Hydraulic Safety Interlock Manifold Systems

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As the need to apply Hydraulic Safety Interlock Systems to machinery in Australia becomes more prevalent we need to be able to respond quickly to our customers with concise answers and technical information.

In order to achieve this it is important to understand the requirements of the relevant Australian standards and how we can use our products to allow system integrators to achieve the safety system compliance.

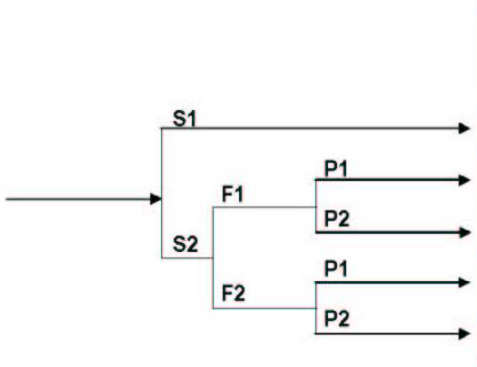
Hydraulic Safety Interlock Manifold Systems

- Designers of Safety Systems must comply with local laws and standards
- In Australia, AS4024.1 – Safe Guarding of Machinery is the standard that needs to be adhered to (also currently under review to be updated)
- In Europe, EN954 – is the standard that needs to be adhered to AS 4024.1 is based on this standard.
- The question is what information do we need from our customer to proceed with our design and offer a solution?

Hydraulic Safety Interlock Manifold Systems

- The customer must first detail for us the “Determination of Machine Category”. This will then allow us to offer the appropriate design

AS 4024 – Determination of Machine Catergory



Catergory					Interlock Category
B	1	2	3	4	
•	●	○	○	○	1 and 2
•	●	●	○	○	3
	•	●	●	○	4
	•	•	●	○	5
		•	•	●	6

Legend

S = Severity of Injury
S1= Slight (normally reversible) injury
S2= Serious (normally irreversible) injury, incl. Death

F= Frequency of exposure/ or exposure time
F1= Seldom to quite often/exposure time short
F2= Frequent to continuous/exposure time long

P= Possibility of avoiding the hazard
P1= Possible under specific conditions
P2= Scarcely possible

● Preferred
• Possible
○ Over dimensioned

Hydraulic Safety Interlock Manifold Systems

- The determination of the machine category is critical in determining what hydraulic circuit option you can offer. The Australian Standard AS4024.1 is specific. It states “The designer must consider the flow of power in the system and the action of the stored energy. If the flow of power can be reliability blocked and the stored energy dissipated or controlled a machine is considered safe”.

- It is not for us to decide the machine category. This is to be done by either a Risk Management Consultant or a System Integrator.

Hydraulic Safety Interlock Manifold Systems

- Once the Category of the “Safety Required” is determined what does it mean to us?
- What do we have to supply to comply with the rules as detailed in AS4024.1?

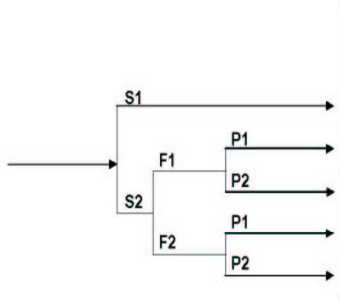
Hydraulic Safety Interlock Manifold Systems

- Category 1. Single valve without indication of failure
- Category 2. Two independent valves each with position monitoring must be used to block the flow of power.
- Category 3. Two independent valves each with position monitoring must be used to block the flow of power. Indication of a failure is required.
- Category 4. Two independent valves each with position monitoring must be used to block the flow of power and the control system must incorporate cross monitoring of the signals.

Hydraulic Safety Interlock Manifold Systems

- AS4024.1 has 2 charts
  - Interlock Category has 6 levels and the Safety category has 4 levels
  - We should be using the 4 Safety Levels
  - Safety Category 1 would most likely never apply to hydraulics
    - This level 1 needs Interlocks as shown on the chart to categories 1 & 2
  - Safety Category 2 needs two isolating valves in series. No indication is required by Interlock Category 3
  - Safety Category 3 & 4 needs two isolating valves in series with indication is required by Interlock Category 4,5 & 6. There is no difference between the hydraulics of Safety Category 3 & 4 only the electrical control changes.

AS 4024 – Determination of Machine Catergory



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Hydraulic Safety Interlock Manifold Systems

- Typically most applications using hydraulics will fall into the Category 3 or 4.
- As we move further through the presentation you will realize that the valves we offer can be used in either Category 3 or Category 4. The system integrator can use self monitoring PLC equipment to indicate failure of any of the hydraulic safety valves thus the system meets Category 4.
- We (Bosch Rexroth) are not system integrators we are offering valves & manifolds for use by system integrators. It is important to note the hydraulic valving is only part of the safety system. Controls need to be in place to stop the machine and take the energy source away as well as indicating a fault should a valve indicate a problem during the cycle
- So what questions can we be asked by the customer and how can we best answer them?

Hydraulic Safety Interlock Manifold Systems

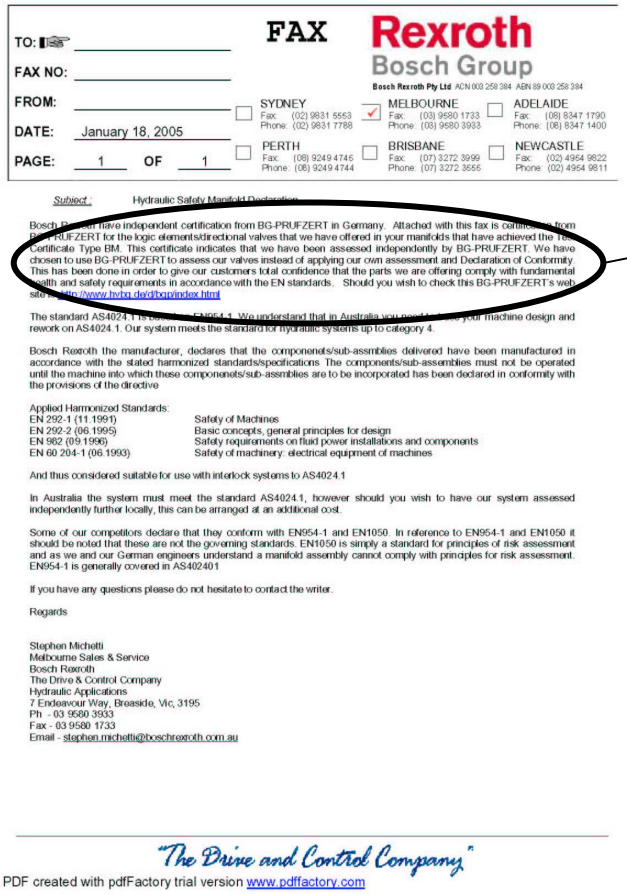
- Some customers may ask you questions like
  - Q1. Does your Hydraulic Safety Interlock Manifold meet AS4024.1?
  - Q2. Do you have CE Certification?
  - Q3. Have your valves been assessed independently?
  - Q4. What valve options are available
  - Q5. Do you meet the Machinery Directive: 98/37/EC – EN292-1, EN292-2, EN982, EN954-1 and EN1050 (European Standards)

Hydraulic Safety Interlock Manifold Systems

- Q1. Does your Hydraulic Safety Interlock Manifold meet AS4024.1?

- Answer – No, our valves have been design and tested and meet particular EN standards. These individual standards have been meet and we have the documentation proving this. It means that our safety interlock valves are suitable to be used by a system integrator in an application that is required to meet AS4024.1. We have here a statement/declaration that should be used to give to a customer with every quote to explain exactly specifically what RR Australia has to offer.

Hydraulic Safety Interlock Manifold Systems



FAX

Rexroth
Bosch Group

TO:
FAX NO:
FROM:
DATE: January 18, 2005
PAGE: 1 OF 1

Bosch Rexroth Pty Ltd ACN 003 258 384 ABN 89 003 258 384

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ADELAIDE Fax: (08) 8347 1790 Phone: (08) 8347 1400
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BRISBANE Fax: (07) 3272 3999 Phone: (07) 3272 3555
NEWCASTLE Fax: (02) 4964 9822 Phone: (02) 4964 9811

Subject : Hydraulic Safety Manifold Declaration

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The standard AS4024.1 is based on EN954-1. We understand that in Australia you need to have your machine design and rework on AS4024.1. Our system meets the standard for hydraulic systems up to category 4.

Bosch Rexroth the manufacturer, declares that the componenets/sub-assmblies delivered have been manufactured in accordance with the stated harmonized standards/specifications The components/sub-assemblies must not be operated until the machine into which these componenets/sub-assmblies are to be incorporated has been declared in conformity with the provisions of the directive

Applied Harmonized Standards:

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If you have any questions please do not hesitate to contact the writer.

Regards

Stephen Michetti
Melbourne Sales & Service
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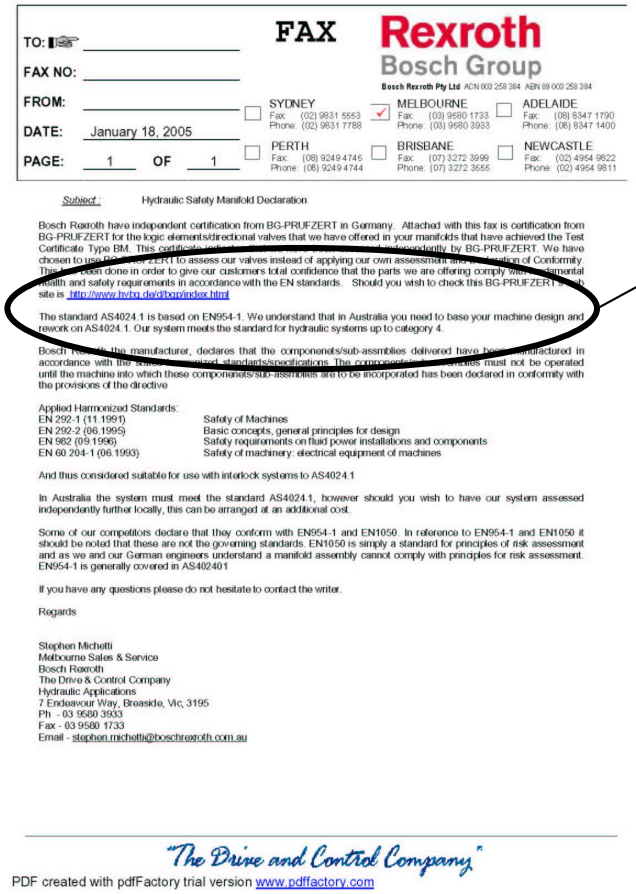

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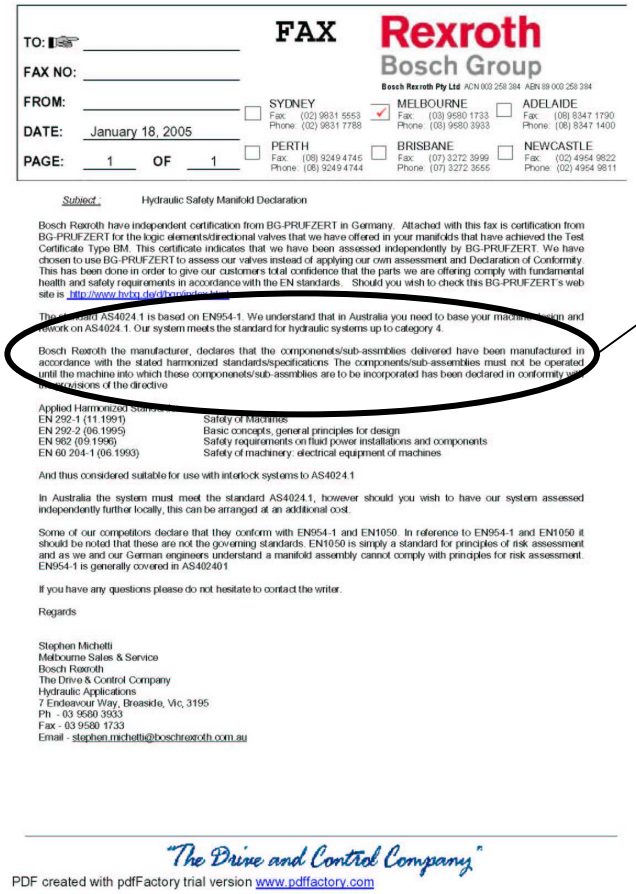

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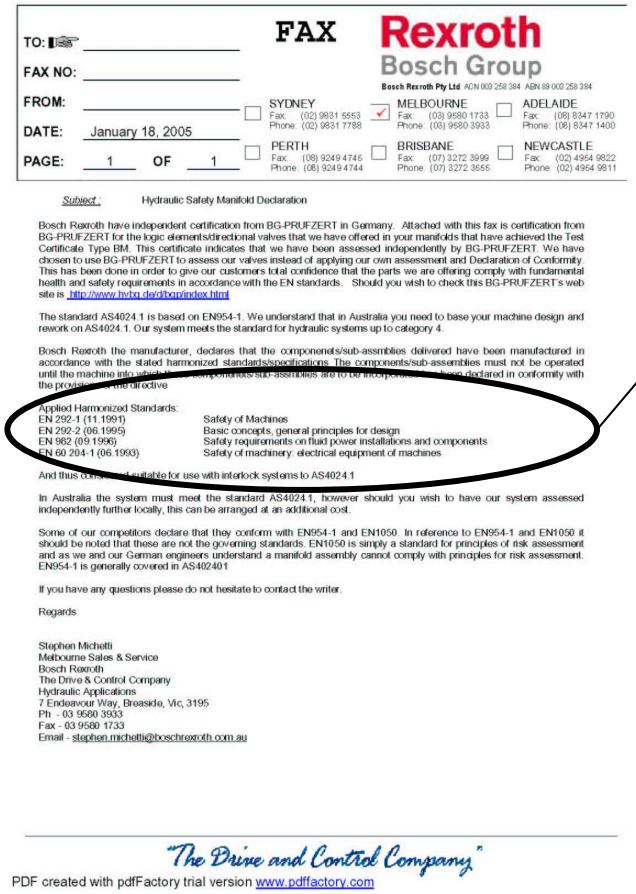

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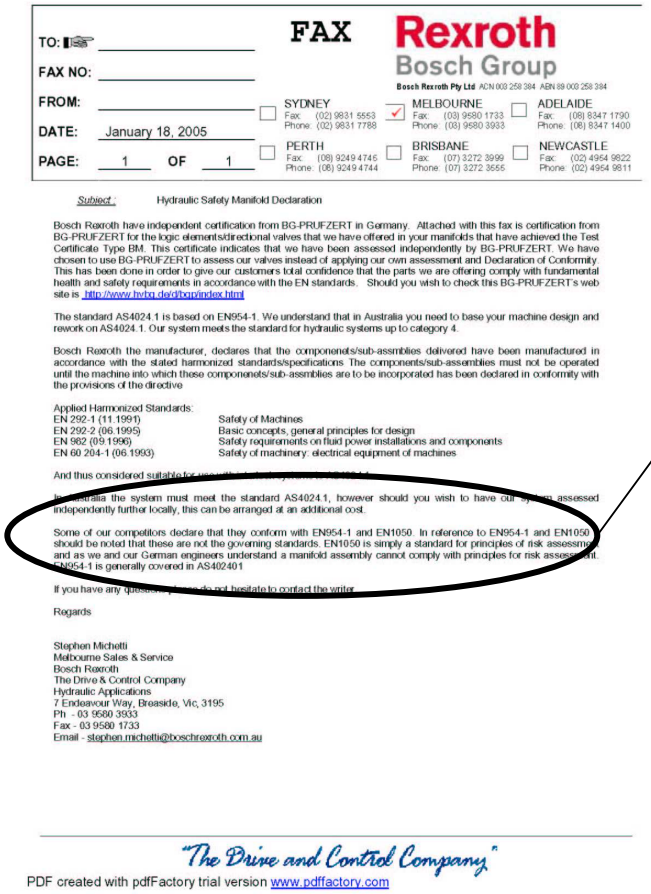

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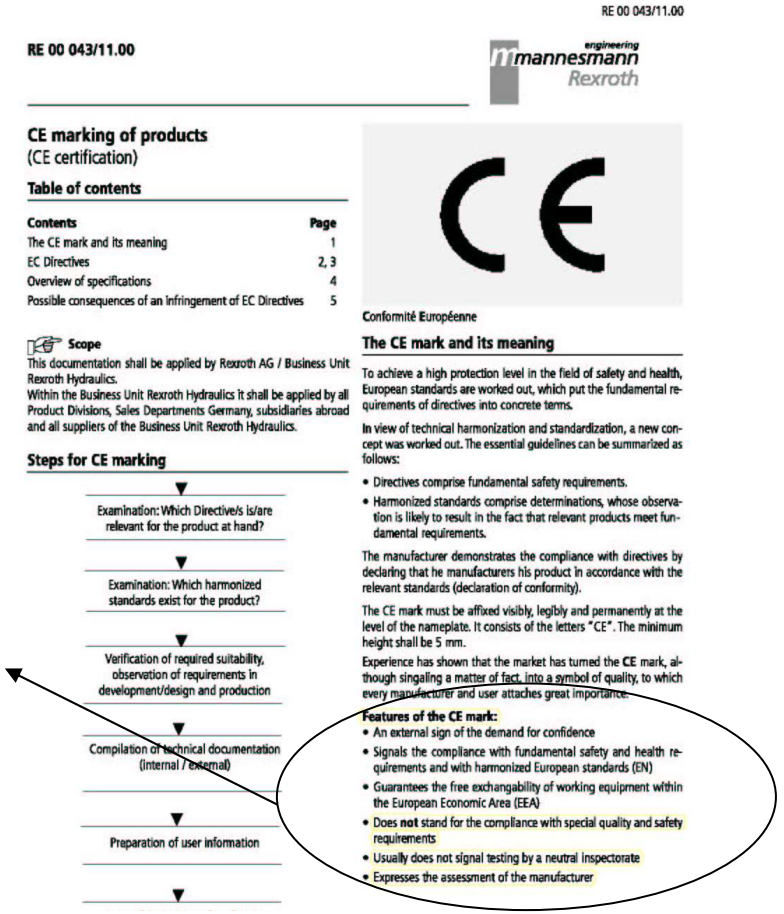
EN954-1 is generally covered in AS4024.1

Hydraulic Safety Interlock Manifold Systems

- Q2. Do you have CE Certification?
- Answer – Yes, and we also have independent certification from BG-Prufzert in Germany.
- However, the following points can be made.
  - AS4024.1 does not require that any equipment “must” have the CE marking.
  - AS4024.1 does not state that independent certification of any assemblies including manifold assemblies is required.
  - AS4024.1 places the responsibility squarely on the system integrator to ensure that the total system meets the requirements of the Australian Standard.

Hydraulic Safety Interlock Manifold Systems

- CE Marking
  - RE00 042/11/00 is available and explains the CE mark and it's meaning.
  - The features of the CE mark:
    - Does **not** stand for the compliance with special quality and safety requirements
    - Usually does not signal testing by a neutral inspectorate
    - Expresses the assessment of the manufacturer



RE 00 043/11.00

RE 00 043/11.00

mannesmann Rexroth

CE marking of products
(CE certification)

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Possible consequences of an infringement of EC Directives	5

Scope
This documentation shall be applied by Rexroth AG / Business Unit Rexroth Hydraulics.
Within the Business Unit Rexroth Hydraulics it shall be applied by all Product Divisions, Sales Departments Germany, subsidiaries abroad and all suppliers of the Business Unit Rexroth Hydraulics.

Steps for CE marking

Examination: Which Directive/s is/are relevant for the product at hand?

Examination: Which harmonized standards exist for the product?

Verification of required suitability, observation of requirements in development/design and production

Compilation of technical documentation (internal / external)

Preparation of user information

CE

Conformité Européenne

The CE mark and its meaning

To achieve a high protection level in the field of safety and health, European standards are worked out, which put the fundamental requirements of directives into concrete terms.

In view of technical harmonization and standardization, a new concept was worked out. The essential guidelines can be summarized as follows:

- Directives comprise fundamental safety requirements.
- Harmonized standards comprise determinations, whose observation is likely to result in the fact that relevant products meet fundamental requirements.

The manufacturer demonstrates the compliance with directives by declaring that he manufacturers his product in accordance with the relevant standards (declaration of conformity).

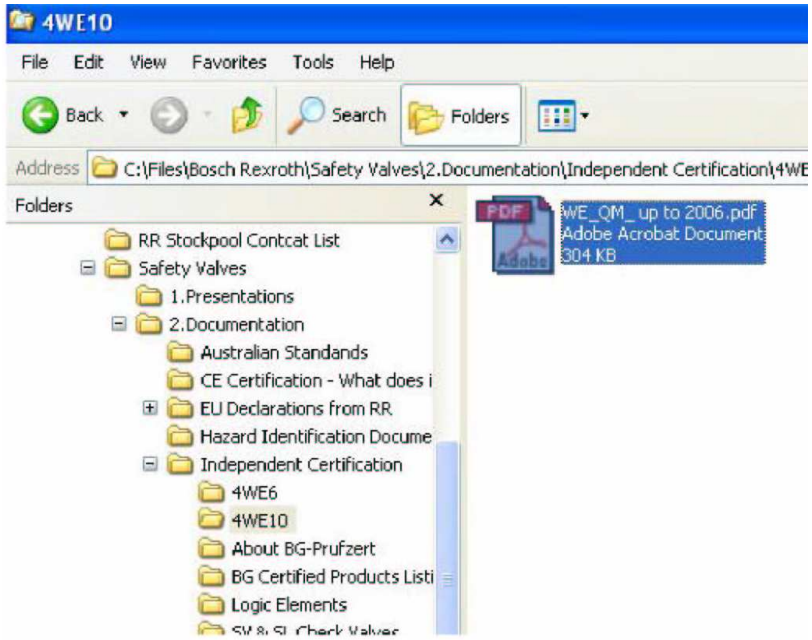
The CE mark must be affixed visibly, legibly and permanently at the level of the nameplate. It consists of the letters "CE". The minimum height shall be 5 mm.

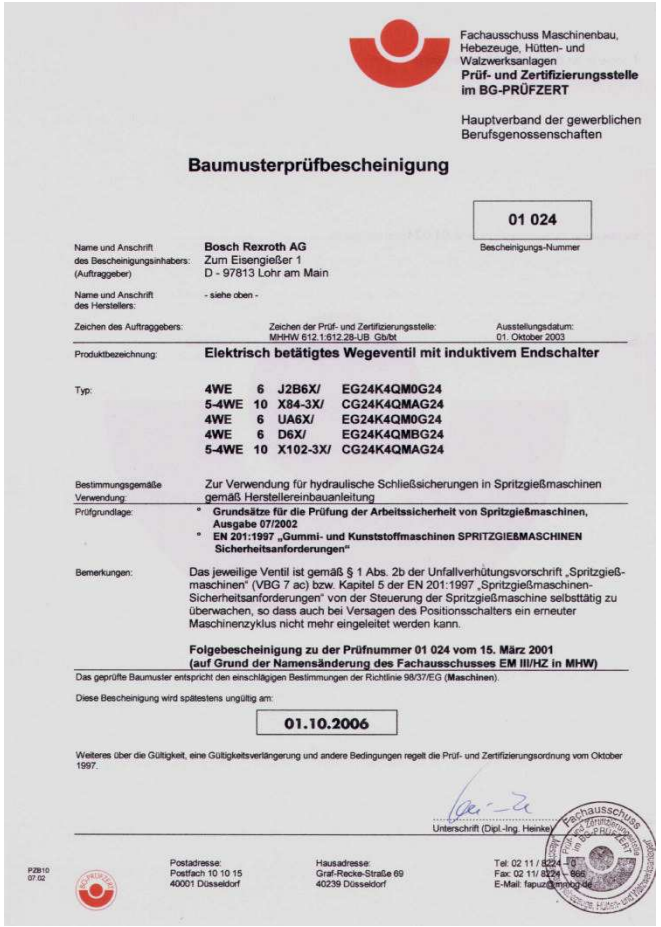
Experience has shown that the market has turned the **CE** mark, although singaling a matter of fact, into a symbol of quality, to which every manufacturer and user attaches great importance.

Features of the CE mark:
- An external sign of the demand for confidence
- Signals the compliance with fundamental safety and health requirements and with harmonized European standards (EN)
- Guarantees the free exchangability of working equipment within the European Economic Area (EEA)
- Does **not** stand for the compliance with special quality and safety requirements
- Usually does not signal testing by a neutral inspectorate
- Expresses the assessment of the manufacturer

Hydraulic Safety Interlock Manifold Systems

Typical Current BG Certificate





Fachausschuss Maschinenbau, Hebezeuge, Hütten- und Walzwerksanlagen
Prüf- und Zertifizierungsstelle im BG-PRÜFZERT

Hauptverband der gewerblichen Berufsgenossenschaften

Baumusterprüfbescheinigung

01 024
Bescheinigungs-Nummer

Name und Anschrift des Bescheinigungsinhabers: (Auftraggeber) **Bosch Rexroth AG**, Zum Eisengießer 1, D - 97813 Lohr am Main

Name und Anschrift des Herstellers: - siehe oben -

Zeichen des Auftraggebers:

Zeichen der Prüf- und Zertifizierungsstelle: MHHW 612.1:612.28-UB Gäbt

Ausstellungsdatum: 01. Oktober 2003

Produktbezeichnung: **Elektrisch betätigtes Wegeventil mit induktivem Endschalter**

Typ:

4WE	6	J2B6X/	EG24K4QM0G24
5-4WE	10	X84-3X/	CG24K4QMAG24
4WE	6	UA6X/	EG24K4QM0G24
4WE	6	D6X/	EG24K4QMBG24
5-4WE	10	X102-3X/	CG24K4QMAG24

Bestimmungsgemäße Verwendung: Zur Verwendung für hydraulische Schließsicherungen in Spritzgießmaschinen gemäß Herstellereinbauanleitung

Prüfgrundlage:
- **Grundsätze für die Prüfung der Arbeitssicherheit von Spritzgießmaschinen, Ausgabe 07/2002**
- **EN 201:1997 „Gummi- und Kunststoffmaschinen SPRITZGIEßMASCHINEN Sicherheitsanforderungen"**

Bemerkungen: Das jeweilige Ventil ist gemäß § 1 Abs. 2b der Unfallverhütungsvorschrift „Spritzgießmaschinen" (VBG 7 ac) bzw. Kapitel 5 der EN 201:1997 „Spritzgießmaschinen-Sicherheitsanforderungen" von der Steuerung der Spritzgießmaschine selbsttätig zu überwachen, so dass auch bei Versagen des Positionsschalters ein erneuter Maschinenzyklus nicht mehr eingeleitet werden kann.

Folgebescheinigung zu der Prüfnummer 01 024 vom 15. März 2001 (auf Grund der Namensänderung des Fachausschusses EM III/HZ in MHW)

Das geprüfte Baumuster entspricht den einschlägigen Bestimmungen der Richtlinie 98/37/EG (**Maschinen**).

Diese Bescheinigung wird spätestens ungültig am:

01.10.2006

Weiteres über die Gültigkeit, eine Gültigkeitsverlängerung und andere Bedingungen regelt die Prüf- und Zertifizierungsordnung vom Oktober 1997.

Unterschrift (Dipl.-Ing. Heinke)

PZB10 07.02

Postadresse: Postfach 10 10 15, 40001 Düsseldorf

Hausadresse: Graf-Recke-Straße 69, 40239 Düsseldorf

Tel. 02 11 / 8224 - 0
Fax 02 11 / 8224 - 666
E-Mail: fapuz@mhhw.de

Hydraulic Safety Interlock Manifold Systems

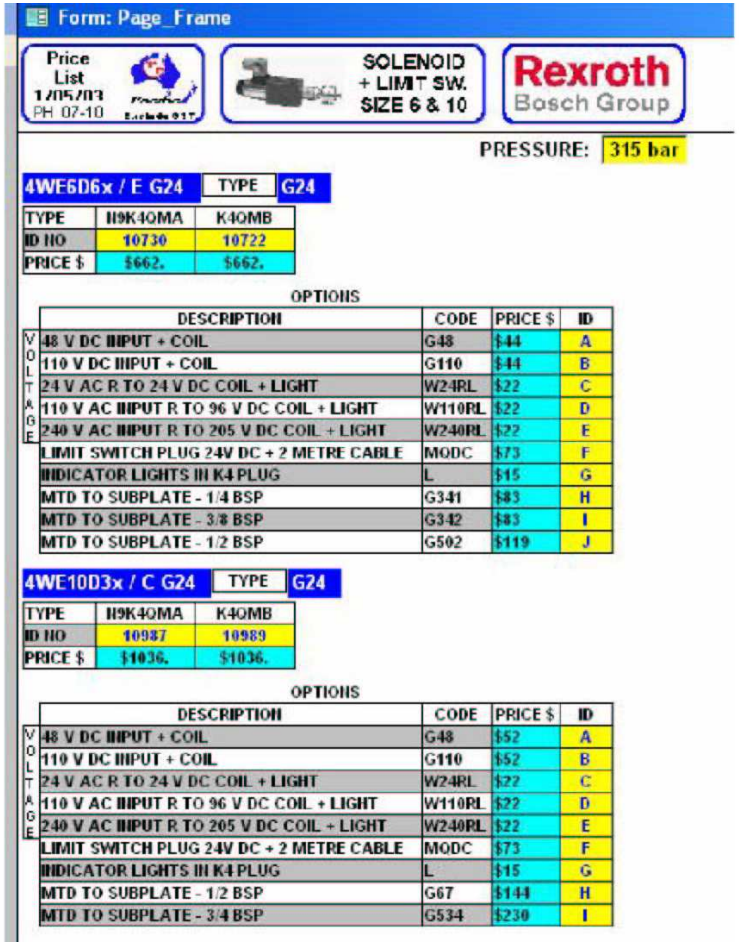
- Q3. Have your valves been assessed independently?

- Answer - Yes, we have up to date independent certification from BG-Prufzert in Germany for our NG6, NG10, SL Check Valves, LFA…E-7X and LFA…QR10-6X/CA20 & 40D Logic Elements. These certificates are available and are in German. They are not available in English. BG Prufzert (testing and certification system) brings together the 19 test and certification bodies of Germany's statutory accident insurance and prevention institutions. A BG Prufzert Information Sheet is available detailing exactly what this organization does.
- 4WEH, LFA…EWA, EWB & EH2 are not certified by BG Prufzert

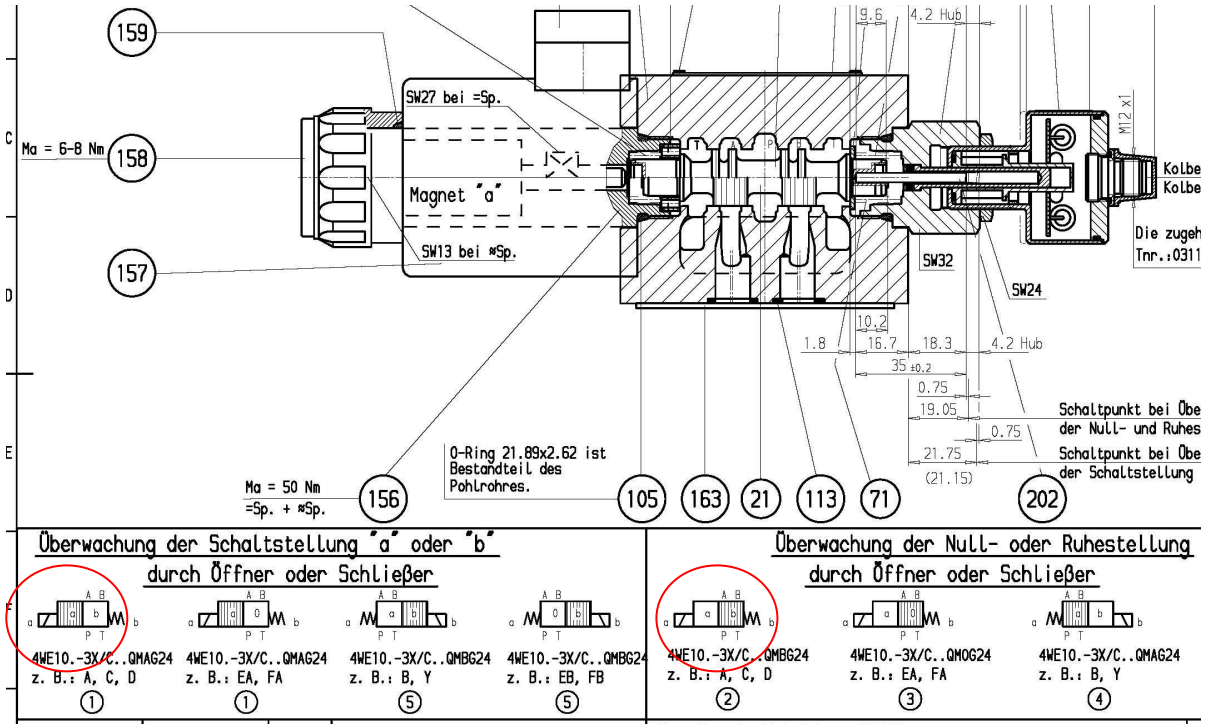
- The BG Prufzert mark awarded to certified products holds a higher accreditation that the self assessed CE Marking.

Hydraulic Safety Interlock Manifold Systems

- Q4. What valve options are available, what do we stock.
- We stock valves in NG6 and NG10. Monitoring is available on NG16 up NG102 however these are not certified by BG Prufzert. For the larger flows we think using the logic elements is a better option. These are not in MR range.
- For the NG6 & NG10 valves we stock QMA option and QMB option.



Hydraulic Safety Interlock Manifold Systems



QMA QMB

QMB senses the spool when is has completely returned to the de-energized position.

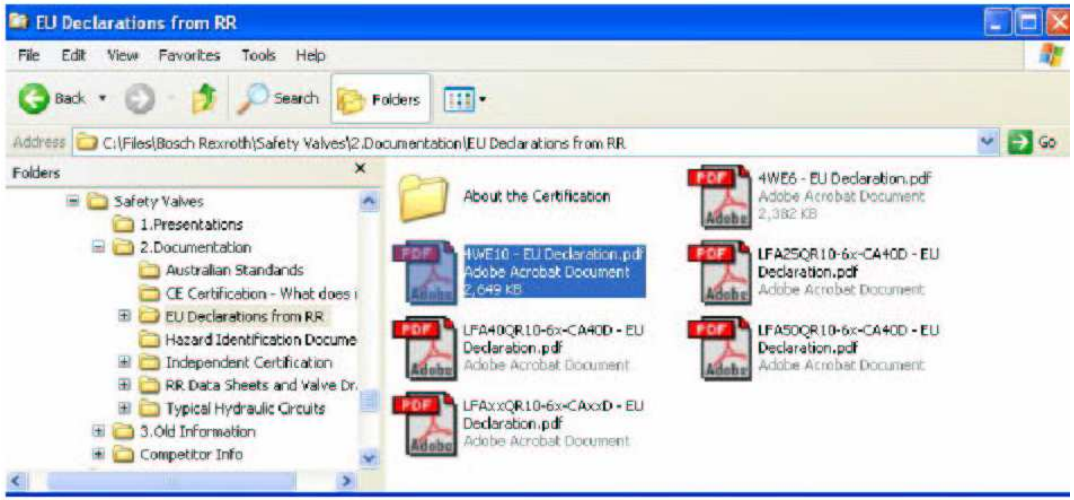
QMA senses when the spool has moved from the fully energized position and is moving back to the rest position. The oil path is not blocked when the switch shows a change of state and is therefore in some applications maybe unsuitable or unsafe

Hydraulic Safety Interlock Manifold Systems

- Q5. Do you meet the Machinery Directive: 98/37/EC – EN292-1, EN292-2, EN982, EN954-1 and EN1050

- Answer – Yes as detailed on the certificate (next page) that can be supplied for system integrators using our valves and requiring documentation

Hydraulic Safety Interlock Manifold Systems



Industrial Hydraulics | Electric Drives and Controls | Linear Motion and Assembly Technologies | Pneumatics | Service Automation | Mobile Hydraulics

Rexroth Bosch Group

RDEF 00 025/10.01

Ersetzt / *Replaces / Remplace:* 11.00

EG-Herstellererklärung / *EC-Declaration by the manufacturer / Déclaration CEE du fabricant*

im Sinne der EG-Maschinen-Richtlinie 98/37/EG, Anhang II Abschnitt B
as defined by EC-machinery directive 98/37/EC, Annexe II Section B
au sens de la directive machines de la CEE 98/37 CEE, Annexe II Section B

Der Hersteller erklärt, dass die gelieferten Bauteile/Baugruppen in Übereinstimmung mit den angewendeten harmonisierten Normen/Spezifikationen hergestellt worden sind.
Die Inbetriebnahme dieser Bauteile/Baugruppen ist solange untersagt, bis festgestellt wurde, dass die Maschine, in die diese Bauteile/Baugruppen eingebaut werden sollen, den Bestimmungen der EG-Richtlinie entspricht.

The manufacturer declares that the components/sub-assemblies delivered have been manufactured in accordance with the stated harmonized standards/ specifications.
The components/sub-assemblies must not be operated until the machine into which these components/sub-assemblies are to be incorporated has been declared in conformity with the provisions of the directive.

Le fabricant déclare que les composants/sous-ensembles livrés ont été fabriqués conformément aux normes/spécifications harmonisées utilisées.
La mise en service de ces composants/ sous-ensembles est interdite jusqu'à ce qu'il ait été constaté que la machine dans laquelle ces composants/sous-ensembles doivent être intégrés est conforme aux stipulations de la directive européenne.

Angewendete harmonisierte Norm:

EN 292 -1 (11.1991)
Sicherheit von Maschinen

EN 292 -2 (06.1995)
Grundbegriffe, allgemeine Gestaltungsleitsätze

EN 982 (09.1996)
Sicherheitstechnische Anforderungen an fluidtechnische Anlagen und Bauteile; Hydraulik

EN 983 (09.1996)
Sicherheitstechnische Anforderungen an fluid-technische Anlagen und Bauteile; Pneumatik

EN 60 204-1 (06.1993)
Sicherheit von Maschinen;
Elektrische Ausrüstung von Maschinen

Applied harmonised standards:

EN 292 -1 *(11.1991)*
Safety of machines

EN 292 -2 *(06.1995)*
Basic concepts, general principles for design

EN 982 *(09.1996)*
Safety requirements on fluid power installations and components Hydraulics

EN 983 *(09.1996)*
Safety requirements on fluid power installations and components Pneumatics

EN 60 204-1 *(06.1993)*
Safety of machinery. electrical equipment of machines

Norme harmonisée utilisée:

EN 292 -1 *(11.1991)*
Sécurité des machines, terminologie de base, méthodologie

EN 292 -2 *(06.1995)*
Sécurité des machines, principes techniques et spécifications

EN 982 *(09.1996)*
Prescriptions de sécurité d'installations et composants fluidiques Hydraulique

EN 983 *(09.1996)*
Prescriptions de sécurité d'installations et composants fluidiques Pneumatique

EN 60 204-1 *(06.1993)*
Sécurité des machines. équipement électrique des machines

Hersteller / *Manufacturer / Fabricant:*
Bosch Rexroth AG
Industrial Hydraulics

Postfach
D - 97813 Lohr am Main

Bauteil / Baugruppe:
Component / Sub-assembly:
Composant / Sous-groupes: . . . . . Part Number . . . . . .

Seriennummer / Auftrags-Nr:
Serial number / Order Nbr:
Numéro de série / Commande No: . . Serial Number of Valve Nameplate

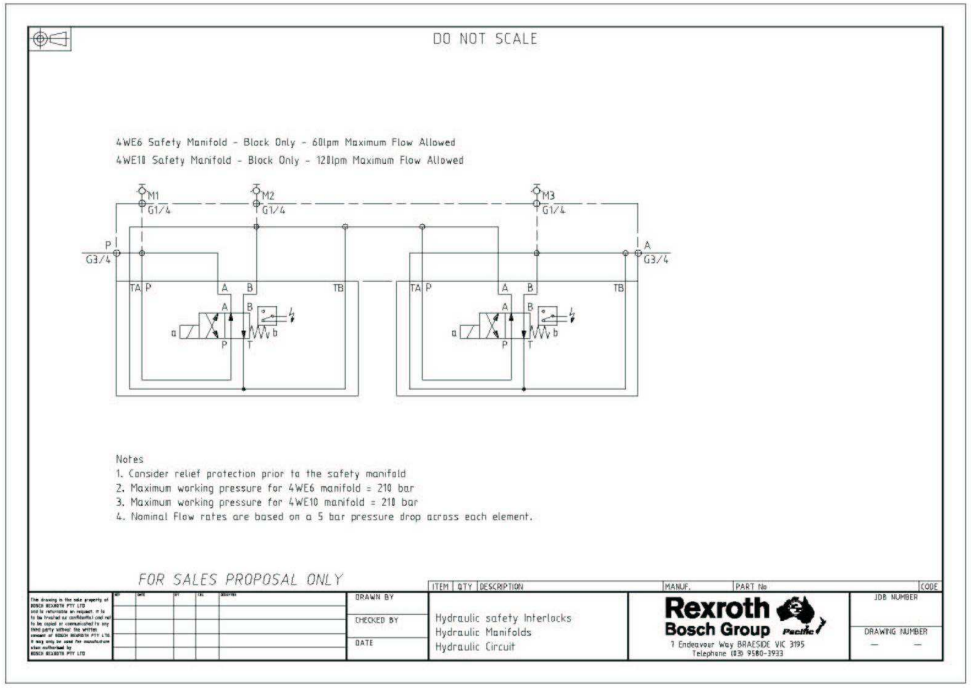
Baujahr:
Date of construction:
Date de fabrication: . . . . . 2003/2004 . . . . . .

Stellung im Betrieb:
Position:
Position: . . . . . Appliacable Sales Eng Name . . . . . .

. . . . . Signature . . . . . .
(Datum, Unterschrift) *(Date, Signature) (Date, Signature)*

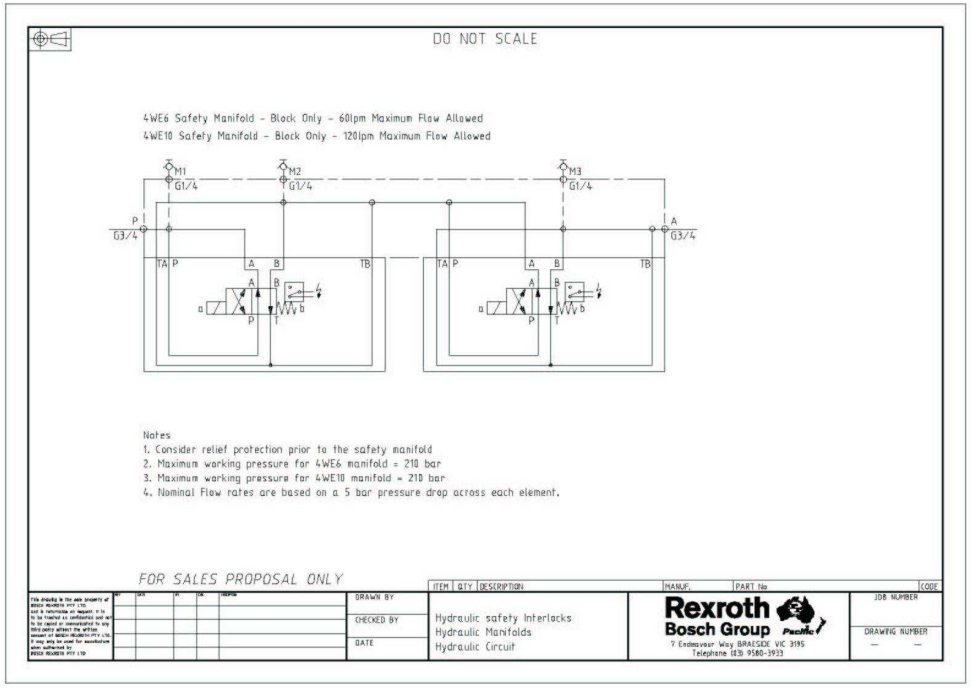
Hydraulic Safety Interlock Manifold Systems

- Typical Circuits we use that meet the requirements.
- NG6 Cat 3 or 4 Block Only



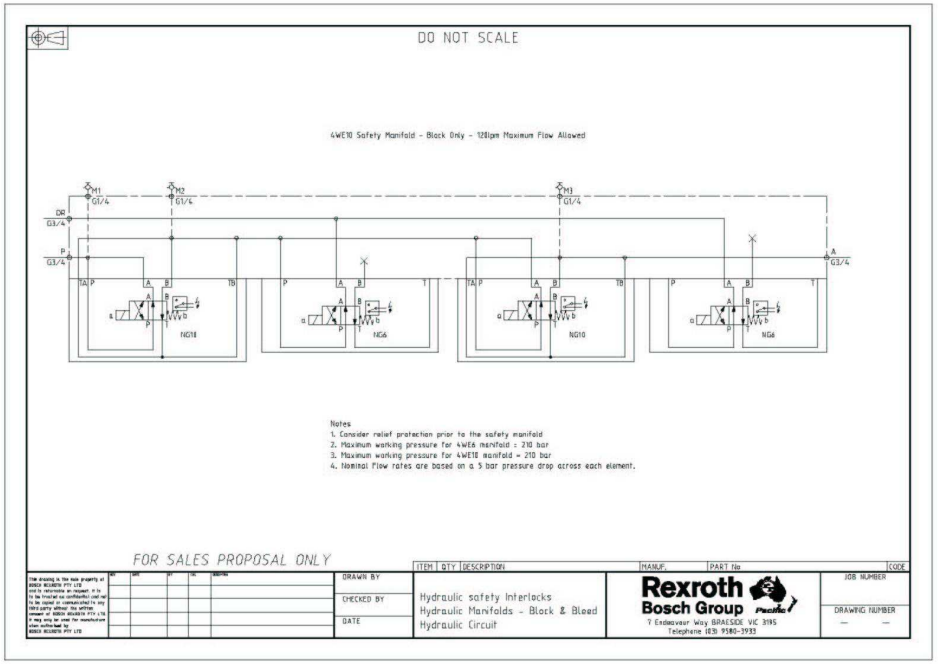
Hydraulic Safety Interlock Manifold Systems

- Typical Circuits we use that meet the requirements.
- NG10 Cat 3 or 4 Block Only



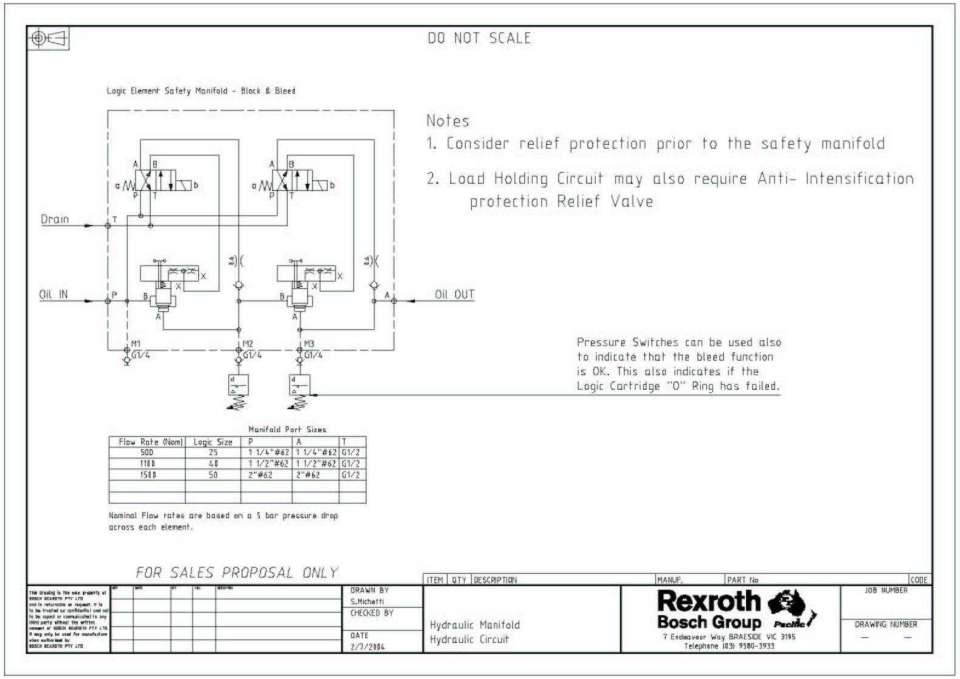
Hydraulic Safety Interlock Manifold Systems

- Typical Circuits we use that meet the requirements.
- NG10 Cat 3 or 4 Block and Bleed



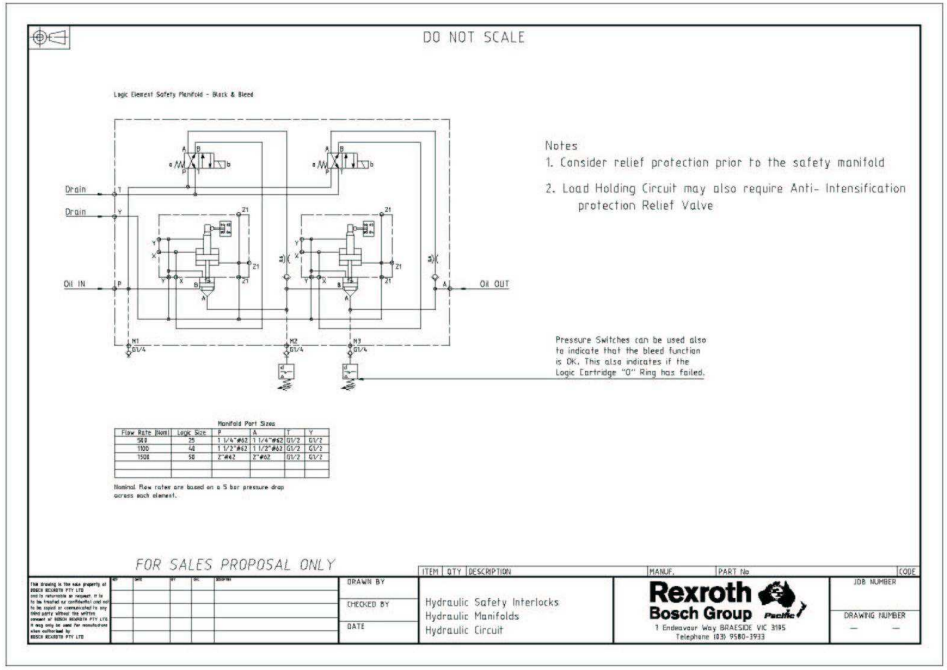
Hydraulic Safety Interlock Manifold Systems

- Typical Circuits we use that meet the requirements.
- Logic Element 3 or 4 Block and Bleed



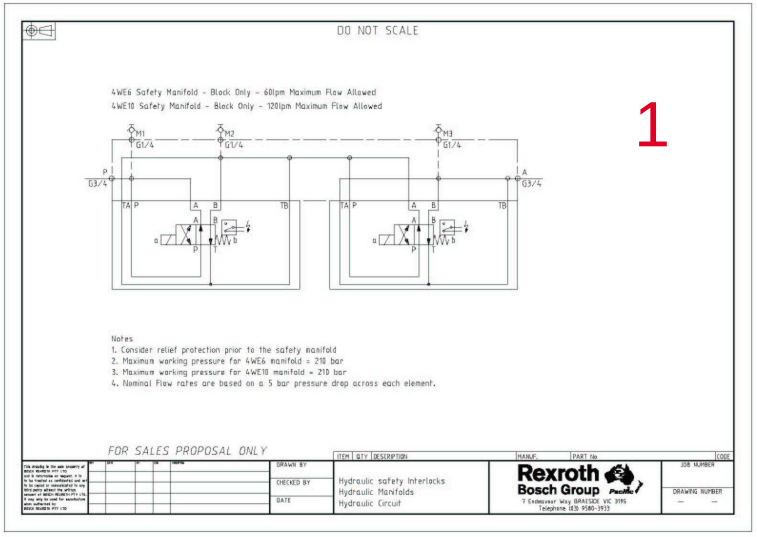
Hydraulic Safety Interlock Manifold Systems

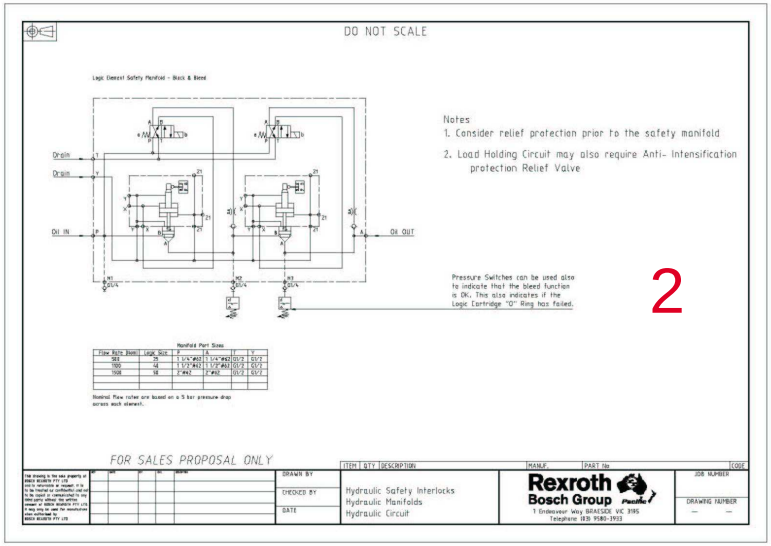
- Typical Circuits we use that meet the requirements.
- Logic Element with active piston 3 or 4 Block and Bleed



Hydraulic Safety Interlock Manifold Systems

1. What is Dual Flow Path and why do we use it?
2. What is a Logic Element with Active Piston and why do we use it?

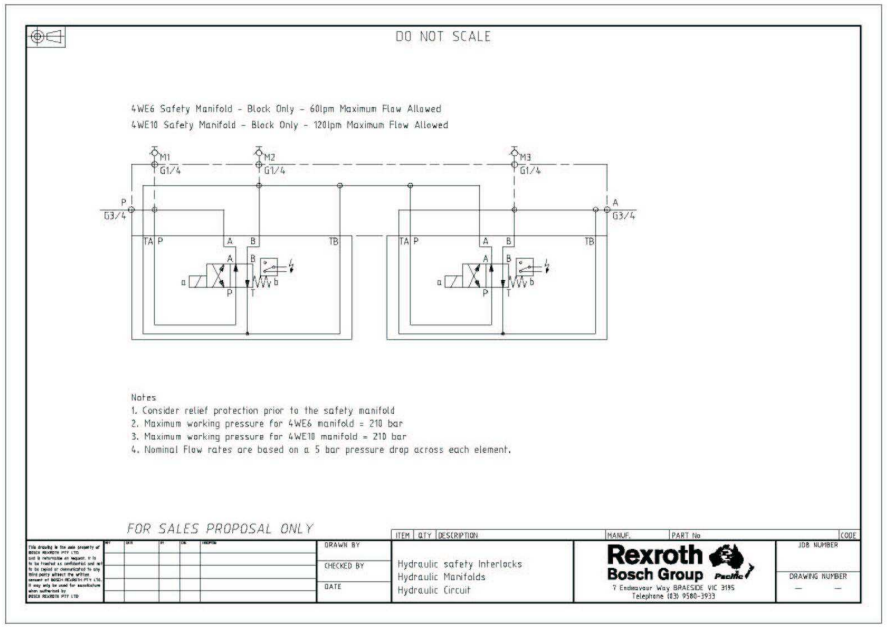




Hydraulic Safety Interlock Manifold Systems

What is Dual Flow Path and why do we use it?

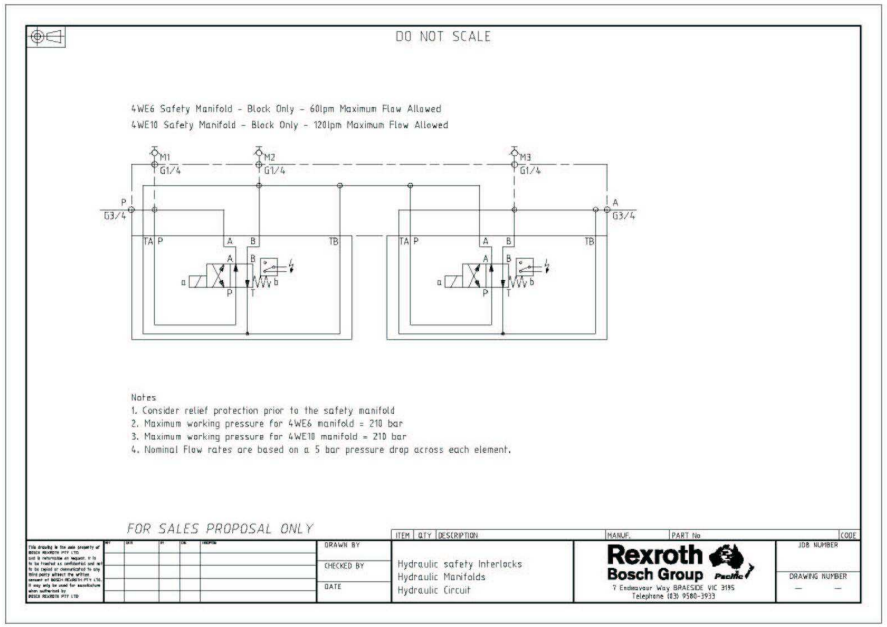
Dual flow path means that we connect the P & A ports together in the manifold and the B & T ports together in the manifold. How this helps us is to allow high flow rates through the DCV without causing unbalanced Bernoulli forces on the spool within the DCV. The data sheet states that single flow path through any DCV will result in significantly less flow capacity than specified on the tables. The data sheet only allows for “Dual Flow paths through the valve”



Hydraulic Safety Interlock Manifold Systems

What is Dual Flow Path and why do we use it?

In the de-energized position the valve provides a safe blocked condition. When energized the flow is allowed to pass from P to B and from A to T. The maximum pressures need to be checked to ensure that the tank port pressure as specified by the data sheet is not exceeded. Otherwise this circuit works perfectly well. Using this circuit we can easily pass 60lpm (NG6) and 120lpm (NG10) at no more than 5 bar pressure drop through the valve.

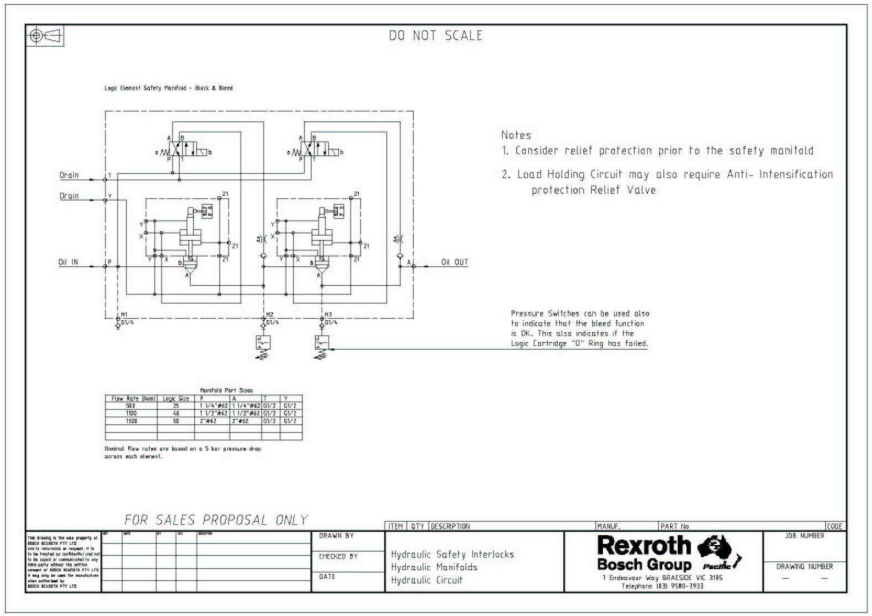


Hydraulic Safety Interlock Manifold Systems

What is a Logic Element with Active Piston and why do we use it?

Our logic element with active piston has advantages that can be used to overcome particular circuit problems.

The piston assembly mounted to the top of the logic element has an area much greater than any area on the actual poppet element of the assembly. This offers to distinct advantages



Hydraulic Safety Interlock Manifold Systems

What is a Logic Element with Active Piston and why do we use it?

1. Using the pressure from the inlet side (P port) of the manifold to drive the poppet shut in the de-energized safe position you can always be assured that the poppet will be driven home as the force generated always exceeds ant downstream pressures.

2. If the system requires the poppet to be driven open for response of flow rate reasons it can easily be done by connecting the Z1 port to the pilot DCV instead of to tank