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MODULE F
Welding technology

Welding technology

Preparation of weld surfaces during gas welding

- For the welding of weld joint according to the defined requirements, it is necessary to prepare the weld surface and the welded parts.
- As it is generally known to be governed by the shape of the weld surfaces of the material thickness.
- Technology autogenous (gas welding) according to this standard (ISO 857) has the numerical designation of third
- IN This standard for autogenous weld bevels especially given:
  - Backseamed
  - Blunt I weld
  - Blunt V weld
  - Blunt X weld.

Bind contention

- With it is preferably used for thin sheet to a thickness of 2 mm.

Blunt I weld

- Use welding thickness of 1 mm to 4 mm.

In blunt weld

- For welding of sheets of thickness greater than 4 mm is used in butt weld.
- This weld with optimal choice of dimensions of the weld root (spaces and dulling) allows good root fusion weld.
- Training the dimensions of the weld root mostly chosen welder himself.
- According to their dispositions and abilities.

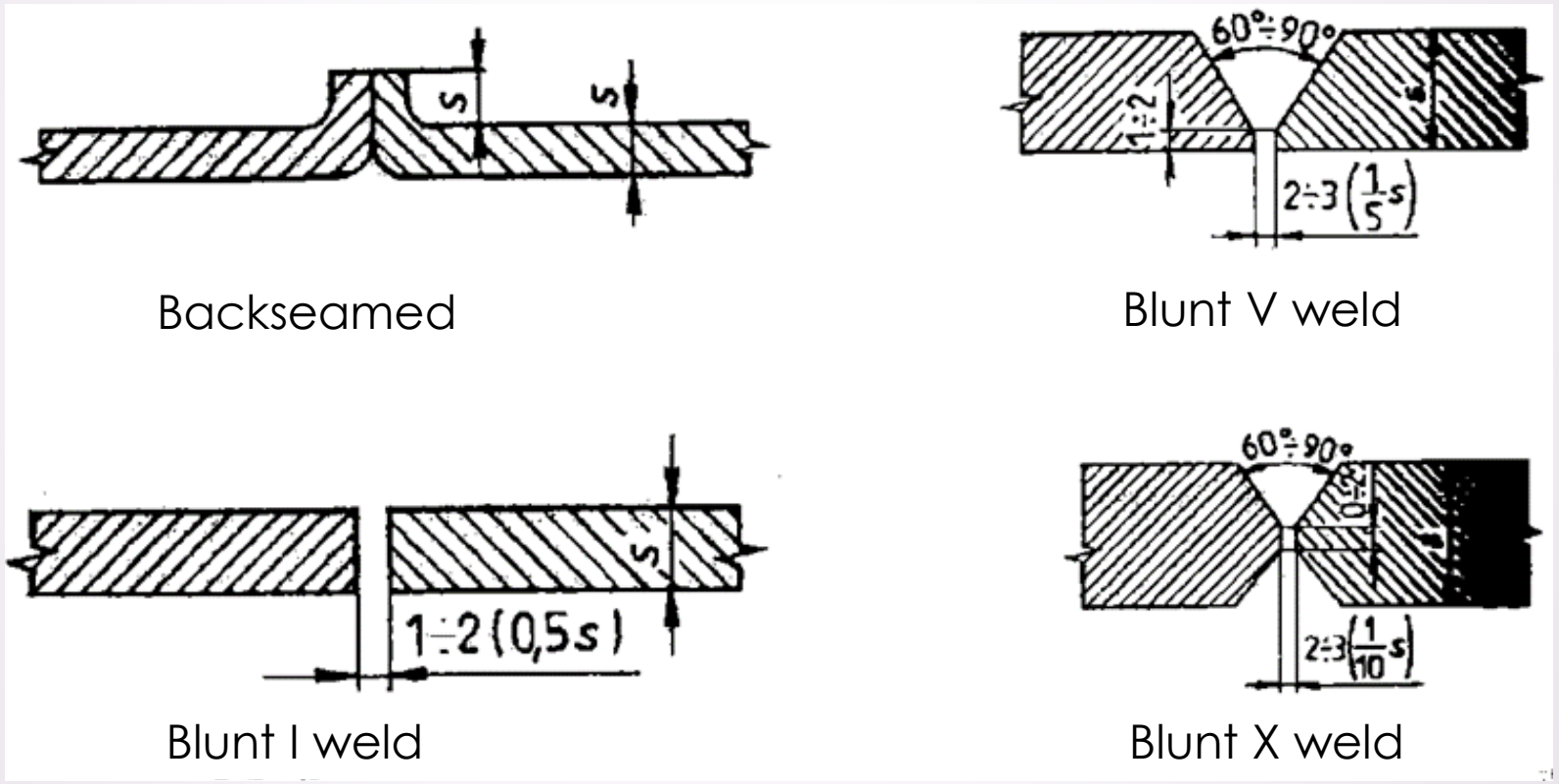
X blunt weld

- For welding the sheet thickness more than 12 mm is used to butt weld X.
- Dimensions bevels are the same as in the weld.
- At AC welding bevels of both parts can be lowered somewhat angular deformation in the weld joint.

The shapes and dimensions of the weld surfaces

a) backseamed
b) blunt I weld
c) blunt V weld
d) blunt X weld

Draft weldment

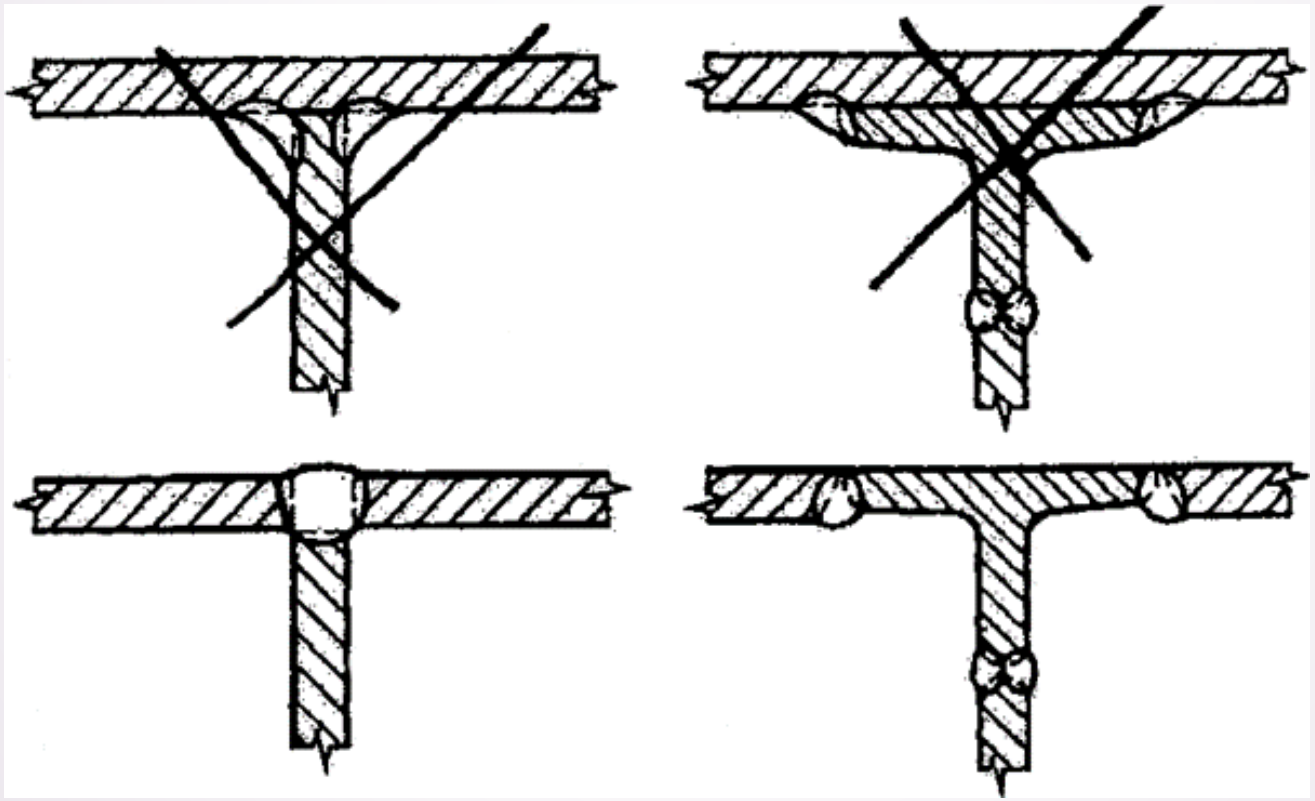


AMBROŽ, O. A KOL. *Technologie svařování a zařízení: učební texty pro kurzy svářečských inženýrů a technologů*. Ostrava: ZEROSS, 2001. s. 41.

Welds

- It is recommended for use mainly gas welding butt welds.
- Lapped welded joints are not recommended, they are used only when absolutely necessary and only welding backward.
- At welding is not recommended for fillet welds.
- Better replace fillet joints butt.
- It but applies also to the weld flange, which is preferably recommended to use butt weld fillet before.
- Basic principle welds performed gas welding is that the weld joints should preferably be subjected to tension or pressure and exceptionally bending.
- It applies also preferably loaded dynamically at welds.

Proposals perpendicular joining plates - replacement of fillet joints butt joints



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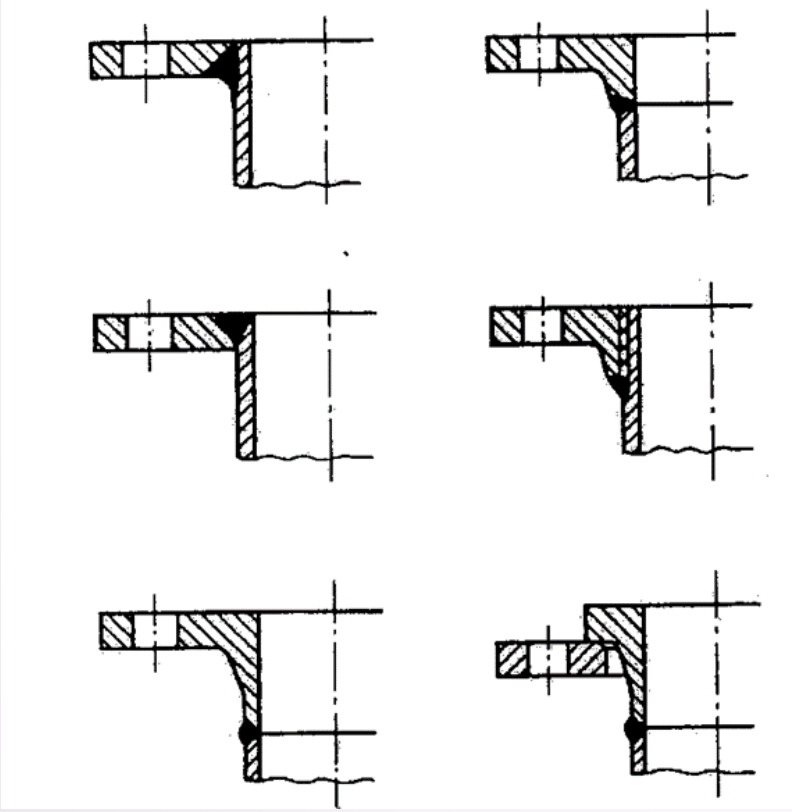
Structural design of welded pipe joints with a flange



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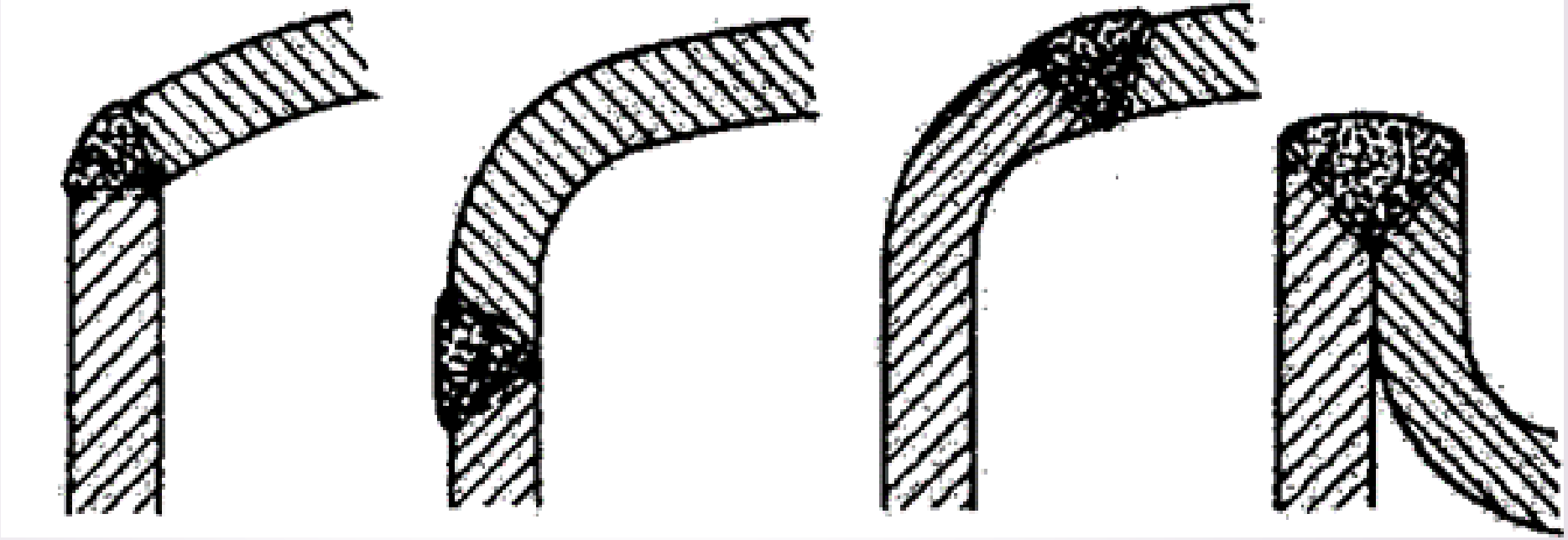
Structural adjustment connection cylindrical tank shell to the bottom of the container



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Welding technology

- Welding forward - the additional material is fed to the burner in the direction of welding. It is less demanding welding method than the reverse.
- Hereby the procedure is a greater danger of incomplete penetration weld root due to overtaking the weld pool.
- Flame preheating the base material, but not temper and protect weld created - higher hardness and oxidation of the weld.
- Use this process is suitable for a thin sheet to a thickness of 4 mm.

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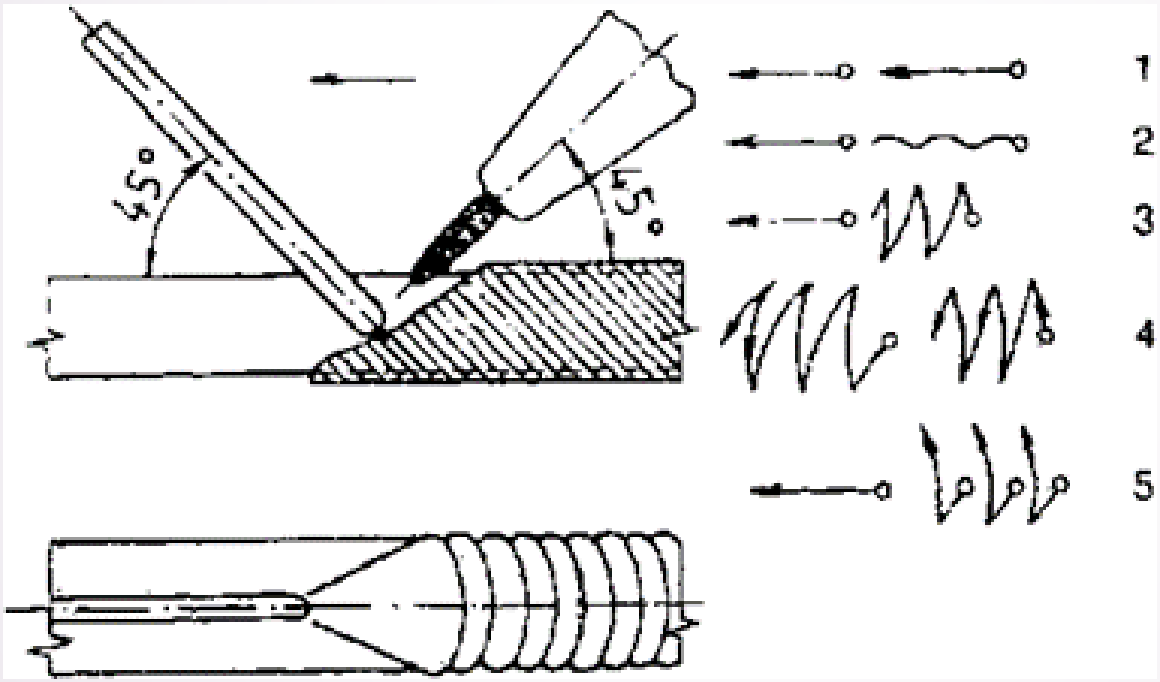
welding forward



Welding Forward - The butt weld
The torch and wire:
1. *thin plates*
2. *Even weld to 4 mm*
3. *The weld 8 mm*
4. *In the above weld 8 mm*
5. *improper management burner*

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Backward welding

- Welding backwards - additional material proceeds downstream of the burner and formed weld bead surface.
- Flame It is directed on to the weld pool and cooling weld, which is protected by a flue gas heating reduces the cooling rate.
- There thereby protecting the melt pool and solidified weld from the adverse effects of the atmosphere.
- Welding reverse achieve higher quality welds, the guaranteed penetration of the root, a smaller stress and deformation.
- This method is prescribed for a variety of structures exposed welds

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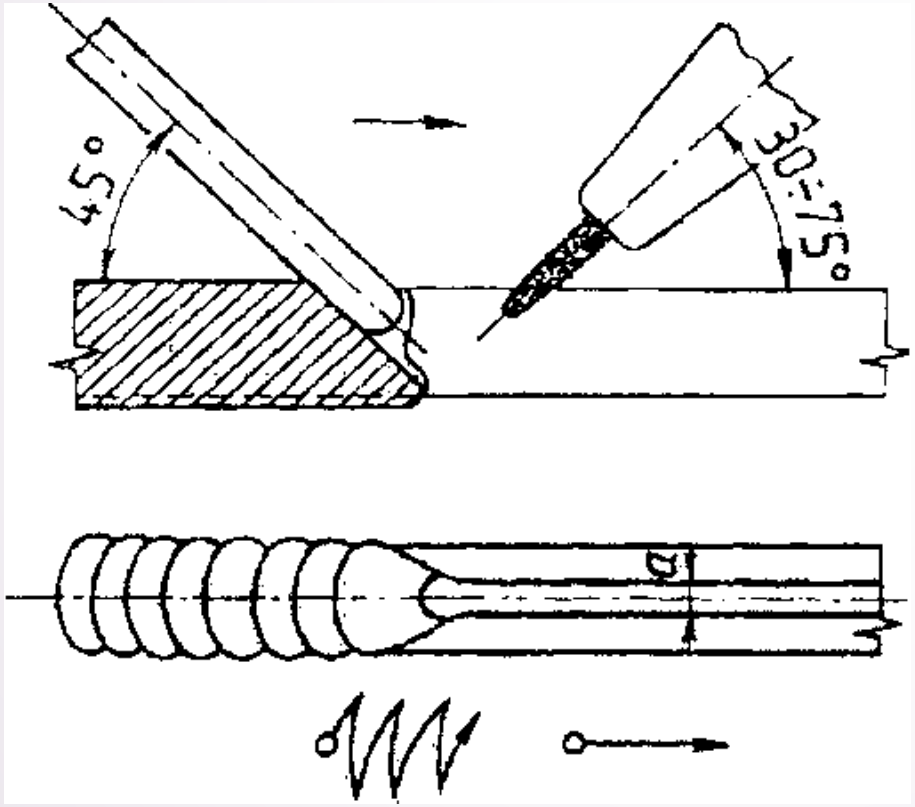
backward welding



movement of the wire
movement of the torch

welding butt back in contention

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Reverse backfiring

- This phenomenon is not desirable when flame welding.
- If welder does not respond properly, and this phenomenon may also become very dangerous.
- At back-lash flame enters the torch, burning there.
- If gets to the injector, the symptoms of this condition, whistling.

Welding consumables flame

- As additional material during the welding wire using the flame.
- Because that additional material significantly affects the quality of the weld quality must be additional material continued attention.
- Additional material - wire, is always selected for similar or the same chemical composition as the base weld material.

Welding consumables flame

- Welding bright wires are supplied and drawn without heat treatment.
- Surface the wire must be without defects and defects in many cases, the copper-plated wire surface slightly.
- Wires Gas welding are available in length of 1 m in bundles of 100 pieces.
- Exception forming rods for welding cast iron and for surfacing special properties.
- Wires are manufactured in diameters: 1.6 mm; 2.0 mm; 2.5 mm; 3.2 mm; 4.0 mm; 5.0 mm; 6.3 mm; 8.0 mm; 10.0 mm.
- Welding wire diameters are chosen with regard to the thickness of the base material to be welded.

The diameter of the welding wire and its assignment to the thickness of the base material

Thickness (mm)	0.5 to 1.0	1.0 to 3.0	4.0 to 5.0	6.0 to 7.0	8.0 to 9.0	10.0 to 15.0	20.0 to 30.0
Wire diameter (mm)	1.6	2.0	3.2	4.0	5.0	6.3	8.0

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The diameter of the welding wire

- You can also successfully be used empirical formulas for calculating the diameter of the welding wire.
- According to these relationships designed for thin sheet welding with additional materials selected diameter of 0.5 mm to 1 mm larger than half the thickness of the base material.

Marking of additional materials

- Designation of welding consumables flame is not currently very topical given the market a number of suppliers of these materials.
- Let us so at least the labeling of additional materials by ESAB, given that it is a manufacturer of auxiliary materials in the country.

Marking of additional materials

- According to ESAB wires are called one letter and three numbers. For example:
- G XXX
  - G indicates that it is a filler material for autogenous
  - X indicates the first number for which group of basic materials, the filler material is intended
  - XX, XXX, second and third number have only the character of the serial number and importance to the manufacturer
- According to the numerical designator of additional materials can be e.g. wire 102 labeled G indicate:
- G102 (CSN 05 5321): percentage composition of the wire C = 0.1; Si = 0.15;Mn = 0.5
- Use:
  - For demanding welds pipes and thin sheets for common construction and metal welding.

Further work using a torch

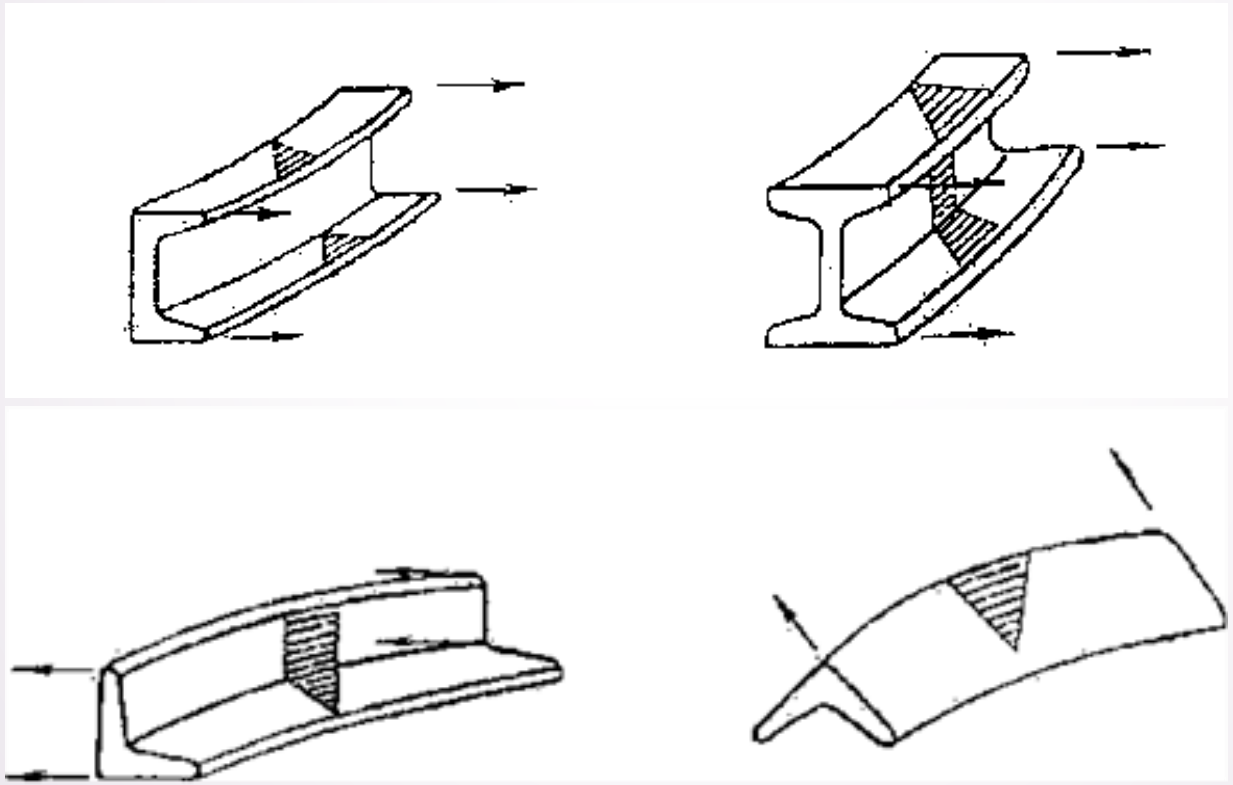
- Straightening flame
- Gouging oxygen
- Cleaning flame

straightening flame

- Technology flame straightening is used for correcting the distorted parts and components.
- It uses the plastic deformations during cooling material.
- Thus expansion of the metal used in the metal heating and shrinkage during their cooling.
- Low carbon steel heated to 600 ° C to 700 ° C and alloy steels at 400 ° C to 600 ° C.
- If the deformed part of the larger size, it is necessary to perform this procedure several times.

1. Cuneiform heating for straightening profiles
2. Tracked heater for straightening structure
3. Annular heating pipe straightening

A method of heating sections in straightened



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Gouging

- Gouging is used for removal of weld metal when removing a defective weld before correction when preparing root welds (padded root) for the preparation of complex shaped welding surfaces.
- Principle It is very similar to oxygen cutting, when the metal burns in a stream of oxygen to molten slag and oxygen flow blows it out of the joint.
- Completely different when grooving position of the nozzle which is directed almost parallel with the surface material to form the desired slot or is tilted according to the position and depth of the defect.

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Flame cleaning

- The principle of cleaning (jetting) a flame, the use of different thermal expansion coefficient relatively cold material being heated and the oxide layer on the surface.
- Influence the resulting voltage is violating mutual relations and pressure oxidative flame surface layers are removed.
- Technology It can be used to clean a variety of materials - hot rolled and forged profiles and sheets with a layer of mill-scale steel structures covered with paint or corrosion, even offshore systems covered in vegetation.
- Cleaning flame is also used for thermal processing and preparing the repair area of concrete and stone surfaces.
- It uses to form a voltage between the cold and the hot substrate surface and thus form a subsurface cracks that lead to peeling of the surface layer.

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Questions to ponder

1. Describe the welding equipment and methodology for safe handling and work.
2. Describe the welding back and forth.
3. To what material thickness is welded way forward?
4. What advantages provides a method for welding backwards?
5. What additional material is used in gas welding?
6. What is the principle of flame straightening?
7. How is Gouging?
8. What is based flame cleaning?
9. What are the areas of application of welding flame?

Recommended literature and information sources

- AMBROŽ, O. A KOL. Technologie svařování a zařízení: učební texty pro kurzy svářečských inženýrů a technologů. Ostrava: ZEROSS, 2001, 395 s. Svařování. ISBN 80-85771-81-0.
- BERNASOVÁ, E. A KOL. Svařování. Praha: SNTL, 1987. ISBN 04-221-88.
- KOUKAL, J., SCHWARZ, D., HAJDÍK, J. Materiály a jejich svařitelnost. 1. vyd. Ostrava: VŠB – Technická univerzita Ostrava, 2009, 240 s. ISBN 978-80-248-2025-5.
- KUBÍČEK, J. DANĚK, L. KANDUS, B. Technologie svařování a zařízení. Učební texty pro kurzy svařovacích inženýrů a technologů. Plzeň: ŠKODA WELDING, s. r. o., 2011, 242 s.