

## Hydraulic Installation for the Rotary Crane of a Railway Track Welding Machine

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**Abstract:** A railway track welding machine has several components in its structure, the most important being the welding head, which performs the electric flash-butt (end-to-end) welding of the train and tram tracks. Maneuvering the welding head and positioning it on the rails to be welded is done with the help of a rotary crane. This article presents the hydraulic installation from the structure of a railway track welding machine.

**Keywords:** Hydraulic installation, welding head, rotary crane, flash-butt welding

### 1. Introduction

Flash- butt welding of train or tram tracks is done by a complex mechanical - electrical equipment called "welding head". To maneuver the welding head, this machine is equipped with a handling device with hydraulic arms. It is provided to support a load of about 4,500 kg at a length of 3... 4 m. This rotary crane has a pivoting capacity of 75° on each side of the center thus allowing welding of adjacent rails. This ability to pivot, together with the arm extension function, covers a wide operating area for the welding head.

The functions of the equipment are:

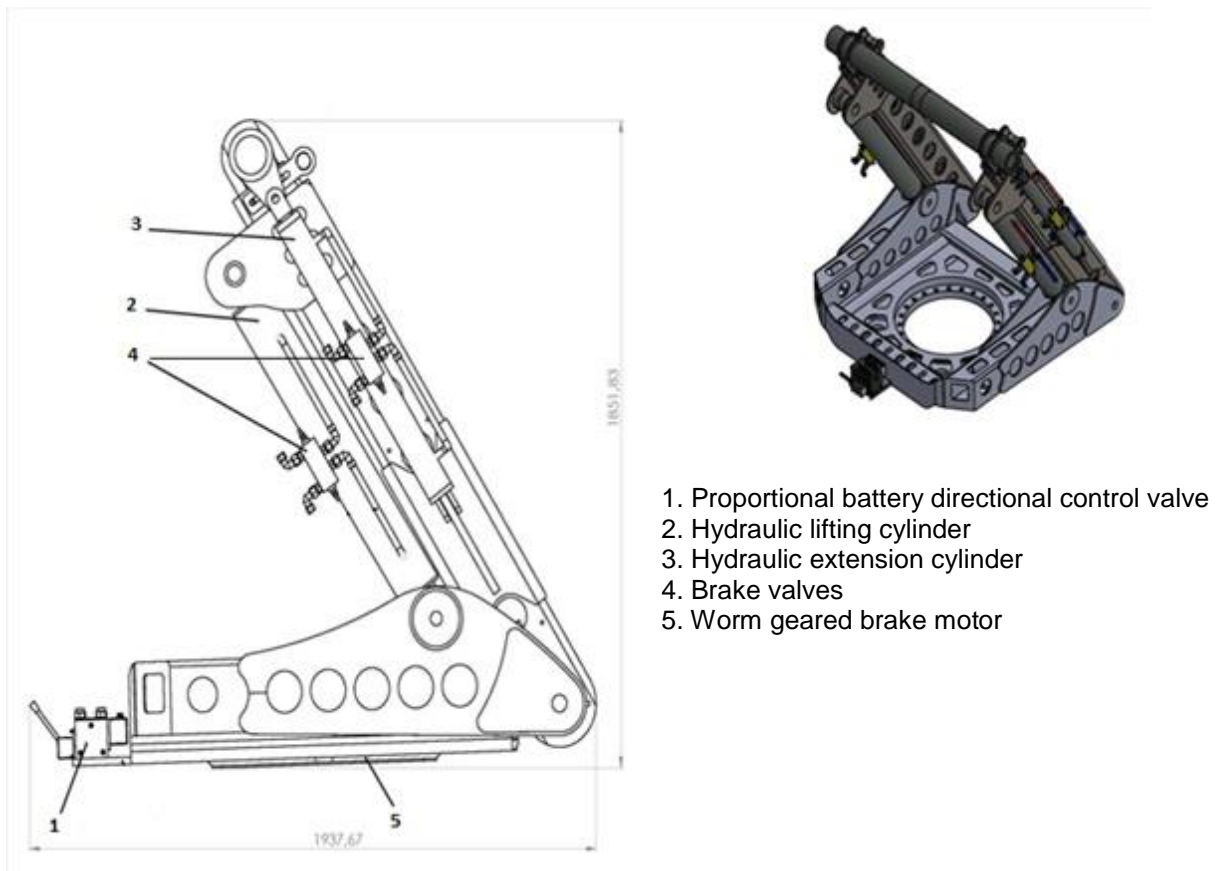
- lifting: up /down;
- extension: outside /inside;
- rotation: left / right.

### 2. Technical characteristics and performance of the rotary crane

- Maximum pressure: ..... 160 bar;
- Maximum flow rate: ..... 40 l / min;
- Supply voltage: ..... 24 Vdc;
- Control voltage: ..... 0 ... 10 V;
- Lifting cylinders:
  - piston diameter: ..... 125 mm;
  - rod diameter: ..... 50 mm;
  - stroke: ..... 880 mm;
  - maximum pressure: ..... 315 bar;
- Extension cylinders:
  - piston diameter: ..... 60 mm;
  - rod diameter: ..... 35 mm;
  - stroke: ..... 1370 mm;
  - maximum pressure: ..... 315 bar.
- Rotation mechanism
  - speed: ..... 3 rpm;
  - maximum torque: ..... 800 Nm.

### 3. Presentation of the hydraulic installation of the rotary crane

The rotary crane of a railway track welding machine is shown in fig. 1.



**Fig. 1.** The rotary crane of a railway track welding machine

The main components of the rotary crane hydraulic installation: battery directional control valve 1, hydraulic lifting cylinder 2, hydraulic extension cylinder 3, brake valves 4, and hydraulic gear reducer 5.

#### 3.1. Proportional battery directional control valve

Proportional battery directional control valve 1 (fig. 2) [1] is fixed on the crane platform. It is controlled by a digital electronic amplifier.



**Fig. 2.** Proportional battery directional control valve

#### 3.2. Lifting hydraulic cylinder

Hydraulic cylinder [2, 3] for lifting the crane arm (hydraulic lifting cylinder 2) (fig. 3) is articulated at the end of cylinder liner on the rotary platform, and at the end of rod - on the tilting arm of the crane.

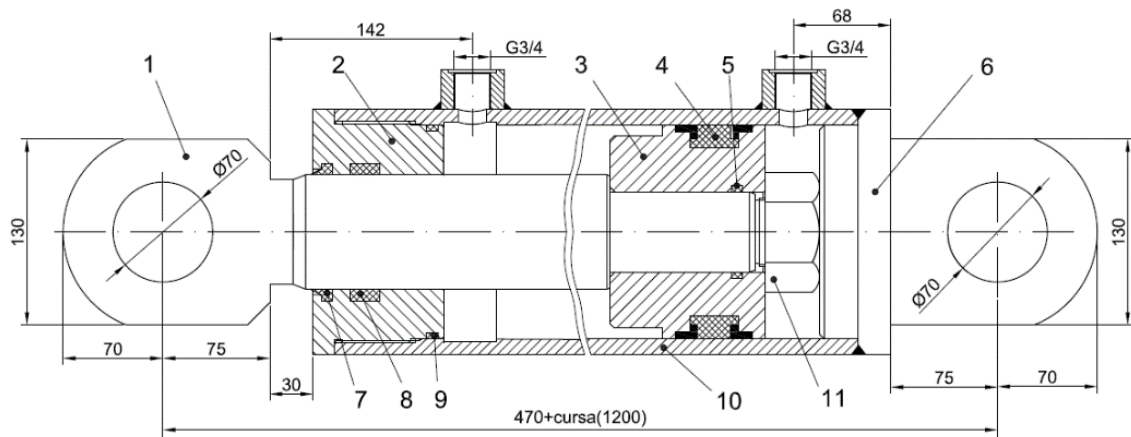


Fig. 3. Hydraulic lifting cylinder

3.3. Hydraulic extension cylinder

Hydraulic cylinder [2, 3] for extending the crane arm (hydraulic extension cylinder 3) (fig. 4) is articulated at the end of cylinder liner on the tilting arm, and at the end of rod it is fixed on the extendable arm.

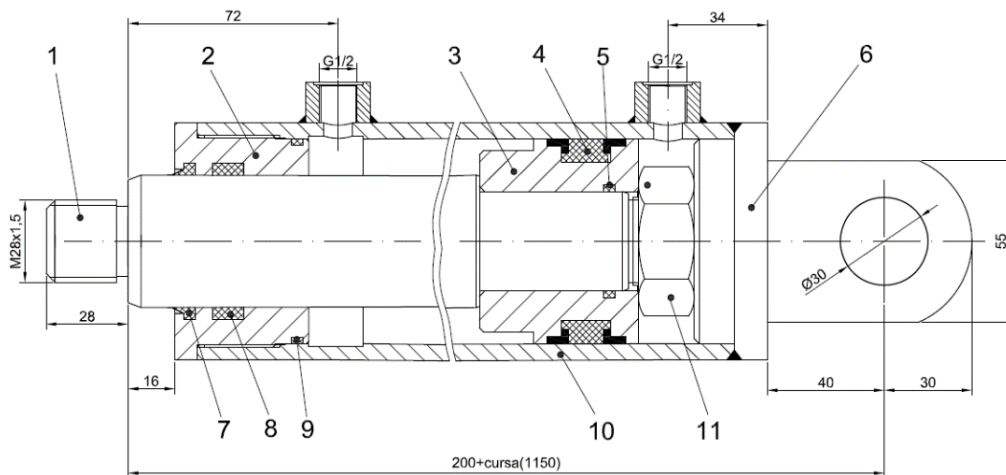


Fig. 4. Hydraulic extension cylinder

3.4. Brake valves

Brake valves [1, 4] 4 (fig. 5) are fixed on hydraulic cylinders 2 and 3.

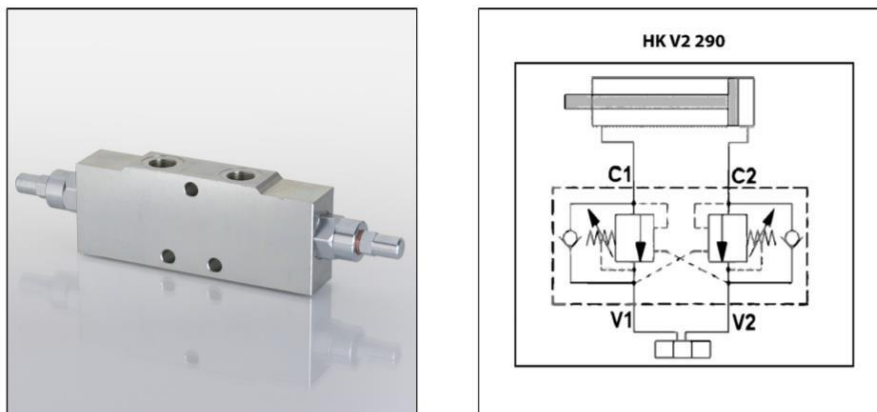


Fig. 5. Brake valves

3.5. Worm geared brake motor

Worm geared brake motor 5 (Fig. 6) [1, 5, 6, 7] is placed with the fixed part on the welding machine frame, and with the mobile part on the rotary platform of the crane.



Fig. 6. Worm geared brake motor

4. Operation of the rotary crane hydraulic installation

The functional role of the rotary crane within the structure of a railway track welding machine is to maneuver and position the welding head above the rails to be welded.

The diagram of the rotary crane hydraulic installation is presented in fig. 7 below.

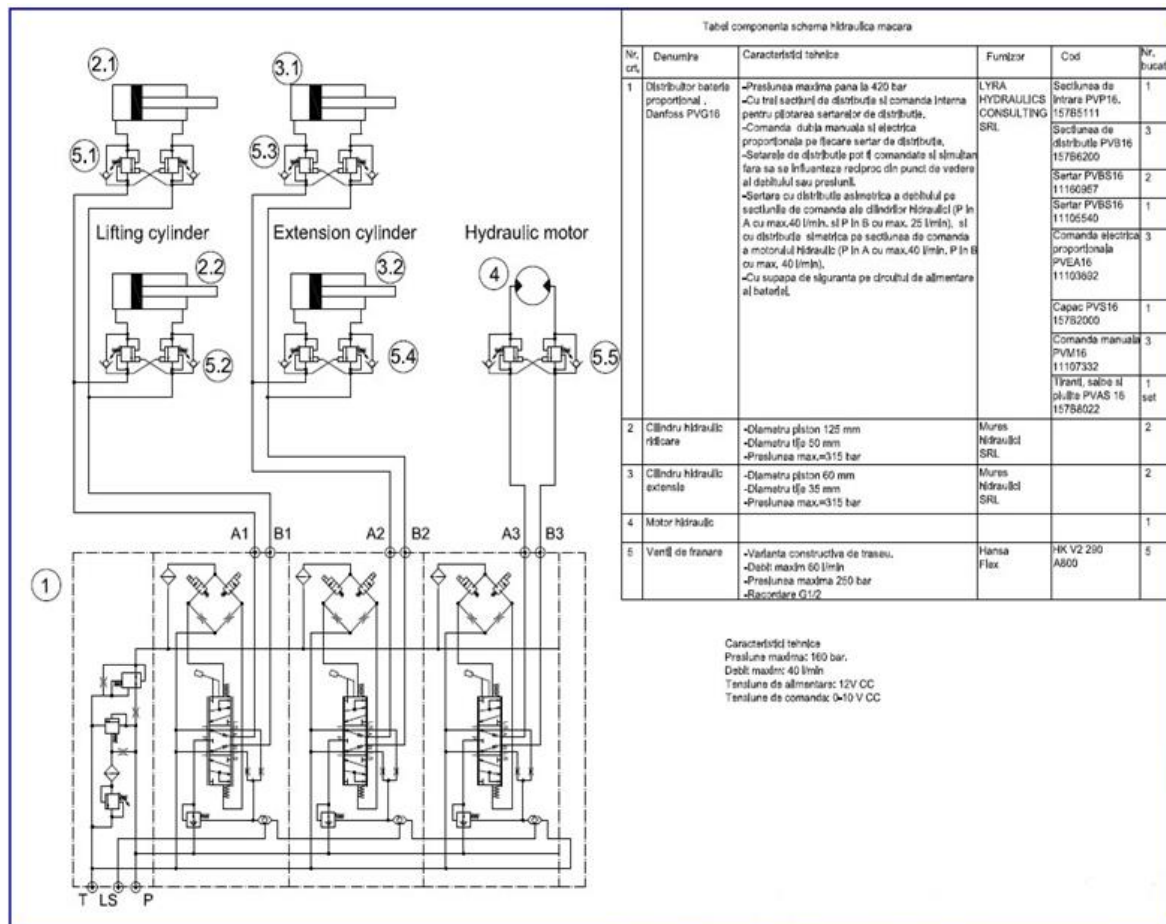


Fig. 7. The diagram of the rotary crane hydraulic installation

Proportional battery directional control valve 1 directs flow from the pump to the lifting or extension cylinders and to the hydraulic motor that rotates the crane platform. The slide valves of the directional control valve make crossing sections proportional to size of the variable electrical signal (0 ... 10 V). The LS pressure signal is sent to pump which changes its capacity depending on the proportional electrical signal applied to the directional control valve. Possibility of achieving a variable flow rate actually means possibility of achieving variables speeds for lifting and extending the crane arm. Lifting and lowering of the crane arm is done by hydraulic cylinders 2.1 and 2.2. Circuit A1 performs lifting of the arm, and circuit B1 - lowering. Brake valves 5.1 and 5.2 prevent accelerated lowering of the crane arm. Extension and retraction of the crane arm is done by hydraulic cylinders 3.1 and 3.2. Circuit A2 performs extension of the arm, and circuit B2 - lowering. Brake valves 5.3 and 5.4 prevent accelerated retraction of the crane arm. Rotating of the crane platform is done by hydraulic engine 4. Circuit A3 performs rotation in a direction, and circuit B3 - in the opposite direction of rotation. Worm geared brake motor reduces the rotational speed of 105 rpm received from hydraulic motor to 1 rpm required to rotate the crane platform. Brake valve 5.5 prevents uncontrolled rotating of the rotary crane (under the action of the force of wind).

## 5. Conclusions

The hydraulic installation of the rotary crane within the structure of a train or tram tracks welding machine performs the intended functions:

- lifting: up / down;
- extension: outside / inside;
- rotation: left / right.

## Acknowledgments

This paper has been developed in INOE 2000-IHP, as part of a project co-financed by the European Union through the European Regional Development Fund, under Competitiveness Operational Programme 2014-2020, Priority Axis 1: Research, technological development and innovation (RD&I) to support economic competitiveness and business development, Action 1.2.3 – Partnerships for knowledge transfer, project title: *Development of energy efficient technologies in niche applications of the manufacture of on-demand mechanical-hydraulic subassemblies and maintenance of mobile hydraulic equipment*, project acronym: MENTEH, SMIS code: 119809, Financial agreement no. 6 /25.06.2018, subsidiary contract no. 45 /17.01.2022.

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