Fachbereich AKTUELL

FBHM-050

DGUV
Fachbereich Holz und Metall
Berufsgenossenschaft
Holz und Metall

Sachgebiet Maschinen, Robotik und Fertigungsautomation

Fluid power elements

Hydraulic and pneumatic motors and cylinders

Stand: 01.10.2018

Translation of German version

This information gives guidance on the proper approach to fluid power elements (e. g. motors, cylinders) in machinery. It is intended to provide information to designers and users of machines which fall within the scope of the European Machinery Directive [1].

The DIN EN ISO 13849 Parts 1 and 2 [2, 3] specifies design requirements for safety-related parts of machine control systems. According to the scope of the standard, the safety function begins at the point where safety-related signals are generated and ends at the outputs of the power control elements (valves).

Figure 1: Power element *cylinder* on a test machine

Table of contents

1 Power elements

Fluid power elements such as e. g. motors and cylinders do not fall within the scope of DIN EN ISO 13849-1 and do thus not belong to the safety-related parts of a control system (SRP/CS).

If hazardous situations occur in the de-energized state (e. g. hazardous movement of the power element due to the effects of external forces), additional safety features have to be added to the power elements, e. g. by using piloted check valves, brakes or holding devices. See sections 2 and 3 for more information. Power elements (e. g. motors and cylinders) are not considered when determining the Performance Level (PL) for a safety function.

In each application, it has to be determined on a case-by-case basis whether additional hazards exist or can be excluded. The requirements for specific equipment as defined in C-standards must also be taken into account.

Fluid power elements such as e. g. motors and cylinders do not fall within the scope of DIN EN ISO 13849-1 and do thus not belong to the safety-related parts of a control system (SRP/CS).

2 External forces

If external forces have an effect on the power elements, e. g. on gravity-loaded axes (rotary axes with eccentric load moments, vertical axes, etc.), the power elements may have to be equipped with additional components, e. g. by means of an additional mechanical brake.

The power elements must be considered in the risk assessment. If failures can be reasonably excluded, (e. g. adequate dimensioning), no further measures need to be taken.

On hydraulic motors, the design-related internal leakage has to be considered.

The suitability of the hydraulic motor to keep up loads must be verified.

When evaluating potential failure modes, appropriate guidelines may be used such as BIA fault list 340225 for hydraulic and pneumatic components. The list can be found in BIA Report 6/97 [4].

3 Safety upgrading of power elements

If a component such as e. g. a check valve, a load lowering valve, a load holding valve or line burst valve is only used to provide protection on a gravity-loaded axis in case of a line rupture and is not directly involved in the execution a safety function as defined in DIN EN ISO 13849-1, only the control valve (e. g. direction valve with neutral position/ all ports are closed) of the power element and not the component must be included in the assessment of the safety function. The same applies to the use of a holding device (clamp head) intended to statically keep the load up in case of a line rupture.

If, however, a brake on the piston rod enables a controlled braking of the hazardous movement of a power element (e. g. motor or cylinder) or prevents it, both the brake control valve and the brake itself are included in the control system assessment according to DIN EN ISO 13849-1. For a brake and the brake control mechanism (e. g. valve), however, $B10_d$ values are required.

4 Fluctuation, loss and restoration of hydraulic or pneumatic energy

Fluctuation, loss and restoration of energy must not result in a hazardous movement of the power element (e. g. lowering of a load). This is also required by the Machinery Directive and harmonized standards.

According to DIN EN ISO 13849-1 section 5.2.8, the safety-related part of the control system must continue to provide or induce output signals which enable other parts of the machine to remain in a safe state.

5 Summary and limits of application

This Information is based on expert knowledge gathered by the expert committee woodworking and metalworking, subcommittee machinery, robotics and automation of DGUV in the field of hydraulic equipment of machines and systems.

The present Information has been developed in cooperation with the „Institut für Arbeitsschutz (IFA) of Deutsche Gesetzliche Unfallversicherung (DGUV). It is particularly intended as information to manufacturers and users of those machines which fall within the scope of the European Machinery Directive. It is furthermore intended to point out to different aspects as to fluid power elements (e. g. motors, cylinders).

The particular specifications for other applications (in mining or similar) have to be taken into account.

The provisions according to individual laws and regulations remain unaffected by this DGUV information or the information sheet. The requirements of the legal regulations apply unrestrictedly.

In order to get complete information, it is necessary to consult all applicable regulation contents.

The expert committee woodworking and metalworking is composed of representatives of the German Social Accident Insurance Institutions, federal authorities, social partners, manufacturers and users.

This Fachbereich AKTUELLreplaces the expert committee information sheet No. 050 of the same

title (issue 03/2015). An updating has become necessary due to editorial amendments.

This information is the English translation of the German issue “FBHM-050” of 01.10.2018.

Further information sheets of the expert committee woodworking and metalworking (Fachbereich Holz und Metall) or Fachbereich AKTUELL are available for download on the internet [5].

As to the aims of the Fachbereich AKTUELL or DGUV information, refer to DGUV information FBHM-001 „Aims of the DGUV information published by the expert committee woodworking and metalworking“.

German Bibliography:

[1] Richtlinie 2006/42/EG (Maschinenrichtlinie; MRL) Amtsblatt der Europäischen Gemeinschaften Nr. L 157/24 vom 09.06.2006 mit Berichtigung im Amtsblatt L76/35 vom 16.03.2007

[2] DIN EN ISO 13849-1 Sicherheit von Maschinen – Sicherheitsbezogene Teile von Steuerungen – Teil 1: Allgemeine Gestaltungsleitsätze, Ausgabe 2016-06, Beuth-Verlag, Berlin.

[3] DIN EN ISO 13849-2 Sicherheit von Maschinen – Sicherheitsbezogene Teile von Steuerungen – Teil 2: Validierung, Ausgabe 2013-02, Beuth-Verlag, Berlin.

[4] Kategorien für sicherheitsbezogene Steuerungen, BIA-Report 6/1997 sowie Funktionale Sicherheit von Maschinensteuerungen – Anwendung der DIN EN ISO 13849 (BGIA-Report 2/2008, aktualisiert IFA-Report 2/2017)

[5] Internet: www.dguv.de/fbhm Publikationen oder www.bghm.de Webcode: <626>

Picture Credits:

The picture shown in this Fachbereich AKTUELL of the expert committee woodworking and metalworking have been kindly provided by:

Figure 1: Institut für Arbeitsschutz (IFA) der Deutschen Gesetzlichen Unfallversicherung DGUV, 53754 Sankt Augustin

Publisher

Deutsche Gesetzliche
Unfallversicherung e.V. (DGUV)

Glinkastraße 40
10117 Berlin
Tel.: 030 13001-0 (Zentrale)
Fax: 030 13001-6132
E-Mail: info@dguv.de
Internet: www.dguv.de

Sachgebiet „Maschinen, Robotik und Fertigungsautomation“
im Fachbereich „Holz und Metall“
der DGUV > www.dguv.de Webcode: d544722

An der Erarbeitung dieser Fachbereich AKTUELL haben mitgewirkt:
- Referat 5.3 Schutz- und Steuereinrichtungen des Instituts für Arbeitsschutz der DGUV (IFA)