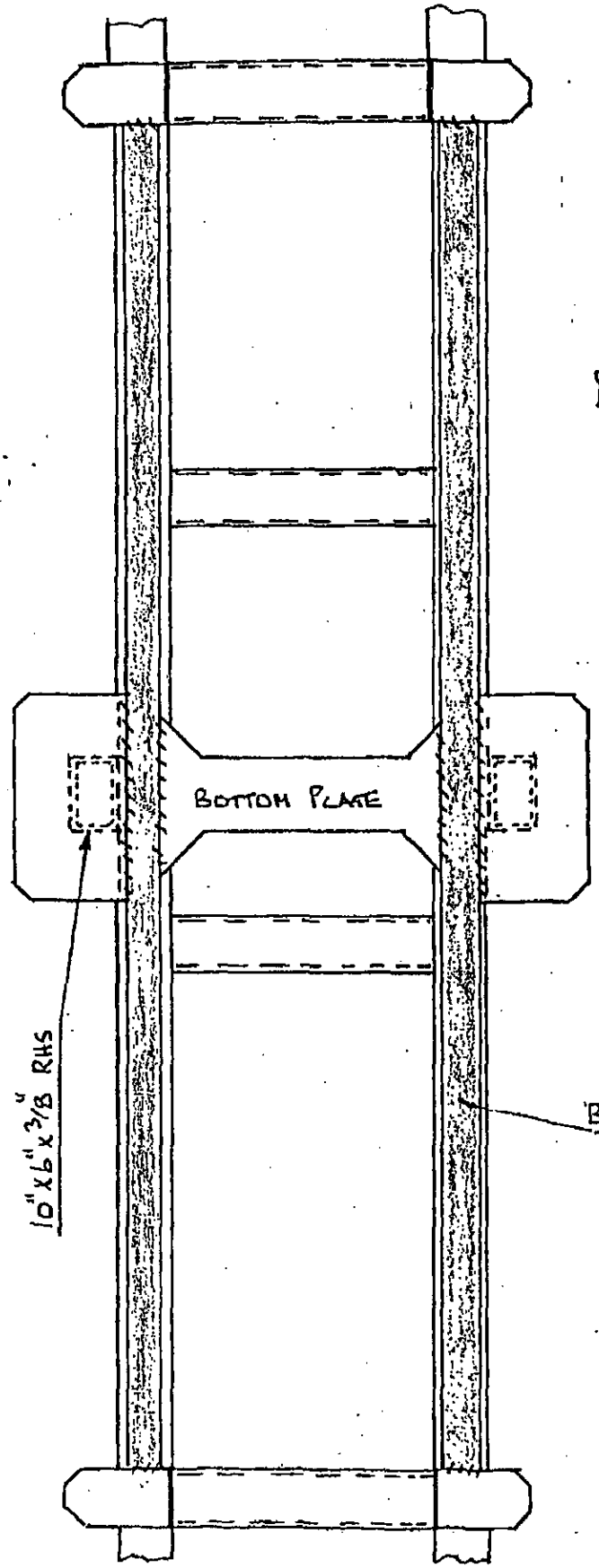
ORIGINAL CONSTRUCTION (CRANKED TYPE)



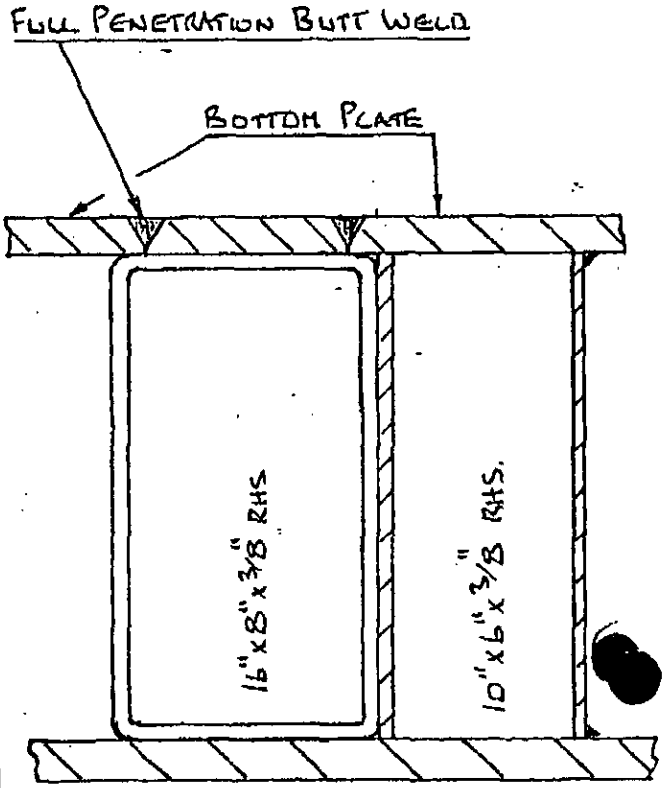
PART SECTION THRO CENTRE

VIEW ON UNDERSIDE

MODIFIED CONSTRUCTION (STRAIGHT TYPE)

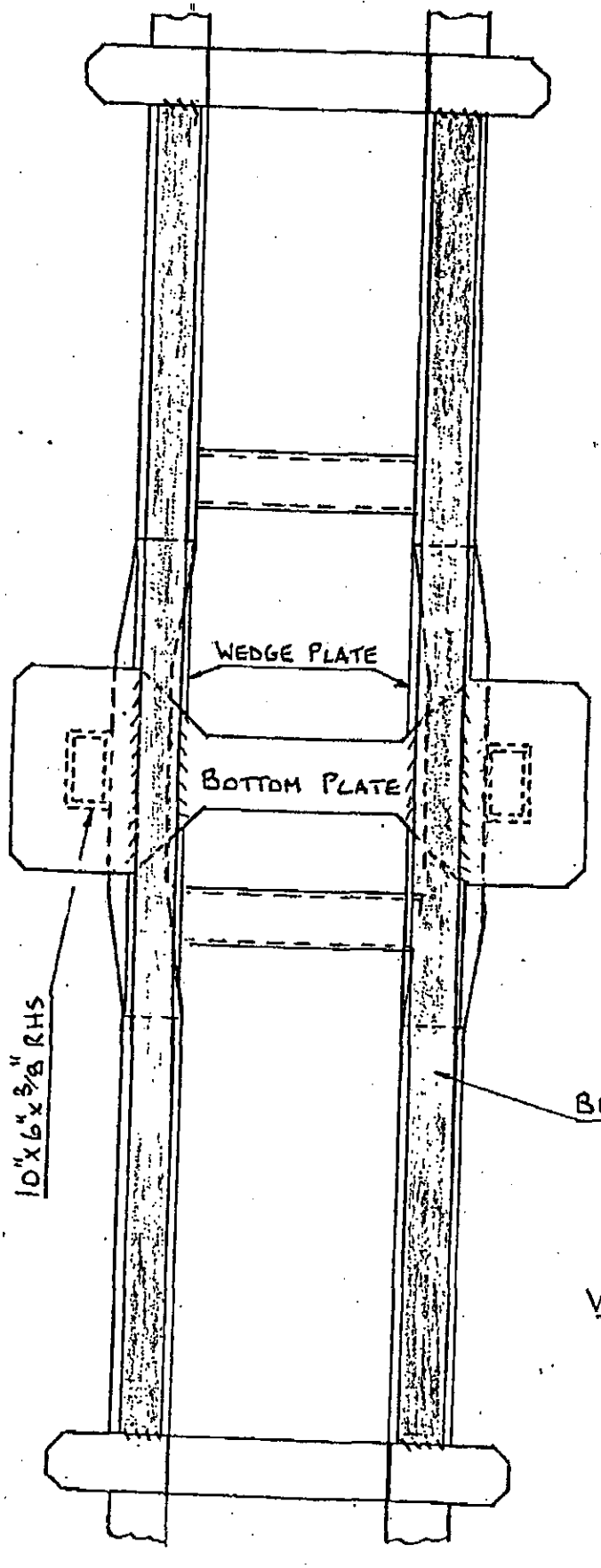


VIEW ON UNDERSIDE

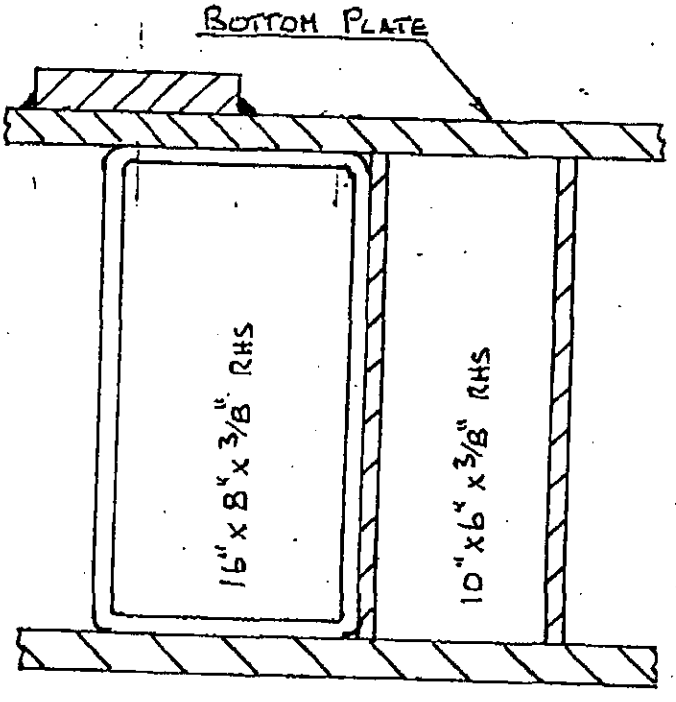


SECTION THRU CENTER

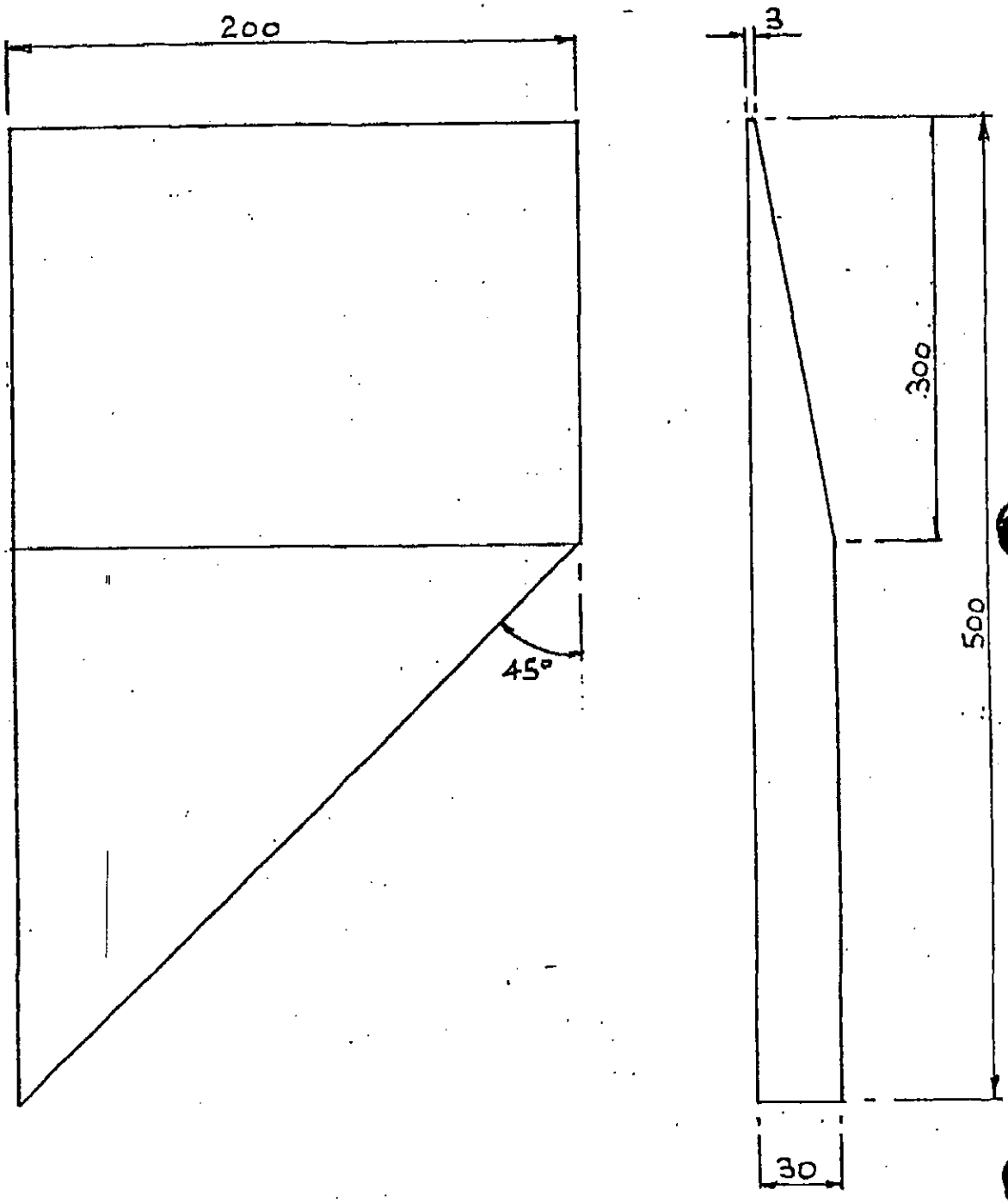
MODIFIED CONSTRUCTION (CRANK TYPE)



VIEW ON UNDERSIDE



SECTION THRO CENTER



DETAIL OF WEDGE PLATE. MAKE IN PAIRS 2-LH & 2 R.H.

MAT^{L} M.S. TO BS4360-G43A OR EQUIVLANT

MFG: A.R.M. (UK) LTD.
NAME: QUASAR
TYPE: NON-KIDDIE

Number: S.B.QSR 001

Date: 8th Oct 1993

Supercedes: N/A

SERVICE BULLETIN

Effective Serial Numbers: All Quasars

Subject: Cracks found on 'H' Frame.

It has been noted that one Quasar has developed cracks on the 'H' frame upper pivot points, radiating from the hinge pin holes (see attached sketch).

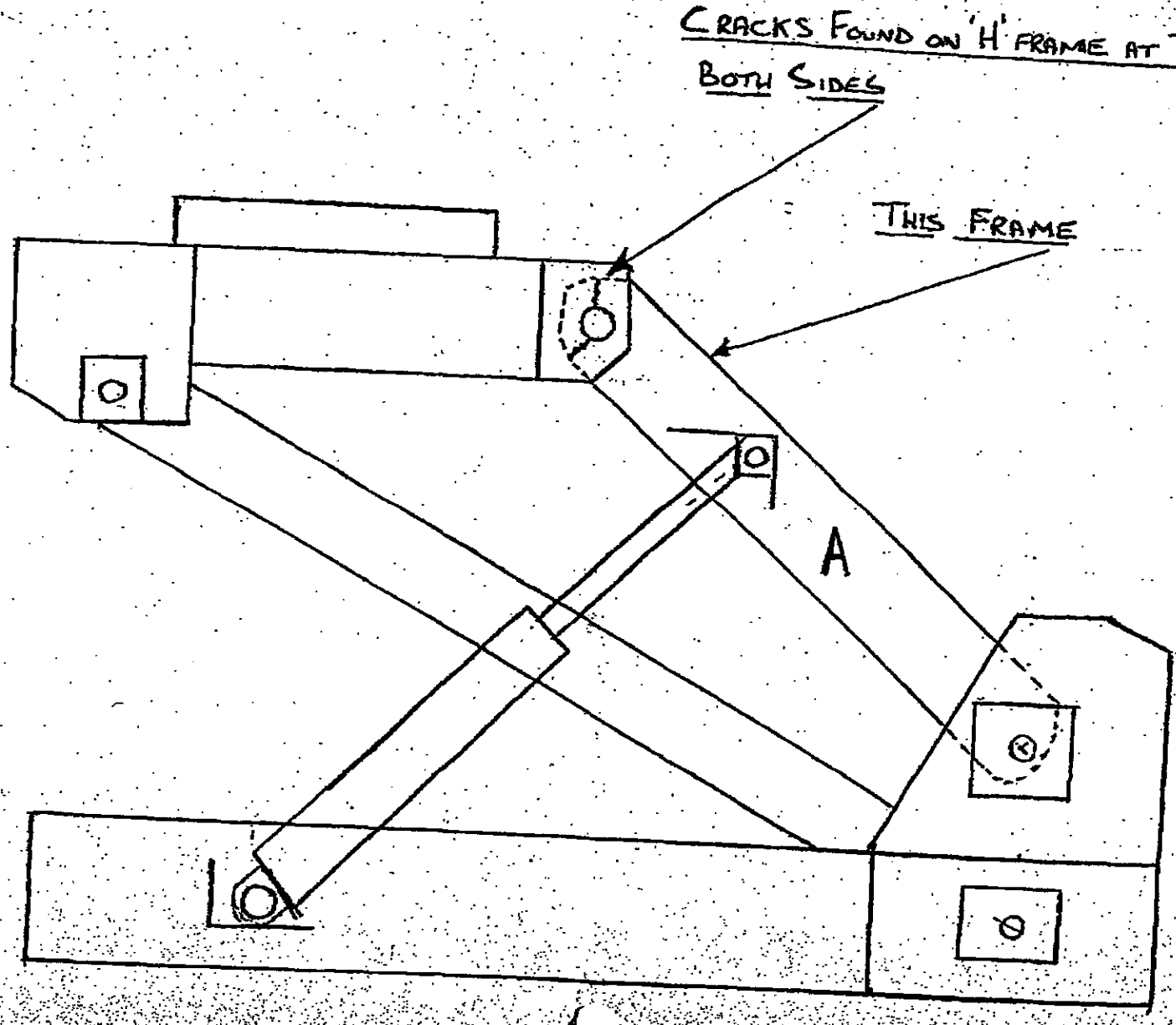
All operators must inspect for cracks in this area. If any cracks are found, please inform the manufacturer and ensure that the ride is not used until repairs have been carried out.

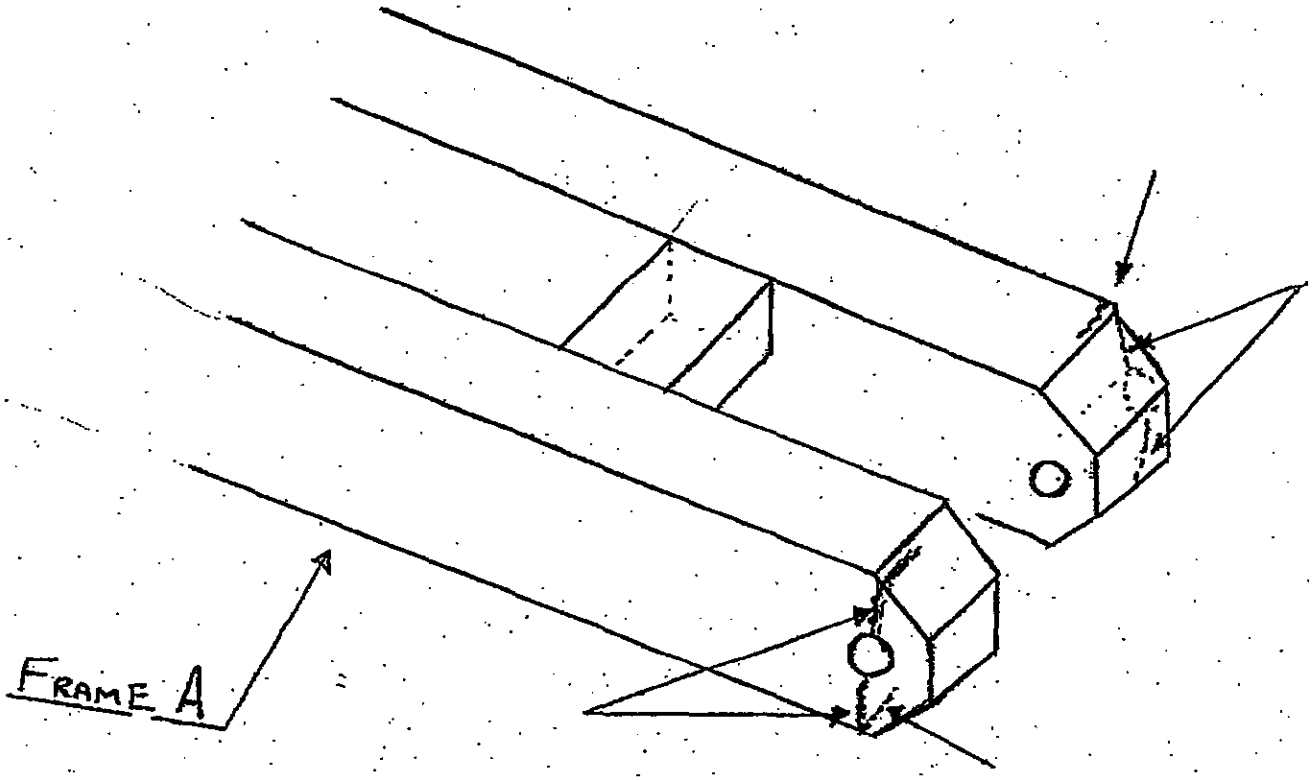
A Repair bulletin will follow shortly.

A.R.M. (U.K.) LTD.
Unit 1, Enstone Airfield,
Enstone, Oxford OX7 4NW, England
Tel:(0608) 677468 Fax:(0608)678765

USA Office
Box 2042, Wintersville
Ohio 43952
Tel: 614 2646599 Fax: 614 2662953

QUASAR SUB-FRAME





CRACKS RADIATING FROM HINGE PIN HOLES BOTH SIDES AND RUNNING ACROSS BOX SECTION

#03267

Service Bulletin No S.B./QUA/03/003.
Dated February 1994

Subject :- Main Lifting Frame Links.

A.R.M. (UK) Ltd have been alerted to the possibility of a potential problem in the Quasar lifting frames involving the weldment of the main hinge boss to the link assembly.
On investigation it would appear that some hinge bosses may have inadequate weld preparation and may suffer fatigue induced cracking emanating from the area of the hinge boss and ropagating outward at 45° into the parent metal of the links.
In view of the facts above we have prepared a service bulletin containing an appropriate inspection schedule and repair method if inspection proves it is required.

Inspection Schedule For Main Lifting Frame.

Weekly Inspection.

1) Visual inspection of the area immediately in the vicinity of the hinge bosses situated at either of the two main travelling links, one link being ram driven and one being a trailing link

Check for any indication of a crack both in the weldment of the boss to the link and also in the link parent metal. If cracks are visible then these areas are to be subjected to non destructive testing as in 2) and 3) below to determine the extent of any possible damage.
If crack damage is confirmed by N.D.T. inspection then the repair schedule described in the service bulletin QUA/03/003/01 to QUA/03/003/04 inclusive is to be carried out immediately.

Annual Inspection.

2) The area as described in 1) above to be checked by non destructive testing for cracks in the weldment or surrounding parent metal, and to be certified sound in writing by a suitably qualified inspector.

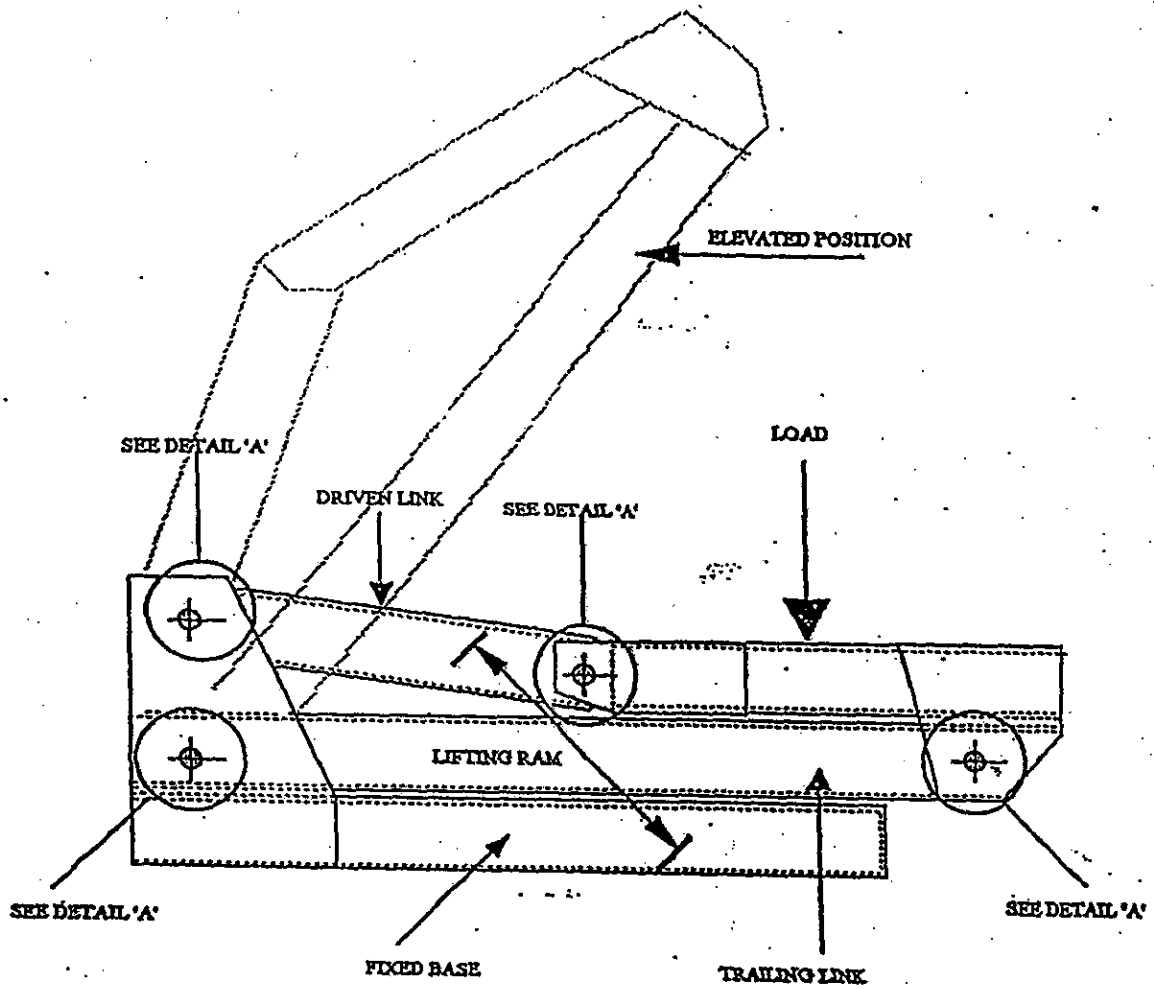
3) Recommended methods of non destructive testing :- Electromagnetic and Ultrasonic.

4) If the non destructive testing establishes the existence of cracks then repairs must be made immediately in conformity to the manufactures laid down procedures in service bulletin pages :-

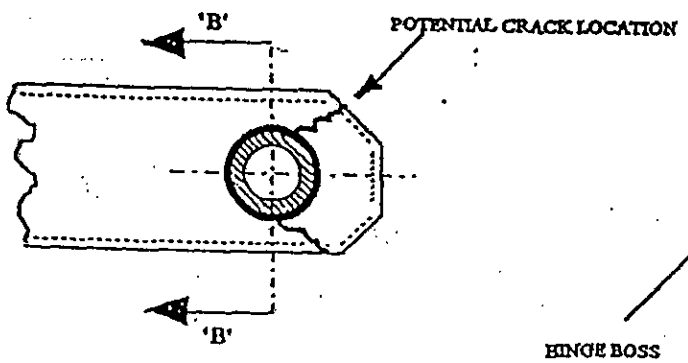
QUA/03/003/01 To QUA/O3/003/04 Inclusive.

5) On completion of repairs and before operating the machine the repair is to be confirmed as sound and with no significant defects using test methods as in 2) and 3) above.
This to be certified in writing by a suitably qualified person.

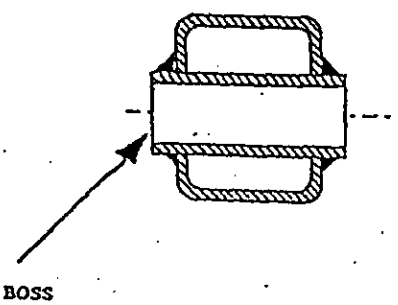
Quasar Lifting Frame



SIDE ELEVATION ON LIFTING FRAME



DETAIL 'A'



SECTION ON 'B'-'B'

Mike Triplett

From: Richard Osworth <rosworth@dca.state.nj.us>
To: Michael Triplett <mtriplett@dca.state.nj.us>
Sent: Friday, October 27, 2000 11:14 AM
Subject: Fw: A.R.M. Quasar sweep-tub cable failure

----- Original Message -----
From: Michael W Rinehart <rineham@doacs.state.fl.us>
To: Isadore Rommes <rommesi@doacs.state.fl.us>; Carl Dills <carl.dills@kyagr.com>
Sent: Tuesday, September 19, 2000 1:37 PM
Subject: A.R.M. Quasar sweep-tub cable failure

> There has been a cable sweep-tub failure on an A.R.M. "Quasar" in
> Kentucky yesterday. The 7 or 8 year old ride, owned by Casey Shows,
> operating in
> Hazard, KY, had one (or more) safety cables that run from the sweep to
> the tub break in or at the cable swage. Unlike our recent cable swage
> failure
> on the Ejection Seat which slipped out of the swage, this time the cable
>
> broke off inside or at the swage. No one was injured due to the
> failure but two were transported for injuries after slipping and falling
> leaving the ride.
> Examination of additional tub safety cable swages on Casey's Quasar
> found frayed cables at the point the cable enters the swage after it
> passed around the thimble.
> According to our database we have two Quasars active in Florida, one
> belonging to A of A and the other to Mergerles.
> Because the breaking point is impossible to see, we are requiring
> that A of A and Mergerles to replace their sweep-tub safety cables, or
> an
> NDT must be performed on all cable swages on each of the rides to verify
>
> they do not need to be replaced.
> If you have any questions about the specific failure call Carl Dills
> for more information.
> Mike Rinehart
> Florida BFI
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