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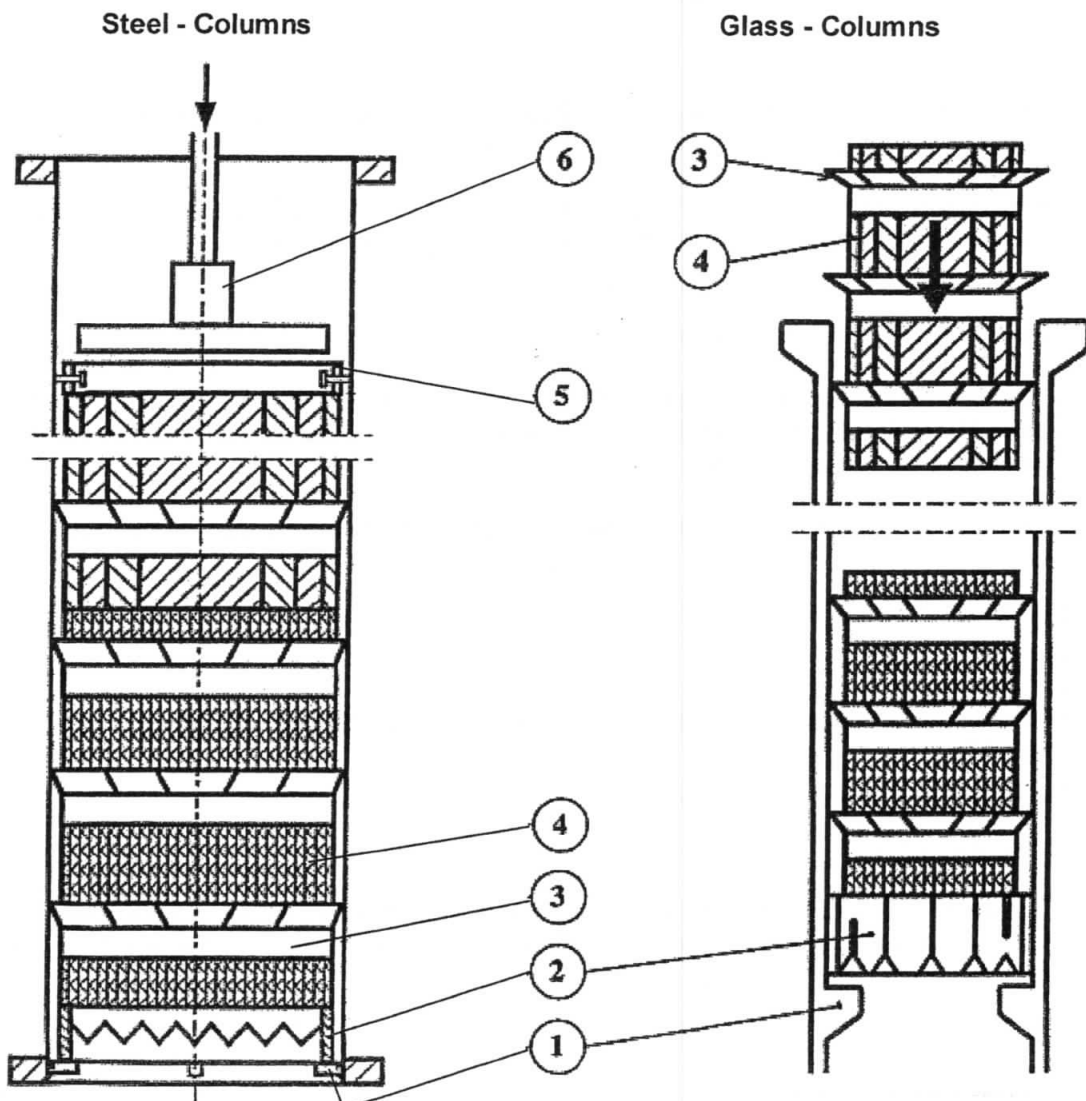
14 Specification for the erection of SULZER pilot columns

Scope: Column inside diameter: 25 - 300 mm

Gap between packing and column wall

Sulzer packings gives best efficiency when there is a small gap between the packings and the column wall.

Therefore, the outer diameter of the packings is a few millimeter less than the inside diameter of the column. In order to prevent vapour and liquid bypass, sealing collars are attached to the packing elements.



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15 Installation instructions for Sulzer pilot columns

1	<p>Support clips / support ring</p> <p>Support clips or rings are welded or fitted inside to column wall.</p>
2	<p>Support grid</p> <p>Minimum height of 25 mm with a free cross section $\geq 80\%$. The provided drop-off plates prevent a premature flooding. This is especially for Packing DX, EX, DXM and DYM.</p>
3	<p>Collar</p> <p>Before the Packing installing, the sealing collars made of metal must be well bent out. When installed the collars will adapt to the column wall.</p> <p>Exceptions are: BX made of plastic with diameters below 100 mm. For this packings the collars i.e. the sealing device is a cord often made of the same material.</p>
4	<p>Installing of packing on site</p> <p>The column has to be positioned vertically. The packings with the bent out collars facing upward have to be orientated correctly and carefully lowered . Successive packings are always placed rotated by 90° to the previous one.</p> <p>Exceptions are: For easier installation Packing ≤ 100 mm can also be installed in horizontal column position.</p>
5	<p>Locating grid</p> <p>For metallic columns with a diameter greater than or equal to 100 mm locating grids can be installed.</p>
6	<p>Liquid Supply</p> <p>The liquid should be fed into the middle of the column. For metallic columns with a diameter ≥ 100 mm, a distributor will improve the efficiency of the packing by providing an equal distribution over the whole cross section.</p>
7	<p>Tolerances</p> <p>The column in the installed position is allowed to deviate by a maximum of 0,3% from the vertical.</p>

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13 Supervision report

Client (Name, Address):

Project name: **Project.-No:**

Column No:

Responsible coordinator: **Installation company:**

Supervisor:

	Executed work inspections	YES	NO	N.A.	REMARKS
1	Vertical deviation of column < 3 ‰				
2	SULZER Packing installed according to installation instructions				
3	Internals are installed according to installation instructions				
4	Liquid distributor levelled				
5	Inlet pipe correctly introduced into main channel (pipe distance as per drawing)				
6	Vane collector correctly installed (overlapping ring channel)				
7	Vane collector for flanged columns correctly sealed				
8	Leak test of Chimney tray performed				
9	Opening for temperature sensor in packing performed				
10	Demister correctly installed				
11	Visual cleanliness of column satisfactory				
12	All manholes closed				

13 Packing type
H1 [mm or In] = Distance between top layer of packing and lower edge of manhole
 flange

	Bed 1	Bed 2	Bed 3	Bed 4	Bed 5	Bed 6
Packing type						
H1 [mm / in]						

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CLIENT

Name: Name:
Signature: Signature:
Location / Date: Location / Date:

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10 Final Inspection of Installation

On completion of the plant installation, before the column entry manways will be closed, inspection has to be carried out.

The correct installation of packing and internals is essential for a good column performance and hence recommend that a Sulzer supervisor is used to supervise the installation. Our erection supervisor will write an erection supervision protocol relating to the scope of work applicable to the Sulzer packing and internals.

11 Experience and frequent errors

A few items are listed below which have a negative influence on the proper functioning of Sulzer columns:

- inlet pipes without filters, with filters dismantled or bypass open
- pipes installed without downwards gradient or with liquid catchments
- suction head of circulating pump too small
- irregular reflux from condenser which flows back uncontrollably into the column
- unsuitable measuring and control instruments, e.g. for the pressure drop
- operating conditions not constant
- poor thermal insulation
- sub cooling of the reflux which is not taken into account for the thermal balance
- blocked distributor
- distributor too little loaded (liquid well below minimum load)

12 Installation Services Sulzer Tower field service

To get column internals installed the SULZER Tower field service group can be asked for support and organisation of the whole revamp or supervision. Sulzer Tower Field Service personnel have extensive knowledge of all types of vessel and tower internals to support for all internals equipment installation requirements.

Contact:


- tfs.australia@sulzer.com
- tfs.brazil@sulzer.com
- tfs.canada@sulzer.com
- tfs.china@sulzer.com
- tfs.germany@sulzer.com
- tfs.india@sulzer.com
- tfs.mexico@sulzer.com
- tfs.middle-east@sulzer.com
- tfs.asiapacific@sulzer.com
- tfs.thailand@sulzer.com
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8 Filtration of the Feeds outside the Columns

<p>The filtration of the liquid feed to ensure that no solids are entering the column is the responsibility of the customer.</p> <p>Cleanliness is an important factor for good functioning of the column because of the risk to plug the distributor holes.</p>	<p>Recommended external filtration for Feed and Reflux</p> <p>max Mesh size [mm]</p> 
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Basically, two sources of contamination have to be prevented:

- a) Contamination caused by new equipment, pipes and by installation
- b) Contamination caused by the feeds, reflux, vapour inlet, and other inlets

If contamination arises from a), filters are to be fitted for the first start-up phase.
If contamination as per b) should arise, continuous filtration is required.

Two filters are always to be fitted together with a switch-over facility. The mesh aperture size is to be chosen to match the diameter of the hole of the liquid distributor. Filter size is dependent on the flow rate, the degree of contamination and on the pumping capacity.

Should as well fine or coarse particles be deposited in the distributor arm channels, as liquid flow velocity is very low, it could be only then a question of time before the distributors are blocked. In this situation you must as well implement a filtering device, inside or outside the column.

9 Degreasing of internals

Where oil residues on packings, internals and column parts are to be removed before the column is commissioned and where the product itself is too valuable or unsuitable for use as a cleaning agent, the degreasing of internals takes place after assembly of said items into the column. A suitable solvent such as Acetone or Perchlor is added into the column. Care should be taken that all inlet and outlet pipelines are flushed out and that the connected equipment and reservoirs are likewise clean. Afterwards, the column is to be operated for about 8 hrs under total reflux conditions and with sufficient gas loading. This means that column, packing and internals are washed down with clean solvent and that fats and oils collect in the sump or in the evaporator. (If the solvent was merely circulated, the contaminants would only be diluted!)

If aqueous mixtures are to be distilled in operation, or if packings and internals have to be free from grease for other reasons, it is worthwhile to order degreased packings and internals from Sulzer. In such a case, however, it has to be established that the column, pipelines, connected equipment and tanks are absolutely clean and free from grease before fitting and that the assembly itself is carried out with the highest degree of cleanliness. If necessary, a final cleaning as described above has to be carried out.

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7.5 Tolerances for brackets

Maximal accepted deviation for brackets and support rings according **Fig.5**

Vertical bars to liquid collector must be parallel to centre line. Maximal accepted deviation see **Fig.6**.

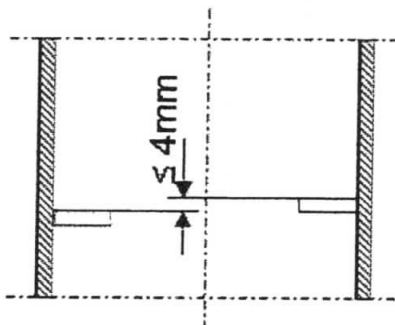


Fig. 5

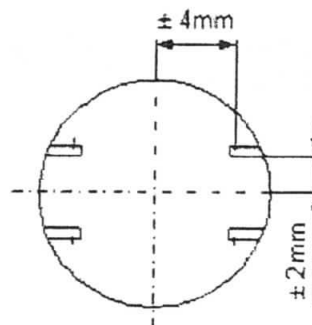


Fig. 6

7.6 Typical installation tools necessary for revamping columns

Proposed tools:

- Block chain (500 kg) [1100 lbs]
- Motor cable winch
- Mobil crane
- Magazine container
- Acetylene/oxygen torch, 3 x 50 m [160 ft] hose
- Arc welding machines incl. 5 x 40 m [130 ft] cable
- Electric grinding machine (slider) angular-type diameter \varnothing 150 mm [6"]
- Electric grinding machine, diameter \varnothing 115 mm [4.5"]
- 220 V Isolating transformer
- Halogen lamp 500 W
- Cables lightening
- Sledge hammer (fore hammer) and hammers
- Aluminium directing bar (lath) 3 m [10 ft] long, new and accurate
- Tape measure (surveyor's tape) 10 m [32 ft]
- Spiral level bars
- Plasma cutting machine
- Ventilation units
- Fitter tool boxes
- Levelling instrument (Laser)

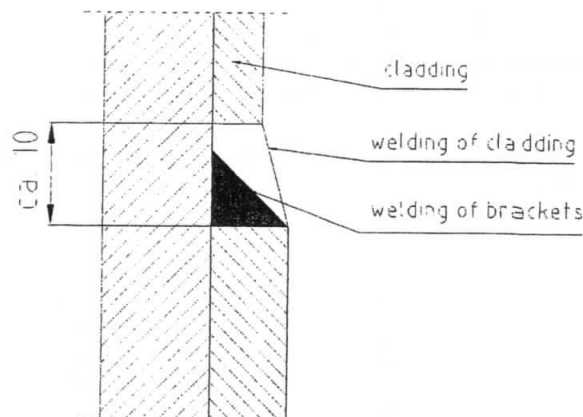
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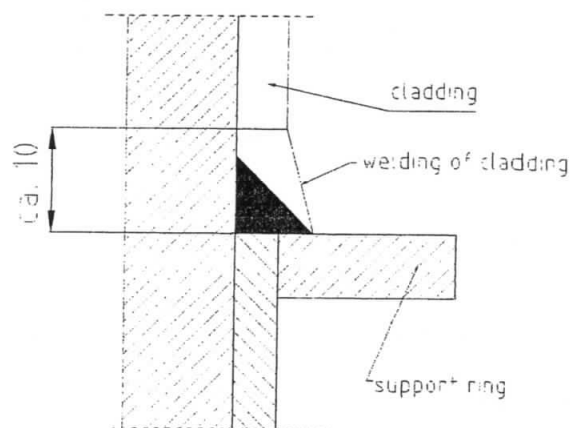
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For load carrying brackets (beam brackets), the bracket welding to the vessel wall should be executed as follows:

Note: Venting holes in reinforcement plate to be closed in hot condition.



Supports and support rings are welded as follows:



Before any welding application on to the vessel wall the base or ground clean surfaces must be checked visually for cleanliness and by PT (liquid penetration method) for any material flaw. After welding the weldments i.e. the vessel surfaces must be checked again.

Cracks or any indication of flaws shall be submitted for consideration or decision by the client resp. any other statutory organisation determined by the refinery or contractor.

Nozzles and manholes are welded and tested according to the refinery procedures and specification.

Chimney trays, downcomers and ring channels to be seal welded. Following instructions are important:

- seal weld sizes must be kept to the minimum necessary to effect liquid tight joints
- the heat build up must be kept to a minimum to reduce plate distortion.
- welding must start from the centre progressing forward the side.
- the last weld must be the welding on to the support ring or vessel wall.

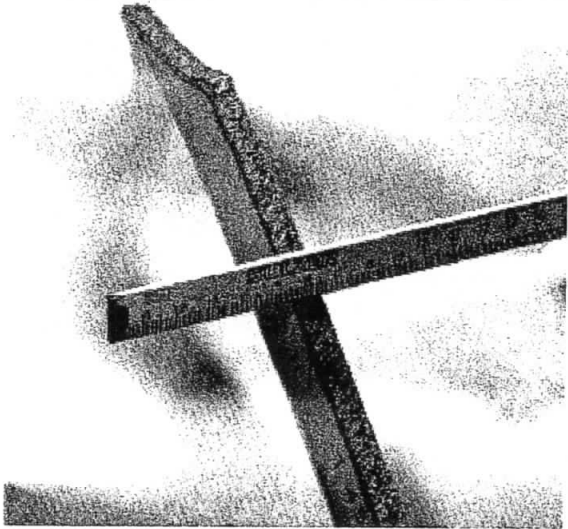
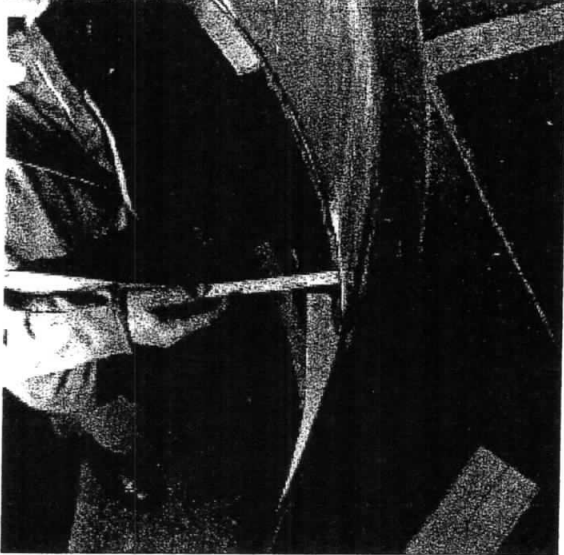
7.4 Welding on lattice beams

This welding must be done in stitch fashion. No great heat build up is allowed in order to avoid distortion.

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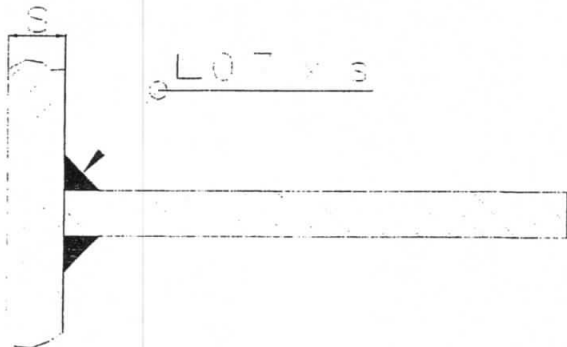
	
<p>Surface of cut out ring segment, material space thickness 1 to 12.5 mm</p>	<p>Ring 5 to 10 mm deep, clean cut with wire brush</p>

7.3 Welding

All welding to be performed by qualified welders according to the applicable pressure vessel code.

Welding procedure specifications (WPS) and Procedure Qualification Records (PQR) for the involved materials must be available.

Site welds are clearly marked with the sign on the drawings submitted.

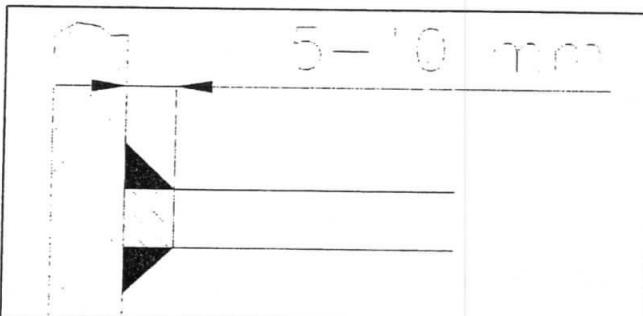
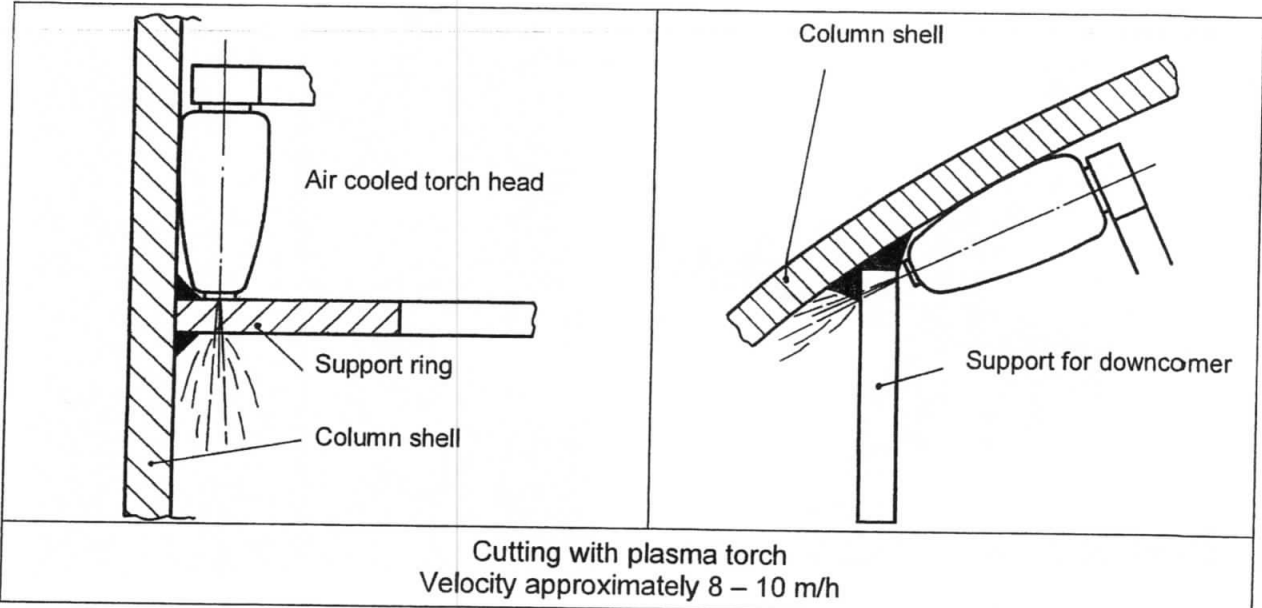
<p>Parts welded to the column wall must be welded on both sides with thoroughly filled welds. If not specified on drawings, all weldments to be as follows.</p>	
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7.2 Cutting of tray support rings in stainless steel



Rest of ring after flame cutting < 5 – 10 mm
Cut has to be cleaned with brush. Normally slight grinding is required before wire brushing.



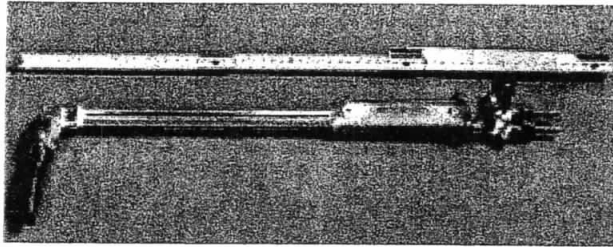
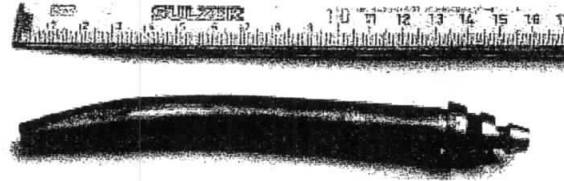
Stainless steel tray ring cut out with plasma torch

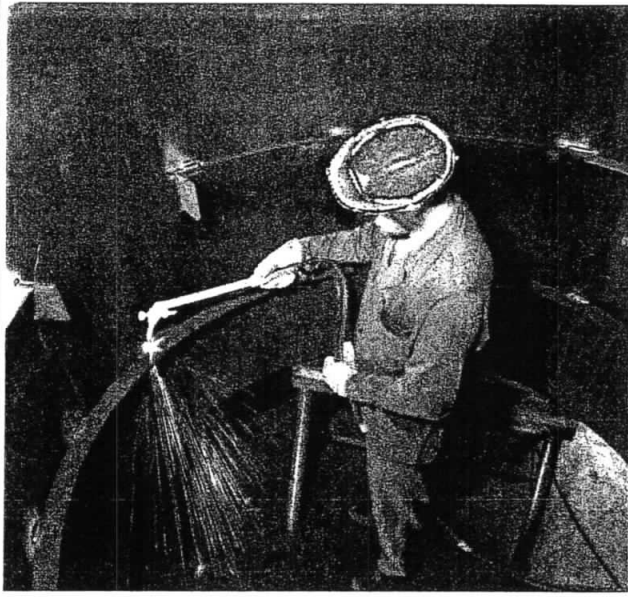
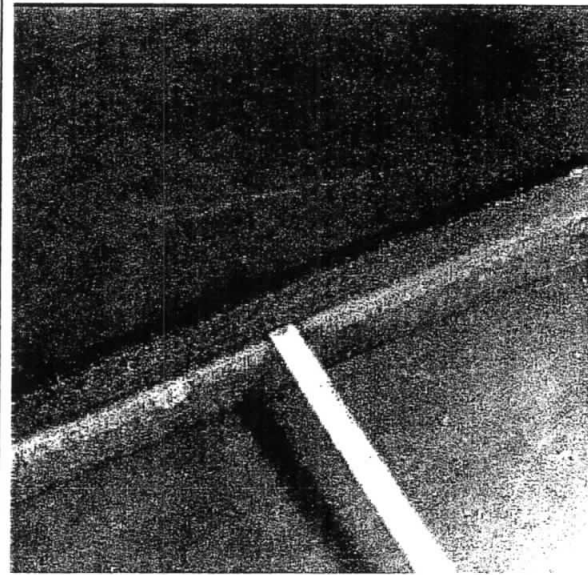
Air-cooled torch equipped with push button switch for main arc and cutting-air

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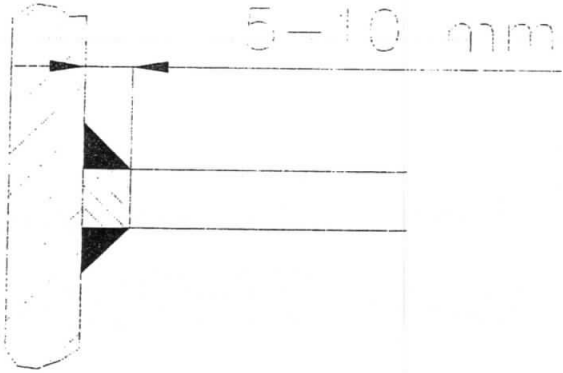
	
<p>Torch for Oxy-Acetylene/O₂ mixture with jetvalve to purge Oxygen</p>	<p>Nozzle of torch, especially long and bent</p>

	
<p>Cutting of carbon steel tray ring with Acetylene/Oxygen torch</p>	<p>Cut-remnant 5 to 10 mm, shown before cleaning with wire brush</p>

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 <p>5-10 mm</p>	<p>Rest of ring after flame cutting < 5 – 10 mm</p> <p>Cut has to be cleaned with brush. Normally slight grinding is required before wire brushing.</p>
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7 Cutting off the rings

Attention: When welding in the column, no inflammable products should be present, and all necessary safety precautions are to be taken.



Structured packing is fire hazardous!

The use of standard cleaning processes are not a guarantee that all traces of hydrocarbons have been completely removed from used packing. There is **always** the potential for residual traces of material to remain upon any packing even after cleaning has been performed. Due to this risk, any work performed above, below or near a packed bed should always be viewed as work performed next to a potential fuel source. Therefore, no hot work, oxy cutting, welding, grinding, or gouging should ever be performed above, below or near a packed bed. For further details we recommend to contact our Tower Field Service Specialist.

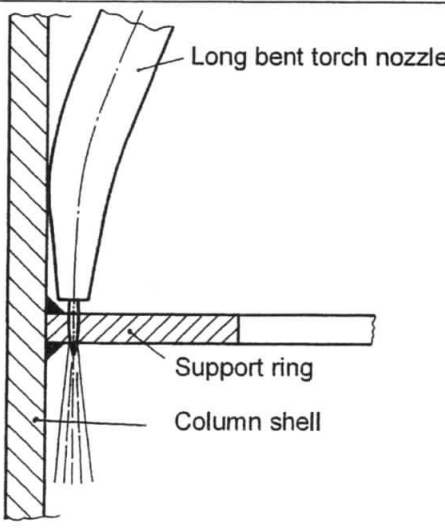
All rings, brackets, inward projecting pipe connections have to be removed from the area into which the structured packings are to be installed. Any unavoidable projections still remaining after removal of the rings etc. are not to exceed:

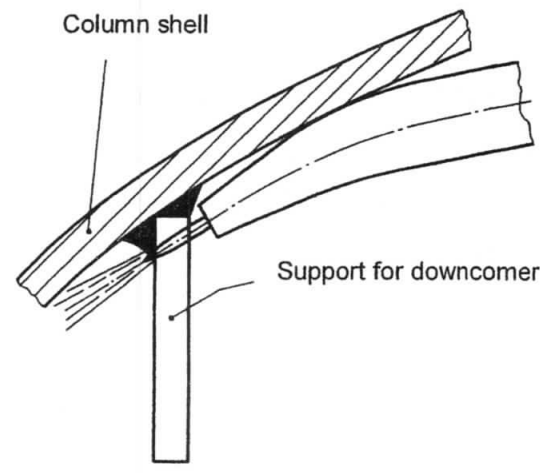
- 5 – 10 mm for welded carbon and stainless steel columns

Tray rings are to be removed by flame cutting.

Wherever possible, existing rings are to be utilised and, if necessary, supplemented to carry new ring channels and support beams.

7.1 Cutting of tray support rings in carbon steel





Cutting with acetylene/oxygen torch
Velocity approx. 5-8 m/h

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6 Column revamps

Responsibility of client: column gas free, cleaned and isolated, accessibility, safety and waste disposal.

Existing nozzles and manholes which will be reused to be checked for correct elevation and orientation.

After removal of existing trays and rings, the column diameter as out of column roundness must be checked. If necessary recommendation for corrective action to be taken.

The final phase of the removal of the old internals and the installation of the Sulzer components are to be supervised by Sulzer personnel.

6.1 Preparation

A well carried out preparation shortens the installation time. The following items have to be attended to:

- general procedures made known
- clearance for entering column (gas free)
- ventilation (fans or breathing apparatus)
- lighting within the column (low voltage)
- accessibility, scaffolding, cranes, hoists, rope-ladder, rope set, etc.
- means of transport and routes to be followed
- partial pre-assembly (in order to save time during shut down)
- telephone or radio communication
- safety regulations
- correct storage of hardware

6.2 Dismantling of existing trays

The rational removal of the trays is dependent on the following:

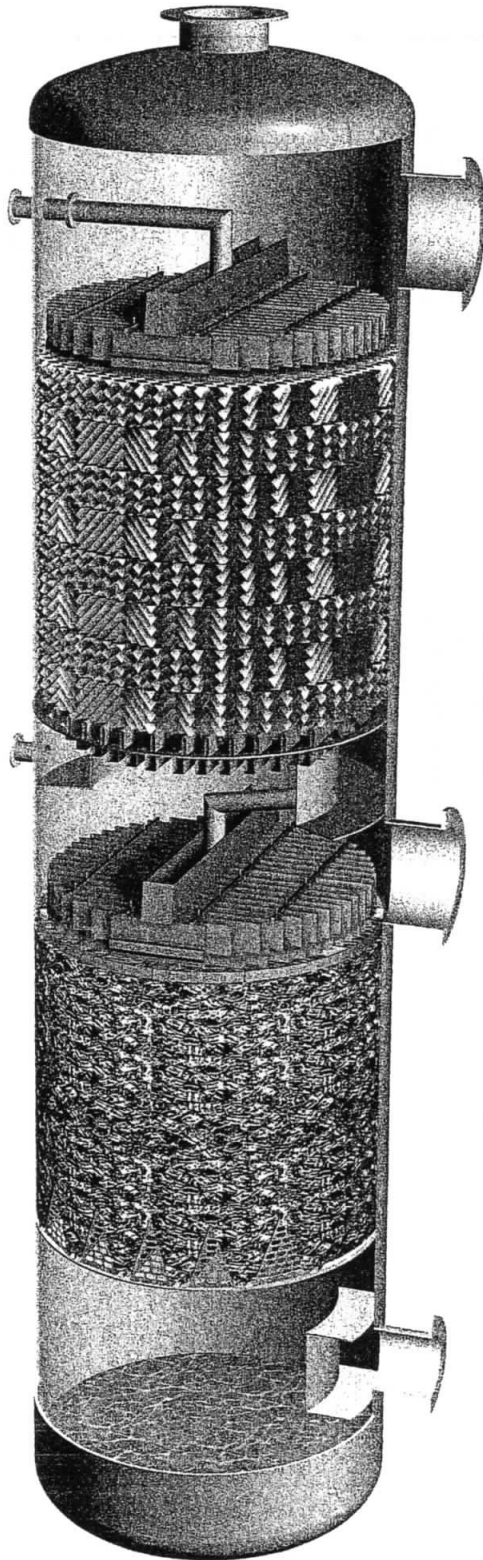
- type of tray
- type of fastening (clips, screws, welded construction etc.)
- year of construction, material
- corrosion and product residue
- check for presence of Asbestos tape

Note: Some trays might be used as platforms

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5.2 Welded vessel columns, monoblock type

The column is set upright by means of suitable lifting equipment and lowered onto the prepared foundation, and the required verticality checked.

All segmental internals are installed through the manholes.

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5 Setting-up the column

All equipment is to be checked for cleanliness before installation. Sealing surfaces are to be very carefully handled during the assembly work.

The erection sequence for the two principal column designs is as follows:

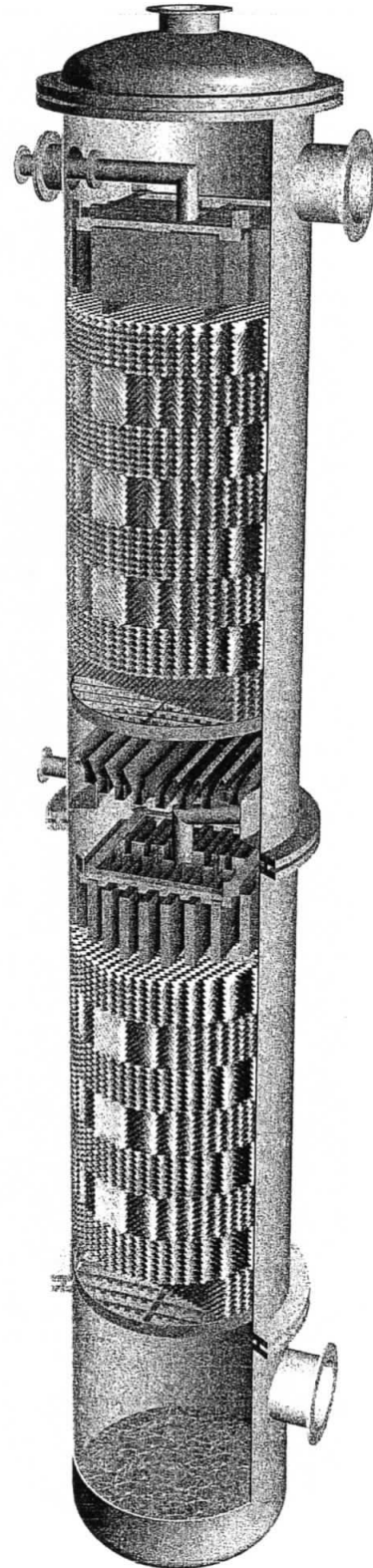
5.1 Flanged columns of sectional design

First the column sump with the skirt or the part of the column carrying the support lugs are placed in position and the connecting flange of the column is aligned to the horizontal, maximum deviation 0,1 %. After assembly of all column sections, the verticality is to be checked by using a plumb line or a theodolite. The assembly of the vertical sections of the column takes place section by section. Instructions for this are given in the column assembly drawing.

Already assembled sections have to be transported in the vertical position and with minimum mechanical stressing.

Slim columns have one or more guide supports. Ensure that the column can expand along its axis.

Packings and internals are installed through the column flange.



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4 Vessel tolerances

The diameters of columns are to be measured and the results compared with the maximum tolerances given below:

Packing type	allowed tolerances in diameter [mm]						
	< 700	701	1'301	2'101	4'101	7'001	> 10'000
		-1300	-2100	-4'100	-7'000	-10'000	
BX, CY Mellapak ≥ 500	+/- 0.3% of column inside diameter						
Mellapak < 500	+/- 0.5% of column inside diameter						
Horizontal transport	Inside diameter + 5 / 0 [mm], circumference +/-5						

Where the internal diameter is outside (above or below) the mentioned tolerance limits, a check is to be made with Sulzer Chemtech as to whether replacement or adjustment of the packings and internals is required.

4.1 Vertical tolerance V of vessel

For proper operation of packing a maximal allowed verticality is to be kept. The verticality V is a function of the column height. The horizontal difference x between column head and sump is verified.

$$V = \frac{x[\text{mm}]}{\text{column_height}[\text{mm}]} \cdot 100[\%]$$

Column type	column head to sump	per section
flanged columns	0.3 %	0.1 %
welded columns	0.3 %	

4.2 Tolerances for weldings

To prevent wall leakage during operation of packing the column welding must be defined as following.

Flanged columns: grind welding ropes complete for:

- ID < 800 mm and BX, CY packings

max. 2 mm welding ropes allowed



- ID > 800 mm and BX or other packings

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Attention: When welding in the column, no inflammable products should be present, and all necessary safety precautions are to be taken.

Structured packing is fire hazardous!

The use of standard cleaning processes are not a guarantee that all traces of hydrocarbons have been completely removed from used packing. There is **always** the potential for residual traces of material to remain upon any packing even after cleaning has been performed. Due to this risk, any work performed above, below or near a packed bed should always be viewed as work performed next to a potential fuel source. Therefore, no hot work, oxy cutting, welding, grinding, or gouging should ever be performed above, below or near a packed bed. For further details we recommend to contact our Tower Field Service Specialist.

All employees will endeavour to keep their workplace clean and tidy to ensure safe working at all times.

Openings in the area where welding is taking place must be closed, as far as practicable if they have any adverse effect on the process being used.

3 Transport and storage

Under normal circumstances, the internals are not assembled before the on-site installation at the customer's premises. The Sulzer structured packings are delivered on pallets or in closed wooden crates. Preferable the storage should be close to column.

The column internals are normally transported banded on open pallets or light crates. Certified to being crane/winch lifted to appropriate installation manways.

The columns are dispatched by rail or road vehicle, unpacked. All openings are closed.

The packing cases are not to be opened until immediately before commencement of installation, preferably in the presence of a specialist from Sulzer. Transport damage to packing case has to be reported immediately to the responsible person.

Inventory checks of boxes / crates to be executed in accordance with Packing Lists. Any shortages to be reported immediately.

The Sulzer structured packings and internals supplied are to be transported and stored in a manner appropriate for the constructional material used:

C-steel / AISI 410S: protect from moisture and dirt

Stainless steel: protect against surface contamination, in particular against the deposition of rust from other sources

Graphite: to be carefully transported, to be stored in a clean and dry environment

Plastics: to be stored in a clean environment, protected from sun light.

The packing cases containing the structured packings will carry suitable instructions concerning transport, e.g. "this way up ↑↑" or "protect from moisture".

The pallets transporting packings and internals cannot be stacked.

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1 Introduction

We recommend that a supervisor from Sulzer is present during the installation and assembly of the Sulzer structured packings and internals, as well as during the subsequent check of the column alignment.

The supervisor from Sulzer is always to be present, if Sulzer has to give a capacity or purity guarantee. Sulzer reserves the right to reject any claims in connection with the guarantee if the installation has not been supervised by its own specialists.








Sulzer does not take over costs aroused by unqualified installation.

You must work to the specific drawings for internals and trays you are fitting. **Ask supervisor if unsure!**

The high degree of effectiveness inherent in Sulzer columns can only be achieved when all parts are correctly installed and the following specifications are complied with.

2 GENERAL SAFETY INSTRUCTIONS

"It shall be the duty of every employee while at work - to take reasonable care for the health and safety of himself and other person who may be affected by his acts or omissions at work..."

 	<p>Important:</p> <p>Because of danger of injury, do not handle packing without wearing protective clothing and anti-cut gloves!</p>
 	<p>Eye protection and safety helmets must be worn at all times!</p>
	<p>Protective footwear must be worn and should be part of normal workwear every day!</p>
 	<p>Be aware of not standing under floating load!</p>

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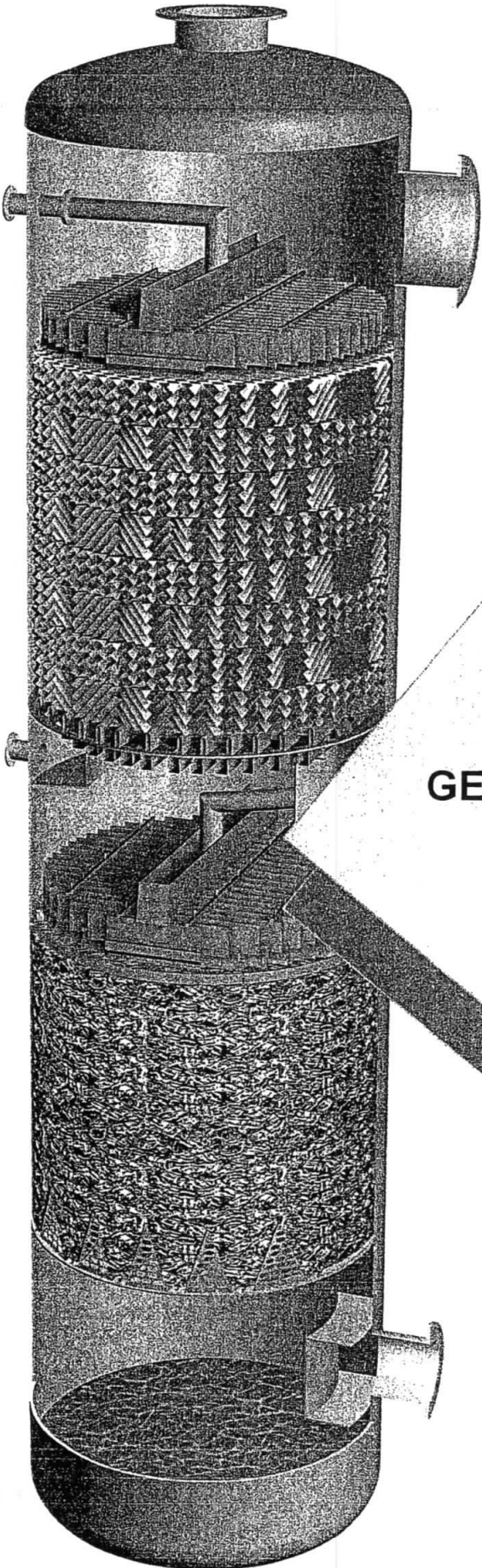
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**GENERAL INSTALLATION
INSTRUCTIONS
T-Hbl - 01**

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