Instructions

Information about the oxygen thermic lance (spezial combustion tube)

Produced by:

W. Humberg GmbH & Co. KG
General Information

The oxygen thermic lance makes use of a thermic cutting process which is referred to as flame boring or thermic hole drilling. Following ignition of the thermic tube tip with an oxyacetylene torch, pure oxygen is fed through a steel tube with built-in core wires. This leads to the ‘burning’ (oxidation) of the lance material at the tip of the thermic lance. In the process a temperature of approximately 2,200°C develops, allowing the melting of both metallic and non-metallic materials. Our range of special thermic lances includes different standard dimensions. We supply the following special thermic lances in accordance with DIN EN 10255, free of oil, grease or other residues:

- Lengths of 1.5m, 2m, 3m (standard), 4m and 6m
- In sizes ¼"', 3/8" and ½" (13.5 mms, 17.2 mms and 21.3 mms)
- With and without thread and sleeve,

According to requirements to avoid left-over lengths (material savings). On request we can produce special thermic lances to meet your individual requirements, e.g. as partially-filled tubes.

Application

- In industrial applications oxygen thermic lances are used to cut large metal sections (all alloys and material thicknesses), for demolition work, for cutting of bulkheads, loosening jammed bolts and for other uses in foundries.
Personal protection equipment

Because of the high temperatures produced (2,200°C) and the splattering of the melted material, the following personal protection equipment is recommended:

- A protective helmet in accordance with EN 397, with helmet holder and face protection (visor against splashes of liquid material, tint flame-resistant protective working clothing
- Aluminium-coated front apron with 1/1 sleeves, in accordance with EN 531
- Aluminium-coated protective gloves in accordance with EN 407
- High boots of rubber with non-slip soles and steel toe caps
- When cutting certain materials (lead, zinc, tin, and aluminium) the use of appropriate personal breathing equipment might be necessary.

No part of the clothing may be made of artificial fibres (e.g., fleece)!

The following illustration shows the complete protective clothing.

![Figure 1: Protective clothing](image-url)
The personal protective clothing and equipment should be stored so that the visor and protective clothing are not damaged.

![Figure 2: Protective equipment](image)

**Fire Prevention**

Fire prevention is of utmost importance when working with the thermic lance (position fire fighting equipment nearby). When cutting near inflammable materials the highest level of care should be taken. Fire blankets are suitable for covering areas at risk.

**Work and Safety Notes**

1. Follow the accident prevention regulations for welding, cutting and similar processes (BGV D1).
2. Adopt a safe position before starting work.
3. Wear suitable protective clothing.
4. When you change the pressure regulator (empty oxygen cylinder) then **always** relieve the pressure, and completely, otherwise the membrane will be damaged.
5. When taking a break, always turn off the oxygen supply completely.
Equipment

The equipment of the oxygen thermic lance includes:

- Thermic lance holder (with shut-off valve)
- Metal braided oxygen hose in accordance with DIN 8541 Part 2 (armoured hose)

High performance pressure regulator (capacity >100m³ per hour).

IMPORTANT:
Components transporting oxygen must not come into contact with oils or grease!
Danger of explosion!

Starting Up

The start-up described here refers only to the oxygen thermic lance. The following can be used for ignition: welding torch, oxyacetylene cutter or electrical ignition source.

To start the thermic lance the pressure regulator is connected to the oxygen supply. This may be a single cylinder (at least 10m³) a set of linked cylinders, or a gas cylinder manifold. The oxygen source must be outside the direct danger area, i.e. it may not stand in an area where sparks are flying during working.

The armoured hose is screwed to the outlet of the pressure regulator.
The other end of the armoured hose is to be connected to the handle of the thermic lance holder. Care should be taken for all connections that the sealing materials used are suitable for oxygen, that they are undamaged and that there are no leaks. (Danger of oxygenation!). The shut-off valve on the thermic lance holder must also be closed. The thermic lance can be inserted into the handle by loosening the coupling nut on the thermic lance holder slightly (a few turns).

In order to now set the flow pressure required for working, the valve on the thermic lance holder and the ball valve on the pressure regulator must be open. Turn the setting screw on the pressure regulator until a flow pressure of 6 to 8 bar is set.
The setting of the optimum pressure is dependent on the material and the cutting depth, and may require adjustment during the cutting process. A lower pressure is required for shallower holes than for deep holes. The selection of the correct pressure has a major influence on the cut, the progress of the work and the consumption of lances and oxygen.

**In summary, with regard to the oxygen pressure the following can be said:**

The oxygen pressures are to be so set that the melted material can flow away from the cut. Pressure that is too low leads to ‘freezing’ of the lance, whilst pressure that is too high leads to heavy splashing of the melted material and can thus represent a danger to those working. The flow pressure of the oxygen should as a rule remain between 6 bars and 8 bars. When the material is thicker the pressure has to be increased so as to enable the melted material to flow away.
Consumption and Dangers

In order to enable an estimation of the material requirement when using the oxygen lance, it is important to evaluate the cutting task. Since the consumption of thermic tubes and oxygen basically depend on the material, its thickness and the length of the cutting, the following formula permits an approximate estimate of the material requirement:

Burning a Single Hole:

**Ratio:** length of the hole: thermic tube consumption approximately 1:5 (up to 1m hole length) / approximately 1:6 to 1:7 (for hole lengths which are larger than 1m)

Cutting a Surface Opening:

**Separated area (m²) = cutting length (m) x material thickness (m)**

Example: cutting length 5m x material thickness 0.2m = 1m² separated area

Consumption during use with metallic materials (steel/iron/cast materials):

- Guideline value of approximately 22 thermic tubes of 3m length for 1m² of separated material.
- Burning period: approximately 2 hours per 1m² of separated area.
- Oxygen consumption: approximately 2.4m³ of oxygen per 3/8” thermic tube at 8 bar flow pressure (=> approximately 4 thermic tubes per 10m³ oxygen cylinder)

Consumption during use on concrete (up to 45cm thickness):

- Guideline value of approximately 34 thermic tubes of 3m length for 1m² of separated material.
- Burning period: approximately 3.5 hours per 1m² separated material.
- Oxygen consumption: approximately 2.4m³ of oxygen per thermic tube at 8 bar flow pressure.
- The necessary pressure changes according to the thickness of the material.
- **The amount of reinforcement in the material has a major influence on the consumption rate values.**
Fumes
When cutting and burning iron and steel, iron oxide is produced in the form of brown fumes. The concentrations which are produced are of no concern for the environment. When working in closed or badly-ventilated rooms care should be taken to provide both sufficient oxygen and extract the fumes.

Overview table:

<table>
<thead>
<tr>
<th></th>
<th>Steel/iron/cast</th>
<th>Concrete</th>
<th>NF metals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thermic tube</strong></td>
<td>approx. 22 / m²</td>
<td>approx. 34 / m²</td>
<td>approx. 22 / m²</td>
</tr>
<tr>
<td><strong>consumption</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Oxygen</strong></td>
<td>2.4 m³ / lance</td>
<td>2.4 m³ / lance</td>
<td>2.4 m³ / lance</td>
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<tr>
<td><strong>consumption</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Burning period</strong></td>
<td>2 h / m²</td>
<td>3.5 h / m²</td>
<td>material dependent</td>
</tr>
<tr>
<td><strong>Oxygen pressure</strong></td>
<td>6 – 8 bar</td>
<td>6 – 8 bar</td>
<td></td>
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<tr>
<td><strong>Dangers</strong></td>
<td>temperature</td>
<td>temperature</td>
<td>temperature and fumes</td>
</tr>
</tbody>
</table>

**Working with the Thermic Lance**

To ignite the thermic lance an external energy source is required. This may be an oxyacetylene torch, a short circuit device to produce an arc, or a coal fire. Following the fitting of the thermic tube into the handle section and the setting of the flow pressure the cylinder valve and the ball valve on the pressure regulator remain open. Only the valve on the thermic lance handle is closed. In case of longer breaks during work the cylinder valve and the ball valve must be closed. Release the pressure by opening and closing the valve on the handle section. To ignite the lance the tip of the thermic tube is heated using the oxyacetylene torch until the tip is red hot.
Then the operator turns the hand valve slightly so that the oxidation process begins at the tip of the lance and a flame appears.

Figure 6: The ignition process

Figure 7: The flame development
The opening of the oxygen valve leads to a larger flame.

When starting work with the thermic lance the oxygen valve on the handle should not be completely open. Only after initial penetration by the thermic lance and the first few centimetres of cut have been completed must the hand valve be fully opened so as to transport the melted material out of the cutting groove. When burning, the lance must be moved backwards and forwards slightly so as to permit the melted material to flow out. If required a rotating motion can be used to enlarge the size of the hole.
When cutting round forms (e.g. thick cylinder shafts) or solid rectangular shapes, the cut should be so carried out that the thermic lance is aimed at the material at an angle which is constantly changed (the shortest possible burning distances).
When cutting very solid structures cutting can be carried out in several places at the same time (see figure 12).

For work in inaccessible positions the thermic lance can be bent into any shape which may be required. Because of the internal rods the oxygen supply cannot be blocked.
Apart from the possibility of cutting structures, there is also the possibility of cutting fixed bolts, e.g. on cranes and building equipment. To do this, the bolt is melted by using the oxygen thermic lance with a rotation movement. Once the bolt has cooled, it contracts and can be driven out without difficulty.
When cutting mineral materials, e.g. concrete, it should be remembered that these materials are much worse conductors of heat than metals. The following illustration shows the heat distribution against the distance to the lance hole. It can be seen that at a distance of just 10mm around the hole the temperature only amounts to approximately 60°C.

![Figure 15: Heat distribution in concrete](image)

If you have questions for specific applications, please do not hesitate to contact us for further information:

W. Humberg GmbH & Co. KG
c/o Dieter oder Stephan Holzmayer
Schöllinger Feld 10
D-58300 Wetter

Tel.: + 49 – 23 35 / 6 66 78
Fax: + 49 – 23 35 / 6 14 12
e-Mail: info@whumberg.com