

Appendix R – Rollcage Construction & Installation

1. General

The following suggestions are offered as a guide to rollcage purchase, construction and installation and are put forward, based upon experience to assist those competitors installing new cages in their vehicle:

- When purchasing a new rollcage constructed of seamless, DOM or ERW tubing, the competitor is encouraged to exceed the minimum mounting foot and reinforcing plate dimensions contained in these Rollover Protection Regulations;
- All terms used herein are defined under clause 4 (v)(ii) A through K;
- In the cases of cages that are to be permanently installed, the cage should be made integral with the chassis or body structure of the vehicle wherever possible by bolting or welding it to the vehicle's frame or body structure;
- The main rollbar and lateral rollbar (where fitted) should be located in a manner which achieves the maximum attainable distance between the rollcage components and the driver's and navigator's heads;
- Where rollbar padding is used in the vicinity of the driver's and navigator's heads, FIA approved energy absorbing material is recommended in lieu of softer cosmetic foam materials.
- Entrants, who are building a car for other events, as well as Targa Newfoundland, should check regulations for such events.

2. New or Different Designs

If an entrant wishes to have a specific rollcage design (new, unusual or removable) approved in advance of the event, he may do so by submitting the design to the Rollover Protection Committee of Targa Newfoundland. The committee may be reached at the Event Headquarters provided in Section 1.4. The committee will either approve the submitted design or recommend those changes required for the design to be accepted. All decisions of this committee will be final and not subject to appeal.

3. Rollover Protection Approval

Specific rollover protection is subject to the approval of the scrutineer at the event. Entrants are encouraged to submit their proposed rollover protection designs or completed installations to the Rollover Protection Committee for review prior to the event.

4. Roll Cages

(i) Basic Design Considerations

The essential features of rollover cages are sound construction designed to suit the particular vehicle, adequate mountings and a close fit to the body shell.

- (i) The basic purpose of the rollover protection is to prevent serious body shell deformation, and so reduce the risk of injury to occupants, in the case of a collision or of a car turning over. The rollover cage must not unduly impede the entry or exit of the driver and co-driver.
- (ii) The rollcage is a structural framework made up of a main rollbar and a front rollbar (or a main rollbar and two lateral rollbar), their connecting members, diagonal members, backstays and mounting points (for example, see drawings 253-3 253-4 and 253-5 which appear at the end of this Appendix). Longitudinally, the rollover cage must be entirely contained between the top mounting points of the front suspension and the top mounting points of the rear suspension or centre line of the rear axle.

- a) Main rollbar: structure consisting of a near-vertical frame or hoop located across the vehicle just behind the front seats.
 - b) Front rollbar: similar to main rollbar but its shape follows the windscreen pillars and top screen edge.
 - c) Lateral rollbar: similar to main rollbar but its shape follows the outline of the door from the top of the main rollbar, along the roof and the windscreen pillar to the floor. The front leg must be against the windscreen pillar and the door pillar such that it does not unduly impede the entry or exit of driver and co-driver.
 - d) Connecting member: longitudinal tube which is not a part of the main, front or lateral rollbar but which links them.
 - e) Diagonal member: transverse tube between a top corner of the main rollbar or upper end of a backstay and a lower mounting point on the other side of the rollbar or backstay.
 - f) Framework reinforcement: reinforcing member fixed to the rollcage to improve its structural efficiency.
 - g) Reinforcement plate: metal plate fixed to the body shell or chassis structure under a rollbar mounting foot to spread load into the structure.
 - h) Mounting foot: plate welded to a rollbar tube to permit its bolting or welding to the body shell or chassis structure, usually onto a reinforcement plate.
 - i) Removable members: structural members of a rollover cage which are able to be removed.
 - k) Rear Stay: a bracing member which connects the top of the main hoop to the body of the car behind the main hoop.
- (iii) Basic rollover cage:
- a) Compulsory diagonal member: different ways of fitting the compulsory diagonal member: see drawings 253-3 to 253-5. The combination of several members is permitted.
 - b) Optional reinforcing members: each type of reinforcement (drawings 253-6 to 253-17, 253-17A and 253-17C) may be used separately or combined with others. Longitudinal rollcage extensions are allowed up to the level of the original suspension mounting points on the shell. There must not be direct connection between the top extension and the bottom extension.
- (iv) Main, front and lateral rollbar: These frames or hoops must be made in one piece without joints. Their construction must be smooth and even, without ripples or cracks. The vertical part of the main rollbar must be as straight as possible and as close as possible to the interior contour of the body shell. The front leg of a front rollbar or of a lateral rollbar must be straight, or if it is not possible, must follow the windscreen pillars and have only one bend with its lower vertical part. Where a main rollbar forms the rear legs of a lateral rollbar (drawing 253-4), the connection to the lateral rollbar must be at roof level. The included angle between the mounting foot and the front leg of a front rollbar or of a lateral rollbar shall be less than 90°. One continuous length of tubing must be used for each of the hoops with smooth continuous bends and no evidence of crimping or wall failure. The tubing must be bent by a cold working process and the centreline bend radius must be at least 3 times the tube diameter. If the tubing is ovalised during bending, the ratio of minor to major diameter must be 0.9 or greater. To achieve an efficient mounting to the body shell, the original interior trim may be modified around the rollover cages and their mountings by cutting it away or by distorting it. However, this modification does not permit the removal of complete parts of upholstery or trim unless permitted elsewhere in these regulations.
- (v) Protective Padding: Where the occupants' bodies or their crash helmets could come into contact with the rollover cage, non-flammable padding must be provided for protection.

(vi) **Door bars** (for side protection): One or more longitudinal members fitted at each side of the vehicle (see drawings 253-7, 253-8, 253-12, 253-17) **are required**. They may be removable. The side protection must be as high as possible, but its upper attachment points must not be higher than half the total height of the door measured from its base. If these upper attachment points are located in front of or behind the door opening, this height limitation is also valid for the corresponding intersection of the strut and the door opening.

(vii) **Backstays**: These are compulsory and must be attached near the roof line and near the top outer bends of the main rollbar on both sides of the car. They must make an angle of at least 30 degrees with the vertical, must run rearwards and be straight and as close as possible to the interior side panels of the body shell. Their materials specification, diameter and thickness must be as defined in 4 (ii) [Material]. Their mountings must be reinforced by plates. Each backstay should be secured by bolts having a cumulative section area at least two thirds of that recommended for each rollbar leg mounting in 4 (iii) [Mounting of Rollcages to the Body shell] and with identical reinforcement plates of at least 60 cm² area (see drawing 253-25).
A single bolt in double shear is permitted, provided it is of adequate section and strength (see drawing 253-26) and provided that a sleeve is welded into the backstay.

(viii) **Diagonal Members**: at least one diagonal member must be fitted. Drawings 253-3 to 253-5 are examples of diagonal members and they must be straight, not curved. The attachment points of the diagonal members must be so located that they cannot cause injuries. They may be made removable but must be in place during events. The lower end of the diagonal must join the main rollbar or backstay not further than 100 mm from the mounting foot. The upper end must join the main rollbar not further than 100 mm from the junction of the backstay joint, or the backstay not more than 100 mm from its junction with the main rollbar.
Maximum spacing of the mounting feet on twin diagonals within the plane of the main rollbar shown in drawing 253-3 (< 30 cm) shall be as measured in the horizontal plane and shall be strictly observed. They must comply with the minimum specification set out in 4 (ii) [Material]. Diagonal members fixed to the body-shell must have reinforcement plates as defined in 4 (iii) [Mounting the Rollcages to the Body-shell].

(ii) Material

All rollcages shall be manufactured from cold drawn seamless ERW or DOM mild steel tubing.

| | | |
|-----------------------|----------------|---------------|
| Gross vehicle weight. | Under 2000 lbs | Over 2000 lbs |
| | Under 910 kgs | Over 910 kgs |
| MILD STEEL | 1.50 x .120 | 1.75 x .120 |

(ii) Note that these figures represent the minima allowed. In selecting the steel, attention must be paid to obtaining good elongation properties and adequate weld ability. An inspection hole of at least 4.5 mm diameter must be drilled in a non-critical area of the main hoop to facilitate verification of wall thickness.

(iii) Where nuts and bolts are used, they must be of at least 3/8 inch diameter Grade 5 or M8 size of ISO standard 8.8 or better. Fasteners must be self-locking or fitted with lock washers.

(iv) Mounting of Rollcages to the Body-shell

Minimum mountings are:

- 1 for each leg of the main or lateral rollbar;
- 1 for each of the front rollbar;
- 1 for each backstay.

Each mounting foot of the front, main and lateral rollbar must include a reinforcement plate, of a thickness of at least 3 mm which must not be less than that of the tube onto which it is welded. Each mounting foot must be attached by at least three bolts on a steel reinforcement plate at least 3 mm thick and of at least 120 cm² area which is welded to the body shell. Examples are shown in drawings 253-18 to 253-24. This does not necessarily apply to backstays (see 4 (i) (vii) [Backstays]).

These are minimum requirements. In addition to these requirements, more fasteners may be used, the rollbar legs may be welded to reinforcement plates, the rollcage may be welded to the body shell. Rollbar mounting feet must not be welded directly to the body shell without a reinforcement plate.

(v) Required Reinforcement of Bends and Joints

Gussets or corner braces joining the front continuous tubing, whether front rollbar or lateral rollbar, and the brace tubing are required in all newly built cages. The gusset or brace shall span the weld that joins the two tubes and may be positioned either in the roof quadrangle or in the windshield area.

If gussets are used they must be of a thickness equal to the wall thickness of the rollcage tubing and must be a minimum of 5 cm long where they contact the rollcage tubing. They must be welded along this entire length and relieved in the corners so as to not interfere with existing welds.

If reinforcing tubes are used they must span at least 13 cm across the corner at its longest point but must not be more than half way down or along the members to which they are attached, except for those of the junction of the front rollbar, which may join the junction of the door strut/front rollbar.

(vi) Optional Reinforcement

The diameter, thickness and material of reinforcements shall be as defined in 4 (ii) [Materials]. They shall be either welded in position or installed by means of demountable joints.

(i) Rollcage reinforcement: It is permitted to reinforce the junction of the main rollbar or the front rollbar with the longitudinal struts (drawings 253-10 and 253-16), as well as the top rear bends of the lateral rollbar and the junction between the main rollbar and the backstays. A reinforcement as in drawing 253-17B may be added on each side of the front rollbar between the upper corner of the windscreen and the base of this rollbar.

(ii) Roof reinforcement: Reinforcing the upper part of the rollcage by adding members as shown in drawings 253-9 and 253-9A is permitted.

(iii) Transverse reinforcing members: The fitting of two transverse members as shown in drawing 253-7 is permitted. The transverse member fixed to the front rollbar must not encroach upon the space reserved for the occupants. It must be placed as high as possible but its lower edge must not be higher than the top of the dashboard.

(vii) Removable Members

Should removable members be used in the construction of a rollcage, the demountable joints used must comply with a type approved by the FIA (see drawings 253-27 to 253-36). They must not be welded.

Where nuts and bolts are used, they must be of at least M8 size of ISO standard 8.8 or better. Fasteners must be self-locking or fitted with lock washers.

It should be noted that demountable joints must not be used as part of a main, front or lateral rollbar because they act as hinges in the principal structure and allow deformation. Their use is solely for attaching members to the rollbar and for attaching a lateral rollbar to a main rollbar (drawing 253-4). In this last case, hinged joints such as

illustrated in drawings 253-30, 253-33 and 253-36 must not be used.

(viii) Guidance on Welding

All welding must be of the highest possible quality with full penetration and preferably using a gas shielded arc. Although good external appearance of a weld does not necessarily guarantee its quality, poor looking welds are never a sign of good workmanship.

When using heat-treated steel the special instructions of the manufacturers must be followed (special electrodes, gas protected welding).

It must be emphasised that the use of heat-treated or high carbon steels may cause problems and that bad fabrication may result in a decrease in strength (caused by brittle heat-affected zones) or inadequate ductility.

(ix) Removable rollcages

Removable rollcages (bolt in) that can be installed without welding may be accepted upon application to the Rollover Protection Committee. Generally these cages will be cages that would be acceptable to compete in SCCA & NASA Showroom Stock & Improved Touring classes.

(x) Other rollover protection designs.

Rollover protection of alternate material or design may be accepted by the scrutineer provided the entrant can produce a certificate specifying the following: the quality of steel used, the dimensions of the tubes, the optional reinforcing members and the mounting to the vehicle, and that the construction is certified to withstand the stress minima given hereafter in any combination on top of the rollover cage:

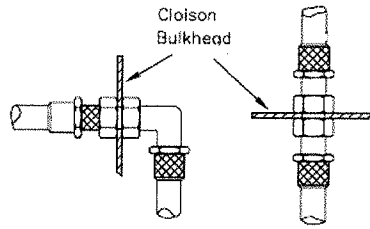
- 1.5 W* lateral;
- 5.5 W fore and aft;
- 7.5 W vertical.

where W = weight of the car + 150 kg).

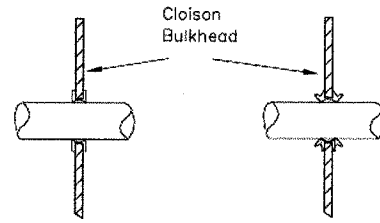
The certificate, approved by Targa Newfoundland and signed by qualified technicians, must be presented to the event's scrutineers. It must contain drawings or photos of the rollover cage in question including its fixation and particularities, and must declare that the rollcage can resist the forces specified above.

5 Roll Bars

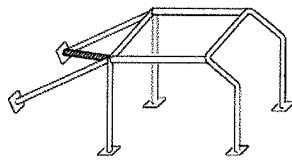
Where Roll bars are permitted 3.4.(b)(i) drawings and/or photos of the existing rollbar must be submitted to the Rollover Protection Committee of Targa Newfoundland. You are also required to submit evidence of actual prior competition history for the entered vehicle.



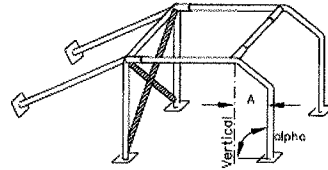
Dessin / Drawing N° 253-1



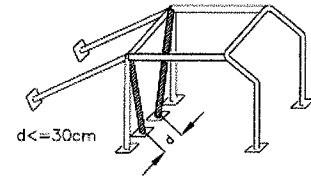
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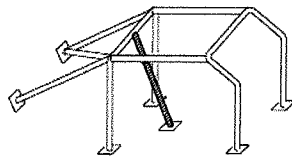
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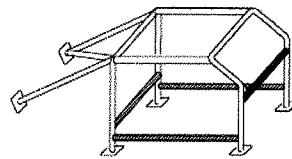
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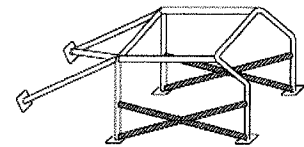
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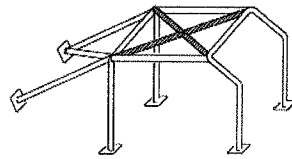
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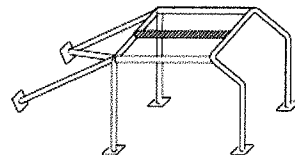
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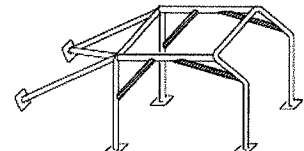
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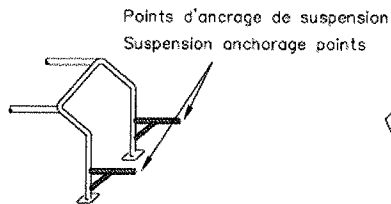
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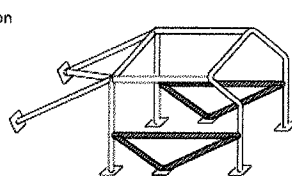
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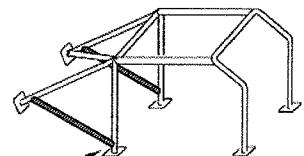
Dessin / Drawing N° 253-10



Dessin / Drawing N° 253-11

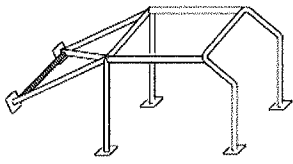


Dessin / Drawing N° 253-12

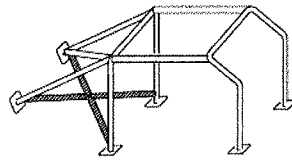


Cette connexion peut être située au niveau de l'entretoise de portière
This connection may be situated at the level of the doorbar

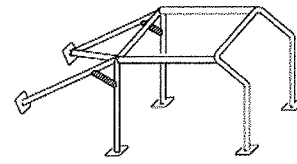
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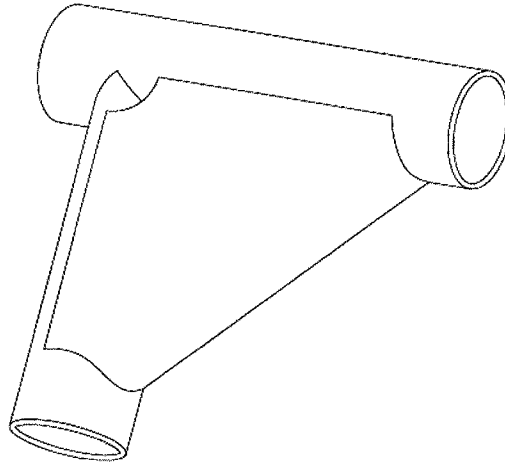
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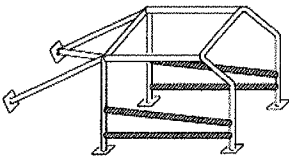
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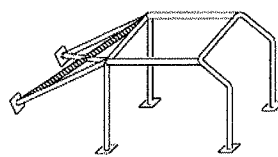
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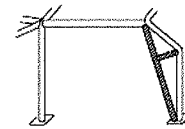
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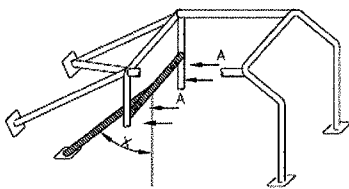
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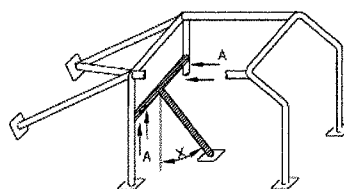
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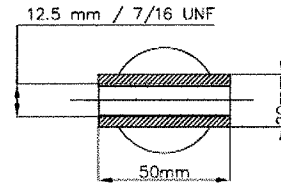
Dessin / Drawing N°253-17B



Ⓐ Trous de montage pour harnais
Mounting holes for harnesses

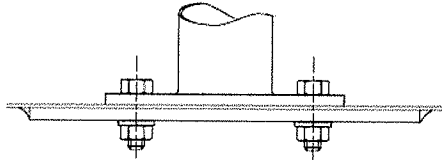


ⓧ Angle minimum 30°
Minimum angle 30°

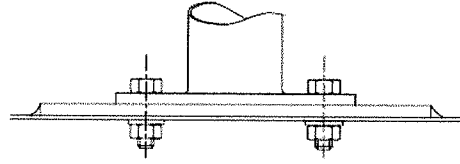


Agrandissement de A
Magnification of A

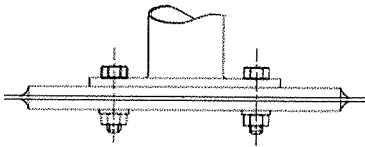
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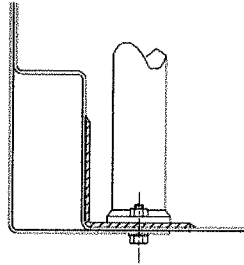
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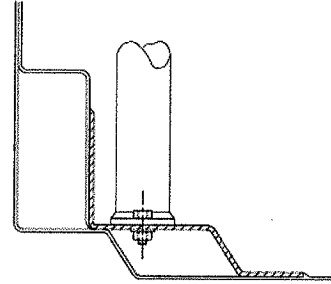
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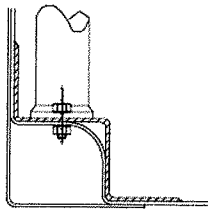
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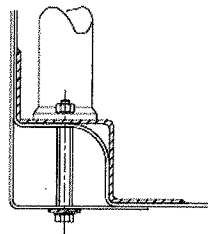
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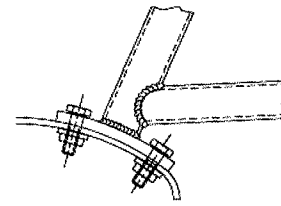
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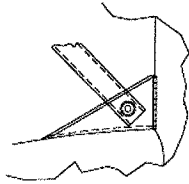
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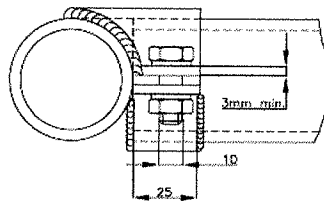
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Dessin/Drawing N°253-25



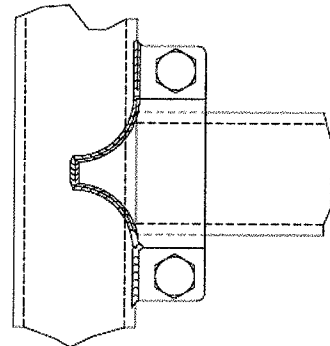
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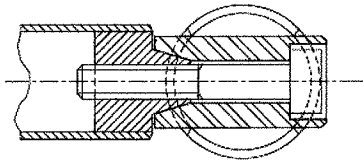


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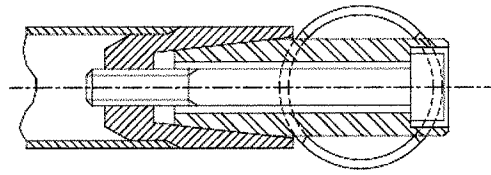


Direction d'application de la charge
Direction of applied load

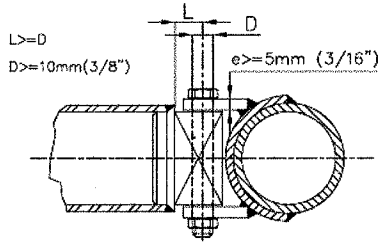




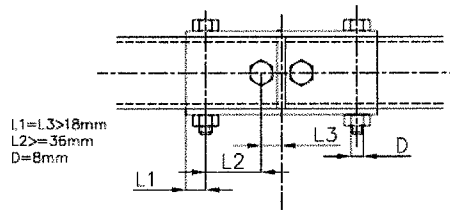
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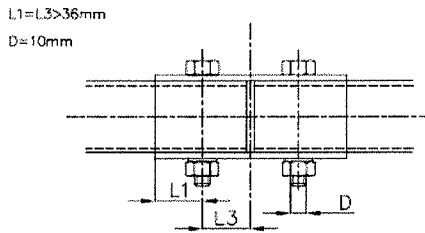
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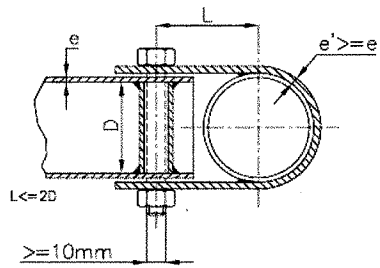
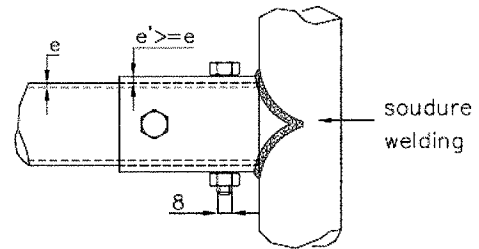
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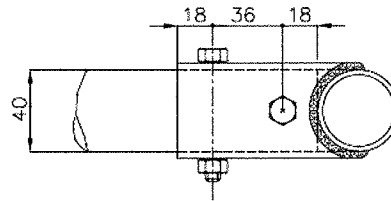
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Dessin / Drawing N°253-32



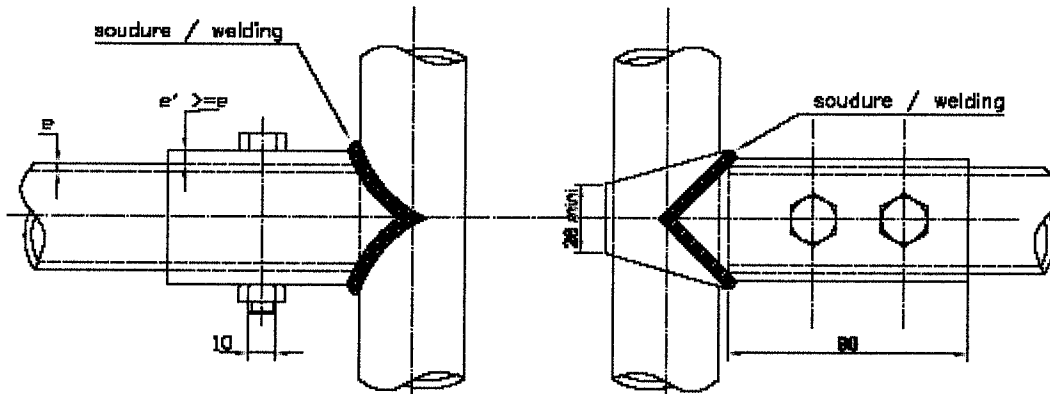
Dessin / Drawing N°253-33



Dessin / Drawing N°253-34
 (Dimensions en/in mm)

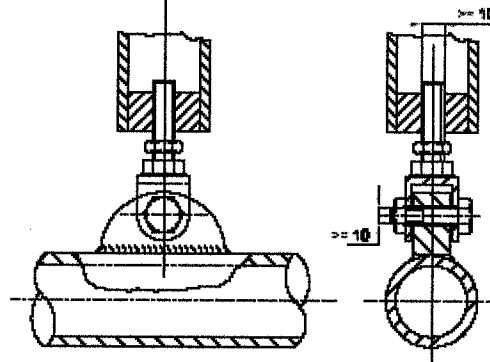
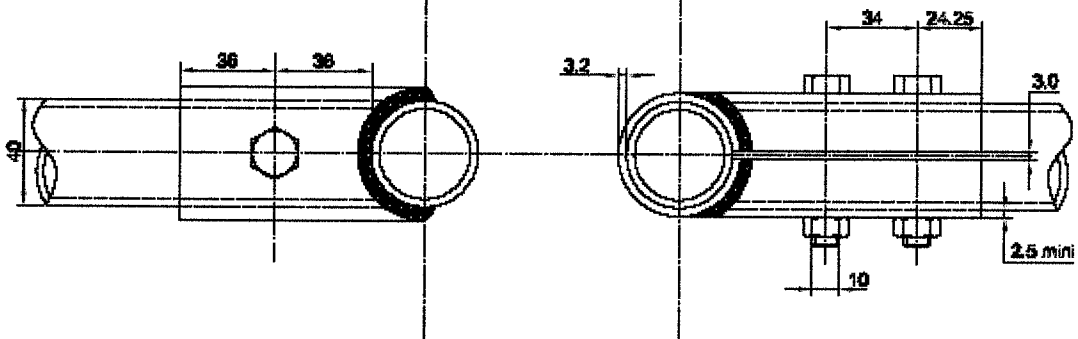
L doit être minimum
 La largeur de la patte doit
 être d'au moins 25mm

L must be minimum
 The clamp width must
 be at least 25mm



Dessin / Drawing N° 253-35

Dessin / Drawing N° 253-36



Dessin / Drawing N°253-37