国际标准 ISO 15500-1

公路车辆—压缩天然气（CNG）燃料系统部件
—第 1 部分：一般要求和定义

Road vechicles—Compressed natural gas (CNG) fuel system components—
Part 1:
General requirements and definitions

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前言

国际标准化组织（ISO）是各国标准化组织（ISO 成员体）在世界范围内的联盟。国际标准的制定工作通常是由 ISO 技术委员会来完成。任何一个成员体如果对 ISO 技术委员会已经确定的课题感兴趣，均具有在该技术委员会表达意见的权利。与 ISO 有联系的各种政府性的或非政府性的国际组织，也参与了这项工作。有关电器技术标准化的一切事项，ISO 均与国际电工技术委员会（IEC）进行密切合作。

国际标准依据 ISO/IEC 指令第三部分的规则起草。

技术委员会所采纳的国际标准草案，要向各个成员分发，进行表决。而作为正式国际标准出版，则要求至少得到 75%的成员体投票赞成。

ISO 15500 本部分的某些内容可能申请了专利。ISO 没有责任证实其中的部分或全部专利。

ISO 15500-1 国际标准是由 ISO/TC 22（公路车辆技术委员会）下的 SC 25（用天然气的公路车辆分委会）制定。

ISO 15500 其总标题为通用公路车辆——压缩天然气（CNG）燃料系统部件，由以下部分组成：

——第 1 部分：一般要求和定义
——第 2 部分：性能和一般试验方法
——第 3 部分：单向阀
——第 4 部分：手动阀
——第 5 部分：手动气瓶阀
——第 6 部分：自动阀
——第 7 部分：燃气喷射器
——第 8 部分：压力指示器
——第 9 部分：调压器
——第 10 部分：燃气流量调节器
——第 11 部分：燃气和空气的混合器
——第 12 部分：压力泄放阀（PRV）
——第 13 部分：压力泄放装置(PRD)
——第 14 部分：限流阀
——第 15 部分：密封的壳体和通气的软管
——第 16 部分：燃料硬管
——第 17 部分：燃料软管
——第 18 部分：过滤器
——第 19 部分：接口配件

公路车辆—压缩天然气（CNG）燃料系统部件

—第 1 部分：一般要求和定义

1 范围

ISO 15500 中的本部分规定了压缩天然气燃料系统部件的一般要求和定义，适用的机动车型号见 ISO 3833 的定义。本部分同时还规定了一般设计原则以及操作指南和标识的具体要求。

ISO 15500 中的本部分适用于符合 ISO 15403(单一燃料、双燃料和双元燃料的应用)的天然气车辆。不适用于下列：

a) 液化天然气（LPG）燃料系统部件设置在上游的，并且包括，汽化器。

b) 燃料用容器；

c) 固定式的燃气发动机；

d) 容器安装件；

e) 电子燃料的使用；

f) 需加注燃料的容器。

注 1　对于本部分没有包括的集成式的部件，可以按照 ISO 15500 中的本部分的准则进行检查，并按照相应的功能性试验要求进行试验。

注 2　除非有其它的规定，ISO 15500 中的本部分所涉及的压力均为表压。

注 3　ISO 15500 中的本部分，以天然气在 15℃时 20 MPa（200bar）的使用压力为基准。其它的使用压力，以适当的系数（比率）进行调节。如 25 MPa（250bar）的使用压力系统要求压力乘以 1.25。

2 规范性引用文件

下列引用性文件中所属的条款，一旦被本标准的正文所引用，便是 ISO 15500 中 的 本部分的合法条款。凡是注明日期的引用文件，其随后的修改单或修订版均不适用于本标准。本标准的编写组赞同以 ISO 15500 中的本部分为基准，鼓励对使用下列最新版本引用文件的可能性进行调查。凡不注明日期的引用文件，其最新版本适用于本标准。ISO 和 IEC 的成员体对当前有效的国际标准保持登记。

ISO 3833:1977　公路车辆——类型——术语和定义。

ISO 6722-1:1996　公路车辆——没有保护装置的低压电缆——第 1 部分：试验方法。

ISO 6722-2:1996　公路车辆——没有保护装置的低压电缆——第 2 部分：要求。

ISO 6722-3:1993　公路车辆——没有保护装置的低压电缆——第 3 部分：厚壁绝缘电缆的导线尺寸和面积。

ISO 6722-4:1993　公路车辆——没有保护装置的低压电缆——第 4 部分：薄壁绝缘电缆的导线尺寸和面积。

ISO 15403：——[1)]　天然气——车用压缩燃料的天然气质量标示。

ISO 15500－2——[1)]　公路车辆——压缩天然气（CNG）燃料系统的部件——第 2 部分：性能和一般试验方法。

ISO 15500－3——[1)]　公路车辆——压缩天然气（CNG）燃料系统的部件——第 3 部分：单向阀。

ISO 15501－1——[1)]　公路车辆——压缩天然气燃料系统——第 1 部分：安全性要求。

DIN 477-1:1990　试验压力大于 300bar 等级的气瓶阀——型号、大小、连接件和螺纹。
ANSI/ASME B1.1：1989　统一的英寸螺纹（UN 和 UNR 螺纹形式）。

3 术语和定义

ISO 15000 中的本部分应用了以下术语和定义：

3.1
阀（valve）
可以控制燃料流动的装置。

3.1.1
手动阀（manual valve）
手工操作的阀。

3.1.2
自动阀(automatic valve)
非手工操作的阀。

3.1.3
自动气瓶阀（automatic cylinder valve）
精确安装在气瓶上的自动阀，能控制燃料系统的气体流量。

3.1.4
单向阀（check valve）
只允许气体沿单一方向流动的自动阀。

3.1.5
限流阀（excess flow valve）
当气体流量超过设定值时，能自动关闭或限流的阀。

3.1.6
手动气瓶阀（manual cylinder valve）
精确安装在气瓶上的手动阀。

3.1.7
压力泄放阀（pressure relief valve）
PRV
防止超过预先设定的压力上限的装置。

3.1.8
检修阀（service valve）
只有当车辆维修时才关闭的手动阀。

3.2
压缩天然气（compressed natural gas）

CNG

压缩并储存的天然气，用作汽车的燃料。

3.3

过滤器（filter）

从气流中分离出异物的保护性滤器。

3.4

接口配件(fitting)

与管道、管子或软管系统相连的连接器。

3.5

燃料软管(flexible fuel line)

用于天然气流动的弹性管道或软管。

3.6

燃气和空气的混合器(gas/air mixer)

将气态燃料和供给发动机的吸入空气相混合的装置。

3.7

燃气流量调节器(gas flow adjuster)

限制气体流量的装置，安装在调压器的下方，用于控制到发动机的气体流量。

3.8

密封壳体(gas tight housing)

释放气体至车辆以外的装置，包括通气软管，完全打开时至少为 450mm^2。

3.9

天然气车辆(natural gas vehicle)

NGV

以天然气为动力的公路车辆。

3.10

压力指示器(pressure indicator)

指示气体压力的压力装置。

3.11

调压器(pressure regulator)

用于控制传递气体燃料到发动机的压力装置。

3.12

压力泄放装置(pressure relief device)

PRD

超温或超温加超压时流动的一次性使用的装置，以释放气体来保护气瓶防止破裂。

3.13
燃料硬管(rigid fuel line)
在正常的操作条件下，设计为天然气流动时不易弯曲的管子。

3.14
使用压力(service pressure)
在15℃的恒定气体温度下，设定的压力值为20Mpa(200bar)。

3.15
试验压力(test pressure)
在接受试验期间，部件所承受的压力。

3.16
工作压力(working pressure)
设计时所能承受的部件的最大压力，该压力是在考虑到的范围内确定部件强度的基础。

3.17
爆破压力(burst pressure)
导致失效并引起流体从密封部件中泄出的压力。

3.18
燃气喷射器(gas injector)
向发动机或相关的吸入系统输入气态燃料的装置。

4 结构和装配

4.1 部件应由适用于CNG的材料组成。

4.1 有接口的部件应具有气密性。当接口有拆卸要求时，推荐更换成带螺纹的配件。

4.2 与气瓶相配的部件应采用以下螺纹中的一种：

—— DIN 477 W 28.8-14 F×1″

—— 1 - 3/16 SAE

—— 2 – 12UNJ(公称2″)

4.4 发动机零件中的部件应适用于－40℃～120℃的温度范围。所有其它的部件适用的范围是－40℃～85℃。

4.5 所有密封件和膜片中的合成材料应符合ISO 15500-2氧气老化试验的规定。

4.6 所有与天然气接触的合成材料都应符合ISO 15500-2非金属合成剂浸泡试验的规定。

4.7 暴露在恶劣天气和其它腐蚀条件下的所有部件，应使用耐腐蚀性的材料或采用其它防护措施。

4.8 具有多种功能的部件可以由若干个部件组成，其定义见ISO 15500-3。这样的部件应按照ISO 15500中的本部分进行检查，并进行恰当的性能试验。

4.9 应使用故障安全机械装置关闭流动的燃料。

5 电器设备和接线

5.1 电线部件的端口应配备一些手段，防止绝缘金属丝网的擦破和磨损。

5.2 电器设备和部件中的环线，应按照 ISO 6722 中第 1～4 部分，考虑在机械强度、绝缘和载电容量方面的汽车品质。

5.3 电器结构用材应适用于其特殊的用途。对电器绝缘材料进行合格测定时，应考虑机械强度、抗电强度、耐热性能、关闭住或保护的级别，以及其它对火灾或其它事故灾害起作用的特性。

6 指示

6.1 应由部件和部件外壳的制造商提供现成可使用的：清晰、简要的操作指南和简图印件，明确地清晰可懂的说明，恰当地装配、安装、维修和安全操作。

6.2 应按照要求提供部件定期维修的操作指南，应验明要求更换的元件。

6.3 印制操作指南时，应说明其安装与地方政府法规相符。当没有地方法规时，应与 ISO 15500-1 相符。

6.4 此信息应在指定的国家有易懂的格式。

7 标识

部件应包括以下规定的信息：

a) 制造商或代理商的名称、商标或符号；
b) 型号的标示（改型序号）；
c) 使用压力或压力和温度的范围；
d) 流向（正确安装所必需的）；
e) 燃料的型号；
f) 电的额定功率；
g) 证书机构的标志；
h) 认可号；
i) 编号或日期编码；
j) ISO 15500 本部分的标准号。

注 1 规定的信息要求包括 ISO 15500-3 以及本标准随后的 ISO 15500-4～19 中所属的每个部件。

注 2 当部件由两个或两个以上元件组成时，至少在其中的一个元件上应标识合适的识别号。

公路车辆—压缩天然气（CNG）燃料系统部件
—第 2 部分：性能和一般试验方法

Road vechicles—Compressed natural gas (CNG) fuel system components—
Part 2:
Performance and general test methods

第一版
2001 年 2 月 15 日

前言

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ISO 15500 其总标题为通用公路车辆——压缩天然气（CNG）燃料系统部件，由以下部分组成：

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——第 2 部分：性能和一般试验方法
——第 3 部分：单向阀
——第 4 部分：手动阀
——第 5 部分：手动气瓶阀
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公路车辆—压缩天然气（CNG）燃料系统部件

—第 2 部分：性能和一般试验方法

1 范围

ISO 15500 中的本部分规定了压缩天然气燃料系统部件的性能和一般试验方法，其适用的机动车类型见 ISO 3833 的定义。

ISO 15500 中的本部分适用于符合 ISO 15403(单一燃料、双燃料和双元燃料的应用)的天然气车辆。不适用于下列：

a) 液化天然气（LPG）燃料系统部件设置在上游的，并且包括，汽化器。

b) 燃料用容器；

c) 固定式的燃气发动机；

d) 容器安装件；

e) 电子燃料的使用；

f) 需加注燃料的容器。

注 1　对于本部分没有包括的集成式的部件，可以按照 ISO 15500 中的本部分的准则进行检查，并按照相应的功能性试验要求进行试验。

注 2　除非有其它的规定，ISO 15500 中的本部分所涉及的压力均为表压。

注 3　ISO 15500 中的本部分，以天然气在 15℃时 20 MPa（200bar）的使用压力为基准。其它的使用压力，以适当的系数（比率）进行调节。如 25 MPa（250bar）的使用压力系统要求压力乘以 1.25。

2 规范性引用文件

下列引用性文件中所属的条款，一旦被本标准的正文所引用，便是 ISO 15500 中的本部分的合法条款。凡是注明日期的引用文件，其随后的修改单或修订版均不适用于本标准。本标准的编写组赞同以 ISO 15500 中的本部分为基准，鼓励对使用下列最新版本引用文件的可能性进行调查。凡不注明日期的引用文件，其最新版本适用于本标准。ISO 和 IEC 的成员体对当前有效的国际标准保持登记。

ISO 188:1998　橡胶、硫化或热塑性——加速老化和耐热性试验。

ISO 1817:　橡胶、硫化——液体影响的测定。

ISO 3833:1977　公路车辆——类型——术语和定义。

ISO 9227　在人造空气中的腐蚀性试验——盐雾试验。

ISO 15403　天然气——车用压缩燃料的天然气质量标示。

ISO 15500－1　公路车辆——压缩天然气（CNG）燃料系统的部件——第 1 部分：一般要求和定义。

ISO 15500－3　公路车辆——压缩天然气（CNG）燃料系统的部件——第 3 部分：单向阀。

ISO 15500(4～19 部分) 公路车辆——压缩天然气（CNG）燃料系统的部件。

1）　1bar = 0.1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

3 术语和定义

ISO 15000 中的本部分应用了 ISO 15500-1 中的术语和定义。

4 通则

4.1 除非另有规定，试验应在常温下进行，如 20℃±5℃。

4.2 部件应符合 ISO 15500-3 和随后部分的试验规定，也要符合 ISO 15500 中的本部分适用的试验规定。对于 ISO 15500 中的本部分(5 到 15 条款)所列的试验项目还不够全面的一些特殊的部件，需加做其它附加试验，其规定见其它相关的部分。

4.3 除非另有规定，都应用干燥的空气或氮气进行试验。具有资质的人员在安全措施得当的条件下也可使用天然气。在试验压力下试验气体的露点应为没有结冰或没有水合物或没有液体形成时的温度。

4.4 承认 ISO 15500-3 或随后部分中可能没有包括新技术。

5 液压强度试验

部件在经受以下试验步骤时不应破裂。

堵住呈开启状态的部件出口，使阀回落到阀座的位置上，或如果是在开启的位置则将其内部堵住。用试验液体在部件的进口施加 ISO 15500-3 以及 ISO 15500 随后部分规定的液压压力，时间至少为 3 分钟。

本次试验用的试样不可用于其它试验。

6 气密性

6.1 通则

6.1.1 前提条件是用氮气来净化部件或装置，然后用氮气、干燥的空气或天然气在 30%的使用压力下封住部件或装置。

6.1.2 在进行所有的试验时，装置应始终处于规定的试验温度下。装置在使用以下的试验方法时，应无气泡或其泄漏率应小于 20cm^3/h（通常条件下）。

6.2 外部气密性

6.2.1 用恰当的连接配件堵住每个装置的出口，并对进口施加试验压力。

6.2.2 对试验装置施加增压用的空气、氮气或天然气。

6.2.3 在所有的试验温度下，将部件至于适当的试验介质下，时间为 2 分钟，或者用氦气真空试验（总积累方法）或者其它相当的方法。

6.2.4 如果在规定的时间内没有气泡，则认定该试样通过了试验。如果发现有气泡，则需用适当的方法测其泄漏率。

6.3 内部气密性

6.3.1 当装置处于关闭位置时，进行内部泄漏率的试验，试验的目的是为了检查该关闭系统的压力密封性能。

6.3.2 在移去相对的连接件或连接件处于开启的位置时，用适当的连接配件连接装置的进口或出口（应用时）。

6.4 试验条件

6.4.1 通则

气密性试验的条件取决于部件是否暴露在气瓶压力下或位于减压第一级的下游。

6.4.2 暴露在气瓶压力下的装置

6.4.2.1 在－40℃的低温条件下，对装置施加 75%的使用压力和 2.5%的使用压力。

6.4.2.2 在 20℃的室温条件下，对装置施加 2.5%的使用压力和 150%的使用压力。

6.4.2.3 在 85℃或 120℃的高温条件下，对装置施加 5%的使用压力和 150%的使用压力。

6.4.3 减压第一级下游的装置

6.4.3.1 在－40℃的低温条件下，对装置施加 75％的使用压力和 2.5％的工作压力。

6.4.3.2 在 20℃的室温条件下，对装置施加 2.5％的使用压力和 150％的工作压力。

6.4.3.3 在 85℃或 120℃的高温条件下，对装置施加 5％的使用压力和 150％的工作压力。

7 耐超力矩试验

直接与螺纹配件连接的部件，应按照以下试验步骤，在 150％的安装力矩下，无变形、损坏或泄漏。

a) 在未使用过的部件上进行试验，对相邻的接口配件施加该力矩。

b) 对带一个螺纹接头或带多个螺纹接头的部件，该力矩施加 15 分钟，然后解除该力矩，撤去部件，并检查部件是否变形和损坏。

c) 按照第 6 款的规定对该部件进行气密性试验。

8 弯曲力矩试验

部件在以下试验步骤下应无裂纹、损坏或泄漏。

a) 将该部件的接头同与其相配的一个或多个接头（满足设计要求的）进行紧密地装配。装配后，入口管的长度应大于 300mm（见图 1）。

b) 应在部件出口 25mm 处刚性支撑出口的连接件，除非在以下情况：

——如果部件以一个独立于进口和出口接头之外的整体装配的方式，则部件应按照制造商规定的整体装配方式进行装配。

——如果部件以整体装配方式或部件出口进行装配，装配方法应用该产品装配方式中最苛刻的试验条件。

c) 在进行 d)步骤之前检查该组件的密封性。

d) 在部件处于关闭位置时，对系统增压至 5kPa(50mbar)，并在进口 300mm 处按照表 1 的要求施加一个力，保持 15 分钟，在不撤除该力的情况下，常温下按照第 6 款规定的试验方法检查该部件的气密性。

注 根据试验的进行情况，必要时可以增加载荷以此来平衡浮力。

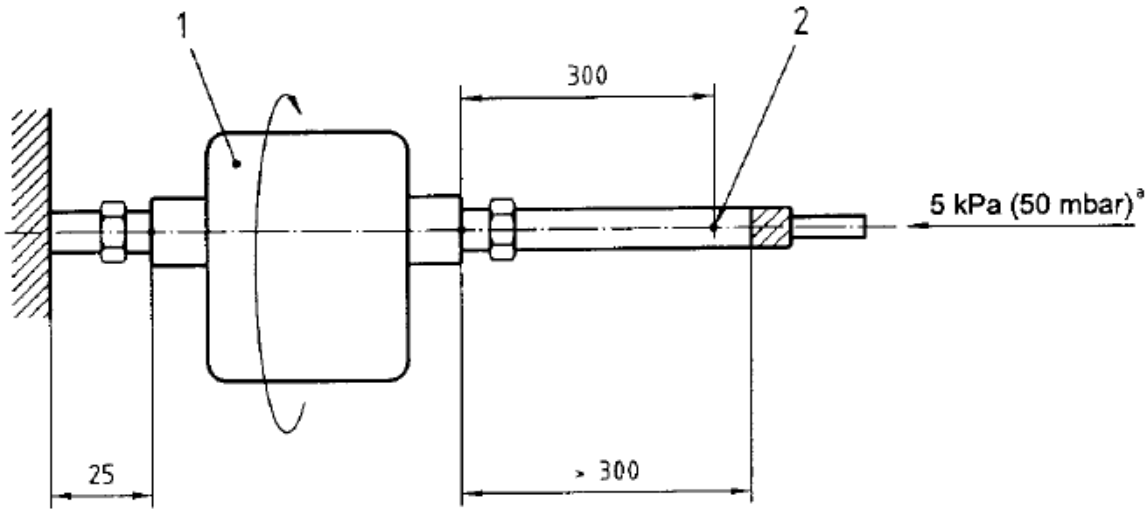
e) 做 4 次步骤 d)，每次试验将部件沿水平轴旋转 90º。试验与试验之间，用弯曲力矩开启和关闭（应用时）该部件 3 次。

f) 完成上述试验后，撤除该部件，并检查是否有变形。然后按照第 6 款的规定对该部件进行气密性试验。

表 1、弯曲力矩试验的受力

管子的外直径 mm	受力 N
6	3.4
8	9.0
≥12	17.0

单位：毫米



注：

1 部件

2 受力点

3 4×90º旋转

图 1、弯曲力矩试验

9 连续性运行试验

9.1 通则

特定部件的具体试验方法见 ISO 15500 的其它部分。本条款规定的是一般要求，也适用于集成式的部件。

9.2 试验方法

9.2.1 试验步骤

用恰当的接口配件有把握将部件连接到干燥空气、氮气或天然气的增压源上，并完成 ISO 15500-3 及 ISO 15500 随后部分规定的循环次数。一次循环由一次开启部件和（应用时）一次关闭部件组成，时间需少于 10 秒±2 秒。

在循环处于关闭状态时，试验装置器的下游压力应低于 50%试验压力的最大值。

在减压第一级下游的部件，试验压力应以 100%的工作压力为基准。

除非另有规定，应符合 9.2.2 和 9.2.3 的规定。

9.2.2 室温下的循环试验

按照第 6 条款， 在常温和使用压力下，完成部件 96%的总循环次数。

试验可以中断，如有要求，20%的时间间隔是用于气密性试验。

9.2.3 高温下的循环试验

按照 ISO 15500-1:2000 中 4.4 的规定， 在适当的最高温度和使用压力下，完成部件 2%的总循环次数。部件在适当的最高温度下，完成高温循环次数，应符合 ISO 15500 中的本部分第 6 条款的规定。

9.2.4 低温下的循环试验

按照 ISO 15500-1:2000 中 4.4 的规定， 在适当的最低温度和 50%使用压力下，完成部件 2%的总循环次数。部件在适当的最低温度下，完成低温循环次数，应符合 ISO 15500 中的本部分第 6 条款的规

定。

10 耐腐蚀试验

10.1 所有的部件应是安全的，按照以下的试验方法进行盐雾试验，应符合第 6 条款的要求。
10.2 将部件置于正常的安装位置上，按照 ISO 9227 的规定，进行 96 小时的盐雾试验。
10.3 盐雾室内的温度保持在 33℃和 36℃之间。
10.4 该盐溶液应由 5%的氯化钠（重量）和 95%的蒸馏水组成（重量）。
10.5 在腐蚀试验以后，应立即冲洗试样，并轻轻地拭去盐的沉积物，然后按照第 6 条款的规定进行试验。

11 氧气老化试验

对于起燃料密封性作用的所有合成剂部件或非金属元件的部件，如果申请人不能提供满意的性能声明书，应按照下列试验步骤，在完成氧气老化试验后应无裂纹和可见的损坏。

代表的试样在 2MPa(20bar)和 70℃的温度下，按照 ISO 188 的规定，置于氧气中 96 小时。

12 电器超压试验

所有的电器部件或装置，包括电器附属部件，在 3 分钟内应能承受 1.5 倍的额定电压（±5%的偏差），不发生失效。

13 非金属合成剂的浸泡试验

13.1 除非申请人能够递交由制造商提供的材料试验结果声明书，用于部件中的非金属合成材料，应由试验机构按照 13.2 和 13.3 的条款进行试验。
13.2 与天然气接触的，由非金属合成材料组成的元件，在按照以下步骤进行试验时，在体积或重量方面应没有超标的变化。
a）对一个标准的试样或用于部件中的各种非金属合成材料试样做好准备、测量和称重，在常温下，用天然气将上述试样在 20MPa(200bar)下至少浸泡 70 小时。
b）浸泡后，迅速将试验压力减小至大气压力，试样没有撕碎或分裂现象。
13.3 将用于部件中的非金属合成材料置于酯类或 α 烯烃的合成压缩机油内（包括非合成压缩机油），在按照 ISO 1817 或以下步骤进行试验时，在体积或重量方面应没有超标的变化。
a）对一个标准的试样或用于部件中的各种非金属合成材料试样做好准备、测量和称重，在常温下，分别用试验液体中的一种浸泡上述试样，每次时间至少为 70 小时。
b）在浸泡试验后，取出并检测试样。

试样的膨胀率应小于等于 25%，收缩率应小于等于 1%。重量的变化不应超过 10%。

14 抗振性试验

所有带活动元件的部件应保持不损坏状态，在按照以下试验步骤完成 6 小时的振动试验后，应能继续工作，并满足气密性试验的要求。
a)将部件安置在一个试验装置上，以 17Hz 的频率，沿三个定位轴的方向各振动 2 小时，其振幅为 1.5mm。
b）在完成总计 6 小时的振动后，部件应满足第 6 条款的要求。

15 黄铜材料的相容性试验

所有装燃料的黄铜部件或其附属部件，如果申请人不能提供满意的性能声明书，应按照下列试验步骤进行试验（若部件制造商能提供文件证明其产品的价值范围，可免除这一要求。
a） 通常对每个试样或者包括在与其它部件相配的元件上，施加一个应力。在试验之前先对试样施加这些应力，并在试验过程中一直保持（这些应力）。对安装产品用的带螺纹的试样，力矩应按照手工操作

试样的要求预紧，螺纹上不应使用聚四氟乙烯的胶布或管状的复合物。

b) 去除三个试样上的油脂，在容积约为 30 升带玻璃盖的玻璃器皿中，以固定的位置在潮湿、氨-空气混合物的条件下放置 10 天。氨水保持在 600cm^3 左右,在试样下方玻璃器皿的底部，其相对密度为 0.94（重量）。在氨水溶液上方 40mm 的位置，用一个不起反应的托盘放置试样。使器皿始终处于大气压和温度为 34℃±2℃的潮湿的氨－空气混合物中。

在本步骤完成后，试样在 25 倍的放大率下应无裂纹。

国际标准 ISO 15500-3

公路车辆—压缩天然气（CNG）燃料系统部件
—第 3 部分：单向阀

Road vechicles—Compressed natural gas (CNG) fuel system components—
Part 3:
Check valve

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前言

国际标准化组织（ISO）是各国标准化组织（ISO 成员体）在世界范围内的联盟。国际标准的制定工作通常是由 ISO 技术委员会来完成。任何一个成员体如果对 ISO 技术委员会已经确定的课题感兴趣，均具有在该技术委员会表达意见的权利。与 ISO 有联系的各种政府性的或非政府性的国际组织，也参与了这项工作。有关电器技术标准化的一切事项，ISO 均与国际电工技术委员会（IEC）进行密切合作。

国际标准依据 ISO/IEC 指令第三部分的规则起草。

技术委员会所采纳的国际标准草案，要向各个成员分发，进行表决。而作为正式国际标准出版，则要求至少得到 75%的成员体投票赞成。

ISO 15500 本部分的某些内容可能申请了专利。ISO 没有责任证实其中的部分或全部专利。

ISO 15500-3 国际标准是由 ISO/TC 22（公路车辆技术委员会）下的 SC 25（用天然气的公路车辆分委会）制定。

ISO 15500 其总标题为公路车辆——压缩天然气（CNG）燃料系统部件，由以下部分组成：

——第 1 部分：一般要求和定义
——第 2 部分：性能和一般试验方法
——第 3 部分：单向阀
——第 4 部分：手动阀
——第 5 部分：手动气瓶阀
——第 6 部分：自动阀
——第 7 部分：燃气喷射器
——第 8 部分：压力指示器
——第 9 部分：调压器
——第 10 部分：燃气流量调节器
——第 11 部分：燃气和空气的混合器
——第 12 部分：压力泄放阀（PRV）
——第 13 部分：压力泄放装置(PRD)
——第 14 部分：限流阀
——第 15 部分：密封的壳体和通气的软管
——第 16 部分：燃料硬管
——第 17 部分：燃料软管
——第 18 部分：过滤器
——第 19 部分：接口配件

公路车辆—压缩天然气（CNG）燃料系统部件

—第 3 部分：单向阀

1 范围

ISO 15500 中的本部分规定了压缩天然气燃料系统部件单向阀的试验和要求，其适用的机动车类型见 ISO 3833 的定义。

ISO 15500 中的本部分适用于符合 ISO 15403(单一燃料、双燃料和双元燃料的应用)的天然气车辆。不适用于下列：

a) 液化天然气（LPG）燃料系统部件设置在上游的，并且包括，汽化器。

b) 燃料用容器；

c) 固定式的燃气发动机；

d) 容器安装件；

e) 电子燃料的使用；

f) 需加注燃料的容器。

注 1　对于本部分没有包括的集成式的部件，可以按照 ISO 15500 中的本部分的准则进行检查，并按照相应的功能性试验要求进行试验。

注 2　除非有其它的规定，ISO 15500 中的本部分所涉及的压力均为表压。

注 3　ISO 15500 中的本部分，以天然气在 15℃时 20 MPa（200bar）的使用压力为基准。其它的使用压力，以适当的系数（比率）进行调节。如 25 MPa（250bar）的使用压力系统要求压力乘以 1.25。

2 规范性引用文件

下列引用性文件中所属的条款，一旦被本标准的正文所引用，便是 ISO15500 中的本部分的合法条款。凡是注明日期的引用文件，其随后的修改单或修订版均不适用于本标准。本标准的编写组赞同以 ISO15500 中的本部分为基准，鼓励对使用下列最新版本引用文件的可能性进行调查。凡不注明日期的引用文件，其最新版本适用于本标准。ISO 和 IEC 的成员体对当前有效的国际标准保持登记。

ISO 3833　　公路车辆——类型——术语和定义。

ISO 15403　　天然气——车用压缩燃料的天然气质量标示。

ISO 15500－1　公路车辆——压缩天然气（CNG）燃料系统的部件——第 1 部分：一般要求和定义。

ISO 15500－2　公路车辆——压缩天然气（CNG）燃料系统的部件——第 2 部分：性能和一般试验方法。

3 术语和定义

ISO 15000 中的本部分应用了 ISO 15500-1 中的术语定义。

4 标识

部件的标识应充分提供以下信息：

a)　制造商或代理商的名称、商标或符号；

b)　型号的标示（改型序号）；

c） 使用压力或压力和温度的范围；

推荐提供以下附加的标识：

d） 流向（正确安装所必需的）；

e） 燃料的型号；

f） 电的额定功率（应用时）；

g） 证书机构的标志；

h） 认可号；

i） 编号或日期编码；

j） ISO 15500 中的本部分的标准号。

注 当部件由两个或两个以上元件组成时，至少在其中的一个元件上应标识合适的识别号。

5 结构和装配

单向阀应符合 ISO 15500-1 和 ISO 15500-2 的适当条款，并符合 ISO 15500 中的本部分第 6 条规定的试验要求。

6 试验

6.1 应用性试验

试验要求按表 1 执行。

表 1、应用的试验

试验方法	应用	ISO 15500-2 规定的试验步骤	ISO 15500 中本部分规定的试验要求
液压强度试验	╳	╳	╳（见 6.2）
气密性试验	╳	╳	╳（见 6.3）
耐超力矩试验	╳[a]	╳	
弯曲力矩试验	╳	╳	
连续性运行试验	╳	╳	╳（见 6.4）
耐腐蚀试验	╳	╳	
氧气老化试验	╳	╳	
电器超压试验			
非金属合成剂的浸泡试验	╳	╳	
抗振性试验	╳	╳	
黄铜材料的相容性试验	╳	╳	
a 不适用于装在其它部件上的单向阀。			

6.2 液压强度试验

按照 ISO 15500－2 规定的液压强度试验步骤进行单向阀的试验。试验压力应为 100 MPa（1000bar）。

6.3 气密性试验

单向阀试验的温度和压力见表 2。

表 2、试验温度和压力

温度 ℃	压力 MPa [bar]	
	第一次	第二次

－40	15[150]	0.5[5]
20	0.5[5]	30[300]
85 到 120	1 [10]	

6.4 连续性运行试验

按照下列试验步骤，单向阀应能承受 20000 次的循环操作和 24 小时的颤流。

a）将单向阀连接到固定的试验装置上，在单向阀的进气口施加一个 25 MPa（250bar）的压力，然后从它的出气口放出压力。在下一个循环之前，单向阀出气口侧施加一个较低的压力，其值在 0～12.5 MPa（125bar）之间。

b）在 20000 次的循环操作以后，单向阀应进行 24 小时的颤流，其流速为最大颤流时的流速。完成这个试验以后，应按照 6.3 条进行气密性试验。

试验过程中的失败，应视为单向阀的失效。本次试验完成后，所有的元件应保持适当的位置和功能。

国际标准 ISO 15500-4

公路车辆—压缩天然气（CNG）燃料系统部件
—第 4 部分：手动阀

Road vechicles—Compressed natural gas (CNG) fuel system components—
Part 4:
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ISO 15500-4 国际标准是由 ISO/TC 22（公路车辆技术委员会）下的 SC 25（用天然气的公路车辆分委会）制定。

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——第 10 部分：燃气流量调节器
——第 11 部分：燃气和空气的混合器
——第 12 部分：压力泄放阀（PRV）
——第 13 部分：压力泄放装置(PRD)
——第 14 部分：限流阀
——第 15 部分：密封的壳体和通气的软管
——第 16 部分：燃料硬管
——第 17 部分：燃料软管
——第 18 部分：过滤器
——第 19 部分：接口配件

公路车辆—压缩天然气（CNG）燃料系统部件

—第 4 部分：手动阀

1 范围

ISO 15500 中的本部分规定了压缩天然气燃料系统部件手动阀的试验和要求，其适用的机动车类型见 ISO 3833 的定义。

ISO 15500 中的本部分适用于符合 ISO 15403(单一燃料、双燃料和双元燃料的应用)的天然气车辆。不适用于下列：

a) 液化天然气（LPG）燃料系统部件设置在上游的，并且包括，汽化器。

b) 燃料用容器；

c) 固定式的燃气发动机；

d) 容器安装件；

e) 电子燃料的使用；

f) 需加注燃料的容器。

注 1　对于本部分没有包括的集成式的部件，可以按照 ISO 15500 中的本部分的准则进行检查，并按照相应的功能性试验要求进行试验。

注 2　除非有其它的规定，ISO 15500 中的本部分所涉及的压力均为表压。

注 3　ISO 15500 中的本部分，以天然气在 15℃时 20 MPa（200bar）的使用压力为基准。其它的使用压力，以适当的系数（比率）进行调节。如 25 MPa（250bar）的使用压力系统要求压力乘以 1.25。

2 规范性引用文件

下列引用性文件中所属的条款，一旦被本标准的正文所引用，便是 ISO 15500 中的本部分的合法条款。凡是注明日期的引用文件，其随后的修改单或修订版均不适用于本标准。本标准的编写组赞同以 ISO 15500 中的本部分为基准，鼓励对使用下列最新版本引用文件的可能性进行调查。凡不注明日期的引用文件，其最新版本适用于本标准。ISO 和 IEC 的成员体对当前有效的国际标准进行登记。

ISO 3833:1977　公路车辆——类型——术语和定义。

ISO 15403　　天然气——车用压缩燃料的天然气质量标示。

ISO 15500－1　公路车辆——压缩天然气（CNG）燃料系统的部件——第 1 部分：一般要求和定义。

ISO 15500－2　公路车辆——压缩天然气（CNG）燃料系统的部件——第 2 部分：性能和一般试验方法。

3 术语和定义

ISO 15000 中的本部分应用了 ISO 15500-1 中的术语和定义。

4 标识

部件应充分提供以下信息：

a)　制造商或代理商的名称、商标或符号；

b)　型号的标示（变型序号）；

c)　使用压力或压力和温度的范围；

d） 流向（正确安装所必需的）；
e） 燃料的型号；
f） 电的额定功率；
g） 证书机构的标志；
h） 认可号；
i） 编号或日期编码；
j） ISO 15500 中的本部分的标准号。

注 当部件由两个或两个以上元件组成时，至少在其中的一个元件上应标识合适的识别号。

5 结构和装配

5.1 手动阀应符合 ISO 15500-1 和 ISO 15500-2 的适当条款，并符合 ISO 15500 中的本部分第 6 条规定的试验要求。

5.2 设有自动阀手轮，应牢固的与阀杆相配。

5.3 手动阀从“开”到“关”旋转 90º 的位置应具有严密而牢固的填塞，限制手动阀的转动。

5.4 手动阀可以被用作检修阀。

6 试验

6.1 应用性试验

试验要求按表 1 执行。

表 1、应用的试验

试验方法	应用	ISO 15500-2 规定的试验步骤	ISO 15500 中本部分规定的试验要求
液压强度试验	╳	╳	╳（见 6.2）
气密性试验	╳	╳	╳（见 6.3）
耐超力矩试验	╳	╳	
弯曲力矩试验	╳	╳	
连续性运行试验	╳	╳	╳（见 6.4）
耐腐蚀试验	╳	╳	
氧气老化试验	╳	╳	
电器超压试验			
非金属合成剂的浸泡试验	╳	╳	
抗振性试验	╳	╳	
黄铜材料的相容性试验	╳	╳	

6.2 液压强度试验

按照 ISO 15500－2 规定的液压强度试验步骤进行手动阀的试验。试验压力应为 100 MPa（1000bar）。

6.3 气密性试验

手动阀试验的温度和压力见表 2。

表 2、试验温度和压力

温度	压力
℃	MPa [bar]

	第一次压力	第二次压力
－40	15[150]	0.5[5]
20	0.5[5]	30[300]
85 到 120	1 [10]	

6.4 连续性运行试验

6.4.1 手动阀应按照 ISO 15500-2 规定的步骤进行连续性的运行试验，循环次数为 10000 次，但是其试验装置的下游压力降至小于 0.5MPa（5bar），并依据 ISO 15500 中的本部分 6.3 进行气密性试验。

6.4.2 循环和重复气密性试验之后，手动阀在力矩不大于表 3 规定的数值，手轮处于完全开启的方向和关闭的方向时，应能完全开启和关闭。

表 3、力矩试验

部件的进气口尺寸 mm	最大力矩 N•m
6	1.7
8 到 10	2.3
12	2.8

6.4.3 按照 ISO 15500-1:2000 中第 4.4 条，在适当的最高温度下进行试验。然后在温度为-40℃以及下表 4 规定的适当的最大力矩下进行重复试验。

表 4、重复力矩试验

部件的进气口尺寸 mm	最大力矩 N•m
6	3.4
8 到 10	4.5
12	11.3

国际标准 ISO 15500-5

公路车辆—压缩天然气（CNG）燃料系统部件
—第 5 部分：手动气瓶阀

Road vechicles—Compressed natural gas (CNG) fuel system components—
Part 5:
Manual cylinder valve

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前言

国际标准化组织（ISO）是各国标准化组织（ISO 成员体）在世界范围内的联盟。国际标准的制定工作通常是由 ISO 技术委员会来完成。任何一个成员体如果对 ISO 技术委员会已经确定的课题感兴趣，均具有在该技术委员会表达意见的权利。与 ISO 有联系的各种政府性的或非政府性的国际组织，也参与了这项工作。有关电器技术标准化的一切事项，ISO 均与国际电工技术委员会（IEC）进行密切合作。

国际标准依据 ISO/IEC 指令第三部分的规则起草。

技术委员会所采纳的国际标准草案，要向各个成员分发，进行表决。而作为正式国际标准出版，则要求至少得到 75%的成员体投票赞成。

ISO 15500 本部分的某些内容可能申请了专利。ISO 没有责任证实其中的部分或全部专利。

ISO 15500-5 国际标准是由 ISO/TC 22（公路车辆技术委员会）下的 SC 25（用天然气的公路车辆分委会）制定。

ISO 15500 其总标题为通用公路车辆——压缩天然气（CNG）燃料系统部件，由以下部分组成：

——第 1 部分：一般要求和定义
——第 2 部分：性能和一般试验方法
——第 3 部分：单向阀
——第 4 部分：手动阀
——第 5 部分：手动气瓶阀
——第 6 部分：自动阀
——第 7 部分：燃气喷射器
——第 8 部分：压力指示器
——第 9 部分：调压器
——第 10 部分：燃气流量调节器
——第 11 部分：燃气和空气的混合器
——第 12 部分：压力泄放阀（PRV）
——第 13 部分：压力泄放装置(PRD)
——第 14 部分：限流阀
——第 15 部分：密封的壳体和通气的软管
——第 16 部分：燃料硬管
——第 17 部分：燃料软管
——第 18 部分：过滤器
——第 19 部分：接口配件

公路车辆—压缩天然气（CNG）燃料系统部件

—第 5 部分：手动气瓶阀

1 范围

ISO 15500 中的本部分规定了压缩天然气燃料系统部件手动气瓶阀的试验和要求，其适用的机动车类型见 ISO 3833 的定义。

ISO 15500 中的本部分适用于符合 ISO 15403(单一燃料、双燃料和双元燃料的应用)的天然气车辆。不适用于下列：

a) 液化天然气（LPG）燃料系统部件设置在上游的，并且包括，汽化器。

b) 燃料用容器；

c) 固定式的燃气发动机；

d) 容器安装件；

e) 电子燃料的使用；

f) 需加注燃料的容器。

注 1　对于本部分没有包括的集成式的部件，可以按照 ISO 15500 中的本部分的准则进行检查，并按照相应的功能性试验要求进行试验。

注 2　除非有其它的规定，ISO 15500 中的本部分所涉及的压力均为表压。

注 3　ISO 15500 中的本部分，以天然气在 15℃时 20 MPa（200bar）的使用压力为基准。其它的使用压力，以适当的系数（比率）进行调节。如 25 MPa（250bar）的使用压力系统要求压力乘以 1.25。

2 规范性引用文件

下列引用性文件中所属的条款，一旦被本标准的正文所引用，便是 ISO 15500 中的本部分的合法条款。凡是注明日期的引用文件，其随后的修改单或修订版均不适用于本标准。本标准的编写组赞同以 ISO 15500 中的本部分为基准，鼓励对使用下列最新版本引用文件的可能性进行调查。凡不注明日期的引用文件，其最新版本适用于本标准。ISO 和 IEC 的成员体对当前有效的国际标准保持登记。

ISO 3833:1977　公路车辆——类型——术语和定义。

ISO 15403　天然气——车用压缩燃料的天然气质量标示。

ISO 15500－1　公路车辆——压缩天然气（CNG）燃料系统的部件——第 1 部分：一般要求和定义。

ISO 15500－2　公路车辆——压缩天然气（CNG）燃料系统的部件——第 2 部分：性能和一般试验方法。

3 术语和定义

ISO 15000 中的本部分应用了 ISO 15500-1 中的术语和定义。

4 标识

部件的标识应充分提供以下信息：

1）　1bar = 0.1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

a)　制造商或代理商的名称、商标或符号；

b)　型号的标示（改型序号）；

c） 使用压力或压力和温度的范围；

推荐提供以下附加的标识：

d） 流向（正确安装所必需的）；

e） 燃料的型号；

f） 电的额定功率（应用时）；

g） 证书机构的标志；

h） 认可号；

i） 编号或日期编码；

j） ISO 15500 中的本部分的标准号。

注 当部件由两个或两个以上元件组成时，至少在其中的一个元件上应标识合适的识别号。

5 结构和装配

手动气瓶阀应符合 ISO 15500-1 和 ISO 15500-2 的适当条款，并符合 ISO 15500 中的本部分第 6 条规定的要求。

6 试验

6.1 应用性试验

试验按表 1 的要求进行。

表 1、应用的试验

试验方法	应用	ISO 15500-2 规定的试验步骤	ISO 15500 中本部分规定的试验要求
液压强度试验	╳	╳	╳（见 6.2）
气密性试验	╳	╳	╳（见 6.3）
耐超力矩试验	╳	╳	
弯曲力矩试验	╳	╳	
连续性运行试验	╳	╳	╳（见 6.4）
耐腐蚀试验	╳	╳	
氧气老化试验	╳	╳	
电器超压试验			
非金属合成剂的浸泡试验	╳	╳	
抗振性试验	╳	╳	
黄铜材料的相容性试验	╳	╳	

6.2 液压强度试验

按照 ISO 15500－2 规定的液压强度试验步骤进行手动气瓶阀的试验，其试验压力应为 80 MPa（800bar）。

6.3 气密性试验

手动气瓶阀试验的温度和压力见表 2。

表 2、试验温度和压力

温度 ℃	试验压力 MPa [bar]	
	第一次	第二次

-40	15[150]	0.5[5]
20	0.5[5]	30[300]
85	1 [10]	

6.4 连续性运行试验

6.4.1 对于手动气瓶阀，应按照 ISO 15500-2 的规定进行连续性的运行试验，循环次数为 10000 次，但是试验装置的下游压力降至小于 0.5MPa（5bar），应依据 ISO 15500 中的本部分 6.3 条进行气密性试验。

6.4.2 循环和重复气密性试验之后，手动气瓶阀在力矩不大于表 3 规定的数值，手轮处于完全开启的方向和关闭的方向时，应能完全开启和关闭。

表 3、力矩试验

部件的进口尺寸 mm	最大力矩 N•m
6	1.7
8 到 10	2.3
12	2.8

6.4.3 按照 ISO 15500-1:2000 中第 4.4 条，在适当的最高温度下进行试验。然后在温度为-40℃以及下表 4 规定的适当的最大力矩下进行重复试验。

表 4、重复力矩试验

部件的进口尺寸 mm	最大力矩 N•m
6	3.4
8 到 10	4.5
12	11.3

国际标准 ISO 15500-6

公路车辆—压缩天然气（CNG）燃料系统部件
—第 6 部分：自动阀

Road vechicles—Compressed natural gas (CNG) fuel system components—
Part 6:
Automatic valve

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前言

国际标准化组织（ISO）是各国标准化组织（ISO 成员体）在世界范围内的联盟。国际标准的制定工作通常是由 ISO 技术委员会来完成。任何一个成员体如果对 ISO 技术委员会已经确定的课题感兴趣，均具有在该技术委员会表达意见的权利。与 ISO 有联系的各种政府性的或非政府性的国际组织，也参与了这项工作。有关电器技术标准化的一切事项，ISO 均与国际电工技术委员会（IEC）进行密切合作。

国际标准依据 ISO/IEC 指令第三部分的规则起草。

技术委员会所采纳的国际标准草案，要向各个成员分发，进行表决。而作为正式国际标准出版，则要求至少得到 75%的成员体投票赞成。

ISO 15500 本部分的某些内容可能申请了专利。ISO 没有责任证实其中的部分或全部专利。

ISO 15500-6 国际标准是由 ISO/TC 22（公路车辆技术委员会）下的 SC 25（用天然气的公路车辆分委会）制定。

ISO 15500 其总标题为通用公路车辆——压缩天然气（CNG）燃料系统部件，由以下部分组成：

——第 1 部分：一般要求和定义
——第 2 部分：性能和一般试验方法
——第 3 部分：单向阀
——第 4 部分：手动阀
——第 5 部分：手动气瓶阀
——第 6 部分：自动阀
——第 7 部分：燃气喷射器
——第 8 部分：压力指示器
——第 9 部分：调压器
——第 10 部分：燃气流量调节器
——第 11 部分：燃气和空气的混合器
——第 12 部分：压力泄放阀（PRV）
——第 13 部分：压力泄放装置(PRD)
——第 14 部分：限流阀
——第 15 部分：密封的壳体和通气的软管
——第 16 部分：燃料硬管
——第 17 部分：燃料软管
——第 18 部分：过滤器
——第 19 部分：接口配件

公路车辆—压缩天然气（CNG）燃料系统部件

—第 6 部分：自动阀

1 范围

ISO 15500 中的本部分规定了压缩天然气燃料系统部件自动阀的试验和要求，其适用的机动车类型见 ISO 3833 的定义。

ISO 15500 中的本部分适用于符合 ISO 15403(单一燃料、双燃料和双元燃料的应用)的天然气车辆。不适用于下列：

a) 液化天然气（LPG）燃料系统部件设置在上游的，并且包括，汽化器。

b) 燃料用容器；

c) 固定式的燃气发动机；

d) 容器安装件；

e) 电子燃料的使用；

f) 需加注燃料的容器。

注 1　对于本部分没有包括的集成式的部件，可以按照 ISO 15500 中的本部分的准则进行检查，并按照相应的功能性试验要求进行试验。

注 2　除非有其它的规定，ISO 15500 中的本部分所涉及的压力均为表压。

注 3　ISO 15500 中的本部分，以天然气在 15℃时 20 MPa（200bar）的使用压力为基准。其它的使用压力，以适当的系数（比率）进行调节。如 25 MPa（250bar）的使用压力系统要求压力乘以 1.25。

2 规范性引用文件

下列引用性文件中所属的条款，一旦被本标准的正文所引用，便是 ISO 15500 中的本部分的合法条款。凡是注明日期的引用文件，其随后的修改单或修订版均不适用于本标准。本标准的编写组赞同以 ISO 15500 中的本部分为基准，鼓励对使用下列最新版本引用文件的可能性进行调查。凡不注明日期的引用文件，其最新版本适用于本标准。ISO 和 IEC 的成员体对当前有效的国际标准保持登记。

ISO 3833:1977　公路车辆——类型——术语和定义。

ISO 15403　天然气——车用压缩燃料的天然气质量标示。

ISO 15500－1　公路车辆——压缩天然气（CNG）燃料系统的部件——第 1 部分：一般要求和定义。

ISO 15500－2　公路车辆——压缩天然气（CNG）燃料系统的部件——第 2 部分：性能和一般试验方法。

3 术语和定义

ISO 15000 中的本部分应用了 ISO 15500-1 中的术语和定义，以及以下定义：

3.1

自动阀（automatic valve）

用电或气来阻止高压气体从气瓶中流出的装置。

1）　1bar = 0.1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

4 标识

部件的标识应充分提供以下信息：

a） 制造商或代理商的名称、商标或符号；

b） 型号的标示（改型序号）；

c） 使用压力或压力和温度的范围；

推荐提供以下附加的标识：

d） 流向（正确安装所必需的）；

e） 燃料的型号；

f） 电的额定功率（应用时）；

g） 证书机构的标志；

h） 认可号；

i） 编号或日期编码；

j） ISO 15500 中的本部分的标准号。

注 当部件由两个或两个以上元件组成时，至少在其中的一个元件上应标识合适的识别号。

5 结构和装配

5.1 自动阀应符合 ISO 15500-1 和 ISO 15500-2 的适当条款，并符合 ISO 15500 中的本部分第 6 条规定的试验要求。包括螺线管阀、气瓶阀和带旁路的手动阀在内的所有的自动阀，都应按照第 6 条款的规定进行试验。

5.2 当切断电压时，自动阀应关闭。

5.3 对于带手动操作旁路的自动阀，应符合 ISO 15500 中的本部分的最低要求。

试验按表 1 的要求进行。

表 1、应用的试验

试验方法	应用	ISO 15500-2 规定的试验步骤	ISO 15500 中本部分规定的试验要求
液压强度试验	╳	╳	╳（见 6.2）
气密性试验	╳	╳	╳（见 6.3）
耐超力矩试验	╳	╳	
弯曲力矩试验	╳	╳	
连续性运行试验	╳	╳	╳（见 6.4）
耐腐蚀试验	╳	╳	
氧气老化试验	╳	╳	
电器超压试验	╳	╳	
非金属合成剂的浸泡试验	╳	╳	
抗振性试验	╳	╳	
黄铜材料的相容性试验	╳	╳	
耐绝缘性试验	╳		╳（见 6.5）
最小开启电压试验	╳		╳(见 6.6)

6.2 液压强度试验

按照 ISO 15500－2 规定的液压强度试验步骤进行自动阀的试验，其试验压力应为 100 MPa （1000bar）。

6.3 气密性试验

自动阀试验的温度和压力见表 2。

表 2、试验温度和压力

温度 ℃	试验压力 MPa [bar]	
	第一次	第二次
－40	15[150]	0.5[5]
20	0.5[5]	30[300]
85 到 120	1 [10]	

6.4 连续性运行试验

自动阀应按照 ISO 15500-2 规定的步骤进行连续性的运行作试验，循环次数为 50000 次，但是其试验装置的下游压力降至小于 0.5MPa（5bar），应按照 ISO 15500 中的本部分 6.3 进行气密性试验。

6.5 耐绝缘性试验

该试验是为了检查双插脚线圈的组合体和自动阀壳体之间绝缘的电压失灵。

在连接器插脚之一和自动阀壳体之间施加 1000 V 的直流电，时间至少为 2s，允许的最小抗阻应为 240kΩ。

6.6 最小开启电压试验

在常温下，对于 12V 系统其最小开启电压应≤6，对于 24V 系统其最小开启电压应≤16V。

INTERNATIONAL STANDARD

ISO 15500-7

First edition
2002-09-01

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 7: Gas injector

Véhicules routiers — Composants des systèmes de combustible gaz naturel comprimé (GNC) —

Partie 7: Injecteur de gaz

Reference number
ISO 15500-7:2002(E)

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 15500 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15500-7 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 25, *Road vehicles using natural gas*.

ISO 15500 consists of the following parts, under the general title *Road vehicles — Compressed natural gas (CNG) fuel system components*:

— *Part 1: General requirements and definitions*

— *Part 2: Performance and general test methods*

— *Part 3: Check valve*

— *Part 4: Manual valve*

— *Part 5: Manual cylinder valve*

— *Part 6: Automatic valve*

— *Part 7: Gas injector*

— *Part 8: Pressure indicator*

— *Part 9: Pressure regulator*

— *Part 10: Gas-flow adjuster*

— *Part 11: Gas/air mixer*

— *Part 12: Pressure relief valve (PRV)*

— *Part 13: Pressure relief device (PRD)*

— *Part 14: Excess flow valve*

— *Part 15: Gas-tight housing and ventilation hose*

— *Part 16: Rigid fuel line*

— *Part 17: Flexible fuel line*

— *Part 18: Filter*

— *Part 19: Fittings*

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 7: Gas injector

1 Scope

This part of ISO 15500 specifies tests and requirements for the gas injector, a compressed natural gas fuel system component intended for use on the types of motor vehicles defined in ISO 3833.

This part of ISO 15500 is applicable to vehicles using natural gas in accordance with ISO 15403 (mono-fuel, bi-fuel or dual-fuel applications). It is not applicable to injectors intended for high-pressure injection to the combustion chamber, or to the following:

a) liquefied natural gas (LNG) fuel system components located upstream of, and including, the vaporizer;

b) fuel containers;

c) stationary gas engines;

d) container mounting hardware;

e) electronic fuel management;

f) refuelling receptacles.

NOTE 1 It is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this part of ISO 15500 and tested according to the appropriate functional tests.

NOTE 2 All references to pressure in this part of ISO 15500 are to be considered gauge pressures unless otherwise specified.

NOTE 3 This part of ISO 15500 is based upon a service pressure for natural gas as fuel of 20 MPa [200 bar] settled at 15 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio). For example, a 25 MPa [250 bar] service pressure system will require pressures to be multiplied by 1,25.

NOTE 4 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15500. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15500 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3833:1977, *Road vehicles — Types — Terms and definitions*

ISO 15500-1, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 1: General requirements and definitions*

ISO 15500-2, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 2: Performance and general test methods*

ISO 15403, *Natural gas — Designation of the quality of natural gas for use as a compressed fuel for vehicles*

3 Terms and definitions

For the purposes of this part of ISO 15500, the terms and definitions given in ISO 15500-1 and the following apply.

3.1
duty cycle
percentage of time that the gas injector is operating in the period

3.2
period
P
time elapsed between the beginning of one injection pulse and the beginning of the next injection pulse

NOTE It is expressed in milliseconds.

4 Marking

Marking of the component shall provide sufficient information to allow the following to be traced:

a) the manufacturer's or agent's name, trademark or symbol;

b) the model designation (part number);

c) the service pressure or pressure and temperature range.

The following additional markings are recommended:

d) the direction of flow (when necessary for correct installation);

e) the type of fuel;

f) electrical ratings (if applicable);

g) the symbol of the certification agency;

h) the type approval number;

i) the serial number or date code;

j) the reference to this part of ISO 15500.

NOTE This information can be provided by a suitable identification code on at least one part of the component when it consists of more than one part.

5 Construction and assembly

5.1 The gas injector shall be in the closed position when de-energized.

5.2 The gas injector shall comply with the applicable provisions of ISO 15500-1 and ISO 15500-2, and with the tests specified in clause 6 of this part of ISO 15500.

6 Tests

6.1 Applicability

The tests required to be carried out are indicated in Table 1.

Table 1 — Test applicable

Test	Applicable	Test procedure as required by ISO 15500-2	Specific test requirements of this part of ISO 15500
Pneumatic strength	X		X (see 6.2)
Leakage	X	X	
Excess torque resistance	X	X	
Bending moment	X	X	
Continued operation	X		X (see 6.3)
Corrosion resistance	X	X	
Oxygen ageing	X	X	
Electrical overvoltages	X	X	
Non-metallic synthetic immersion	X	X	
Vibration resistance	X	X	
Brass material compatibility	X	X	
Insulation resistance	X		X (see 6.4)
Minimum opening voltage	X		X (see clause 7)

6.2 Pneumatic strength

This test has two parts, with the procedures to be carried out in the sequence as given.

a) Plug the outlet opening of the gas injector and have the valve seat or internal blocks assume the open position. Apply two times the working pressure to the inlet of the gas injector for a period of at least 3 min.

   On completion of this procedure, the gas injector shall remain gas-tight.

b) Increase the gas inlet pressure from two times the working pressure up to a maximum of four times the working pressure, until such time as the gas injector leaks or bursts.

   On completion of this procedure, the gas injector shall not have burst before leaking.

NOTE If the gas injector fails in the closed position due to its construction, then it is considered to have passed both parts of this test.

The test samples used for this test shall not be used for any other tests.

6.3 Continued operation

6.3.1 Bench durability

Prior to this test, the gas injector shall pass the leakage test in accordance with ISO 15500-2:2001, clause 6, and the insulation resistance test given in this part of ISO 15500 (see 6.4).

Subject the gas injector to 600×10^6 pulses at working pressure and room temperature. This procedure may be interrupted at 20 % intervals in order to check test criteria.

Upon completion of this test, the gas injector shall pass the leakage test in accordance with ISO 15500-2:2001, clause 6, and the insulation resistance test given in this part of ISO 15500 (see 6.4).

6.3.2 Temperature

6.3.2.1 Hot static

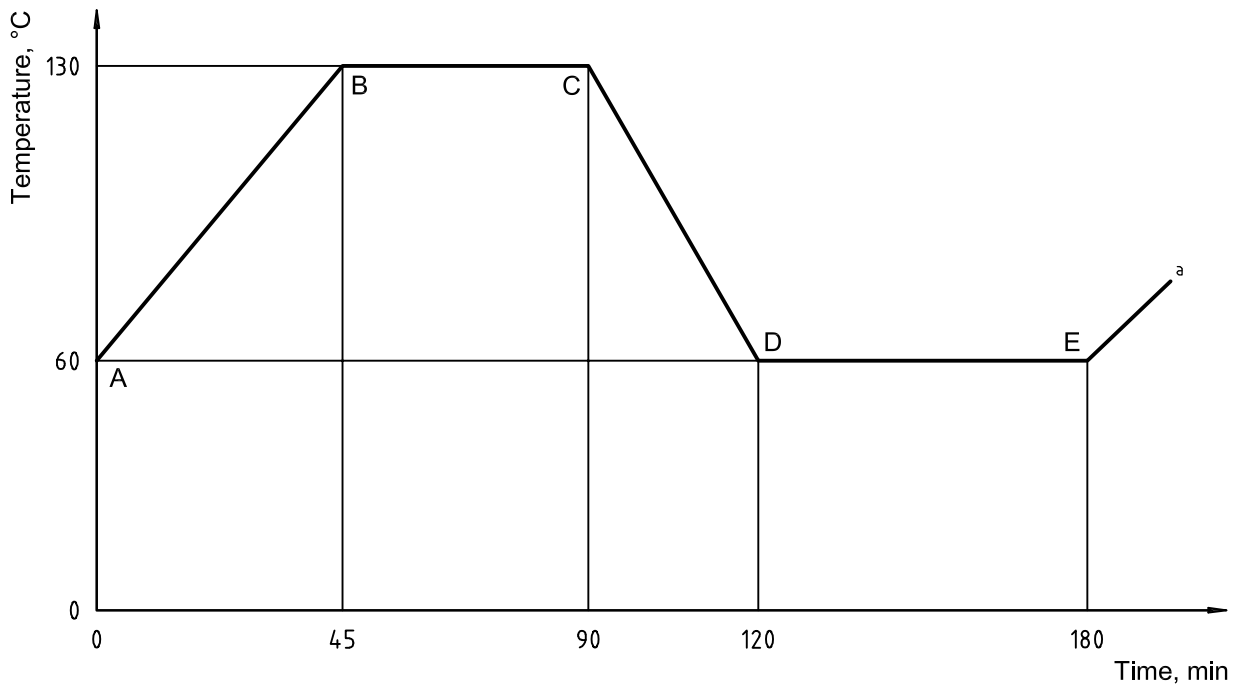
Expose the gas injector to a stabilized ambient temperature of 140 °C ± 2 °C for 16 h. The gas injector shall not be operated during this test.

6.3.2.2 Cold static

Expose the gas injector to a stabilized ambient temperature of −40 °C ± 2 °C for 16 h. The gas injector shall not be operated during this test.

6.3.2.3 Thermocycle

Expose the gas injector to the thermocycle in accordance with Figure 1 for a total of 140 cycles. The gas injector shall be operated only during segment D to E as shown in Figure 1 with a 50 % duty cycle and a period of 7 ms.



[a] Repeat cycle.

Figure 1 — Thermocycle

6.3.2.4 Requirements

Upon completion of the procedures given in 6.3.2.1, 6.3.2.2 and 6.3.2.3, the test samples shall pass the leakage test in accordance with ISO 15500-2:2001, clause 6, and the insulation resistance test given in this part of ISO 15500 (see 6.4).

6.4 Insulation resistance

This test is designed for checking the insulation resistance between the connector pin and the housing.

Apply a test voltage of 500 V d.c. for a duration of 60 s. For injectors with circuitry of 3,8 mm pitch or below, 100 V d.c. shall be used.

The minimum allowable resistance shall be $> 10\ M\Omega$.

7 Minimum opening voltage

This is an interface requirement. It shall be in line with existing petrol or diesel injector practice.

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INTERNATIONAL STANDARD

ISO 15500-8

First edition
2001-01-15

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 8: Pressure indicator

Véhicules routiers — Composants des systèmes de combustible gaz naturel (GNC) —

Partie 8: Indicateur de pression

Reference number
ISO 15500-8:2001(E)

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International Standard ISO 15500-8 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 25, *Road vehicles using natural gas*.

ISO 15500 consists of the following parts, under the general title *Road vehicles — Compressed natural gas (CNG) fuel system components*:

— *Part 1: General requirements and definitions*

— *Part 2: Performance and general test methods*

— *Part 3: Check valve*

— *Part 4: Manual valve*

— *Part 5: Manual cylinder valve*

— *Part 6: Automatic valve*

— *Part 7: Gas injector*

— *Part 8: Pressure indicator*

— *Part 9: Pressure regulator*

— *Part 10: Gas-flow adjuster*

— *Part 11: Gas/air mixer*

— *Part 12: Pressure relief valve (PRV)*

— *Part 13: Pressure relief device (PRD)*

— *Part 14: Excess flow valve*

— *Part 15: Gas-tight housing and ventilation hose*

— *Part 16: Rigid fuel line*

— *Part 17: Flexible fuel line*

— *Part 18: Filter*

— *Part 19: Fittings*

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 8:
Pressure indicator

1 Scope

This part of ISO 15500 specifies tests and requirements for the pressure indicator, a compressed natural gas fuel system component intended for use on the types of motor vehicles defined in ISO 3833.

This part of ISO 15500 is applicable to vehicles using natural gas in accordance with ISO 15403 (mono-fuel, bi-fuel or dual-fuel applications). It is not applicable to the following:

a) liquefied natural gas (LNG) fuel system components located upstream of, and including, the vaporizer;

b) fuel containers;

c) stationary gas engines;

d) container mounting hardware;

e) electronic fuel management;

f) refuelling receptacles.

NOTE 1 It is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this part of ISO 15500 and tested according to the appropriate functional tests.

NOTE 2 All references to pressure in this part of ISO 15500 are to be considered gauge pressures unless otherwise specified.

NOTE 3 This part of ISO 15500 is based upon a service pressure for natural gas as a fuel of 20 MPa [200 bar[1)]] settled at 15 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio). For example, a 25 MPa (250 bar) service pressure system will require pressures to be multiplied by 1,25.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15500. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15500 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3833, *Road vehicles — Types — Terms and definitions.*

---

1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

ISO 15403, *Natural gas — Designation of the quality of natural gas for use as a compressed fuel for vehicles.*

ISO 15500-1, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 1: General requirements and definitions.*

ISO 15500-2, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 2: Performance and general test methods.*

3 Terms and definitions

For the purposes of this part of ISO 15500, the terms and definitions given in ISO 15500-1 and the following apply.

3.1
pressure indicator
only that part of the system exposed to service pressure

4 Marking

Marking of the component shall provide sufficient information to allow the following to be traced:

a) the manufacturer's or agent's name, trademark or symbol;

b) the model designation (part number);

c) the service pressure or pressure and temperature range.

The following additional markings are recommended:

d) the direction of flow (when necessary for correct installation);

e) the type of fuel;

f) electrical ratings (if applicable);

g) the symbol of the certification agency;

h) the type approval number;

i) the serial number or date code;

j) reference to this part of ISO 15500.

NOTE This information can be provided by a suitable identification code on at least one part of the component when it consists of more than one part.

5 Construction and assembly

5.1 Pressure traducers and gauges shall comply with the applicable provisions of ISO 15500-1 and ISO 15500-2, and with the tests specified in clause 6 of this part of ISO 15500.

5.2 The pressure indicator shall be capable of displaying at least 30 MPa (300 bar).

5.3 If the pressure indicator is a gauge, it shall be equipped with a shatter-proof lens and possess a means of pressure relief located in the rear of its body.

6 Tests

6.1 Applicability

The tests required to be carried out are indicated in Table 1.

Table 1 — Tests applicable

Test	Applicable	Test procedure as required by ISO 15500-2	Specific test requirements of this part of ISO 15500
Hydrostatic strength	X	X	X (see 6.2)
Leakage	X	X	X (see 6.3)
Excess torque resistance	X	X	
Bending moment	X	X	
Continued operation	X		X (see 6.4)
Corrosion resistance	X	X	
Oxygen ageing	X	X	
Electrical overvoltages	X	X	
Non-metallic synthetic immersion	X	X	
Vibration resistance	X	X	
Brass material compatibility	X	X	
Insulation resistance	X		X (see 6.5)
Minimum opening voltage	X		X (see 6.6)

6.2 Hydrostatic strength

Test the pressure indicator according to the procedure for testing hydrostatic strength specified in ISO 15500-2. The test pressure shall be 80 MPa (800 bar).

6.3 Leakage

Test the pressure indicator at the temperatures and pressures given in Table 2.

Table 2 — Test temperatures and pressures

Temperature °C	Pressure MPa [bar]	
	First	Second
– 40	15 [150]	0,5 [5]
20	0,5 [5]	30 [300]
85	1 [10]	

6.4 Continued operation

6.4.1 Test the pressure indicator in accordance with the procedure for testing continued operation given in ISO 15500-2, for 20 000 cycles; a cycle consists of pressurization to 20 MPa (200 bar), followed by depressurization to less than 1 MPa (10 bar).

6.4.2 Perform the leakage test in accordance with 6.3 of this part of ISO 15500.

6.5 Insulation resistance

This test is designed to check for a potential failure of the insulation between the two-pin coil assembly and the pressure indicator casing.

Apply 1 000 V d.c. between one of the connector pins and the housing of the pressure indicator for at least 2 s. The minimum allowable resistance shall be 240 kΩ.

6.6 Minimum Opening Voltage

The minimum opening voltage at room temperature shall be $\leqslant$ 6 V for a 12 V system and $\leqslant$ 16 V for a 24 V system.

ISO 15500-9

First edition 2001-01-15

Road vehicles – Compressed natural gas (CNG) fuel system components -

Part 9: Pressure regulator

Véhicules routiers – Composants des systèmes de combustible gaz naturel comprimé (GNC) –

Partie 9: Régulateur de pression

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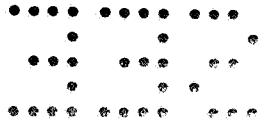

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International Standard ISO 15500-9 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 25, *Road vehicles using natural gas*.

ISO 15500 consists of the following parts, under the general title *Road vehicles — Compressed natural gas (CNG) fuel system components*:

— *Part 1: General requirements and definitions*

— *Part 2: Performance and general test methods*

— *Part 3: Check valve*

— *Part 4: Manual valve*

— *Part 5: Manual cylinder valve*

— *Part 6: Automatic valve*

— *Part 7: Gas injector*

— *Part 8: Pressure indicator*

— *Part 9: Pressure regulator*

— *Part 10: Gas-flow adjuster*

— *Part 11: Gas/air mixer*

— *Part 12: Pressure relief valve (PRV)*

— *Part 13: Pressure relief device (PRD)*

— *Part 14: Excess flow valve*

— *Part 15: Gas-tight housing and ventilation hose*

— *Part 16: Rigid fuel line*

— *Part 17: Flexible fuel line*

— *Part 18: Filter*

— *Part 19: Fittings*

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 9: Pressure regulator

1 Scope

This part of ISO 15500 specifies tests and requirements for the pressure regulator, a compressed natural gas fuel system component intended for use on the types of motor vehicles defined in ISO 3833.

This part of ISO 15500 is applicable to vehicles using natural gas in accordance with ISO 15403 (mono-fuel, bi-fuel or dual-fuel applications). It is not applicable to the following:

a) liquefied natural gas (LNG) fuel system components located upstream of, and including, the vaporizer;

b) fuel containers;

c) stationary gas engines;

d) container mounting hardware;

e) electronic fuel management;

f) refuelling receptacles.

NOTE 1 It is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this part of ISO 15500 and tested according to the appropriate functional tests.

NOTE 2 All references to pressure in this part of ISO 15500 are to be considered gauge pressures unless otherwise specified.

NOTE 3 This part of ISO 15500 is based upon a service pressure for natural gas as a fuel of 20 MPa [200 bar[1)]] settled at 15 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio). For example, a 25 MPa (250 bar) service pressure system will require pressures to be multiplied by 1,25.

2 Normative references

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1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

ISO 3833, *Road vehicles — Types — Terms and definitions.*

ISO 15403, *Natural gas — Designation of the quality of natural gas for use as a compressed fuel for vehicles.*

ISO 15500-1, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 1: General requirements and definitions.*

ISO 15500-2, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 2: Performance and general test methods.*

3 Terms and definitions

For the purposes of this part of ISO 15500, the terms and definitions given in ISO 15500-1 and the following apply.

3.1
lock-up pressure
stabilized outlet pressure of the regulator at 0 (zero) flow

4 Marking

Marking of the component shall provide sufficient information to allow the following to be traced:

a) the manufacturer's or agent's name, trademark or symbol;

b) the model designation (part number);

c) the service pressure or pressure and temperature range.

The following additional markings are recommended:

d) the direction of flow (when necessary for correct installation);

e) the type of fuel;

f) electrical ratings (if applicable);

g) the symbol of the certification agency;

h) the type approval number;

i) the serial number or date code;

j) reference to this part of ISO 15500.

NOTE This information can be provided by a suitable identification code on at least one part of the component when it consists of more than one part.

5 Construction and assembly

5.1 The pressure regulator shall comply with the applicable provisions of ISO 15500-1 and ISO 15500-2, and with the tests specified in clause 6 of this part of ISO 15500.

5.2 A pressure relief valve shall be of a type that resets after relieving; it is intended that downstream components be protected from exposure to cylinder pressure.

5.3 A pressure relief valve may be integral to the pressure regulator, or not.

5.4 The pressure regulator shall have a factory-set maximum outlet pressure. The maximum outlet pressure rating and the inlet pressure rating shall be marked on the regulator.

6 Tests

6.1 Applicability

The tests required to be carried out are indicated in Table 1.

Table 1 — Tests applicable

Test	Applicable	Test procedure as required by ISO 15500-2	Specific test requirements of this part of ISO 15500
Hydrostatic strength	X	X	X (see 6.2)
Leakage	X	X	X (see 6.3)
Excess torque resistance	X	X	
Bending moment	X	X	
Continued operation	X	X	X (see 6.4)
Corrosion resistance	X	X	
Oxygen ageing	X	X	
Electrical overvoltages	X	X	
Non-metallic synthetic immersion	X	X	
Vibration resistance	X	X[a]	
Brass material compatibility	X	X	
Insulation resistance	X		X (see 6.5)
Minimum opening voltage	X		X (see 6.6)
Pressure impulse	X		X (see 6.7)
Water jacket freezing	X		X (see 6.8)

[a] The vibration resistance test in ISO 15500-2 is not applicable if the pressure regulator is engine-mounted.

6.2 Hydrostatic strength

6.2.1 Test the pressure regulator according to the procedure for testing hydrostatic strength specified in ISO 15500-2.

6.2.2 Test the inlet of the first stage of the pressure regulator using a pressure of at least 100 MPa (1 000 bar).

6.2.3 Test the inlet or inlets of the downstream stage or stages at four times the working pressure.

6.2.4 Test the outlet chamber, port and all outlet fittings at four times the working pressure, or 0,4 MPa (4 bar), whichever is the greater.

6.3 Leakage

Test the pressure regulator at the temperatures and pressures given in Table 2.

Table 2 — Test temperatures and pressures

Temperature °C	Percentage	Inlet test pressure MPa [bar]	
		First test	Second test
– 40	1	15 [150]	0,5 [5]
20	1	0,5 [5]	30 [300]
120	1	0,5 [5]	
– 40	2, 3, ...	0,75 × working pressure	1
20	2, 3, ...	1	1,5 × working pressure
120	2, 3, ...	1	1,5 × working pressure

6.4 Continued operation

The regulator shall be able to withstand 50 000 cycles without any failure when tested according to the following procedure. Where the stages of pressure regulation are separate, the service pressure in a) to f) is considered to be the working pressure of the upstream stage.

a) Recycle the regulator for 95 % of the total number of cycles at room temperature and at the service pressure. Each cycle shall consist of flow until stable outlet pressure has been obtained, after which the gas flow shall be shut off by a downstream valve within 1 s, until the downstream lock-up pressure has stabilized. Stabilized outlet pressures are defined as set pressure ± 15 % for at least 5 s. The regulator shall comply with 6.3 at room temperature at intervals of 20 %, 40 %, 60 %, 80 % and 100 % of room temperature cycles.

b) Cycle the inlet pressure of the regulator for 1 % of the total number of cycles at room temperature from 100 % to 50 % of the service pressure. The duration of each cycle shall be no less than 10 s. The regulator shall comply with 6.3 at room temperature at the completion of this test.

c) Repeat the cycling procedure of a) at 120 °C at the service pressure for 1 % of the total number of cycles.

d) Repeat the cycling procedure of b) at 120 °C at the service pressure for 1 % of the total number of cycles. The regulator shall comply with 6.3 at 120 °C at the completion of this test.

e) Repeat the cycling procedure of a) at – 40 °C and 50 % of service pressure for 1 % of the total number of cycles.

f) Repeat the cycling procedure of b) at – 40 °C and 50 % of service pressure for 1 % of the total number of cycles. The regulator shall comply with 6.3 at – 40 °C at the completion of this test.

g) At the completion of the cycles, the lock-up pressure downstream of the regulator shall not exceed the lock-up pressure.

6.5 Insulation resistance

This test is designed to check for a potential failure of the insulation between the two-pin coil assembly and the pressure regulator casing.

Apply 1 000 V d.c. between one of the connector pins and the housing of the pressure regulator for at least 2 s. The minimum allowable resistance shall be 240 kΩ.

6.6 Minimum Opening Voltage

The minimum opening voltage at room temperature shall be $\leqslant$ 6 V for a 12 V system and $\leqslant$ 16 V for a 24 V system.

6.7 Pressure impulse

a) Subject the pressure regulator with its first stage valve rendered fully open to a sudden application of its service pressure at its inlet. The pressure regulator shall retain or release the pressure without any permanent deformation.

b) Record the lock-up pressure of the regulator.

6.8 Water Jacket Freezing

a) Fill the regulator or water jacket, which normally contains an antifreeze solution, with water to normal capacity and expose it at – 40 °C for 24 h. Attach 1 m sections of coolant hose to the coolant inlet and outlet of the regulator or water jacket.

b) Following the freezing conditioning, conduct an external leakage test at room temperature according to 6.3.

A separate sample may be used for this test.

ICS 43.060.40

Price based on 5 pages

INTERNATIONAL STANDARD

ISO 15500-10

First edition
2001-01-15

Corrected version
2003-04-01

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 10: Gas-flow adjuster

Véhicules routiers — Composants des systèmes de combustible gaz naturel comprimé (GNC) —

Partie 10: Régulateur du débit de gaz

Reference number
ISO 15500-10:2001(E)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 15500 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15500-10 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 25, *Road vehicles using natural gas*.

ISO 15500 consists of the following parts, under the general title *Road vehicles — Compressed natural gas (CNG) fuel system components*:

— *Part 1: General requirements and definitions*

— *Part 2: Performance and general test methods*

— *Part 3: Check valve*

— *Part 4: Manual valve*

— *Part 5: Manual cylinder valve*

— *Part 6: Automatic valve*

— *Part 7: Gas injector*

— *Part 8: Pressure indicator*

— *Part 9: Pressure regulator*

— *Part 10: Gas-flow adjuster*

— *Part 11: Gas/air mixer*

— *Part 12: Pressure relief valve (PRV)*

— *Part 13: Pressure relief device (PRD)*

— *Part 14: Excess flow valve*

— *Part 15: Gas-tight housing and ventilation hose*

— *Part 16: Rigid fuel line*

— *Part 17: Flexible fuel line*

— *Part 18: Filter*

— *Part 19: Fittings*

This corrected version of ISO 15500-10:2001 incorporates the following correction:

the pressure, as expressed in kilopascals, has been corrected in 6.3.

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 10: Gas-flow adjuster

1 Scope

This part of ISO 15500 specifies tests and requirements for the gas-flow adjuster, a compressed natural gas fuel system component intended for use on the types of motor vehicles defined in ISO 3833.

This part of ISO 15500 is applicable to vehicles using natural gas in accordance with ISO 15403 (mono-fuel, bi-fuel or dual-fuel applications). It is not applicable to the following:

a) liquefied natural gas (LNG) fuel system components located upstream of, and including, the vaporizer;

b) fuel containers;

c) stationary gas engines;

d) container mounting hardware;

e) electronic fuel management;

f) refuelling receptacles.

NOTE 1 It is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this part of ISO 15500 and tested according to the appropriate functional tests.

NOTE 2 All references to pressure in this part of ISO 15500 are to be considered gauge pressures unless otherwise specified.

NOTE 3 This part of ISO 15500 is based upon a service pressure for natural gas as a fuel of 20 MPa [200 bar[1)]] settled at 15 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio). For example, a 25 MPa (250 bar) service pressure system will require pressures to be multiplied by 1,25.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15500. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15500 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3833, *Road vehicles — Types — Terms and definitions.*

---

1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

ISO 15403, *Natural gas — Designation of the quality of natural gas for use as a compressed fuel for vehicles.*

ISO 15500-1, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 1: General requirements and definitions.*

ISO 15500-2, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 2: Performance and general test methods.*

3 Terms and definitions

For the purposes of this part of ISO 15500, the terms and definitions given in ISO 15500-1 apply.

4 Marking

Marking of the component shall provide sufficient information to allow the following to be traced:

a) the manufacturer's or agent's name, trademark or symbol;

b) the model designation (part number);

c) the service pressure or pressure and temperature range.

The following additional markings are recommended:

d) the direction of flow (when necessary for correct installation);

e) the type of fuel;

f) electrical ratings (if applicable);

g) the symbol of the certification agency;

h) the type approval number;

i) the serial number or date code;

j) reference to this part of ISO 15500.

NOTE This information can be provided by a suitable identification code on at least one part of the component when it consists of more than one part.

5 Construction and assembly

The gas-flow adjuster shall comply with the applicable provisions of ISO 15500-1 and ISO 15500-2, and with the tests specified in clause 6 of this part of ISO 15500.

6 Tests

6.1 Applicability

The tests required to be carried out are indicated in Table 1.

Table 1 — Tests applicable

Test	Applicable	Test procedure as required by ISO 15500-2	Specific test requirements of this part of ISO 15500
Hydrostatic strength	X	X	X (see 6.2)
Leakage	X	X	X (see 6.3)
Excess torque resistance	X	X	
Bending moment	X	X	
Continued operation	X	X	X (see 6.4)
Corrosion resistance	X	X	
Oxygen ageing	X	X	
Electrical overvoltages	X[a]	X	
Non-metallic synthetic immersion	X	X	
Vibration resistance	X	X	
Brass material compatibility	X	X	
Insulation resistance	X[a]		X (see 6.5)
Minimum opening voltage	X[a]		X (see 6.6)

[a] Applicable only if the gas-flow adjuster has an electrical or electronic component.

6.2 Hydrostatic strength

Test the gas-flow adjuster according to the procedure for testing hydrostatic strength specified in ISO 15500-2, at four times the working pressure, or 0,6 MPa (6 bar), whichever is the greater.

6.3 Leakage

Test the gas-flow adjuster at the temperatures of – 40 °C, 20 °C and 120 °C, at a pressure of 150 kPa (1,5 bar).

6.4 Continued operation

If it is intended that the gas-flow adjuster be adjusted at the time of installation or service, no continued operation test is required.

However, if the gas-flow adjuster is to be adjusted repeatedly during engine operation, then it shall undergo 100 000 cycles from minimum to maximum flow. At the completion of this test, the gas-flow adjuster shall comply with 6.3 at room temperature.

6.5 Insulation resistance

This test is designed to check for a potential failure of the insulation between the two-pin coil assembly and the gas-flow adjuster casing.

Apply 1 000 V d.c. between one of the connector pins and the housing of the gas-flow adjuster for at least 2 s. The minimum allowable resistance shall be 240 kΩ.

6.6 Minimum Opening Voltage

The minimum opening voltage at room temperature shall be $\leqslant$ 6 V for a 12 V system and $\leqslant$ 16 V for a 24 V system.

ICS 43.060.40
Price based on 4 pages

INTERNATIONAL STANDARD

ISO 15500-11

First edition
2001-01-15

Corrected version
2003-04-01

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 11: Gas/air mixer

Véhicules routiers — Composants des systèmes de combustible gaz naturel comprimé (GNC) —

Partie 11: Mélangeur air/gaz

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 15500 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15500-11 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 25, *Road vehicles using natural gas*.

ISO 15500 consists of the following parts, under the general title *Road vehicles — Compressed natural gas (CNG) fuel system components*:

— *Part 1: General requirements and definitions*

— *Part 2: Performance and general test methods*

— *Part 3: Check valve*

— *Part 4: Manual valve*

— *Part 5: Manual cylinder valve*

— *Part 6: Automatic valve*

— *Part 7: Gas injector*

— *Part 8: Pressure indicator*

— *Part 9: Pressure regulator*

— *Part 10: Gas-flow adjuster*

— *Part 11: Gas/air mixer*

— *Part 12: Pressure relief valve (PRV)*

— *Part 13: Pressure relief device (PRD)*

— *Part 14: Excess flow valve*

— *Part 15: Gas-tight housing and ventilation hose*

— *Part 16: Rigid fuel line*

— *Part 17: Flexible fuel line*

— *Part 18: Filter*

— *Part 19: Fittings*

This corrected version of ISO 15500-11:2001 incorporates the following correction:

the pressure, as expressed in kilopascals, has been corrected in 6.3.

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 11: Gas/air mixer

1 Scope

This part of ISO 15500 specifies tests and requirements for the gas/air mixer, a compressed natural gas fuel system component intended for use on the types of motor vehicles defined in ISO 3833.

This part of ISO 15500 is applicable to vehicles using natural gas in accordance with ISO 15403 (mono-fuel, bi-fuel or dual-fuel applications). It is not applicable to the following:

a) liquefied natural gas (LNG) fuel system components located upstream of, and including, the vaporizer;

b) fuel containers;

c) stationary gas engines;

d) container mounting hardware;

e) electronic fuel management;

f) refuelling receptacles.

NOTE 1 It is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this part of ISO 15500 and tested according to the appropriate functional tests.

NOTE 2 All references to pressure in this part of ISO 15500 are to be considered gauge pressures unless otherwise specified.

NOTE 3 This part of ISO 15500 is based upon a service pressure for natural gas as a fuel of 20 MPa [200 bar[1)]] settled at 15 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio). For example, a 25 MPa (250 bar) service pressure system will require pressures to be multiplied by 1,25.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15500. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15500 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3833, *Road vehicles — Types — Terms and definitions.*

---

1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

ISO 15403, *Natural gas — Designation of the quality of natural gas for use as a compressed fuel for vehicles.*

ISO 15500-1, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 1: General requirements and definitions.*

ISO 15500-2, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 2: Performance and general test methods.*

3 Terms and definitions

For the purposes of this part of ISO 15500, the terms and definitions given in ISO 15500-1 apply.

4 Marking

Marking of the component shall provide sufficient information to allow the following to be traced:

a) the manufacturer's or agent's name, trademark or symbol;

b) the model designation (part number);

c) the service pressure or pressure and temperature range.

The following additional markings are recommended:

d) the direction of flow (when necessary for correct installation);

e) the type of fuel;

f) electrical ratings (if applicable);

g) the symbol of the certification agency;

h) the type approval number;

i) the serial number or date code;

j) reference to this part of ISO 15500.

NOTE This information can be provided by a suitable identification code on at least one part of the component when it consists of more than one part.

5 Construction and assembly

The gas/air mixer shall comply with the applicable provisions of ISO 15500-1 and ISO 15500-2, and with the tests specified in clause 6 of this part of ISO 15500.

6 Tests

6.1 Applicability

There are many types of gas/air mixers available. This part of ISO 15500 gives requirements for three different existing designs: positive and negative pressure venturi, which have no moving parts, and variable orifice. As gas/air mixer designs vary, so will the tests required.

The tests required to be carried out are indicated in Table 1.

Table 1 — Tests applicable

Test	Applicable	Test procedure as required by ISO 15500-2	Specific test requirements of this part of ISO 15500
Hydrostatic strength	X[a]	X	X (see 6.2)
Leakage	X	X	X (see 6.3)
Excess torque resistance			
Bending moment			
Continued operation	X[b]	X	X (see 6.4)
Corrosion resistance	X	X	X (see 6.5)
Oxygen ageing	X	X	
Electrical overvoltages			
Non-metallic synthetic immersion	X	X	
Vibration resistance	X	X	
Brass material compatibility	X	X	

[a] Gas/air mixers that have a working pressure of < 0,1 MPa (1 bar) are not required to be strength tested.

[b] Gas/air mixers with no moving parts, or with parts that are only moved at the time of installation or servicing, are not required to be tested for continued operation.

6.2 Hydrostatic strength

Test the gas/air mixer according to the procedure for testing hydrostatic strength specified in ISO 15500-2, at four times the working pressure, in bar absolute, recommended by its manufacturer.

6.3 Leakage

Test the gas/air mixer at the temperatures of – 40 °C, 20 °C and 120 °C, at a pressure of 30 kPa (0,3 bar) above its manufacturer's recommended working pressure.

6.4 Continued operation

If the gas/air mixer's components move repeatedly during engine operation, then it shall undergo 100 000 cycles from minimum to maximum flow. At the completion of this test, the gas/air mixer shall comply with 6.3 at room temperature.

6.5 Corrosion Resistance

If materials or designs susceptible to corrosion are used in the component then the corrosion resistance test as given in ISO 15500-2 shall be performed.

ICS 43.060.40

Price based on 3 pages

INTERNATIONAL STANDARD

ISO 15500-12

First edition
2001-01-15

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 12: Pressure relief valve (PRV)

Véhicules routiers — Composants des systèmes de combustible gaz naturel comprimé (GNC) —

Partie 12: Soupapes de sécurité à la pression

Reference number
ISO 15500-12:2001(E)

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Foreword

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Attention is drawn to the possibility that some of the elements of this part of ISO 15500 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15500-12 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 25, *Road vehicles using natural gas*.

ISO 15500 consists of the following parts, under the general title *Road vehicles — Compressed natural gas (CNG) fuel system components*:

— *Part 1: General requirements and definitions*

— *Part 2: Performance and general test methods*

— *Part 3: Check valve*

— *Part 4: Manual valve*

— *Part 5: Manual cylinder valve*

— *Part 6: Automatic valve*

— *Part 7: Gas injector*

— *Part 8: Pressure indicator*

— *Part 9: Pressure regulator*

— *Part 10: Gas-flow adjuster*

— *Part 11: Gas/air mixer*

— *Part 12: Pressure relief valve (PRV)*

— *Part 13: Pressure relief device (PRD)*

— *Part 14: Excess flow valve*

— *Part 15: Gas-tight housing and ventilation hose*

— *Part 16: Rigid fuel line*

— *Part 17: Flexible fuel line*

— *Part 18: Filter*

— *Part 19: Fittings*

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 12: Pressure relief valve (PRV)

1 Scope

This part of ISO 15500 specifies tests and requirements for the pressure relief valve (PRV), a compressed natural gas fuel system component intended for use on the types of motor vehicles defined in ISO 3833.

This part of ISO 15500 is applicable to vehicles using natural gas in accordance with ISO 15403 (mono-fuel, bi-fuel or dual-fuel applications). It is not applicable to the following:

a) liquefied natural gas (LNG) fuel system components located upstream of, and including, the vaporizer;

b) fuel containers;

c) stationary gas engines;

d) container mounting hardware;

e) electronic fuel management;

f) refuelling receptacles.

NOTE 1 It is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this part of ISO 15500 and tested according to the appropriate functional tests.

NOTE 2 All references to pressure in this part of ISO 15500 are to be considered gauge pressures unless otherwise specified.

NOTE 3 This part of ISO 15500 is based upon a service pressure for natural gas as a fuel of 20 MPa [200 bar[1)]] settled at 15 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio). For example, a 25 MPa (250 bar) service pressure system will require pressures to be multiplied by 1,25.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15500. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15500 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3833, *Road vehicles — Types — Terms and definitions*.

1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

ISO 15403, *Natural gas — Designation of the quality of natural gas for use as a compressed fuel for vehicles*.

ISO 15500-1, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 1: General requirements and definitions*.

ISO 15500-2, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 2: Performance and general test methods*.

3 Terms and definitions

For the purposes of this part of ISO 15500, the terms and definitions given in ISO 15500-1 and the following apply.

3.1
set pressure
pressure at which it is intended that the PRV open

4 Marking

Marking of the component shall provide sufficient information to allow the following to be traced:

a) the manufacturer's or agent's name, trademark or symbol;

b) the model designation (part number);

c) the service pressure or pressure and temperature range.

The following additional markings are recommended:

d) the direction of flow (when necessary for correct installation);

e) the type of fuel;

f) electrical ratings (if applicable);

g) the symbol of the certification agency;

h) the type approval number;

i) the serial number or date code;

j) reference to this part of ISO 15500.

NOTE This information can be provided by a suitable identification code on at least one part of the component when it consists of more than one part.

5 Construction and assembly

The PRV shall comply with the applicable provisions of ISO 15500-1 and ISO 15500-2, and with the tests specified in clause 6 of this part of ISO 15500.

6 Tests

6.1 Applicability

The tests required to be carried out are indicated in Table 1.

Table 1 — Tests applicable

Test	Applicable	Test procedure as required by ISO 15500-2	Specific test requirements of this part of ISO 15500
Hydrostatic strength	X	X	X (see 6.2)
Leakage	X	X	X (see 6.3)
Excess torque resistance	X	X	
Bending moment	X	X	
Continued operation	X	X	X (see 6.4)
Operational	X		X (see 6.5)
Corrosion resistance	X	X	
Oxygen ageing	X	X	
Electrical overvoltages			
Non-metallic synthetic immersion	X	X	
Vibration resistance	X	X	
Brass material compatibility	X	X	

6.2 Hydrostatic strength

Test the PRV according to the procedure for testing hydrostatic strength specified in ISO 15500-2 to at least four times its working pressure.

For the purposes of this test, the PRV's mechanism shall be removed and its orifice blocked.

6.3 Leakage

Test the PRV at – 40 °C, 20 °C and 85 °C or 120 °C (if required by the operating conditions), at working pressure.

6.4 Continued Operation

The PRV shall be capable of withstanding 600 cycles of operation when tested according to the provisions of the continued operation test procedure given in ISO 15500-2 and the following.

a) A test cycle consists of, first, pressurizing the PRV to the set pressure. This action shall cause the PRV to open and vent. Once the valve is venting, reduce the inlet pressure; when the PRV re-seats the cycle is finished.

b) After 600 cycles, test the PRV for leakage at 20 °C ± 5 °C at its working pressure. Cycle time shall be within a period of 10 s ± 2 s.

6.5 Operational test

6.5.1 General

Verify the opening and re-seating pressures of the PRV. The opening pressure shall be equal to the set pressure ± 5% at 20 °C, and ± 5 % at – 40 °C and 85 °C or 120 °C (if required by the operating conditions).

6.5.2 Test procedure

Three randomly selected samples shall be subjected to the following test procedure. This test has three steps, which shall be conducted in the order given. Appropriate test media shall be chosen (i.e. air, nitrogen, or natural gas). If the test medium is not natural gas, then the calculated flow values shall be corrected for natural gas.

a) Establish the opening and re-seating values for the samples at 20 °C. Do this by first slowly pressurizing the inlet of the sample to 110 % of the set pressure, noting the value at which it first opens.

b) Lower the inlet pressure until the PRV re-seats; note that value. The valves are considered to have passed if all the following requirements are met:

   — opening pressures shall be ± 5 % of the manufacturer's set pressure;

   — re-seating pressures shall be no less than 90 % of the set pressure;

   — re-seating pressures shall be within ± 5 % of the average re-seating pressure.

c) Repeat a) and b) at – 40 °C and 85 °C or 120 °C (if required by the operating conditions). At each test temperature, the following criteria shall be met:

   — opening pressures ± 15 % of the manufacturer's set pressure;

   — re-seating pressures no less than 80 % of the set pressure;

   — re-seating pressures within ± 15% of the average re-seating pressure.

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INTERNATIONAL STANDARD

ISO 15500-13

First edition
2001-04-15

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 13: Pressure relief device (PRD)

Véhicules routiers — Composants des systèmes de combustible gaz naturel comprimé (GNC) —

Partie 13: Dispositifs de limitation de pression

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 15500 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15500-13 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 25, *Road vehicles using natural gas*.

ISO 15500 consists of the following parts, under the general title *Road vehicles — Compressed natural gas (CNG) fuel system components*:

— *Part 1: General requirements and definitions*

— *Part 2: Performance and general test methods*

— *Part 3: Check valve*

— *Part 4: Manual valve*

— *Part 5: Manual cylinder valve*

— *Part 6: Automatic valve*

— *Part 7: Gas injector*

— *Part 8: Pressure indicator*

— *Part 9: Pressure regulator*

— *Part 10: Gas-flow adjuster*

— *Part 11: Gas/air mixer*

— *Part 12: Pressure relief valve (PRV)*

— *Part 13: Pressure relief device (PRD)*

— *Part 14: Excess flow valve*

— *Part 15: Gas-tight housing and ventilation hose*

— *Part 16: Rigid fuel line*

— *Part 17: Flexible fuel line*

— *Part 18: Filter*

— *Part 19: Fittings*

Annex A forms a normative part of this part of ISO 15500. Annex B is for information only.

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 13: Pressure relief device (PRD)

1 Scope

This part of ISO 15500 specifies tests and requirements for the pressure relief device (PRD), a compressed natural gas fuel system component intended for use on the types of motor vehicles defined in ISO 3833.

This part of ISO 15500 is applicable to vehicles using natural gas in accordance with ISO 15403 (mono-fuel, bi-fuel or dual-fuel applications). It is not applicable to the following:

a) liquefied natural gas (LNG) fuel system components located upstream of, and including, the vaporizer;

b) fuel containers;

c) stationary gas engines;

d) container mounting hardware;

e) electronic fuel management;

f) refuelling receptacles.

NOTE 1 It is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this part of ISO 15500 and tested according to the appropriate functional tests.

NOTE 2 All references to pressure in this part of ISO 15500 are to be considered gauge pressures unless otherwise specified.

NOTE 3 This part of ISO 15500 is based upon a service pressure for natural gas as a fuel of 20 MPa [200 bar[1)]] settled at 15 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio). For example, a 25 MPa (250 bar) service pressure system will require pressures to be multiplied by 1,25.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15500. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15500 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

ISO 3833, *Road vehicles — Types — Terms and definitions*.

ISO 11439, Gas cylinders — *High pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles.*

ISO 15403, *Natural gas — Designation of the quality of natural gas for use as a compressed fuel for vehicles*.

ISO 15500-1, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 1: General requirements and definitions*.

ISO 15500-2, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 2: Performance and general test methods*.

3 Terms and definitions

For the purposes of this part of ISO 15500, the terms and definitions given in ISO 15500-1 and the following apply.

3.1
combination relief device
PRD activated by a combination of high temperature and pressure acting together

3.2
fusible material
metal, alloy, or other material capable of being melted

3.3
rupture disc
operating part of a PRD which, when installed in the device, is designed to burst at a pre-determined pressure to permit discharge of the cylinder

3.4
thermally activated relief device
PRD activated by high temperature and generally containing fusible material

3.5
yield temperature
temperature at which the fusible material becomes sufficiently soft to activate the device and to permit discharge of the cylinder

4 Marking

If a stand-alone component, marking shall provide sufficient information to allow the following to be traced:

a) the manufacturer's or agent's name, trademark or symbol;

b) the fusible material yield temperature or PRD activation temperature (see annex A), and the rupture disc pressure rating, as appropriate.

NOTE This information can be provided by a suitable identification code on at least one part of the component when it consists of more than one part.

5 Construction and assembly

5.1 The PRD shall comply with the applicable provisions of ISO 15500-1 and ISO 15500-2, and with the tests specified in clause 6 of this part of ISO 15500.

5.2 The PRD shall be suitable for the cylinder type and size used. The CNG cylinder and PRD system shall have been tested according to ISO 11439 to ensure suitability.

6 Tests

6.1 Applicability

The tests required to be carried out are indicated in Table 1.

Table 1 — Tests applicable

Test	Applicable	Test procedure as required by ISO 15500-2	Specific test requirements of this part of ISO 15500
Hydrostatic strength	X	X	X (see 6.2)
Leakage	X	X	X (see 6.3)
Excess torque resistance	X	X	
Bending moment	X[a]	X	X (see 6.4)
Continued operation	X	X	X (see 6.5)
Corrosion resistance	X	X	
Oxygen ageing	X	X	
Electrical overvoltages			
Non-metallic synthetic immersion	X	X	
Vibration resistance	X	X	
Brass material compatibility	X	X	
Accelerated life	X		X (see 6.6)
Benchtop activation	X		X (see 6.7)
Thermal cycling	X		X (see 6.8)
Condensate corrosion resistance	X		X (see 6.9)
Flow capacity	X		X (see 6.10)

[a] This test is to confirm proper design and construction of stand-alone, externally threaded PRD designs and is not required if the PRD is internally imbedded in the valve body.

6.2 Hydrostatic strength

6.2.1 Housing

The manufacturer shall either physically test the housing or prove its strength by calculation. The test shall be performed according to the procedure given in ISO 15500-2 using a pressure of 80 MPa (800 bar) at 20 °C ± 5 °C.

6.2.2 Fusible material

6.2.2.1 Test procedure

Test the fusible material in the PRD with water at 30 MPa (300 bar) and 20 °C ± 5 °C for 30 min using the following procedure.

a) Randomly select three test specimens. For combination relief devices, the burst disc shall not be removed. During the test, the fusible material shall not begin to extrude out of the PRD.

b) Increase the pressure at a rate of 0,5 MPa/s (5 bar/s) to 60 MPa (600 bar), or to the pressure at which the fusible material starts to extrude.

6.2.2.2 Requirement

If the extrusion of the fusible material begins at less than 45 MPa (450 bar), the device is considered to have failed the test.

6.3 Leakage

Follow the procedure for testing leakage given in ISO 15500-2, using the test temperatures and pressures given in Table 2, below. The PRD shall be either bubble-free or have a leakage rate < 2 cm^3/h (normal conditions).

Table 2 — Test temperatures and pressures

Temperature °C	**Pressure** MPa [bar]
– 40	15 [150]
82	26 [260]

6.4 Bending moment

The purpose of this test is to confirm proper design and construction of stand-alone, externally threaded PRD designs. Test the PRD using the corresponding procedure given in ISO 15500-2.

6.5 Continued operation

6.5.1 Test procedure

a) Randomly select five test specimens.

b) Cycle the PRD according to Table 3, with water at between 10 % and 130 % of the service pressure, at a maximum cyclic rate of 10 cycles per minute and a temperature of 82 °C ± 2 °C.

Table 3 — Test temperatures and cycles

Temperature °C	**Cycles**
82	2 000
57	18 000

6.5.2 Requirements

6.5.2.1 Following the test there shall be no extrusion of the fusible material from the PRD.

6.5.2.2 At the completion of the test, the PRD shall comply with the requirements of 6.3 and 6.7.

6.6 Accelerated Life

6.6.1 General

Fusible materials can creep and flow within the operating temperature range of natural gas vehicle PRDs. Accelerated life testing is performed to verify that the rate of creep is sufficiently low so that the device can perform reliably for at least one year at 82 °C and for at least 20 years at 57 °C. Accelerated life testing shall be performed on new PRD designs or designs in which the fusible material melt temperature or device activation mechanism is modified. For devices not using activation materials that can creep, testing and analysis shall be performed to verify that the device will perform reliably for at least one year at 82 °C and at least 20 years at 57 °C.

6.6.2 Test procedure

a) Place the test specimens in an oven or liquid bath, holding the specimens' temperature to within ± 1 °C throughout the test.

b) Elevate the pressure on the PRD inlet to 130 % of the service pressure and hold this constant to within ± 0,7 MPa (7 bar) until activation. The pressure supply may be located outside the controlled temperature oven or bath. Limit the volume of liquid or gas to prevent damage to the test apparatus upon activation and venting. Each device may be pressurized individually or through a manifold system. If a manifold system is used, each pressure connection shall include a check valve to prevent pressure depletion of the system if one specimen fails.

6.6.3 Long-term temperature

It is assumed that the time-to-activation, t, of fusible alloys is a rate process governed by the power-law relationship of the formula:

$$t = A \cdot T^{B}$$

where

T is temperature, and

A, B are constants dependent upon the fusible alloy and PRD design.

The calculated time-to-activation for the PRD shall be greater than one year at 82 °C and at least 20 years at 57 °C, and shall exceed 500 hours, long-term test temperature.

Mathematical manipulation results in the following requirement for long-term test temperature:

$$T_{\mathrm{L}} = T(0{,}057)^{0{,}34[\log(T/T_{\mathrm{f}})]}$$

where

T_{L} is the long-term test temperature, in degrees Celsius;

T_{f} is the fusible material yield temperature, in degrees Celsius;

T = 82 °C;

log is base 10.

6.6.4 Requirements

6.6.4.1 Three PRDs shall be tested at the fusible material yield temperature to verify that they activate in less than 10 h.

6.6.4.2 Five PRDs shall be tested at their long-term test temperature. The time-to-activation for long-term test devices shall exceed 500 h.

6.7 Benchtop activation

6.7.1 General

6.7.1.1 The purpose of this test is to demonstrate that a PRD will activate consistently throughout its life.

6.7.1.2 Test two PRDs without subjecting them to other tests in order to establish a baseline time for activation. PRDs subjected to the tests of 6.5 and 6.9 shall activate within the time limits defined in 6.7.2 or 6.7.3, as applicable.

6.7.1.3 Test thermally activated relief devices in accordance with 6.7.2. Combination relief devices, activated by a combination of high pressures and temperatures acting together, shall be tested in accordance with 6.7.3.

6.7.2 Thermally activated relief devices

6.7.2.1 Test setup

The test setup shall consist of either an oven or chimney capable of maintaining a gas temperature at 600 °C $\pm$ 10 °C in the area of the oven or chimney into which the PRD is inserted for testing. The PRD shall not be exposed directly to flame.

6.7.2.2 Test procedure

a) Pressurize the PRD to 25 % of service pressure. The temperature shall remain within the acceptable range for 2 min prior to running the test.

b) Insert the PRD in the oven or chimney and record the time-to-activation, t.

6.7.2.3 Requirements

The PRDs subjected to the tests of 6.5, 6.8, 6.9, and the corrosion resistance and vibration resistance tests of ISO 15500-2, shall activate to meet the following requirements where t, in minutes, is the time-to-activation of the PRDs not subjected to those tests:

$\leqslant 5 \cdot t$

$\leqslant t + 4$ min

6.7.3 Combination relief devices

6.7.3.1 Test procedure

a) Place the PRD in an oven heated to a temperature 10 °C above the yield temperature of the fusible material.

b) Activate the PRD by pressurizing until the rupture disc bursts.

6.7.3.2 Requirement

The PRD subjected to the tests of 6.5, 6.8, 6.9, and the corrosion resistance and vibration resistance tests of ISO 15500-2, shall activate at a pressure > 75 % and < 105 % of the activation pressure of a PRD not subjected to any previous testing.

6.8 Thermal cycling

6.8.1 Test procedure

Thermally cycle the PRD between – 40 °C and 82 °C, as follows.

a) Place a depressurized PRD in a fluid bath maintained at – 40 °C or lower for a period of 2 h or more. Then transfer the device to a fluid bath maintained at 82 °C or higher within 5 min.

b) Leave the depressurized PRD in the fluid bath maintained at 82 °C or higher for a period of 2 h or more. Then transfer the device to the fluid bath maintained at – 40 °C or lower within 5 min.

c) Repeat steps a) and b) until a total of 15 thermal cycles have been achieved.

d) With the PRD conditioned for a period of 2 h or more in the – 40 °C fluid bath, cycle the PRD between no more than 10 % and no less than 100 % of the service pressure for a total of 100 cycles.

6.8.2 Requirement

At the completion of the test, the PRD shall meet all the requirements of 6.3 and 6.7.

6.9 Condensate corrosion resistance

6.9.1 Test procedure

a) Seal the outlet port of the PRD.

b) Fill the PRD with the test solution given in 6.9.2 and soak the device for 100 h at 21 °C.

c) Empty the solution from the PRD and reseal the outlet port, then heat the device for an additional 100 h at 82 °C.

At the end of this test, the PRD shall meet all the requirements of 6.3 and 6.7.

6.9.2 Test solution

The test solution, by volume percentage, consists of

— 84,8 % Stoddard solvent,

— 10,0 % benzene,

— 2,5 % fryquel no. 15 or no. 20 compressor oil,

— 1,5 % water,

— 1,0 % methanol, and

— 0,2 % mercaptan.

6.10 Flow capacity

6.10.1 General

6.10.1.1 Three random samples of the PRD shall be tested for flow capacity. Each device tested shall be caused to operate by temperature or a combination of temperature and pressure.

6.10.1.2 After activation, and without cleaning, removal of parts or reconditioning, each PRD shall be subjected to an actual flow test wherein the amount of air released by the device is measured. The rated flow capacity of the device shall be the average flow capacity of the three samples, provided the individual flow capacities fall within 10 % of the highest flow capacity recorded.

6.10.2 Test procedure

a) Conduct flow testing with air at 0,8 MPa (8 bar) to 0,9 MPa (9 bar).

b) Measure the temperature.

c) Correct the calculation of flow rate to 0,7 MPa (7 bar) absolute and 15 °C.

The PRD shall be tested to establish its flow capacity in m^3/h (normal conditions) of natural gas flow with an accuracy of $\pm$ 10%. One acceptable method is to measure the temperature and pressure of a known volume of compressed air or gas, both before and after conducting a flow test, and measure the time during flow.

7 Production batch inspection and acceptance testing

The PRD manufacturer shall institute a production batch inspection and acceptance testing program that ensures consistent safety performance of the product.

EXAMPLE ANSI/IAS PRD1.

Annex A
(normative)

Determination of fusible material yield temperature and PRD activation temperature

A.1 General

Clause 4 of this part of ISO 15500 gives PRD manufacturers a choice of marking their products with either the fusible material yield temperature or the PRD activation temperature [see b)]. In A.2 and A.3 the methods are given for obtaining these values.

A.2 Fusible material yield temperature

A.2.1 Sample selection

Select at random two samples of the fusible material from each batch (heat) in the manufactured form (e.g. ingot, wire).

A.2.2 Test Setup

For fusible material supplied in ingot form, two specimens, each 50 mm in length and approximately 6 mm in diameter, shall be taken from each ingot for test purposes. For fusible material supplied in wire form, two test specimens shall be taken from each coil with each specimen no less than 38 mm, and no greater than 50 mm, in length. Each test specimen shall be positioned horizontally on two knife edges spaced apart so that the ends of the specimen overhang the knife edges by 12 mm. The supported specimens shall be immersed in a glycerine bath at a minimum distance of 6 mm from the bottom of the container.

A.2.3 Test procedure

a) Test two samples from a given ingot or coil of wire at one time. The bath temperature may be raised at a rate of 3 °C/min up to 5 °C/min below the yield temperature of the material.

b) After the temperature has stabilized at this level, raise the bath temperature at a much slower rate so as not to exceed 0,6 °C/min.

Measure the temperatures using a suitable sensing device inserted in the bath between, and closely adjacent to, the specimens so that the sensor is immersed at the same level as the specimens.

A.2.4 Requirements

The yield temperature shall be taken as the temperature at which the second of the four ends of the specimens loses its rigidity and droops, or at which there is drooping of the sections of the two specimens between the knife edges, or both. After the temperature of the bath and fusible metal have stabilized, yielding shall occur before the allowable yield temperature has been exceeded.

A.3 PRD activation temperature determination

A.3.1 Differential scanning calorimetry (DSC) method

The activation temperature of the fusible material shall be measured by DSC.

A.3.2 Thermocouple method

Slowly heat the PRD, subjected to working pressure, by immersing it in a bath or using a hot air stream, until it activates. Measure the temperature using a thermocouple.

Annex B
(informative)

PRD trigger temperatures

In considering the trigger conditions suitable for PRDs in this part of ISO 15500, it has been necessary to take into account the conflict between certain existing regulations.

The regulation Vd TÜV 757 (Germany) requires the following trigger temperatures for PRDs:

— steel cylinders (Type 1) trigger temperature = (125 ± 10) °C;

— aluminium and composite cylinders (Types 2, 3 and 4) = (110 ± 10) °C.

Whereas, the regulation GRPE TRANS/WP.29/1998/33 (EC), Annex 4A, 4.2.4, requires that aluminium and composite cylinders (Types 2, 3 and 4) = (110 ± 10) °C.

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INTERNATIONAL STANDARD

ISO 15500-14

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Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 14: Excess flow valve

Véhicules routiers — Composants des systèmes de combustible gaz naturel comprimé (GNC) —

Partie 14: Valve de limitation de débit

Reference number
ISO 15500-14:2002(E)

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Foreword

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International Standard ISO 15500-14 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 25, *Road vehicles using natural gas*.

ISO 15500 consists of the following parts, under the general title *Road vehicles — Compressed natural gas (CNG) fuel system components*:

— *Part 1: General requirements and definitions*

— *Part 2: Performance and general test methods*

— *Part 3: Check valve*

— *Part 4: Manual valve*

— *Part 5: Manual cylinder valve*

— *Part 6: Automatic valve*

— *Part 7: Gas injector*

— *Part 8: Pressure indicator*

— *Part 9: Pressure regulator*

— *Part 10: Gas-flow adjuster*

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— *Part 12: Pressure relief valve (PRV)*

— *Part 13: Pressure relief device (PRD)*

— *Part 14: Excess flow valve*

— *Part 15: Gas-tight housing and ventilation hose*

— *Part 16: Rigid fuel line*

— *Part 17: Flexible fuel line*

— *Part 18: Filter*

— *Part 19: Fittings*

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 14:
Excess flow valve

1 Scope

This part of ISO 15500 specifies tests and requirements for the excess flow valve, a compressed natural gas fuel system component intended for use on the types of motor vehicles defined in ISO 3833.

This part of ISO 15500 is applicable to vehicles using natural gas in accordance with ISO 15403 (mono-fuel, bi-fuel or dual-fuel applications). It is not applicable to the following:

a) liquefied natural gas (LNG) fuel system components located upstream of, and including, the vaporizer;

b) fuel containers;

c) stationary gas engines;

d) container mounting hardware;

e) electronic fuel management;

f) refuelling receptacles.

NOTE 1 It is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this part of ISO 15500 and tested according to the appropriate functional tests.

NOTE 2 All references to pressure in this part of ISO 15500 are to be considered gauge pressures unless otherwise specified.

NOTE 3 This part of ISO 15500 is based upon a service pressure for natural gas as fuel of 20 MPa [200 bar] settled at 15 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio). For example, a 25 MPa (250 bar) service pressure system will require pressures to be multiplied by 1,25.

NOTE 4 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15500. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15500 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3833:1977, *Road vehicles — Types — Terms and definitions*

ISO 15403, *Natural gas — Designation of the quality of natural gas for use as a compressed fuel for vehicles*

ISO 15500-1, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 1: General requirements and definitions*

ISO 15500-2, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 2: Performance and general test methods*

3 Terms and definitions

For the purposes of this part of ISO 15500, the terms and definitions given in ISO 15500-1 and the following apply.

3.1
internal excess flow valve
excess flow valve installed inside the cylinder or cylinder valve

3.2
external excess flow valve
excess flow valve installed outside the cylinder or cylinder valve

3.3
shut-off type excess flow valve
excess flow valve that stops flow when in the closed position

3.4
flow-limiter type excess flow valve
excess flow valve that limits flow when activated

NOTE The device resets automatically when the excess flow condition is no longer present.

3.5
activation
differential pressure flow or other condition specified by the manufacturer at which the excess flow valve is activated

4 Marking

Marking of the component shall provide sufficient information to allow the following to be traced:

a) the manufacturer's or agent's name, trademark or symbol;

b) the model designation (part number);

c) the service pressure or pressure and temperature range.

The following additional markings are recommended:

d) the direction of flow (when necessary for correct installation);

e) the type of fuel;

f) electrical ratings (if applicable);

g) the symbol of the certification agency;

h) the type approval number;

i) the serial number or data code;

j) reference to this part of ISO 15500.

NOTE This information can be provided by a suitable identification code on at least one part of the component when it consists of more than one part.

5 Construction and assembly

The excess flow valve shall comply with the applicable provisions of ISO 15500-1 and ISO 15500-2, and with the tests specified in clause 6 of this part of ISO 15500.

6 Tests

6.1 Applicability

There are many types of excess flow valves available. This part of ISO 15500 provides requirements for two different designs: internal and external excess flow valves. A valve of either design could be one of two different types: shut-off or flow-limiter. As excess flow valve designs vary, so will the tests required.

The function of an excess flow valve can be achieved in other ways. For example, instead of using a mechanical device, an electronic system can be adopted to ensure the closing or limiting of the gas flow from the cylinder in an accident.

The tests required to be carried out are indicated in Table 1.

Table 1 — Tests applicable

Test method	Applicable	Test procedure as required in ISO 15500-2	Specific test requirements of this part of ISO 15500
Hydrostatic strength	X	X	X (see 6.2)
Leakage	X	X	X (see 6.3)
Excess torque resistance	X	X	X (see 6.4)
Bending moment	X	X	X (see 6.5)
Continued operation	X	X	X (see 6.6)
Corrosion resistance	X	X	
Oxygen ageing	X	X	
Non-metallic synthetic immersion	X	X	
Vibration resistance	X	X	
Brass material compatibility	X	X	
Operation	X		X (see 6.7)

6.2 Hydrostatic strength

The purpose of this test is to establish the strength of the housing.

Test the excess flow valve according to the procedure for testing hydrostatic strength specified in ISO 15500-2. For an internal excess flow valve, the test pressure shall be 80 MPa [800 bar]; for an external excess flow valve, the test pressure shall be 100 MPa [1 000 bar].

6.3 Leakage

The internal leakage test shall be conducted on shut-off type excess flow valves.

Test the excess flow valve at the temperatures and pressures given in Table 2.

Table 2 — Test temperatures and pressures

Temperature °C	First test pressure MPa [bar]	Second test pressure MPa [bar]
–40	15 [150]	Operational pressure
20	Operational pressure	30 [300]
85	Operational pressure	

6.4 Excess torque resistance

The excess torque resistance test shall be conducted only on external excess flow valves.

See ISO 15500-2.

6.5 Bending moment

The bending moment test shall be conducted only on external excess flow valves.

See ISO 15500-2.

6.6 Continued operation

Cycle the excess flow valve 20 times at 20 MPa [200 bar] differential pressure. One cycle shall consist of one opening and one closing. Upon completion of the test, the valve shall comply with 6.3 and 6.7.

6.7 Operation

Measure the flow of the excess flow valve when it activates. Perform the test using the activation conditions stated by the manufacturer; the measured flow shall meet the manufacturer's specified flow.

ICS 43.060.40

Price based on 4 pages

INTERNATIONAL STANDARD

ISO 15500-15

First edition
2001-01-15

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 15: Gas-tight housing and ventilation hose

Véhicules routiers — Composants des systèmes de combustible gaz naturel comprimé (GNC) —

Partie 15: Compartiment étanche pour gaz et tuyaux de ventilation

Reference number
ISO 15500-15:2001(E)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 15500 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15500-15 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 25, *Road vehicles using natural gas*.

ISO 15500 consists of the following parts, under the general title *Road vehicles — Compressed natural gas (CNG) fuel system components*:

— *Part 1: General requirements and definitions*

— *Part 2: Performance and general test methods*

— *Part 3: Check valve*

— *Part 4: Manual valve*

— *Part 5: Manual cylinder valve*

— *Part 6: Automatic valve*

— *Part 7: Gas injector*

— *Part 8: Pressure indicator*

— *Part 9: Pressure regulator*

— *Part 10: Gas-flow adjuster*

— *Part 11: Gas/air mixer*

— *Part 12: Pressure relief valve (PRV)*

— *Part 13: Pressure relief device (PRD)*

— *Part 14: Excess flow valve*

— *Part 15: Gas-tight housing and ventilation hose*

— *Part 16: Rigid fuel line*

— *Part 17: Flexible fuel line*

— *Part 18: Filter*

— *Part 19: Fittings*

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 15: Gas-tight housing and ventilation hose

1 Scope

This part of ISO 15500 specifies tests and requirements for the gas-tight housing and ventilation hose, compressed natural gas fuel system components intended for use on the types of motor vehicles defined in ISO 3833.

This part of ISO 15500 is applicable to vehicles using natural gas in accordance with ISO 15403 (mono-fuel, bi-fuel or dual-fuel applications). It is not applicable to the following:

a) liquefied natural gas (LNG) fuel system components located upstream of, and including, the vaporizer;

b) fuel containers;

c) stationary gas engines;

d) container mounting hardware;

e) electronic fuel management;

f) refuelling receptacles.

NOTE 1 It is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this part of ISO 15500 and tested according to the appropriate functional tests.

NOTE 2 All references to pressure in this part of ISO 15500 are to be considered gauge pressures unless otherwise specified.

NOTE 3 This part of ISO 15500 is based upon a service pressure for natural gas as a fuel of 20 MPa [200 bar[1)]] settled at 15 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio). For example, a 25 MPa (250 bar) service pressure system will require pressures to be multiplied by 1,25.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15500. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15500 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

ISO 3833, *Road vehicles — Types — Terms and definitions*.

ISO 15403, *Natural gas — Designation of the quality of natural gas for use as a compressed fuel for vehicles*.

ISO 15500-1, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 1: General requirements and definitions*.

ISO 15500-2, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 2: Performance and general test methods*.

3 Terms and definitions

For the purposes of this part of ISO 15500, the terms and definitions given in ISO 15500-1 apply.

4 Marking

Marking of the component shall provide sufficient information to allow the following to be traced:

a) the manufacturer's or agent's name, trademark or symbol;

b) the model designation (part number);

c) the temperature range.

The following additional markings are recommended:

d) the direction of flow (when necessary for correct installation);

e) the type of fuel;

f) electrical ratings (if applicable);

g) the symbol of the certification agency;

h) the type approval number;

i) the serial number or date code;

j) reference to this part of ISO 15500.

NOTE This information can be provided by a suitable identification code on at least one part of the component when it consists of more than one part.

5 Construction and assembly

The gas-tight housing and ventilation hose shall comply with the applicable provisions of ISO 15500-1 and ISO 15500-2, and with the tests specified in clause 6 of this part of ISO 15500.

The gas-tight housing shall be assembled in such a way that the function of the pressure relief device or devices (PRD) will not be affected.

6 Tests

6.1 Applicability

The tests required to be carried out are indicated in Table 1.

Table 1 — Tests applicable

Test	Applicable	Test procedure as required by ISO 15500-2	Specific test requirements of his part of ISO 15500
Leakage	X	X	X (see 6.2)
Excess torque resistance	X	X	
Bending moment			
Continued operation			
Corrosion resistance	X	X	
Oxygen ageing	X	X	
Electrical over-voltages			
Non-metallic synthetic immersion	X	X	
Vibration resistance	X [a]	X	
Brass material compatibility			
Pull-off	X		X (see 6.3)

[a] Applicable only if made of metal.

6.2 Leakage

Test the gas-tight housing according to the procedure for leakage specified in ISO 15500-2, at the temperatures and pressures given in Table 2, below.

Table 2 — Test temperatures and pressures

Temperature °C	Pressure MPa [bar]
– 40	0,05 [0,5]
20	0,05 [0,5]
85	0,05 [0,5]

6.3 Pull-off

Test the ventilation hose, attached by a suitable connection device to the gas-tight housing and to any other connecting point used, according to the following procedure and acceptance criterion.

Place the test specimen in an appropriate test fixture, then statically apply a tensile load along the ventilation hose axis at a maximum rate of 100 N/min until the ventilation hose separates from its connecting points.

The force required to pull the ventilation hose apart from its connecting points shall be not less than 100 N.

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INTERNATIONAL STANDARD

ISO 15500-16

First edition
2001-01-15

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 16: Rigid fuel line

Véhicules routiers — Composants des systèmes de combustible gaz naturel comprimé (GNC) —

Partie 16: Tuyauterie rigide pour combustible

Reference number
ISO 15500-16:2001(E)

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Attention is drawn to the possibility that some of the elements of this part of ISO 15500 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15500-16 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 25, *Road vehicles using natural gas*.

ISO 15500 consists of the following parts, under the general title *Road vehicles — Compressed natural gas (CNG) fuel system components*:

— *Part 1: General requirements and definitions*

— *Part 2: Performance and general test methods*

— *Part 3: Check valve*

— *Part 4: Manual valve*

— *Part 5: Manual cylinder valve*

— *Part 6: Automatic valve*

— *Part 7: Gas injector*

— *Part 8: Pressure indicator*

— *Part 9: Pressure regulator*

— *Part 10: Gas-flow adjuster*

— *Part 11: Gas/air mixer*

— *Part 12: Pressure relief valve (PRV)*

— *Part 13: Pressure relief device (PRD)*

— *Part 14: Excess flow valve*

— *Part 15: Gas-tight housing and ventilation hose*

— *Part 16: Rigid fuel line*

— *Part 17: Flexible fuel line*

— *Part 18: Filter*

— *Part 19: Fittings*

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 16: Rigid fuel line

1 Scope

This part of ISO 15500 specifies tests and requirements for the rigid fuel line, a compressed natural gas fuel system component in accordance with ISO 1127 intended for use on the types of motor vehicles defined in ISO 3833.

This part of ISO 15500 is applicable to vehicles using natural gas in accordance with ISO 15403 (mono-fuel, bi-fuel or dual-fuel applications). It is not applicable to the following:

a) liquefied natural gas (LNG) fuel system components located upstream of, and including, the vaporizer;

b) fuel containers;

c) stationary gas engines;

d) container mounting hardware;

e) electronic fuel management;

f) refuelling receptacles.

NOTE 1 It is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this part of ISO 15500 and tested according to the appropriate functional tests.

NOTE 2 All references to pressure in this part of ISO 15500 are to be considered gauge pressures unless otherwise specified.

NOTE 3 This part of ISO 15500 is based upon a service pressure for natural gas as a fuel of 20 MPa [200 bar[1)]] settled at 15 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio). For example, a 25 MPa (250 bar) service pressure system will require pressures to be multiplied by 1,25.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15500. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15500 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

ISO 1127, *Stainless steel tubes — Dimensions, tolerances and conventional masses per unit length*.

ISO 3833, *Road vehicles — Types — Terms and definitions*.

ISO 15403, *Natural gas — Designation of the quality of natural gas for use as a compressed fuel for vehicles*.

ISO 15500-1, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 1: General requirements and definitions*.

ISO 15500-2, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 2: Performance and general test methods*.

3 Terms and definitions

For the purposes of this part of ISO 15500, the terms and definitions given in ISO 15500-1 apply.

4 Marking

Marking of the component shall provide sufficient information to allow the following to be traced:

a) the manufacturer's or agent's name, trademark or symbol;

b) the model designation (part number);

c) the service pressure or pressure and temperature range.

The following additional markings are recommended:

d) the direction of flow (when necessary for correct installation);

e) the type of fuel;

f) electrical ratings (if applicable);

g) the symbol of the certification agency;

h) the type approval number;

i) the serial number or date code;

j) reference to this part of ISO 15500.

NOTE This information can be provided by a suitable identification code on at least one part of the component when it consists of more than one part.

5 Construction and assembly

The rigid fuel line shall comply with the applicable provisions of ISO 15500-1 and ISO 15500-2, and with the tests specified in clause 6 of this part of ISO 15500.

The rigid fuel line shall be compatible with the fittings specified by the fitting manufacturer.

6 Tests

6.1 Applicability

The tests required to be carried out are indicated in Table 1.

Table 1 — Tests applicable

Test	Applicable	Test procedure as required by ISO 15500-2	Specific test requirements of this part of ISO 15500
Hydrostatic strength	X	X	X (see 6.2)
Leakage	X	X	
Excess torque resistance			
Bending moment			
Continued operation	X	X	X (see 6.3)
Corrosion resistance	X	X	
Oxygen ageing			
Electrical over-voltages			
Non-metallic synthetic immersion			
Vibration resistance			
Brass material compatibility			
Bending	X		X (see 6.4)
Conductivity			

6.2 Hydrostatic strength

The rigid fuel line shall be tested according to the procedure for testing hydrostatic strength specified in ISO 15500-2.

Test pressure upstream of the first stage of the pressure reduction shall be 100 MPa (1 000 bar). Test pressure downstream of the first stage of the pressure reduction shall be four times its working pressure.

6.3 Continued operation

The rigid fuel line shall be subjected to a continued operation test for a total of 100 000 cycles.

6.4 Bending

Test the rigid fuel line according to the following procedure and acceptance criterion.

a) Select a mandrel with a diameter according to Table 2.

b) Bend the rigid fuel line over this mandrel once, forming a “U” shape.

c) Close the rigid fuel line's ends and pressurize it to four times its service pressure.

At completion of the test, the rigid fuel line shall not leak.

Table 2 — Rigid fuel line external (RFLE) and mandrel diameters

RFLE diameter	Mandrel diameter
$\leqslant$ 8 mm	3 $\times$ RFLE diameter
$>$ 8 mm	5 $\times$ RFLE diameter

ICS 43.060.40

Price based on 4 pages

INTERNATIONAL STANDARD

ISO 15500-17

First edition
2001-01-15

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 17: Flexible fuel line

Véhicules routiers — Composants des systèmes de combustible gaz naturel comprimé (GNC) —

Partie 17: Tuyauterie flexible pour combustible

Reference number
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ISO 15500 consists of the following parts, under the general title *Road vehicles — Compressed natural gas (CNG) fuel system components*:

— *Part 1: General requirements and definitions*

— *Part 2: Performance and general test methods*

— *Part 3: Check valve*

— *Part 4: Manual valve*

— *Part 5: Manual cylinder valve*

— *Part 6: Automatic valve*

— *Part 7: Gas injector*

— *Part 8: Pressure indicator*

— *Part 9: Pressure regulator*

— *Part 10: Gas-flow adjuster*

— *Part 11: Gas/air mixer*

— *Part 12: Pressure relief valve (PRV)*

— *Part 13: Pressure relief device (PRD)*

— *Part 14: Excess flow valve*

— *Part 15: Gas-tight housing and ventilation hose*

— *Part 16: Rigid fuel line*

— *Part 17: Flexible fuel line*

— *Part 18: Filter*

— *Part 19: Fittings*

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 17: Flexible fuel line

1 Scope

This part of ISO 15500 specifies tests and requirements for the flexible fuel line, a compressed natural gas fuel system component in accordance with SAE J 517 (100R-8 hose) or JIS B 8362 intended for use on the types of motor vehicles defined in ISO 3833.

This part of ISO 15500 is applicable to vehicles using natural gas in accordance with ISO 15403 (mono-fuel, bi-fuel or dual-fuel applications). It is not applicable to the following:

a) liquefied natural gas (LNG) fuel system components located upstream of, and including, the vaporizer;

b) fuel containers;

c) stationary gas engines;

d) container mounting hardware;

e) electronic fuel management;

f) refuelling receptacles.

NOTE 1 It is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this part of ISO 15500 and tested according to the appropriate functional tests.

NOTE 2 All references to pressure in this part of ISO 15500 are to be considered gauge pressures unless otherwise specified.

NOTE 3 This part of ISO 15500 is based upon a service pressure for natural gas as a fuel of 20 MPa [200 bar[1)]] settled at 15 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio). For example, a 25 MPa (250 bar) service pressure system will require pressures to be multiplied by 1,25.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15500. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15500 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

ISO 3833, *Road vehicles — Types — Terms and definitions.*

ISO 15403, *Natural gas — Designation of the quality of natural gas for use as a compressed fuel for vehicles.*

ISO 15500-1, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 1: General requirements and definitions.*

ISO 15500-2, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 2: Performance and general test methods.*

SAE J 517, *Hydraulic hose.*

JIS B 8362, *Textile reinforced thermoplastic hose assemblies for hydraulic use.*

3 Terms and definitions

For the purposes of this part of ISO 15500, the terms and definitions given in ISO 15500-1 apply.

4 Marking

Marking of the component shall provide sufficient information to allow the following to be traced:

a) the manufacturer's or agent's name, trademark or symbol;

b) the model designation (part number);

c) the service pressure or pressure and temperature range.

The following additional markings are recommended:

d) the direction of flow (when necessary for correct installation);

e) the type of fuel;

f) electrical ratings;

g) the symbol of the certification agency;

h) the type approval number;

i) the serial number or date code;

j) reference to this part of ISO 15500.

NOTE This information can be provided by a suitable identification code on at least one part of the component when it consists of more than one part.

5 Construction and assembly

The flexible fuel line shall comply with the applicable provisions of ISO 15500-1 and ISO 15500-2, and with the tests specified in clause 6 of this part of ISO 15500.

6 Tests

6.1 Applicability

The tests required to be carried out are indicated in Table 1.

Table 1 — Tests applicable

Test	Applicable	Test procedure as required by ISO 15500-2	Specific test requirements of this part of ISO 15500
Hydrostatic strength	X	X	X (see 6.2)
Leakage	X	X	
Excess torque resistance	X [a]	X	
Bending moment			
Continued operation	X	X	X (see 6.3)
Corrosion resistance	X	X	
Oxygen ageing	X	X	
Electrical over-voltages			
Non-metallic synthetic immersion	X	X	
Vibration resistance			
Brass material compatibility	X	X	
Bending	X		X (see 6.4)
Pull-off	X		X (see 6.5)
Conductivity	X		X (see 6.6)
Permeability	X		X (see 6.7)

[a] Applicable to the fittings.

6.2 Hydrostatic strength

The flexible fuel line shall be tested according to the procedure for testing hydrostatic strength specified in ISO 15500-2.

Test pressure upstream of the first stage of the pressure reduction shall be 100 MPa (1 000 bar). Test pressure downstream of the first stage of the pressure reduction shall be four times its working pressure.

6.3 Continued operation

The flexible fuel line shall be subjected to the continued operation test for a total of 20 000 cycles.

6.4 Bending

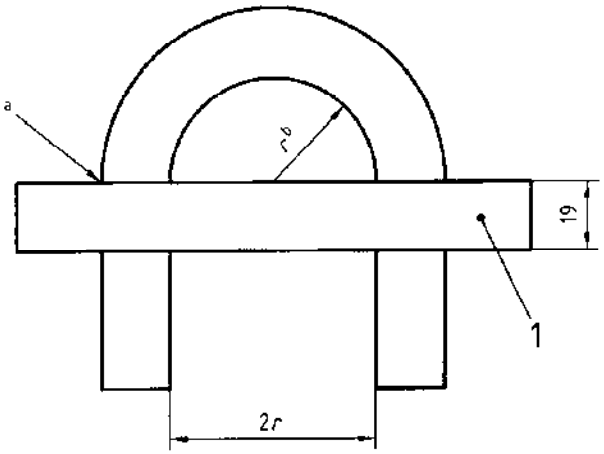
Test the flexible fuel line using a suitable length of hose with no end fittings according to the following procedure and acceptance criteria.

a) Carefully bend the hose and place it in a fixture as shown in Figure 1.

b) After the hose has been left in this position for 5 min, insert into one end of the hose a steel ball having a diameter equal to half the hose's nominal inside diameter.

The fuel line shall not kink and the ball shall pass freely from one end of the hose to the other.

Dimension in millimetres



Key

1 Board

[a] Hole size as necessary to fit hose outside diameter.

[b] r = 10 times the nominal hose inside diameter, or the hose manufacturer's specified minimum bend radius, whichever is less.

Figure 1 — Bending test

6.5 Pull-off

Test the flexible fuel line, attached to its fitting or fittings and coupled to its mating part or parts, according to the following procedure and acceptance criterion.

Secure the subject specimen in an appropriate test fixture, then statically apply a tensile load along the flexible fuel line axis at a maximum rate of 250 N/min until the flexible fuel line separates from its fitting.

The force (F), in newtons, required to pull apart the fuel line from its fitting shall be that calculated as:

$$F = (\pi \cdot d^2 \cdot P) \div 10$$

where

d is the inside diameter, in millimetres;

P is the pressure, in bar.

6.6 Electrical conductivity

Conduct the test with the hose depressurized and at the specified working pressure. Check the hose resistance using an applied potential of up to 500 V DC and measuring the current.

Electrical resistance between couplings at each end of the hose shall be < 1 MΩ/m, in order to dissipate static electricity.

6.7 Permeability

Fill a suitable length of hose with CNG to service or working pressure, place it in an enclosed sealed chamber at ambient temperature and monitor it for leakage for 14 d.

The hourly permeation rate shall be less than 20 cm^3/m. Section the hose and inspect the internal surfaces for any evidence of cracking or deterioration.

Bibliography

[1] ISO 1746, *Rubber or plastics hose or tubing — Bending tests.*

ICS 43.060.40

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INTERNATIONAL STANDARD

ISO 15500-18

First edition
2001-01-15

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 18: **Filter**

Véhicules routiers — Composants des systèmes de combustible gaz naturel comprimé (GNC) —

Partie 18: Filtre

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International Standard ISO 15500-18 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 25, *Road vehicles using natural gas*.

ISO 15500 consists of the following parts, under the general title *Road vehicles — Compressed natural gas (CNG) fuel system components*:

— *Part 1: General requirements and definitions*

— *Part 2: Performance and general test methods*

— *Part 3: Check valve*

— *Part 4: Manual valve*

— *Part 5: Manual cylinder valve*

— *Part 6: Automatic valve*

— *Part 7: Gas injector*

— *Part 8: Pressure indicator*

— *Part 9: Pressure regulator*

— *Part 10: Gas-flow adjuster*

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— *Part 15: Gas-tight housing and ventilation hose*

— *Part 16: Rigid fuel line*

— *Part 17: Flexible fuel line*

— *Part 18: Filter*

— *Part 19: Fittings*

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 18: Filter

1 Scope

This part of ISO 15500 specifies tests and requirements for the filter (standalone compressed natural gas fuel system component) intended for use on the types of motor vehicles defined in ISO 3833.

This part of ISO 15500 is applicable to vehicles using natural gas in accordance with ISO 15403 (mono-fuel, bi-fuel or dual-fuel applications). It is not applicable to the following:

a) liquefied natural gas (LNG) fuel system components located upstream of, and including, the vaporizer;

b) fuel containers;

c) stationary gas engines;

d) container mounting hardware;

e) electronic fuel management;

f) refuelling receptacles.

NOTE 1 It is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this part of ISO 15500 and tested according to the appropriate functional tests.

NOTE 2 All references to pressure in this part of ISO 15500 are to be considered gauge pressures unless otherwise specified.

NOTE 3 This part of ISO 15500 is based upon a service pressure for natural gas as a fuel of 20 MPa [200 bar[1)]] settled at 15 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio). For example, a 25 MPa (250 bar) service pressure system will require pressures to be multiplied by 1,25.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15500. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15500 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

ISO 3833, *Road vehicles — Types — Terms and definitions*.

ISO 15403, *Natural gas — Designation of the quality of natural gas for use as a compressed fuel for vehicles*.

ISO 15500-1, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 1: General requirements and definitions*.

ISO 15500-2, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 2: Performance and general test methods*.

3 Terms and definitions

For the purposes of this part of ISO 15500, the terms and definitions given in ISO 15500-1 apply.

4 Marking

Marking of the component shall provide sufficient information to allow the following to be traced:

a) the manufacturer's or agent's name, trademark or symbol;

b) the model designation (part number);

c) the service pressure or pressure and temperature range.

The following additional markings are recommended:

d) the direction of flow;

e) the type of fuel;

f) electrical ratings (if applicable);

g) the symbol of the certification agency;

h) the type approval number;

i) the serial number or date code;

j) reference to this part of ISO 15500.

NOTE This information can be provided by a suitable identification code on at least one part of the component when it consists of more than one part.

5 Construction and assembly

The filter shall comply with the applicable provisions of ISO 15500-1 and ISO 15500-2, and with the tests specified in clause 6 of this part of ISO 15500.

If non-conductive materials are used, the filter shall be designed to take its conductivity into account.

6 Tests

6.1 Applicability

The tests required to be carried out are indicated in Table 1.

Table 1 — Tests applicable

Test	Applicable	Test procedure as required by ISO 15500-2	Specific test requirements of this part of ISO 15500
Hydrostatic strength	X	X	X (see 6.2)
Leakage	X	X	
Excess torque resistance	X	X	
Bending moment	X	X	
Continued operation	X	X	X (see 6.3)
Corrosion resistance	X	X	
Oxygen ageing	X	X	
Electrical over-voltages			
Non-metallic synthetic immersion	X	X	
Vibration resistance	X		X (see 6.4)
Brass material compatibility	X	X	

6.2 Hydrostatic strength

The filter shall be tested according to the procedure for testing hydrostatic strength specified in ISO 15500-2.

Test pressure upstream of the first stage of the pressure reduction shall be 100 MPa (1 000 bar). Test pressure downstream of the first stage of the pressure reduction shall be four times its working pressure.

6.3 Continued operation

Subject the filter to continued operation for a total of 20 000 cycles.

6.4 Vibration resistance

Vibrate the filter, pressurized to its service or working pressure and sealed at both ends, for 30 min along each of the three orthogonal axes at the most severe resonant frequencies determined as follows:

— by an acceleration of 1,5 g;

— within a sinusoidal frequency range of 10 Hz to 500 Hz;

— with a sweep time of 10 min.

At the completion of the test, the filter shall not show any indication of fatigue or component damage, and shall meet the leakage test requirements.

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Price based on 3 pages

INTERNATIONAL STANDARD

ISO 15500-19

First edition
2001-01-15

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 19: **Fittings**

Véhicules routiers — Composants des systèmes de combustible gaz naturel comprimé (GNC) —

Partie 19: Raccords

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 15500 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15500-19 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 25, *Road vehicles using natural gas*.

ISO 15500 consists of the following parts, under the general title *Road vehicles — Compressed natural gas (CNG) fuel system components*:

— *Part 1: General requirements and definitions*

— *Part 2: Performance and general test methods*

— *Part 3: Check valve*

— *Part 4: Manual valve*

— *Part 5: Manual cylinder valve*

— *Part 6: Automatic valve*

— *Part 7: Gas injector*

— *Part 8: Pressure indicator*

— *Part 9: Pressure regulator*

— *Part 10: Gas-flow adjuster*

— *Part 11: Gas/air mixer*

— *Part 12: Pressure relief valve (PRV)*

— *Part 13: Pressure relief device (PRD)*

— *Part 14: Excess flow valve*

— *Part 15: Gas-tight housing and ventilation hose*

— *Part 16: Rigid fuel line*

— *Part 17: Flexible fuel line*

— *Part 18: Filter*

— *Part 19: Fittings*

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 19: Fittings

1 Scope

This part of ISO 15500 specifies tests and requirements for fittings, compressed natural gas fuel system components intended for use on the types of motor vehicles defined in ISO 3833.

This part of ISO 15500 is applicable to vehicles using natural gas in accordance with ISO 15403 (mono-fuel, bi-fuel or dual-fuel applications). It is not applicable to the following:

a) liquefied natural gas (LNG) fuel system components located upstream of, and including, the vaporizer;

b) fuel containers;

c) stationary gas engines;

d) container mounting hardware;

e) electronic fuel management;

f) refuelling receptacles.

NOTE 1 It is recognized that miscellaneous components not specifically covered herein can be examined to meet the criteria of this part of ISO 15500 and tested according to the appropriate functional tests.

NOTE 2 All references to pressure in this part of ISO 15500 are to be considered gauge pressures unless otherwise specified.

NOTE 3 This part of ISO 15500 is based upon a service pressure for natural gas as a fuel of 20 MPa [200 bar[1)]] settled at 15 °C. Other service pressures can be accommodated by adjusting the pressure by the appropriate factor (ratio). For example, a 25 MPa (250 bar) service pressure system will require pressures to be multiplied by 1,25.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15500. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15500 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

ISO 3833, *Road vehicles — Types — Terms and definitions*.

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ISO 15500-1, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 1: General requirements and definitions*.

ISO 15500-2, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 2: Performance and general test methods*.

3 Terms and definitions

For the purposes of this part of ISO 15500, the terms and definitions given in ISO 15500-1 apply.

4 Marking

Marking of the component shall provide sufficient information to allow the following to be traced:

a) the manufacturer's or agent's name, trademark or symbol;

b) the model designation (part number);

c) the service pressure or pressure and temperature range.

The following additional markings are recommended:

d) the direction of flow (when necessary for correct installation);

e) the type of fuel;

f) electrical ratings (if applicable);

g) the symbol of the certification agency;

h) the type approval number;

i) the serial number or date code;

j) reference to this part of ISO 15500.

NOTE 1 This information can be provided by a suitable identification code on at least one part of the component when it consists of more than one part.

NOTE 2 This information can be located on, or on a notice list inside, the packaging in which the component is shipped.

5 Construction and assembly

The fitting shall comply with the applicable provisions of ISO 15500-1 and ISO 15500-2, and with the tests specified in clause 6 of this part of ISO 15500.

The fitting shall be compatible with the rigid fuel line.

6 Tests

6.1 Applicability

The tests required to be carried out are indicated in Table 1.

Table 1 — Tests applicable

Test	Applicable	Test procedure as required by ISO 15500-2	Specific test requirements of this part of ISO 15500
Hydrostatic strength	X	X	X (see 6.2)
Leakage	X	X	
Excess torque resistance	X	X	
Bending moment	X	X	
Continued operation	X	X	X (see 6.3)
Corrosion resistance	X	X	
Oxygen ageing	X	X	
Electrical over-voltages			
Non-metallic synthetic immersion	X	X	
Vibration resistance	X		X (see 6.4)
Pull-off	X		X (see 6.5)
Brass material compatibility	X	X	

6.2 Hydrostatic strength

The fitting shall be tested according to the procedure for testing hydrostatic strength specified in ISO 15500-2.

Test pressure upstream of the first stage of the pressure reduction shall be 100 MPa (1 000 bar). Test pressure downstream of the first stage of the pressure reduction shall be four times its working pressure.

6.3 Continued operation

Subject the fitting to continued operation for a total of 100 000 cycles.

The fitting shall only be tested while connected with a rigid fuel line.

6.4 Vibration resistance

Vibrate the fitting assembly, pressurized to its service or working pressure and sealed at both ends, for 30 min along each of the three orthogonal axes at the most severe resonant frequencies determined as follows:

— by an acceleration of 1,5 g;

— within a sinusoidal frequency range of 10 Hz to 500 Hz;

— with a sweep time of 10 min.

At the completion of the test, the fitting assembly shall not show any indication of fatigue or component damage, and shall meet the leakage test requirements.

6.5 Pull-off

Test the fitting, attached to its rigid fuel line and coupled to its mating part or parts, according to the following procedure and acceptance criterion.

Secure the subject specimen in an appropriate test fixture, then statically apply a tensile load along the rigid fuel line axis at a maximum rate of 250 N/min until the rigid fuel line separates from the fitting.

The force (F), in newtons, required to pull apart the rigid fuel line from its fitting shall be that calculated as:

$$F = (\pi \cdot d^2 \cdot P) \div 10$$

where

d is the internal diameter, in millimetres;

P is the pressure, in bar.

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Price based on 4 pages

DRAFT INTERNATIONAL STANDARD ISO/DIS 15500-20

ISO/TC **22**/SC **25** Secretariat: **UNI**

Voting begins on: **2005-11-08** Voting terminates on: **2006-04-10**

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 20: Rigid fuel line in material other than stainless steel

Véhicules routiers — Composants des systèmes de remplissage en gaz naturel comprimé —

Partie 20: Circuit de combustible rigide en matériaux autres que l'acier inoxydable

ICS 43.060.40

In accordance with the provisions of Council Resolution 15/1993 this document is circulated in the English language only.

Conformément aux dispositions de la Résolution du Conseil 15/1993, ce document est distribué en version anglaise seulement.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

Pour accélérer la distribution, le présent document est distribué tel qu'il est parvenu du secrétariat du comité. Le travail de rédaction et de composition de texte sera effectué au Secrétariat central de l'ISO au stade de publication.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15500-20 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 25, *Road vehicles using gaseous fuels*.

ISO 15500 consists of the following parts, under the general title *Road vehicles — Compressed natural gas (CNG) fuel system components*:

— *Part 1: General requirements and definitions*

— *Part 2: Performance and general test methods*

— *Part 3: Check valve*

— *Part 4: Manual valve*

— *Part 5: Manual cylinder valve*

— *Part 6: Automatic valve*

— *Part 7: Gas injector*

— *Part 8: Pressure indicator*

— *Part 9: Pressure regulator*

— *Part 10: Gas flow adjuster*

— *Part 11: Gas/air mixer*

— *Part 12: Pressure relief valve*

— *Part 13: Pressure relief device*

— *Part 14: Excess flow valve*

— *Part 15: Gas tight housing and ventilation hose*

— *Part 16: Rigid fuel line*

— *Part 17: Flexible fuel line*

— *Part 18: Filter*

— *Part 19: Fittings*

— *Part 20: Rigid fuel line in other material than stainless steel*

Road vehicles — Compressed natural gas (CNG) fuel system components —

Part 20:
Rigid fuel line in material other than stainless steel

1 Scope

This Part of ISO 15500 provides specific requirements and tests applicable to the Rigid Fuel Line in Carbon Steel, intended for use on the types of motor vehicles as defined in ISO 3833 with a service pressure for natural gas as a fuel of 20 MPa (200 bar) settled at 15 °C.

ISO 15500 is intended to be applied to vehicles using natural gas which comply with requirements established in ISO 15403 (mono-fuel, bi-fuel or dual-fuel applications). This standard does not apply to the following:

a) Liquefied Natural Gas (LNG) fuel system components located upstream of, and including, the vaporizer;

b) fuel containers;

c) stationary gas engines;

d) container mounting hardware;

e) electronic fuel management;

f) refuelling receptacles.

NOTE All references to pressure in this part of ISO 15500 are to be considered gauge pressures unless otherwise specified. 1 bar = 100 kPa = 0,1 MPa

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For the undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3833:1977, *Road vehicles - Types - Terms and definitions*.

EN 10305-1:2003, *Steel tubes for precision applications – Technical delivery conditions – Seamless cold drawn tubes*

ISO 15500-1, *Road vehicles - Compressed natural gas (CNG) fuel system components - Part 1: General requirements and definitions*

ISO 15500-2, *Road vehicles - Compressed natural gas (CNG) fuel system components - Part 2: Performance and general test methods*

ISO 15403, *Natural Gas – Designation of the quality of natural gas for use as a compressed fuel for vehicles.*

3 Terms and definitions

For the purposes of this part of ISO 15500, the terms and definitions given in ISO 15500-1 apply.

4 Marking and labelling

Marking of the component shall provide sufficient information to allow the following to be traced:

a) the manufacturer's or agent's name, trademark or symbol;

b) the model designation (part number);

c) the service pressure or pressure and temperature range.

The following additional markings are recommended:

d) the direction of flow (when necessary for correct installation);

e) the type of fuel;

f) electrical ratings (if applicable);

g) the symbol of the certification agency;

h) the type approval number;

i) the serial number or date code;

j) reference to this part of ISO 15500.

NOTE This information applies to both coated and uncoated tubes and it can be provided by a suitable identification code, according with EN 10305-1:2003.

5 Qualifications for construction and assembly

The rigid fuel line shall comply with the applicable provisions of ISO 15500-1 and ISO 15500-2, and with the tests specified in clause 6 of this part of ISO 15500.

The rigid fuel line in Carbon Steel shall be in accordance with EN 10305-1:2003.

The rigid fuel line in Carbon Steel shall be seamless.

The rigid fuel line and the fittings devices shall be compatible, in order to avoid electrochemical corrosion.

6 Tests

6.1 Applicability

The tests required to be carried out are indicated in Table 1.

Table 1 – Tests applicable

Test methods	Applicable	Test procedure as required by ISO 15500-2	Specific test requirements of this part of ISO 15500
Hydrostatic strength	X	X	X (see 6.2)
Leakage	X	X	
Excess torque resistance			
Bending moment			
Continued operation	X	X	X (see 6.3)
Corrosion resistance	X	X	
Oxygen ageing	X(*)	X(*)	
Electrical over-voltages			
Non-metallic synthetic immersion	X(*)	X(*)	
Vibration resistance			
Brass material compatibility			
Bending	X		X (see 6.4)
Conductivity			

NOTE (*) Applicable to non-metallic coating.

6.2 Hydrostatic strength

The rigid fuel line shall be tested according to the procedure for testing hydrostatic strength specified in ISO 15500-2.

Test pressure upstream of the first stage of the pressure reduction shall be 100 MPa (1 000 bar). Test pressure downstream of the first stage of the pressure reduction shall be four times its working pressure.

6.3 Continued operation

The rigid fuel line shall be subjected to a continued operation test for a total of 100 000 cycles.

6.4 Bending

Test the rigid fuel line according to the following procedure and acceptance criterion.

a) Select a mandrel with a diameter according to Table 2.

b) Bend the rigid fuel line over this mandrel once, forming a “U” shape.

c) Perform corrosion resistance test according ISO 15500-2 clause 10.

d) Close the rigid fuel line's ends and pressurize it to four times its service pressure.

At completion of the test, the rigid fuel line shall not leak and all coatings that provides the corrosion resistance shall not break or crack.

Table 2 — Rigid fuel line external (RFLE) diameter

RFLE diameter	MANDREL diameter
≤ 8 mm	3 x RFLE diameter
> 8 mm	5 x RFLE diameter