



气体冷凝器

系列 TC-Standard X2

安装及使用说明书

原版使用说明书





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使用设备之前，请仔细阅读说明书。请特别注意警告及安全提示。否则可能导致人身伤害与财产损失。比勒科技有限公司不为不正当使用或擅自修改设备承担责任。 比勒科技有限公司不为不正当使用或擅自修改设备承担责任。

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1 引言

1.1 合规应用

本设备被设计用于工业气体分析系统。它是样气制备过程中一个必不可少的组成部分，旨在保护分析仪免受样气中的残留水分破坏。

带高纯度氧气选件（Suffix -O2）的样气泵经过专门优化，与介质接触部件相关，适用于高氧气浓度环境。必须对组件进行特殊清洁，以尽量减少有机和无机污染物。在受控清洁度条件下生产产品，确保符合基于EIGA Doc 33/18的限值。

带高纯度氢气选件的样气泵（Suffix -H2）通过扩展制造措施进行特殊改进，特别是为了避免氢气引起的部件损坏。此外，与介质接触的部件还要进行额外的光学检查，以去除任何残留的金属污染物，例如碎屑和颗粒。最后，进行批量化的密闭性检测。

本设备可在2区爆炸性气体环境中运行，防爆等级为IIC（ATEX，IECEX和EAC Ex），该环境很少、短时间内有爆炸性且在I类2区（US & Kanada）中运行。

当通过易燃气体时，必须注意确保携带或与介质接触的部件在技术上紧密连接。

加装各种附属装置可能限制设备的应用范围。

具有加拿大认证书和IECEX的冷却器

该装置必须安装在受工具保护的符合IP54标准的外壳中。

具有美国认证书的冷却器

该装置必须安装在受工具保护的符合IP54标准的外壳中，其设计用于容纳一种或多种根据国家电气规范（ANSI / NFPA 70）的I类2区布线方法。

具有ATEX认证书的冷却器

设备必须安装在一个符合至少IP54标准的且符合EN 60079-0要求的可上锁的外壳内，或经防爆认证且符合最终应用的外壳、安装、间隙和分隔要求的防爆外壳内。

具有EAC Ex认证书的冷却器

该装置必须安装在符合GOST 14254-2015要求的防护等级为IP54的外壳中。

请注意就特定预期用途、现有的材料组合及压力和温度限制的说明。

1.2 概述

TC-Standard X2系列专为高冷却能力和高环境温度设计。

TC-Standard+ X2系列专为满足依据EN 15267-3的所谓自动测量设备（AMS）的要求而设计。通过换热器热的串联连接，实现两次冷却，从而将冲洗效应降至最低。

带-H2/-O2换热器的TC-Standard X2系列被专门设计用于高纯度氢气和氧气的应用。

珀耳帖冷却器根据冷却功率或工作温度分为两种类型。这种划分体现在型号名称中。您定义的型号的确切产品编号可从订购提示栏的型号码中得出。

应用	标准应用	
工作温度	40 ° C	50 ° C
1个换热器	TC-Standard 6111 X2	TC-Standard 6112 X2
1台适于H ₂ /O ₂ 应用的换热器	TC-Standard 6111 X2	TC-Standard 6112 X2
2个换热器	TC-Standard 6121 X2	TC-Standard 6122 X2
2个串联的换热器	TC-Standard+ 6121 X2	TC-Standard+ 6122 X2

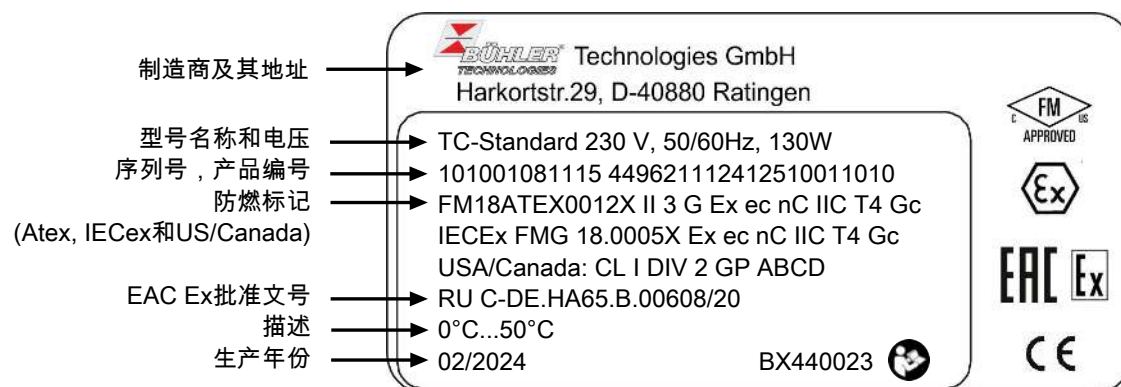
可选的其它组分可以被集成，它们应该存在于每个预处理系统中：

- 用于疏水的蠕动泵，
- 过滤器，
- 检湿器。

因此，带选件的冷却器是高度可配置的。在此是一个通过预装的和用软管连接的组件以具有成本效益的方式简化地建立一个完整系统的方法。此外，注重磨损和消耗部件的拆装方便。

1.3 铭牌

例如:



1.4 供货范围

- 冷凝器
- 产品文档
- 连接或安装配件 (可选)

1.5 订购提示

1.5.1 带换热器的冷却器型号

商品货号将设备配置编号。为此，请使用以下型号代码：

4496	2	1	1	X	2	X	1	X	X	X	0	X	X	X	0	X	0	0	产品特征
																			气体冷却器型号（带1个换热器）
	1																		TC-Standard 6111 X2:环境温度 40 ° C
	2																		TC-Standard 6112 X2:环境温度 50 ° C
																			认证
	2																		适用于易爆性危险区域
																			供电电压
		1																	115 V AC, 50/60 Hz
		2																	230 V AC, 50/60 Hz
		4																	24 V DC
																			换热器
		1	1	0															不锈钢, PTS, 公制
		1	1	5															不锈钢, PTS-I, 英制
		1	2	0															杜兰玻璃, PTG, 公制
		1	2	5															杜兰玻璃, PTG-I, 英制
		1	3	0															PVDF, PTV, 公制
		1	3	5															PVDF, PTV-I, 英制
																			冷凝排除 ¹⁾
			0	0															不带冷凝排除
			1	0															CPsingle X2带软管接头, 有角度的
			3	0															CPsingle X2带接头 ³⁾
																			检湿器/过滤器
			0	0															不带过滤器, 不带检湿器
			0	1															不带过滤器, 1台带适配器PVDF ²⁾ 的检湿器
			1	0															1台过滤器, 不带检湿器
			1	1															1台过滤器, 带集成的检湿器
																			信号输出端
			0	0															仅状态输出
			1	0															模拟输出, 额外4…20 mA
																			三角T型控制器
			0	0															不带三角T型控制器
			1	0															选件 三角T型控制器

¹⁾ 24 V DC CPsingle不被电气连接。

²⁾ 也可购买不锈钢版本。

³⁾ 连接相应的公制或英制换热器。

1.5.2 带一台适用于H2-/O2应用的换热器的气体冷却器型号

商品货号将设备配置编号。为此，请使用以下型号代码：

4496	2	1	1	X	2	X	1	1	X	0	0	0	0	X	0	X	0	X	产品特征
																			气体冷却器型号（带1个换热器）
1																			TC-Standard 6111 X2:环境温度 40 ° C
2																			TC-Standard 6112 X2:环境温度 50 ° C
2																			认证
																			适用于易爆性危险区域
																			供电电压
1																			115 V AC, 50/60 Hz
2																			230 V AC, 50/60 Hz
																			换热器
1 1 0																			-02 不锈钢, PTS-02, 公制
1 1 5																			-02 不锈钢, PTS-I-02, 英制
1 1 0																			-H2 不锈钢, PTS-H2, 公制
1 1 5																			-H2 不锈钢, PTS-I-H2, 英制
																			信号输出端
																			仅状态输出
																			模拟输出4...20 mA, 包括状态输出
																			三角T型控制器
																			不带三角T型控制器
																			选件 三角T型控制器

1.5.3 带两个换热器的冷却器型号

商品货号现将设备配置编号。为此，请使用以下型号代码：

4496	2	1	2	X	2	X	2	X	X	X	0	X	X	X	0	X	0	0	产品特征
气体冷却器型号（带2个换热器）																			
1																			TC-Standard 6121 X2:环境温度 40 ° C
2																			TC-Standard 6122 X2:环境温度 50 ° C
认证																			
2																			适用于易爆性危险区域
供电电压																			
1																			115 V AC, 50/60 Hz
2																			230 V AC, 50/60 Hz
4																			24 V DC
换热器																			
2	1	0																	不锈钢, 2 MTS, 公制
2	1	5																	不锈钢, 2 MTS-I, 英制
2	2	0																	杜兰玻璃, 2 MTG, 公制
2	2	5																	杜兰玻璃, 2 MTG-I, 英制
2	3	0																	PVDF, 2 MTV, 公制
2	3	5																	PVDF, 2 MTV-I, 英制
冷凝排除 ¹⁾																			
0	0																		不带冷凝排除
2	0																		CPdouble X2带软管接头, 有角度的
4	0																		CPdouble X2带接头 ³⁾
检湿器/过滤器																			
0	0																		不带过滤器, 不带检湿器
0	1																		不带过滤器, 1台带适配器PVDF ²⁾ 的检湿器
0	2																		不带过滤器, 2台带适配器PVDF ²⁾ 的检湿器
1	0																		1台过滤器, 不带检湿器
1	1																		1台过滤器, 带集成的检湿器
2	0																		2台过滤器, 不带检湿器
2	1																		2台过滤器, 1台检湿器
2	2																		2台过滤器, 2台检湿器
信号输出端																			
0	0																		仅状态输出
1	0																		模拟输出, 额外4…20 mA
三角T型控制器																			
0	0																		不带三角T型控制器
1	0																		选件 三角T型控制器

¹⁾ 24 V DC CPdouble不被电气连接。

²⁾ 也可购买不锈钢版本。

³⁾ 连接相应的公制或英制换热器。

1.5.4 带两个换热器的冷却器型号

商品货号将设备配置编号。为此，请使用以下型号代码：

4496	2	1	2	X	2	X	1	X	X	X	0	X	X	X	0	0	0	0	产品特征
气体冷却器型号（带2个串联换热器）																			
1																			TC-Standard+ 6121 X2:环境温度 40 ° C
2																			TC-Standard+ 6122 X2:环境温度 50 ° C
认证																			
2																			适用于易爆性危险区域
供电电压																			
1																			115 V AC, 50/60 Hz
2																			230 V AC, 50/60 Hz
4																			24 V DC
换热器																			
1	2	2																	杜兰玻璃, 2x MTG-2, 公制
1	2	7																	杜兰玻璃, 2x MTG-2-I, 英制
1	3	2																	PVDF, 2x MTV-2, 公制
1	3	7																	PVDF, 2x MTV-2-I, 英制
冷凝排除 ¹⁾																			
																			0 0
																			2 0
																			4 0
CPdouble X2带软管接头, 有角度的																			
CPdouble X2带接头 ³⁾																			
检湿器/过滤器																			
																			0 0
																			0 1
																			1 0
																			1 1
1台过滤器, 不带检湿器																			
1台过滤器, 带集成的检湿器																			
信号输出端																			
																			0 0
仅状态输出																			
																			1 0
模拟输出, 额外4...20 mA																			

¹⁾ 24 V DC CPdouble不被电气连接。

²⁾ 也可购买不锈钢版本。

³⁾ 连接相应的公制或英制换热器。

2 安全提示

2.1 重要提示

提示



该设备经认可适用于易爆区域。

仅当符合以下条件时，才允许使用设备：

- 于安装使用说明书中所述的条件下使用，依铭牌且为规定的用途使用本产品。未经授权修改设备时，比勒科技有限公司不承担任何责任，
- 遵守铭牌上的说明和标记，
- 遵循于数据页和说明书中规定的限值，
- 已正确连接了监控设备/保护装置，
- 未在本说明书中描述的维护和维修工作应由比勒科技有限公司进行，
- 使用原装配件。

于易爆区域安装电气装置须遵循所在国的规定：

- IEC/EN 60079-14
- 美国国家电气规程（NEC）
- 加拿大电气规范（CEC）

必须遵照有关调试、运行、维护和废弃处理的其他国家法规。

本操作说明书是设备的一部分。制造商保留更改性能、规格或设计数据的权利，恕不另行通知。请保管好本说明书以备后用。

各种安全警告的定义

危险

提示有紧急危险情况的标识，如不避免会引起重度身体损伤或者直接死亡。

警告

提示有中度风险的危险情况的标识，如不避免可能会引起重度身体损伤或者死亡。

注意

提示有低风险的危险情况的标识，如不避免可能会引起设备损伤或轻微至中度的身体损伤。

提示

提示设备或仪器重要信息的标识。

警告标志

在本手册中，使用以下警告标志：



常规性警告标志



常规性提示标志



电压警告



请拔出电源插头



吸入有毒气体危险警告



请使用呼吸保护器



腐蚀性物质警告



请使用面部防护装置



由爆炸导致的危险警告



请使用手套



灼热表面警告

2.2 常规性危险提示

仅能由熟悉安全要求和风险的专业人员安装该设备。

请务必遵守安装地相关的安全法规和普遍适用的技术规则。请预防故障发生，避免人身伤害和财产损失。

设备操作员必须确保：

- 安全提示和操作说明书可供翻阅并予以遵守，
- 遵守国家有关事故预防条例，
- 不得超过允许的数据并遵循适用条件，
- 使用保护装置和进行规定的维护工作，
- 弃置处理时，遵守法例条文，
- 遵守有效的国家安装规定。

维护和修理

进行维护和修理工作时，须注意以下几点：

- 必须由比勒授权的人员进行设备维修工作。
- 仅进行在操作和安装说明书中描述的改造、维护与安装工作。
- 仅使用原装备件。
- 请勿安装已损坏的或有缺陷的备件。如有必要，请在安装前进行目视检查，以检查备件是否有明显损坏。

在进行任何类型的维护工作时，必须遵守使用国家相关的操作规程和安全指令。

危险 	电压 有触电的危险 a) 在进行所有作业时，断开设备电源。 b) 确保设备不会意外地再次开启。 c) 仅能由训练有素的人员打开设备。 d) 注意电源电压是否正确。	
危险 	有毒、腐蚀性气体/冷凝物 样气/冷凝物有可能危害健康。 a) 必要时，请确保安全地疏导气体/冷凝物。 b) 进行任何维护或维修工作前，请中断气体供给。 c) 维护时，请保护自己免受有毒/腐蚀性气体/冷凝物侵害。请穿戴适当的防护设备。	  
危险 	爆炸危险 不当使用情况下的气体泄漏引起的爆炸危险和生命危险。 a) 请仅依本说明书中描述般使用设备。 b) 请注意工艺条件。 c) 检查管道的密封性。	
警告 	破碎危险 a) 请保护好设备，免其受到撞击。 b) 防止坠落物损害设备。	

3 运输和储存

只应在原包装或合适的替代包装中运输产品。

在不使用时，应对设备加以保护，防止其受潮受热。必须将其储存于-20° C至60° C（-4 ° F bis 140 ° F）下的封顶的、干燥且无尘的室内。

特别是对于用于O₂应用的带有不锈钢换热器的样气冷却器（后缀-02），必须排除在储存过程中与介质接触的组件的任何污染。

4 安装和连接

4.1 安装地点要求

该设备被设计安装于封闭的空间内，作为壁挂式仪器使用。户外使用时，必须提供足够的全天候保护。

请如此安装本设备，使冷却器下方有足够的空间以排除冷凝物。上方为气体供给安排一定的空间。

须确保不超出允许的环境温度范围。冷却器的对流不得受到阻碍。通风口至下一个障碍物间必须留有足够的空间。特别是在空气出口侧，必须保持至少10 cm 的距离。

若安装在封闭的外壳，如分析柜中，须确保足够的通风。若对流不充分，我们建议您用空气冲洗机柜，或设置一个风扇来降低内部温度。

注意



清洁部件的污染

出于防火原因，在处理与介质接触的组件时，必须排除用于O₂应用的带不锈钢换热器的样气冷却器（-O2后缀）的油、油脂、灰尘、颗粒、棉绒、头发等污染。如有必要，请调整您的操作和组织措施，包括要使用的工作服、卫生法规等。如有必要，请将工作迁至合适、污垢较少的工作区域。



4.2 安装

请倾斜铺设至冷却器的气体供给管道。进气口被标记为红色，且另标有“IN”。

若大量出现冷凝物，我们建议使用一个带自动排水阀的脱水罐。为此适用我们的冷凝水分离器11 LD V38、AK20、AK 5.5或AK 5.2型号。

须将冷凝排除用的玻璃容器和自动疏水罐安装于设备的外部下方。当使用自动疏水罐时，须将气泵安装于冷却器的上游（压力驱动），否则不能保证疏水罐正常运行。

若气泵位于冷却器的出口处（抽吸操作），建议使用玻璃制冷凝水收集器或使用蠕动泵。

对于高纯度水或氧气选项（-H2/-O2后缀），单独包装提供组件。这些只能在使用前不久打开包装，以防止弄脏。

附加铭牌-H2的安装规定：

为了对H₂应用中换热器的泄漏测试进行跟踪，请在调试前将随附的附加铭牌在适当的位置。贴在冷却器外壳上时，不得有任何开口，不允许与其他贴纸或部件重叠，最小间距20 mm。

注意



充电警告（-H2）

当应用于冷却器时：
必须按照安装规定将随附的换热器附加铭牌粘在散热器上。

4.2.1 连接气路连接过滤器 (可选)

换热器的输出端和过滤器的输入端之间未整体通过软管连接。须使用合适的螺纹套管接头仔细且专业地连接气体出口处的G1/4或NPT 1/4“接头（过滤器的头上标示有NPT）”。

若订购冷却器时选择了无检湿器的过滤器，过滤器头部可能连有一个旁路。

过滤头上设有一G¼内螺纹，出厂时已以塞子封住。欲使用它，请旋下塞子并拧入一颗合适的螺纹套管接头。请注意是否泄漏。

提示



通过安装过滤器，系统中的最大允许工作压力受到限制！
工作压力 ≤ 2 bar

4.2.2 连接 流量适配器 (可选)

若订购冷却器时选择了无过滤器的检湿器，该冷却器出厂时已被安装于一个流量适配器中。

换热器的输出端和流量适配器的输入端之间未整体通过软管连接。须使用合适的螺纹套管接头仔细且专业地连接气体出口处的G1/4或NPT 1/4“接头（流量适配器上标示有NPT）”。在此，流动方向无关紧要。

4.2.3 连接检湿器 (可选)

若订购冷却器时选择了 检湿器，该冷却器出厂时已被安装于一个流量适配器中或选购了过滤器时已被安装并连接于过滤头上。

4.2.4 连接蠕动泵 (可选)

若您订购了带有蠕动泵的冷却器，该泵已经安装和接线。随附订购的换热器已被安装并连接到蠕动泵。

须仔细、专业地使用合适的软管和管夹连接泵的冷凝物出口用的接口 $\phi 6$ 。

带螺纹连接DN 4/6或1/6 “-1/4” 的型号配有夹紧环和锁紧螺母，必须使用合适的软管小心连接。

提示



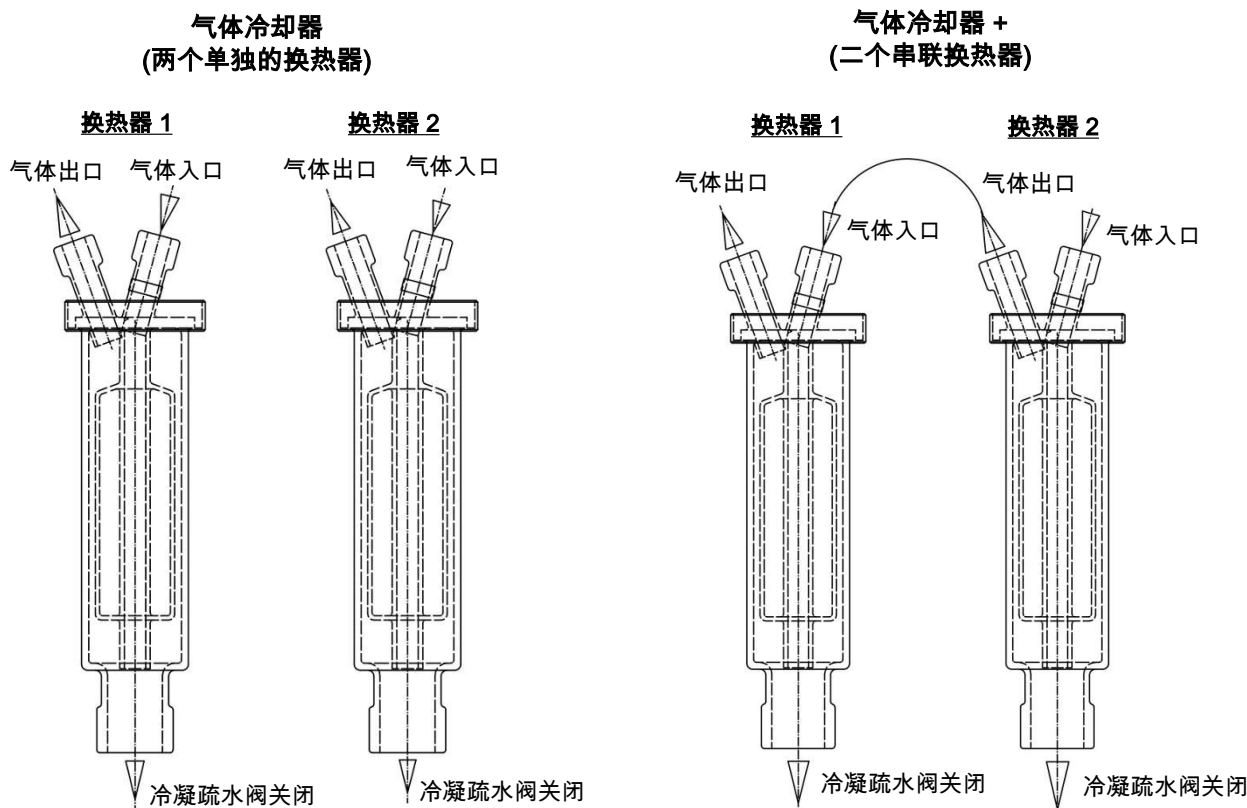
通过安装蠕动 泵CPsingle / CPdouble，系统中的最大允许工作压力受到限制！
工作压力 ≤ 1 bar

4.2.5 连接换热器

左图中示意性地示出了（两个）单独的换热器的连接。

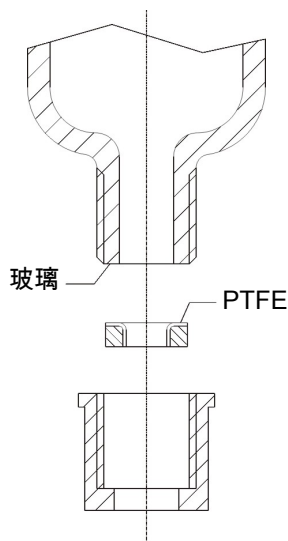
为了最大限度地减少在冷却器中的气体洗出，两个（结构相同的）换热器必须彼此串联运行（右图）。为此可以采取如下措施：

1. 换热器2上的以红色标记的气体入口处的的气体输入管线（预冷）。
2. 换热器2的气体出口与换热器1的以红色标记的气体入口之间的连接线（后冷却）。
3. 在换热器1的气体出口处安装最终的气体输出线。



进气口已被标记为红色。

若使用由玻璃制的换热器，在连接气体管线时，请确保密封件位置正确（见图）。密封件由一个带PTFE垫片的硅环构成。PTFE一面须朝向玻璃螺纹。



对于不锈钢换热器，在选择螺旋接头时必须考虑适当的扳手宽度。

连接气体PTS/PTS-I: SW 14或9/16 “

冷凝水排水管PTS/PTS-I: SW 22

4.2.6 疏水罐连接

取决于材料种类，在换热器与疏水罐间须建立一条由螺纹套管接头与管道或软管构成的连接。若连接管为不锈钢制，可将疏水罐直接悬挂于连接管上，若连接管为软管，须借助于一个夹具将疏水罐单独固定。

可将疏水罐直接连接于换热器上。

对于高纯度氧气选件，请确保选择带有 -02后缀的。

如果 11 LD V 38型疏水罐用于高氢气浓度，则必须对安装它的系统进行泄漏测试。

原则上，须以一定斜率并以最小内直为 6 mm (1/4 “)的管道铺设冷凝排除线。

换热器MTG（在带2个换热器的冷却器中）仅能与蠕动泵一同运行。

4.3 电气连接

操作人员必须为设备安装一个外置分离器，该装置明显地归入设备。

此分离器

- 必须位于设备附近，
- 必须方便用户触及，
- 必须符合IEC 60947-1与IEC 60947-3标准，
- 必须断开所有电源连接和状态输出的载流导体且
- 不得安装于电力线上。

必须根据技术数据中的规格保护设备的电源。

电位均衡/静电

静电会引起易燃火花。避免静电。冷却器的所有导电部件都必须接地！

在外壳上须为接地/电位补偿导体连接一个接头。请为外壳进行足够接地（导体截面至少4 mm²）。

请尤其确定满足EN 60079-14的要求！

警告



危险的电压

仅能由训练有素的专业人员执行线路连接。

注意



错误电压危险

错误的电压会毁坏设备。
正确的电压可以从铭牌上看到。

警告



高电压

进行绝缘测试时将损坏设备
请勿在 **整个设备上以高压进行** 抗电强度试验！

抗电强度试验

本设备配备了大量的EMC防护措施。出厂时，已进行了必要的测试（取决于批准，测试电压为2.1 kV和2.55 kV DC）。

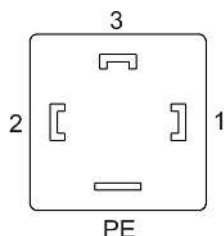
若您想亲自再次测试抗电强度，请在整个设备上。仅使用指定值和直流电压检查设备。用交流电压进行抗电强度试验时，电子元件将受损。推荐电压为2.1 kV DC，2 s。测试前，断开设备的所有电源线。可以直接通过电源连接施加电压。

通过接头连接

本设备配备了分别用于供电和信号输出的EN 175301-803接头各一个。正确连接电缆时，须将各接头无混淆危险地连接。因此，请确保该接头于连接电缆后再次得以妥善连接。随后须说明布线情况，数字应与接头上的相对应。

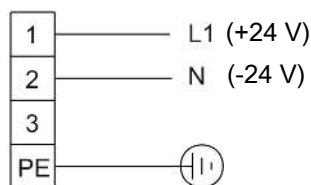
电源线的横截面必须与额定电流相适应。使用的电缆的横截面至多为1.5mm² (AWG 16) 和一根直径为8-10 mm (0.31 - 0.39 英寸) 的电缆。

插头编号

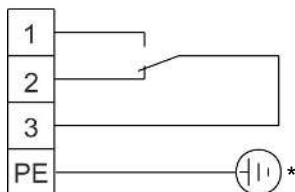


电源连接S1

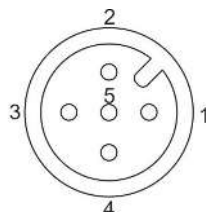
115/230 V (24 V DC)



状态输出 S2 *



模拟输出 S3



- 1-未被占用
- 2-未被占用
- 3- GND
- 4-4-20mA out
- 5- 屏蔽

* 在电压 ≥ 33 V AC或 ≥ 70 V DC 下使用状态输出时请接地（PE）。

卡紧区的直径为8 - 10 mm (0.31 - 0.39英寸)。

4.4 信号输出端

本设备具有各种状态信号。状态输出端的最大断流容量各为250 V AC/150 V DC，2 A，50 VA。

当冷却器的温度超出规定范围，将通过状态输出（S2）引发报警。不会显示警报是由于过热还是低温而触发。

前面板包括三个LED：

颜色	标题	功能
红色	S2	超过/低于温度，设备出错
黄色	S1	---
绿色	OP	正常运行

OP和S2的LED灯指示类似于状态输出S2的设备状态。

若“温度信号”选项已集成，便能显示与冷凝器的模拟输出的实际温度对应的信号。

若已安装了检湿器（可选），当处理过的样气中含有湿气或检测到电缆断裂时，将通过状态输出（S2）引发报警。不能区分报警器/电缆断裂是由检湿器1或2引起。此信息将出现在显示屏上。

可通过带M12x1接口的内置插头（S3）删除该温度信号。此接口位于冷却器顶部的检湿器用端口的旁边。

对信号输出端的描述

	功能/接触	描述
至S2)	内部转换触点: 大 250 V AC/150 V DC, 2 A, 50 VA	通过两个开关输出端可标记以下设备状态: 触点3与2间已闭合 (警报) – 无电源电压和/或温度实际值已超过已设定的阈值 触点3与1间已闭合 (正常) – 已施加电源电压 + 实际温度在设定的阈值之内 带检湿器为选件 触点3与2间已闭合 (警报) – 检湿器确认样气中的残留水分或电缆断裂: 错误消息 触点1与3间已闭合 (正常) – 样气中无残留水分/电缆未断裂
至S3)	4-20 mA 模拟输出 (R _{负载} <500Ω)	实际温度的信令 (请使用屏蔽 电缆) T _{冷凝器} = -20 °C Δ (-4 °F) -> 4 mA/ 2 V T _{冷凝器} = 5 °C Δ (41 °F) -> 9 mA/ 4,5 V T _{冷凝器} = 60 °C Δ (140 °F) -> 20 mA/ 10 V

5 运行和操作

提示



禁止不合规操作设备！

开启冷凝器后，可看到冷却板的温度显示。指示灯闪烁，直至块温度达到设定值（±可调报警范围）。状态触头在报警位置。若已达到设定温度范围，温度将被持续地显示，且状态触头被切换。若在运行过程中，显示屏闪烁或出现错误消息，请查阅“故障排除”一节。功率数据和边界值请参照数据页。

5.1 功能描述

冷却器的控制装置由微处理器实现。通过出厂预设，控制器已考虑到内置的换热器的不同特征。

可编程显示器根据所选择的显示单元（°C / °F）显示块温度（出厂 °C）。可以借助5个键，轻松地进行菜单驱动的应用程序相关的个别设置。这适用于目标出口露点，它可以被设置为2至20 °C（36至68 °F）（出厂5 °C/41 °F）。

其次，可以调节低温或过热的警告阈值。可相对于设定的出口露点 τ_a 设置这些。

低温时，有在 $\tau_a -1$ 至 -3 K（至少 1 °C / 34 °F 冷却块温度）的区间可用，过热时，有在 $\tau_a +1$ 至 $+7$ K 的区间可用。两值的出厂设置为3 K。

超越或低于设定的报警区域（例如，在接通后）时，由显示灯闪烁以及由状态继电器指示。

状态输出可以，例如，用于控制样气泵，以使仅当达到允许的冷却区域时接通气流或在检湿器警报时关闭泵。

分离出冷凝物可以通过连接蠕动泵或安装的自动疏水罐排出。

此外，可装配精细过滤器，可选的检湿器被集成于其中。

很容易透过玻璃罩看到过滤器元件的污染。

只须拆下检湿器。若因故障，水冲入冷却器中，且蠕动泵或自动疏水罐不能将其排出时，可能有必要。

5.2 选件 三角T型控制器

并非所有应用都需要5 °C（41 °F）的出口露点。对于一些应用，较高的露点已足够。在其它应用中，不取决于一个稳定的出口露点，若气体为干燥，即出口露点足够多地低于环境温度已足够。

在此，电子装置测量环境温度并调节出口露点到一个可调的、低于环境温度的数值。以此，可将可能的制冷功率延伸到换热器的界限。须注意，出口露点随环境温度变化，不可将一个稳定的露点作为测量的前提。

目标温度范围由环境温度、可调节温度差和报警限值限定。三角T型控制器活跃时，或块温度不在目标温度范围内，在显示屏上闪烁出现状态消息“dt”。

例如：对于设定的5 °C（41 °F）的出口露点，30 °C（30 K/54 °F）的差值意味着，在低于约35 °C（95 °F）的环境温度下露点是稳定的，并只对环境温度峰值在35 °C（95 °F）以上时，相对于环境温度的安全降温才有优先权。然后，超过35 °C（95 °F）时，冷却功率曲线中标注的35 °C（95 °F）时的冷却功率可用。

5.3 菜单功能操作

就操作原理的简要阐释：

仅需通过5个按键操作。它们有以下功能：

按键	区域	功能
← 或 OK	显示器	– 从测量值显示切换至主菜单
	菜单	– 选择已显示的菜单项
	输入	– 采用或选择一个编辑过的值
▲	显示器	– 临时切换至另一种测量值显示（若选项可用）
	菜单	– 向后翻页
	输入	– 增加值或在选择中翻页 – 此处适用： – 按键1 x 按下 = 一步地改变参数/值； – 按住按键不放 = 快速运行（仅数值） – 显示闪烁：变更了的参数/值 – 显示不闪烁：原先的参数/值
▼	显示器	– 临时切换至另一种测量值显示（若选项可用）
	菜单	– 向前翻页
	输入	– 减少值或在选择中翻页
ESC	菜单	– 返回上级菜单
	输入	– 返回目录 将不保存更改！
F 或 Func		– 确定收藏夹菜单。 （提示：即使启用菜单锁，收藏夹菜单仍可被调出！）

5.3.1 菜单锁定

为了防止意外改变设备的设置，可锁定某些菜单。为此目的，必需确立代码。您如何设定或取消菜单锁定，见菜单项 **toP > L0c**下的菜单“全局设置”（**toP**）。

交付时，未开启菜单锁定且所有菜单项可用。

当开启菜单锁时，若未输入正确的密码，只有下列项目可见：

菜单项	注释
toP > unit	选择显示的温度单位（° C 或 ° F）。
F或Func.	调出收藏夹菜单
	提示! 此菜单可出自通常锁定的区域。

5.3.2 菜单导航概述

若您在正常模式下按下**OK**键，当开启菜单锁定时，在显示器上显示提示输入code。以按键▲和▼输入正确的代码并按下**OK**。输入不正确或无输入时，不可取消菜单锁，您不能使用所有菜单项。

若您忘记了密码，请随时输入主代码287入菜单，以禁用菜单锁定。

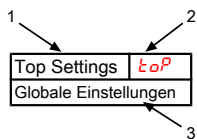
菜单结构的概览见下图。

只有当已采用适当的设置或状态消息存在时，划成虚线的加框的点才会显示。

标准出厂设置和设置区域于概览中以及在相应的菜单项中给出。出厂预设适用，除非另有约定。

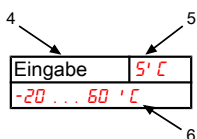
您可以按下按键**ESC**中断输入与菜单选择，不对其保存。

菜单：

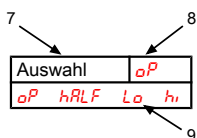


1. 菜单名称
2. 显示器
3. 简要说明

参数：

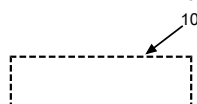


4. 输入一个值
5. 出厂设置
6. 参数范围



7. 从值列表中选择
8. 出厂设置
9. 参数范围/选择

可选的菜单导航：



10. 虚线框 = 选项

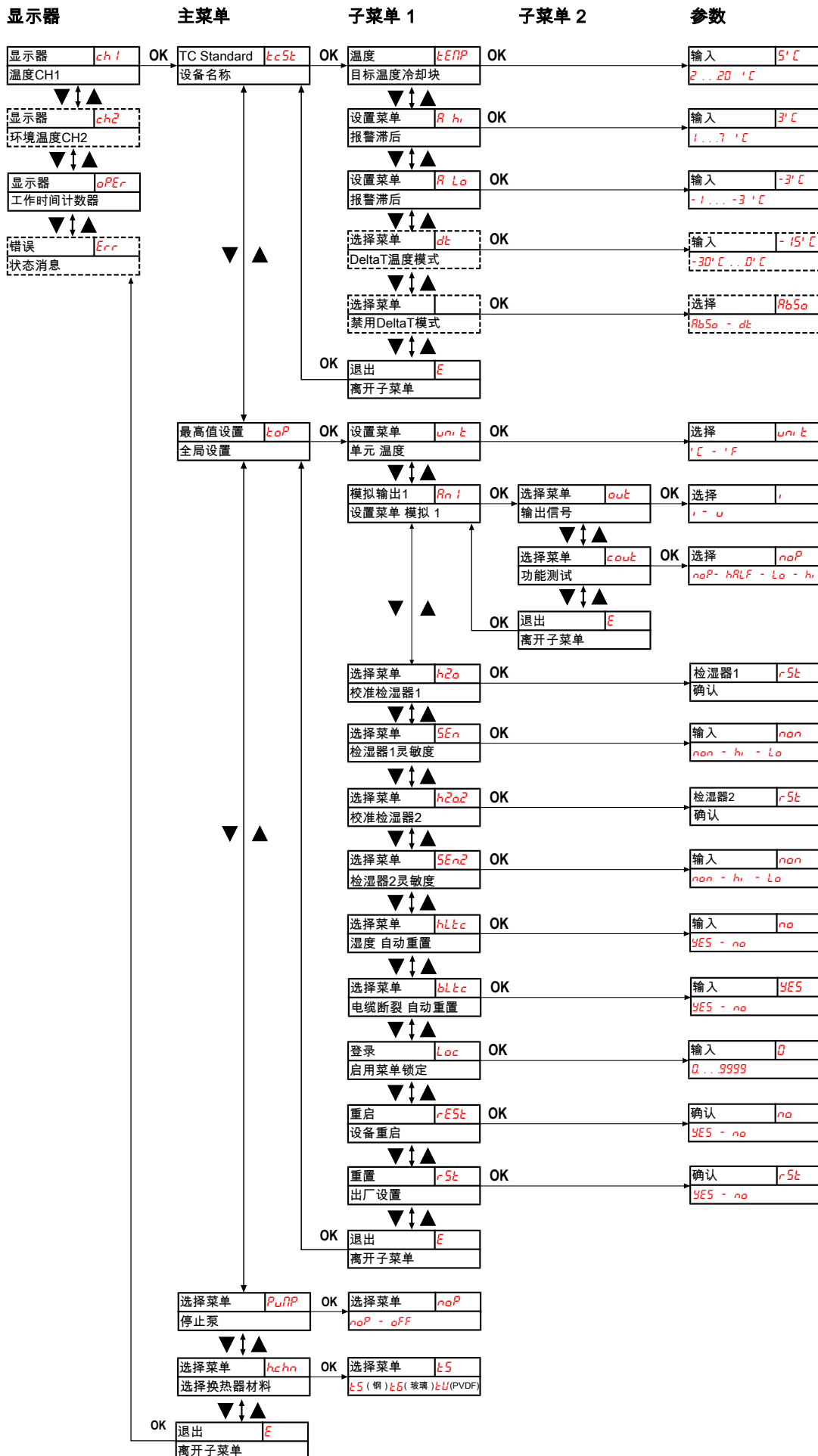


图1: 菜单概览TC Standard

5.4 菜单功能说明

5.4.1 显示菜单

测量显示 块温度

显示 → **chl**



取决于设备状态，温度会持续、闪烁或与状态消息交替显示。

测量显示 环境温度

显示 → **ch2**



该显示仅适用于带有“Delta-T”选项的设备。取决于设备状态，温度会持续、闪烁或与状态消息交替显示。

显示设备运行小时数/时间

显示 → **oper**

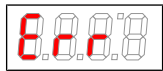


显示设备运行时间设备运行时间无法被复位，可以以各种显示格式输出。要显示/退出运行时间显示，必须按下“Enter”按键。

- **yy.mm** - 以年和月表示（默认）
- **mth** - 以月表示
- **weeh** - 以周表示
- **days** - 以日表示
- 一个月相当于30日。通过按下“F”键，可以在显示形式之间切换。在显示屏中，所选格式可以首先读取为短文本，然后读取持续时间。

错误代码显示

显示 → **err**



如果发生非操作性错误/设备故障，显示的错误号将指示可能的原因和补救措施。

5.4.2 主菜单

珀耳帖冷却器TC-Standard

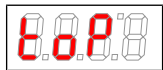
显示 → **tc.st**



从此处可到达设定冷却器的目标温度和容差范围（报警阈值）。

全局设置

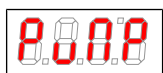
显示 → **toP** (ToP Settings)



在此菜单中，将对冷却器进行全局设置。

蠕动泵

显示 → PuMP



开启及关闭蠕动泵。

参数范围: NoP, oFF

出厂设置: NoP

提示: 状态切换, „PUMP“ 闪烁。

选择换热器材料

显示 → h. chn



选择换热器材料

参数范围: tS (钢), t6 (玻璃), tU (PVDF)

出厂设置: tS (不带换热器的冷却器), 或根据配置的相应材料

退出主菜单

显示 → E



选择该项, 将返回到显示模式。

5.4.3 子菜单 1

目标温度

显示 → 冷却器 → temp



此设定为冷却器温度设定值。

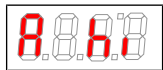
参数范围: 2 ° C至20 ° C (35.6 ° F至68 ° F)

出厂设置: 5 ° C (41 ° F)

提示: 温度改变时, 显示屏将在必要时闪烁, 直到达到新的工作区间。
当键盘上锁时, 该菜单项不可见。

报警上限

显示 → 冷却器 → A Hi (高限报警)



此处可对可视化警报及状态继电器设置上限阈值。报警阈值基于设定的冷却器温度。

参数范围: 1 ° C至7 ° C (1.8 ° F至12.6 ° F)

出厂设置: 3 ° C (5.4 ° F)

提示: 当键盘上锁时, 该菜单项不可见。

报警下限

显示 → 冷却器 → A Lo (低限报警)



此处可对可视化警报及状态继电器设置下限阈值。报警阈值基于设定的冷却器温度。

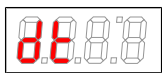
参数范围: -1 ° C至-3 ° C (-1.8 ° F至-5.4 ° F)

出厂设置: -3 ° C (-5.4 ° F)

提示: 当键盘上锁时, 该菜单项不可见。

DeltaT

显示 → 冷却器 → dt



在此，可以调节与环境温度的目标差。

参数范围: -30 K...0 K

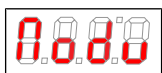
出厂设置: -15 K

提示: 当键盘上锁时，该菜单项不可见。

若块温度不在目标温度范围内，在显示屏上闪烁出现状态消息“dt”。

DeltaT模式

显示 → 冷却器 → Modu



在此可启/禁用DeltaT模式。

参数范围: AbSo , dt

出厂设置: Abso (正常模式)

提示: 当键盘上锁时，该菜单项不可见。

退出子菜单 1

显示 → 子菜单 → E

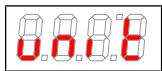


通过选择，返回到主菜单。

5.4.4 子菜单 1 (全局设置)

单元 温度

显示 → toP → unit



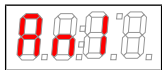
在此，可选择温度显示单元。

参数范围: 'C, 'F

出厂设置: 'C

模拟输出

显示 → toP → An1

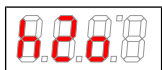


在此子目录中，将设定模拟输出 1，见 子菜单 2（模拟输出 1）章节。

提示: 当键盘上锁时，该菜单项不可见。

校准检湿器

显示 → toP → h2o



若安装有检湿器，可在此进行校准。须以干气冲洗设备。

提示: 出厂前，曾以环境空气进行过校准。更换检湿器后，有必要重新校准。

欲校准检湿器，将菜单sEn设置为 hi。

当键盘上锁时，该菜单项不可见。

若在设置中集成了多台检湿器，它们在菜单中会被编号。在其中，h2o代表第1台，h2o2代表第2台检湿器。同样地也适用于在菜单sEn中设置传感器的灵敏度。

检湿器的灵敏度

显示 → toP → SEn



若安装有检湿器，在此该检湿器的灵敏度可能降低。

参数范围: hi: 高灵敏度
Lo: 低灵敏度
non: 无检湿器

出厂设置: hi

提示: 当键盘上锁时，该菜单项不可见。

检湿器: 湿气侵入后手动或自动复位

显示 → toP → hLtc

(hLtc = 湿度锁存)。该设置适用于所有连接的检湿器。



确定湿气侵入的消息是否被手动重置或在干燥传感器后自动复位。

参数范围: YES: 由用户重新启动设备前，该状态被标记，泵被重新激活。
no: 状态消息将被自动重置/若未检测到湿气，泵被重新开启。

出厂设置: no

提示: 当键盘上锁时，该菜单项不可见。

检湿器: 电缆断裂后自动复位

显示 → toP → bLtc

(bLtc = 断线闭锁)。该设置适用于所有连接的检湿器。



确定电缆断线报警是否手动复位或当测量信号有效时，自动消失。

参数范围: YES: 由用户重新启动设备/确认错误前，该状态被标记，泵被禁用。
no: 若检测到检湿器，错误信息消失/泵被重新开启。

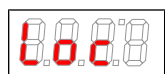
出厂设置: YES

提示: 当键盘上锁时，该菜单项不可见。

菜单锁定

如果你想防止未经授权的访问菜单，输入锁码的值。为此，只有输入正确的密码，才能达到某些菜单项。

显示 → toP → Loc



通过此设置可取消或激活菜单锁。

参数范围: 0 至 9999

出厂设置: 0 (取消键盘锁定)

提示: 当键盘上锁时，该菜单项不可见。

重启

显示 → toP → rEst

(rEst = 重启)



该设备将重新启动，所有的设置仍得到保留。所有的错误信息都被复位。
检湿器将不依赖于菜单 h.Ltc 和 h.Moi 中的设置被复位。

参数范围: YES: 执行重启。显示屏显示设备的软件版本，并返回到测量值显示。
no: 无需重启离开菜单。

提示: 用户设置得以保留。

出厂设置

显示 → toP → rst



通过此设置可恢复出厂设置。

参数范围:

Yes: 已恢复出厂设置。

No: 不保存更改离开菜单。

出厂设置:

No

提示:

当键盘上锁时, 该菜单项不可见。

退出子菜单 1

显示 → 子菜单 → E



通过选择, 返回到主菜单。

5.4.4.1 子菜单 2 (模拟输出 1)

在模拟输出端, 给出冷却器的实际温度。

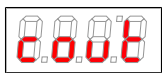
信号行为

在正常模式下 (noP), 在测量点给出实际温度。为了测试, 恒定值 hi, Lo 或 hALF 可被生成。在此, 在模拟输出端有一个恒定的信号等候处理, 其值在表中给出。

常量	电流输出 4 - 20 mA	电压输出 2 - 10 V
hi	20 mA	10 V
Mi	12 mA	6 V
Lo	4 mA	2 V
noP	4 - 20 mA	2 - 10 V

在测试完信号行为后, 请务必调至正常模式 (noP)。

显示 → toP → An1 → cout



在此设置中, 将确定如何模拟输出。

参数范围:

noP = 操作 (普通模式), hi, Lo, hALF

出厂设置:

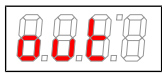
noP

提示:

当键盘上锁时, 该菜单项不可见。

选择 -> 输出信号

显示 → toP → An1 → out



选择输出信号的方式。

参数范围:

i 状态输出 4... 20 mA

u 状态输出 2...10 V

出厂设置:

i

提示:

在更改设置前断开测量设备电源!

当键盘上锁时, 该菜单项不可见。

退出子菜单 2

显示 → toP → An1 → E



通过选择, 返回到子菜单 1。

5.4.5 确定收藏夹菜单

以按键**F**或**Func**（功能键）您可确定一份收藏夹菜单，以后只需轻轻一按即可到达。

- 请调用您欲设为收藏的菜单。此菜单是否可被锁定并不重要。
- 请您按功能键的时长大于3 s。
当前的菜单已确定为收藏。在显示器上短暂地出现消息**FunC**。
- 以**ESC**或**E** (Exit)回到显示。

若您欲调用收藏夹菜单，请按下**F**或**Func**键。

提示! 即使启用菜单锁，收藏夹菜单仍可被调出。

6 保养

冷却器的基本版不需要特殊保养。

然而，取决于冷却器的类型，可包括不同的选件。此时，必须定期进行下列保养工作：

- **选件蠕动泵：**检查软管
- **过滤器为选件：**检查过滤元件
- **选件检湿器：**校准检湿器

进行维护工作时，须注意以下几点：

- 仅能由熟悉安全要求和风险的专业人员维护设备。
- 请您仅执行于本操作和安装说明书中描述的维护。
- 进行保养工作时，请遵循所有相关的安全和管制信息。
- 请仅使用原厂备件。
- 对于高纯度水或氧气选件，仅使用后缀为 -H2或-O2的明确的替代品。

危险

电压



有触电的危险

- 在进行所有作业时，断开设备电源。
- 确保设备不会意外地再次开启。
- 仅能由训练有素的人员打开设备。
- 注意电源电压是否正确。



危险

有毒、腐蚀性气体/冷凝物



样气/冷凝物有可能危害健康。

- 必要时，请确保安全地疏导气体/冷凝物。
- 进行任何维护或维修工作前，请中断气体供给。
- 维护时，请保护自己免受有毒/腐蚀性气体/冷凝物侵害。请穿戴适当的防护设备。



7 服务和维修

若操作过程中发生错误，在此章节中，您可找到就故障诊断和消除的提示。

必须经由比勒授权人员进行设备维修。

若您有任何疑问，请联系我们的客服：

电话：+49-(0)2102-498955 或您当地的销售代表

有关我们的维护和调试个性化服务的更多信息，请访问 <https://www.buehler-technologies.com/service>。

若在消除故障并接通电源后仍不能正常工作，须由制造商检查该设备。为此，请以合适的包装将设备发送至：

Bühler Technologies GmbH

– 维修/服务 –

Harkortstraße 29

40880 Ratingen

Deutschland

对于用于H₂-/O₂应用的设备，请关闭气体和冷凝水路径或将其不带接液部件地完全寄回。

请将填写并签署好的RMA—去污声明—放入包装。否则您的维修委托将不予处理。

该表格位于本手册的附录中，但也可通过e-mail另行索取：

service@buehler-technologies.com

7.1 故障诊断与排除

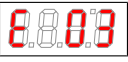
问题/故障	可能的原因	补救
气体出口中有冷凝物	– 冷凝物收集容器已满	– 倒空冷凝水收集容器
	– 在自动疏水罐中阀或许被卡住	– 双向冲洗
	– 冷却器已过载	– 遵从限制参数
减少了的气流量	– 气路堵塞	– 卸下并清洗换热器
		– 必要时更换滤芯
过热	– 冷凝输出口冻结	– 寄回设备
	– 未达到工作点	– 等待（最多20分钟）
	– 虽然冷却器运转，制冷功率过低	– 请务必确保通风槽未被盖住（热量堆积）
	– 过高流量/过高露点/过高气体温度	– 遵循极限参数/装备脱水罐
过热	– 内置风扇停转	– 检查并在必要时更换
	– 控制器损坏	– 寄回冷凝器

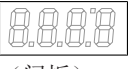
7.1.1 显示屏上有错误信息

若出现错误，将在显示器上显示“Err”。通过按下“▲”键，显示错误编号。

发生故障后，将显示错误消息，直到设备重新启动，或通过按下“Func”键确认了错误。仅当故障条件不存在时，才能确认。

原因/补救:下面列出了各错误最可能的原因和应对措施。若上述措施不能奏效，请联系我们的客服:

问题/故障	可能的原因	补救
无显示	- 无电压 - 连接线散落 - 显示器损坏	- 检查电缆 - 检查保险丝 - 检查连接
 D1. 02 (永久)	(显示显示器的软件版本)。 - 无至控制器的通讯	检查连接
 错误	存在一个错误	读出上述错误编号
 错误01	控制器故障	- 确认错误 (暂时中断) - 切断电源约5s - 联系服务
 错误03	微控制器故障/ MCP2	联系服务
 错误04	EEPROM错误	联系服务
 错误22	检湿器1电缆断裂	- 检查检湿器线缆 - 检查检湿器
 错误32	检湿器2电缆断裂	- 检查检湿器线缆 - 检查检湿器
 错误40	温度传感器1一般错误 (块温度)	传感器可能损坏
 错误41	温度传感器1低温/短路	检查温度传感器连接
 错误42	温度传感器1过热/短路	检查温度传感器连接
 错误43	温度传感器1测量值波动	检查温度传感器连接
 错误50	温度传感器2一般错误 (Delta-T参考温度)	传感器可能损坏
 错误51	温度传感器2低温/短路	检查温度传感器连接
 错误52	温度传感器2过热/短路	检查温度传感器连接
 错误53	温度传感器2测量值波动	检查温度传感器连接

状态文本	可能的原因	补救
 H2o. 1	– 检湿警报 检湿器1	– 干燥 – 检查冷凝物收集容器
 H2o. 2	– 检湿警报 检湿器2	– 干燥 – 检查冷凝物收集容器
 init	– 初始化阶段	– 服务
 PuMP	– 已禁用泵	– 于菜单中再次启用泵
 dt	当时三角T型控制器活跃时：块温度不在限定的温度范围内。 – 冷却器尚处于起动阶段 – 环境温度波动 – 冷却功率不足	– 等候，是否达到目标温度 – 检查环境温度/ 引入的功率 – 流程相关：调整报警域值
 (闪烁)	– 过热/过冷	– 见“故障诊断与排除”章节

7.2 安全提示

- 不得在其规格之外运行本设备。
- 必须由比勒授权的人员进行设备维修工作。
- 请仅进行于本安装与操作说明书中描述的改造、维护或安装工作。
- 请仅使用原厂备件。

对于用于O₂应用的带不锈钢换热器的样气冷却器（-O2后缀），在进行维护工作时，对避免污染有特殊要求：

仅使用清洁且未被损坏的工具。我们建议使用不起毛的清洁布进行清洁，最好预先浸泡在异丙醇和软化水的混合物中，以实现无残留的脱脂。

为H2-/O2冷却器仅使用清洁的原厂备件（参见章节 替换件 和 适于带-H2-/O2换热器的耗材和附件）。

请勿使用原包装损坏的部件。

仅当压缩空气至少符合ISO 8573-1:2010的2级时，才被允许使用。

危险

电压

有触电的危险



- 在进行所有作业时，断开设备电源。
- 确保设备不会意外地再次开启。
- 仅能由训练有素的人员打开设备。
- 注意电源电压是否正确。



危险

有毒、腐蚀性气体/冷凝物

样气/冷凝物有可能危害健康。



- 必要时，请确保安全地疏导气体/冷凝物。
- 进行任何维护或维修工作前，请中断气体供给。
- 维护时，请保护自己免受有毒/腐蚀性气体/冷凝物侵害。请穿戴适当的防护设备。



注意**换热器泄漏的健康危害**

换热器中充满了基于乙二醇的冷却介质。
当换热器泄漏时：

- a) 避免接触皮肤和眼睛。
- b) 在换热器中存在泄漏时，请勿重新运行冷却器。须由制造商对冷却器进行修理。

7.3 清洗和拆卸换热器

只有当换热器堵塞或者损坏的情况下，才须对其进行更换或修理。若出现频率加大，我们建议检查，将来通过使用过滤器是否可加以避免。

对于使用高纯度氧气或氢气的应用，建议进行符合通用应用特定标准的清洁或使用换热器的原装替换件。

- 封锁进气口。
- 关闭设备并拔除所有的连接器（例如，状态输出连接器插头、电源输入等）。
- 断开气体连接和冷凝物排放装置。
- 向上拉出换热器。
- 清洁冷却巢（冷却块中的孔），因为换热器与硅脂一起使用。
- 冲洗换热器，直到所有的杂质被除去。
- 以硅脂润滑经冷却的外表面上的换热器。
- 旋转着将换热器再次插入冷却巢中。
- 重置气体连接和冷凝物排放装置。气体入口被标记为红色。
- 恢复电压供应/供气，并等待操作准备就绪。
- 打开进气口。

7.4 更换蠕动泵软管（可选）

- 封锁进气口。
- 关闭设备并拔除所有的连接器（例如，状态输出连接器插头、电源输入等）。
- 移除蠕动泵上的输入输出软管（**遵守安全指示！**）。
- 松开但并不取下中心翼形螺母。将螺钉向下推
- 向上揭去盖板
- 拉出侧面的接口并卸下软管。
- 更换软管（比勒备件）并以相反的顺序安装蠕动泵。
- 恢复供电、供气。

7.5 更换滤芯（可选）

注意**过滤器上的气体泄漏**

拆卸时，过滤器不能受压。
请勿重复使用损坏的零件或O型圈。

- 封锁进气口。
- 关闭设备并拔下电源插头。
- 拉托架，同时抓牢过滤器玻璃。
- 通过同时抓牢过滤器头和轻微来回摆动来小心地向下取下玻璃。
- 移除滤芯并放上一个新的。
- 检查密封件，必要时更换。
- 通过同时抓牢过滤器头和轻微来回摆动来再次安上玻璃并插入托架并注意稳固性。
- 恢复供电、供气。

提示！处置滤芯时，请遵从法律法规。

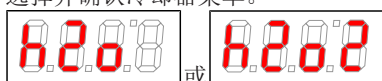
7.6 干燥检湿器（可选）

湿气渗透后，须将检湿器干燥。

- 封锁进气口。
- 关闭设备并拔下电源插头。
- 松开检湿器连接电缆的压紧螺母并取下电缆。
- 逆时针拧开检湿器并拉出检湿器。
- 干燥检湿器。
- 重新插入检湿器，并小心地拧紧螺旋接合。
- 插上连接电缆并拧紧压紧螺母。
- 恢复供电、供气。

7.7 校准检湿器（可选）

- 若替换了检湿器，须将其重新校准。
- 确保干燥气体通过冷却器。
- 选择并确认冷却器菜单。



- 选择检湿器的菜单项。



- 显示屏显示（重置）。
- 通过确认显示屏校准检湿器。

菜单导航的详细综述见“操作和运行”一节。

7.8 更换基本设备

- 封锁进气口。
- 关闭设备并拔除所有的连接器（例如，状态输出连接器插头、电源输入等）。
- 拆除基本设备。
- 拆卸选件/附件。
- 在新设备上安装选件。
- 恢复供电、供气。

7.9 替换件

订购零配件时请注意设备型号和序列号。

附件及设备的升级见参数表或产品目录表。

建议随泵同时订购以下备件：

商品货号	名称
9100100007	显示模块MCD400
9144050080	控制板显示模块连接电缆
9100130380	微控制板MCP2.2
4011000	流量适配器型号G, PVDF G1/4
4011000I	流量适配器型号NPT, PVDF NPT 1/4 “
4011005	流量适配器型号G, 不锈钢, G 1/4
4011005I	流量适配器型号NPT, 不锈钢, NPT 1/4 “
4111100	检湿器FF-3-N, 不带电缆
9144050081	检湿器连接电缆, 300 mm
9144050082	检湿器连接电缆, 450mm
41502999	过滤器AGF-PV-30-F2, G1/4
41502999I	过滤器AGF-PV-30-F2, NPT 1/4 “
446590005	风扇, 12 V DC
9100010198	电路板
9100011198	电路板, 24 V DC
9100011187	控制板
见数据页450022	蠕动泵CPsingle, CPdouble X2

7.9.1 耗材和附件

商品货号	名称
4510008	自动疏水罐 AK 5.2 (仅压力模式)
4510028	自动疏水罐 AK 5.5 (仅压力模式)
4410004	自动疏水罐 AK 20 (仅压力模式)
4410001	自动疏水罐 11 LD V 38 (仅压力模式)
41030050	替换滤芯F2, 一袋5个
9144050038	冷凝器温度模拟输出用电缆 4m
4410005	冷凝物收集容器GL1, 0.4 l
44920035012	冷凝水泵替换软管, Tygon (Norpren), 弯式软管接头
44920035016	冷凝水泵替换软管, Tygon (Norpren), 弯式软管接头和螺纹套管接头 (公制)
44920035017	冷凝水泵替换软管, Tygon (Norpren), 弯式软管接头和螺纹套管接头 (英制)
4381045	螺纹连接 G1/4 - DN 8/12 被动冷凝水连接MTS或MTV (-2) 用
4381048	螺纹连接 NPT 1/4 “ 被动冷凝水连接MTS-I或MTV (-2)-I用

7.9.2 适于带-H2-/-O2换热器的耗材和附件

商品货号	名称
4410001 (见数据页450005)	自动疏水罐 11 LD V 38 ¹⁾
4410001-02 (见数据页450005)	为氧气优化的自动疏水罐 11 LD V 38
见数据页400016	用于高纯氧应用的不锈钢管件

¹⁾ 当使用于高氢气浓度环境时, 最大1.5 bar超压。

8 废弃处理

该换热器包含基于乙二醇的冷却介质。

在废弃处理产品时，必须遵守适用的国家法律法规。请以对健康和环境不产生危害为原则进行废弃处理。

对于Bühler Technologies GmbH的产品，被划掉的带轮垃圾桶的符号指向欧盟（EU）内电气和电子产品的特殊废弃处理说明。



被划掉的垃圾桶的符号表示标有它的电器电子产品必须与生活垃圾分开处理。必须作为废弃的电气和电子设备妥善处理它们。

Bühler Technologies GmbH很乐意废弃处理带有此标签的设备。为此，请将设备寄送到以下地址。

我们在法律上有义务保护我们的员工免受受污染设备造成的危险。因此，我们恳请您理解，只有在设备不含任何刺激性、腐蚀性或其他对健康或环境有害的物料的情况下，我们才能废弃处理您的旧设备。对于每个废弃的电气和电子设备，必须填写“RMA——去污表格和声明”表格，它可在我们的网站上找到。填妥的表格必须贴于包装外部的明显位置。

如需退回废弃电气和电子设备，请使用以下地址：

Bühler Technologies GmbH
WEEE
Harkortstr. 29
40880 Ratingen
Germany

另请注意数据保护规则，您自己有责任确保您退回的旧设备上没有个人数据。因此，请确保在归还之前从旧设备中删除您的个人数据。

9 附录

9.1 气体冷却器技术规格

TC-Standard X2

气体冷却器技术规格

运行就绪	在最多10分钟后					
环境温度	5 ° C 至 50 ° C					
气体出口露点						
预设:	5 ° C					
可调:	2 ° C...20 ° C或Delta T调节					
防护等级	IP 20					
机械应力	经DNV-GL CG0339振动等级A (0.7g) 2 Hz-13.2 Hz 振幅 ± 1.0 mm 13.2 Hz -100 Hz加速的测试					
机壳	拉丝不锈钢					
包装尺寸	约355 x 220 x 205 mm					
包括换热器的重量:	约7.5 kg 约6 kg (在24 V DC下) 约9 kg 在配备齐全时					
电气规格	无附件的设备			带附件的设备 (1台蠕动泵)		
	24 V DC	230 V AC	115 V AC	24 V DC	230 V AC	115 V AC
	±10%	+5/-10%	+5/-10%	±10%	+5/-10%	+5/-10%
	-	50/60 Hz	50/60 Hz	-	50/60 Hz	50/60 Hz
	5 A	0.6 A	1.2 A	5.5 A	0.7 A	1.4 A
	120 W	110 W / 140 VA		130 W	130 W / 160 VA	
推荐保险丝 (特点: 惰性)	6.3 A	1.25 A	2.5 A	6.3 A	1.25 A	2.5 A
开关功率状态输出	最大250 V AC, 150 V DC 2 A, 50 VA, 无电位					
电气连接	符合EN 175301-803标准的插头					
气体连接和冷凝出口	换热器见表格“换热器概述” 过滤器, 检湿器适配器G1/4“或 NPT 1/4“					
接液部件						
过滤器:	参见“选件技术规格”					
检湿器:	参见“选件技术规格”					
换热器:	参见表格“换热器概况”					
蠕动泵:	参见“选件技术规格”					
管件	PTFE/Viton					
标记:	FM18ATEX0012X:II 3 G Ex ec nC IIC T4 Gc IECEX FMG 18.0005X:Ex ec nC IIC T4 Gc FM18US0021X/FM18CA0010X:CL I DIV 2 GP ABCD RU C-DE. HA65. B. 00608/20					

带换热器-H2/-O2的TC-Standard X2

气体冷却器技术规格

运行就绪	在最多10分钟后		
环境温度	5 ° C 至 50 ° C		
气体出口露点 预设: 可调:	5 ° C 2 ° C...20° C或ΔT调节		
防护等级	IP 20		
机械应力	经DNV-GL CG0339振动等级A (0.7g) 2 Hz-13.2 Hz 振幅 ± 1.0 mm 13.2 Hz -100 Hz加速的测试		
机壳	拉丝不锈钢		
包装尺寸	约355 x 220 x 205 mm		
包括换热器的重量	约7.5 kg 约 6 kg (bei 24 V DC)		
电气规格	无附件的设备		
	24 V DC	230 V AC	115 V AC
	±10%	+5/-10%	+5/-10%
	-	50/60 Hz	50/60 Hz
	5 A	0.6 A	1.2 A
	120 W	110 W / 140 VA	
推荐保险丝 (特点: 惰性)	6.3 A	1.25 A	2.5 A
开关功率状态输出	最大250 V AC, 150 V DC 2 A, 50 VA, 无电位		
电气连接	符合EN 175301-803标准的插头		
接液部件 换热器:	参见表格“换热器概述”		
标记:	FM18ATEX0012X:II 3 G Ex ec nC IIC T4 Gc IECEX FMG 18.0005X:Ex ec nC IIC T4 Gc FM18US0021X/FM18CA0010X:CL I DIV 2 GP ABCD RU C-DE. HA65. B. 00608/20		

TC-Standard+ X2

气体冷却器技术规格

运行就绪	在最多10分钟后					
环境温度	5 ° C 至 50 ° C					
气体出口露点						
预设:	5 ° C					
可调:	2 ° C...20° C					
防护等级	IP 20					
机械应力	经DNV-GL CG0339振动等级A (0.7g) 2 Hz-13.2 Hz 振幅 ± 1.0 mm 13.2 Hz -100 Hz加速的测试					
机壳	拉丝不锈钢					
包装尺寸	约355 x 220 x 205 mm					
包括换热器的重量:	约7.5 kg 约6 kg (在24 V DC下) 约9 kg 在配备齐全时					
电气规格	无附件的设备			带附件的设备 (1台蠕动泵)		
	24 V DC	230 V AC	115 V AC	24 V DC	230 V AC	115 V AC
	±10%	+5/-10%	+5/-10%	±10%	+5/-10%	+5/-10%
	-	50/60 Hz	50/60 Hz	-	50/60 Hz	50/60 Hz
	5 A	0.6 A	1.2 A	5.5 A	0.7 A	1.4 A
	120 W	110 W / 140 VA		130 W	130 W / 160 VA	
推荐保险丝 (特点: 惰性)	6.3 A	1.25 A	2.5 A	6.3 A	1.25 A	2.5 A
开关功率状态输出	最大250 V AC, 150 V DC 2 A, 50 VA, 无电位					
电气连接	符合EN 175301-803标准的插头					
气体连接和冷凝出口	换热器见表格“换热器概述” 过滤器, 检湿器适配器G1/4“或 NPT 1/4“					
接液部件						
过滤器:	参见“选件技术规格”					
检湿器:	参见“选件技术规格”					
换热器:	参见表格“换热器概况”					
蠕动泵:	参见“选件技术规格”					
管件	PTFE/Viton					
标记:	FM18ATEX0012X:II 3 G Ex ec nC IIC T4 Gc IECEX FMG 18.0005X:Ex ec nC IIC T4 Gc FM18US0021X/FM18CA0010X:CL I DIV 2 GP ABCD RU C-DE. HA65. B. 00608/20					

9.2 选件技术规格

冷凝器温度模拟输出技术规格

信号	4-20mA或2-10V 相当于-20° C 至 +60° C冷凝器温度
连接	插头M12x1, DIN EN 61076-2-101

检湿器FF-3-N技术规格

环境温度	3 ° C 至 50 ° C
带FF-3-N的最大工作压力	2 bar
材料	PVDF, PTFE, 环氧树脂, 不锈钢 1.4571, 1.4576

Technische Daten peristaltische Pumpen CPsingle X2 / CPdouble X2

环境温度	0 ° C 至 50 ° C
输送功率	0.31/h (50Hz) /0.361/h (60Hz) 带标准软管
真空输入	最高0.8 bar
压力输入	最高1 bar
压力输出	1 巴
软管	4 × 1.6 mm
冷凝出口	软管嘴 Ø6 mm 接头 4/6 (公制), 1/6 “-1/4 “ (英制)
防护等级	IP 44
材料	
软管:	Norprene (标准), Marprene, Fluran
连接:	PVDF

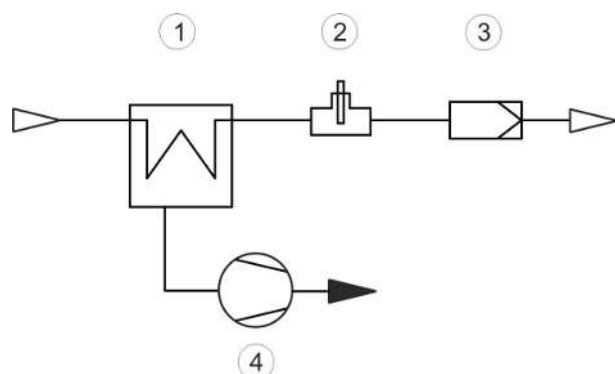
过滤器AGF-PV-30-F2技术规格

环境温度	3 ° C 至 100 ° C
带过滤器的最大工作压力	4 bar
过滤面积	60 cm ²
过滤精度	2 µm
死容积	57 ml
物料	
过滤器:	PVDF, 杜兰玻璃 (接液部分)
密封:	氟橡胶
滤芯:	烧结的PTFE

9.3 流程图

TC-Standard

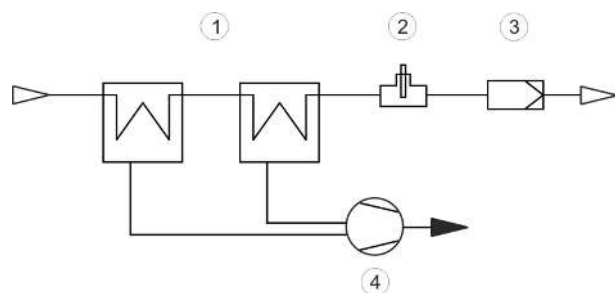
1个气路:



1 冷却器	2 检湿器 (选件)
3 过滤器 (选件)	4 冷凝泵 (选件)

TC-Standard+

1个串联气路:



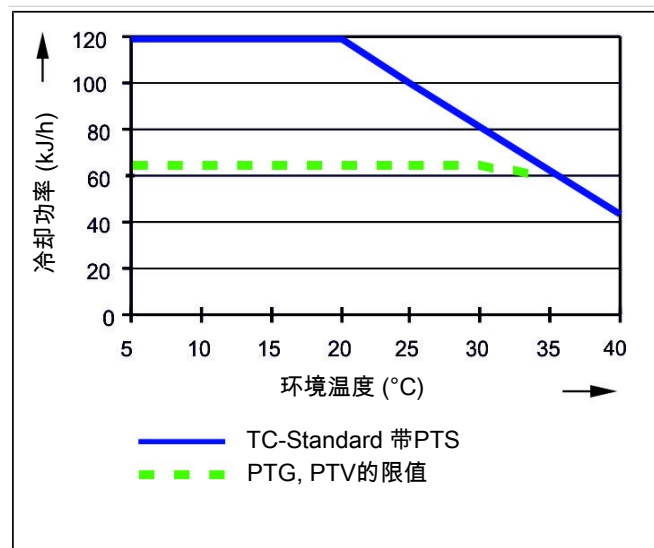
1 冷却器	2 检湿器 (选件)
3 过滤器 (选件)	4 冷凝泵 (选件)

9.4 功率曲线

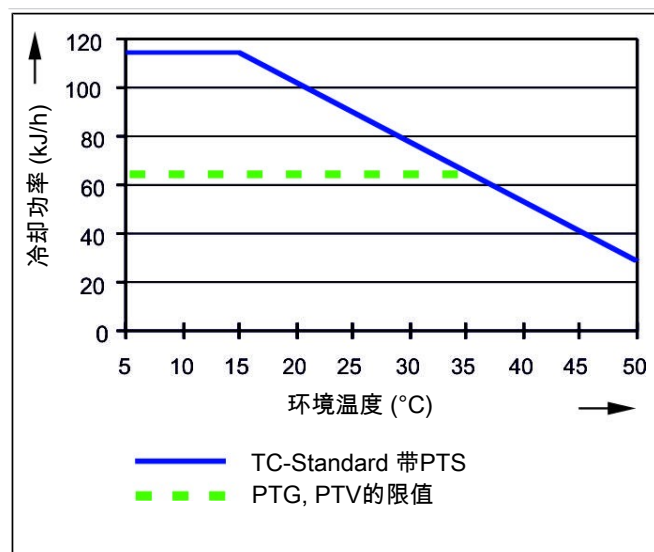
TC-Standard

一台换热器

型号TC-Standard 6111 (X2)	
额定冷却功率 (在25 °C时)	100 kJ/h
最大环境温度	40 °C
露点波动	
静态	± 0.1 K
在整个规格范围内	± 1.5 K

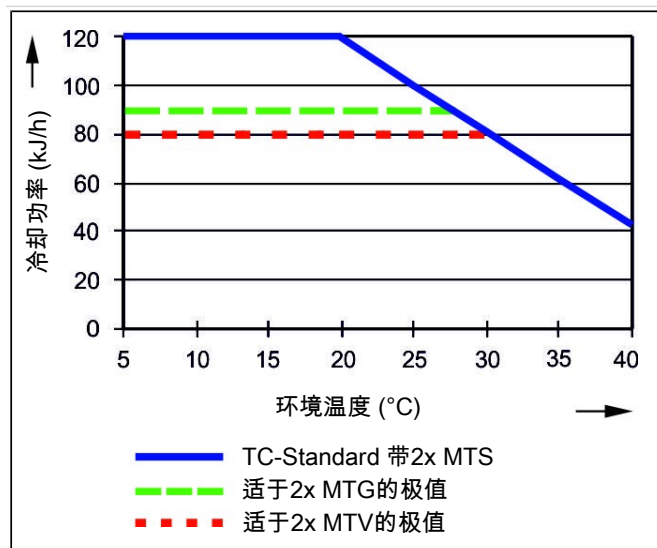


型号TC-Standard 6112 (X2)	
额定冷却功率 (在25 °C时)	90 kJ/h
最大环境温度	50 °C
露点波动	
静态	± 0.1 K
在整个规格范围内	± 1.5 K

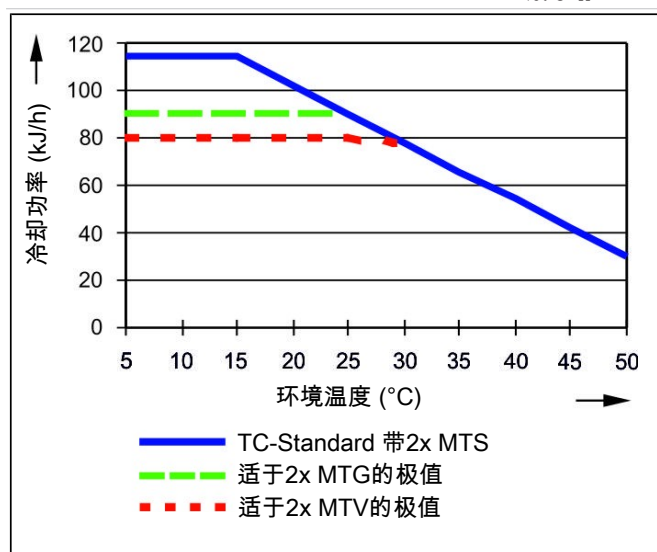


二台换热器

型号TC-Standard 6121 (X2)	
额定冷却功率 (在25 °C时)	100 kJ/h
最大环境温度	40 °C
露点波动	
静态	± 0.1 K
在整个规格范围内	± 1.5 K
换热器间的温度差	<0.5 K



型号TC-Standard 6122 (X2)	
额定冷却功率 (在25 °C时)	90 kJ/h
最大环境温度	50 °C
露点波动	
静态	± 0.1 K
在整个规格范围内	± 1.5 K
换热器间的温度差	<0.5 K

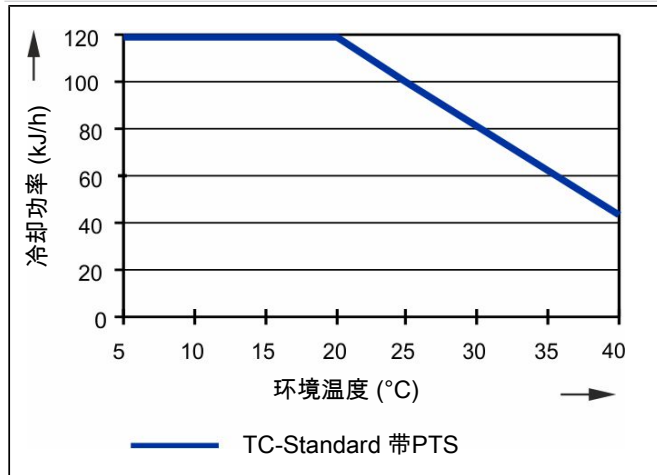


注释：换热器PTG、PTV或MTV的极限曲线适用于40 °C的露点下。

带换热器-H2/-O2的TC-Standard

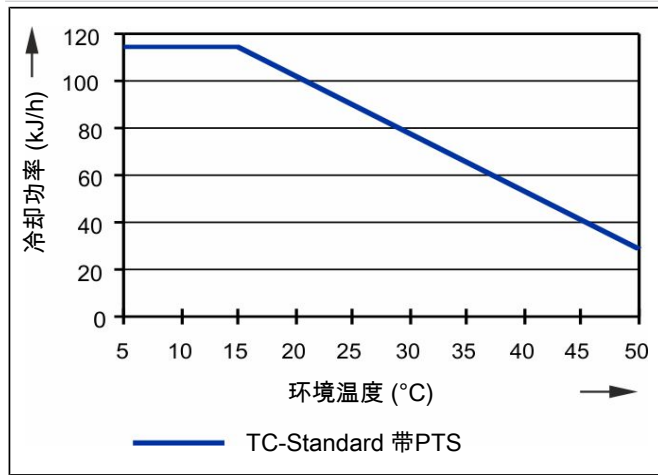
TC-Standard 6111型号

额定冷却功率 (25 °C时)	100 kJ/h
最大环境温度	40 °C
露点波动	
静态	± 0.1 K
在整个规格范围内	± 1.5 K



TC-Standard 6112型号

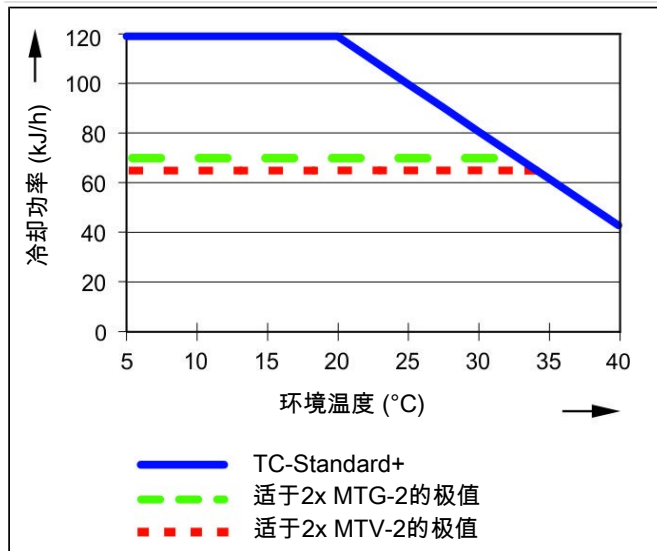
额定冷却功率 (25 °C时)	90 kJ/h
最大环境温度	50 °C
露点波动	
静态	± 0.1 K
在整个规格范围内	± 1.5 K



TC-Standard+

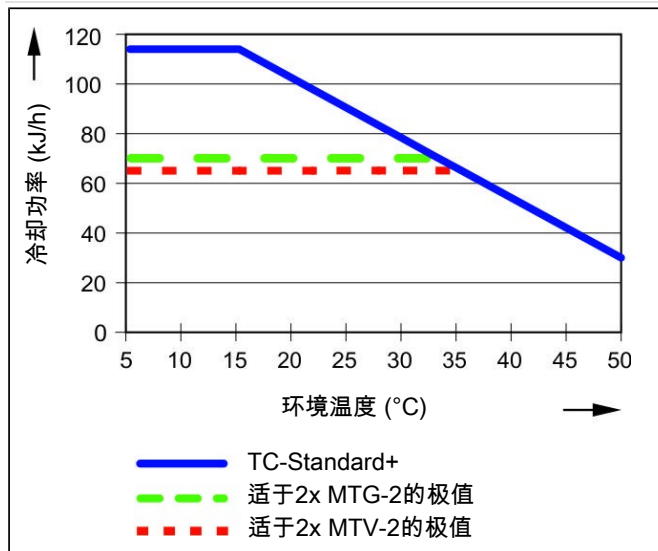
TC-Standard+ 6121型号 (X2)

额定冷却功率 (在25 °C时)	100 kJ/h
最大环境温度	40 °C
露点波动	
静态	± 0.1 K
在整个规格范围内	± 1.5 K
换热器间的温度差	<0.5 K



TC-Standard+ 6122型号 (X2)

额定冷却功率 (在25 °C时)	90 kJ/h
最大环境温度	50 °C
露点波动	
静态	± 0.1 K
在整个规格范围内	± 1.5 K
换热器间的温度差	<0.5 K



注释：换热器MTV-2和MTG-2的极限曲线适用于50 °C的露点下。

9.5 换热器

9.5.1 换热器描述

样气的能量与近似的要求的冷却功率 Q 由三个参数确定：气体温度 ϑ_G ，露点 τ_e （含水量）和体积流量 V 。由物理决定，随气体能量上升，出口露点也上升。对于正常工作点，对于最大流量以下限值为 $\tau_e = 40^\circ \text{C}$ 与 $\vartheta_G = 70^\circ \text{C}$ 。最大体积流量 $v_{\max}$ 以 Nl/h 冷却的空气说明，即水蒸汽凝结后。对于其他的露点和气体入口温度，这些值可以不同。然而，物理关系是如此复杂，不能以一项描述来表示。若有不明之处，请咨询我们，或使用我们的解释程序。

9.5.2 换热器概述

TC-Standard

换热器	PTS PTS-I ²⁾	PTG PTG-I ²⁾	PTV PTV-I ²⁾	MTS ³⁾ MTS-I ²⁾³⁾	MTG ³⁾ MTG-I ²⁾³⁾	MTV ³⁾ MTV-I ²⁾³⁾
接液部件	不锈钢	玻璃 PTFE	PVDF	不锈钢 PVDF	玻璃 PTFE	PVDF
流量 $v_{\max}$ ¹⁾	450 Nl/h	250 Nl/h	250 Nl/h	300 Nl/h	210 Nl/h	190 Nl/h
入口露点 $\tau_{e,\max}$ ¹⁾	65°C	65°C	65°C	65°C	65°C	65°C
气体入口温度 $\vartheta_{G,\max}$ ¹⁾	180°C	140°C	140°C	140°C	140°C	140°C
最大值制冷功率 $Q_{\max}$	150 kJ/h	90 kJ/h	90 kJ/h	95 kJ/h	80 kJ/h	65 kJ/h
气体压力 $p_{\max}$	160 bar	3 bar	2 bar	25 bar	3 bar	2 bar
差压 Δp ($v=150 \text{ l/h}$)	10 mbar	10 mbar	10 mbar	20 mbar	19 mbar	18 mbar
死容积 V_{tot}	29 ml	29 ml	57 ml	19 ml	18 ml	17 ml
气体连接（公制）	6 mm	GL 14 (6 mm) ⁴⁾	DN 4/6	管 6 mm	GL14 (6 mm)	DN 4/6
气体连接（英制）	1/4"	GL 14 (1/4") ⁴⁾	1/4" -1/6"	管 1/4"	GL14 (1/4")	1/4" -1/6"
冷凝水排水管（公制）	G3/8	GL 25 (12 mm) ⁴⁾	G3/8	G1/4	GL18 (8 mm)	G1/4
冷凝水排水管（英制）	NPT 3/8 "	GL 25 (1/2") ⁴⁾	NPT 3/8"	NPT 1/4"	GL18 (8 mm)	NPT 1/4"

¹⁾ 顾及冷却器的最大制冷功率。

²⁾ 带I的型号带有NPT螺纹或英制管。

³⁾ 对于换热器MTG，不能通过自动疏水罐或收集容器被动排水。对于换热器MTS和MTV，应使用至少7 mm的自由通道的螺杆（见附件）用于被动排水。

⁴⁾ 内径密封环。

带换热器-H2/-O2的TC-Standard

换热器	PTS-H2/-O2 PTS-I-H2/-O2 ²⁾
接液部件	不锈钢
流量 $v_{\max}$ ¹⁾	450 Nl/h
入口露点 $\tau_{e,\max}$ ¹⁾	65°C
气体入口温度 $\vartheta_{G,\max}$ ¹⁾	180°C
最大制冷功率 $Q_{\max}$	150 kJ/h
气体压力 $p_{\max}$	1.5 bar
差压 Δp ($v=150 \text{ l/h}$)	10 mbar
死容积 V_{tot}	29 ml
气体连接（公制）	6 mm
气体连接（英制）	1/4"
冷凝水排水管（公制）	G3/8
冷凝水排水管（英制）	NPT 3/8 "

¹⁾ 顾及冷却器的最大制冷功率。

²⁾ 带I的型号带有NPT螺纹或英制管。

TC-Standard+

换热器	2x MTG-2 ³⁾ 2x MTG-2-I ^{2) 3)}	2x MTV-2 ³⁾ 2x MTV-2-I ^{2) 3)}
接液部件	玻璃 PTFE	PVDF
流量 $v_{\max}$ ¹⁾	210 Nl/h	190 Nl/h
入口露点 $\tau_{e,\max}$ ¹⁾	70 ° C	70 ° C
气体入口温度 $\vartheta_{G,\max}$ ¹⁾	140 ° C	140 ° C
最大值制冷功率 $Q_{\max}$	80 kJ/h	65 kJ/h
气体压力 $p_{\max}$	3 bar	2 bar
差压 Δp (v=150 l/h)	19 mbar	18 mbar
死容积 V_{tot}	38 ml	36 ml
气体连接 (公制)	GL14 (6 mm) ⁴⁾	DN 4/6
气体连接 (英制)	GL14 (1/4") ⁴⁾	1/4" -1/6"
冷凝水排水管 (公制)	GL18 (8 mm) ⁴⁾	G1/4
冷凝水排水管 (英制)	GL18 (8 mm) ⁴⁾	NPT 1/4"

¹⁾ 顾及冷却器的最大制冷功率。

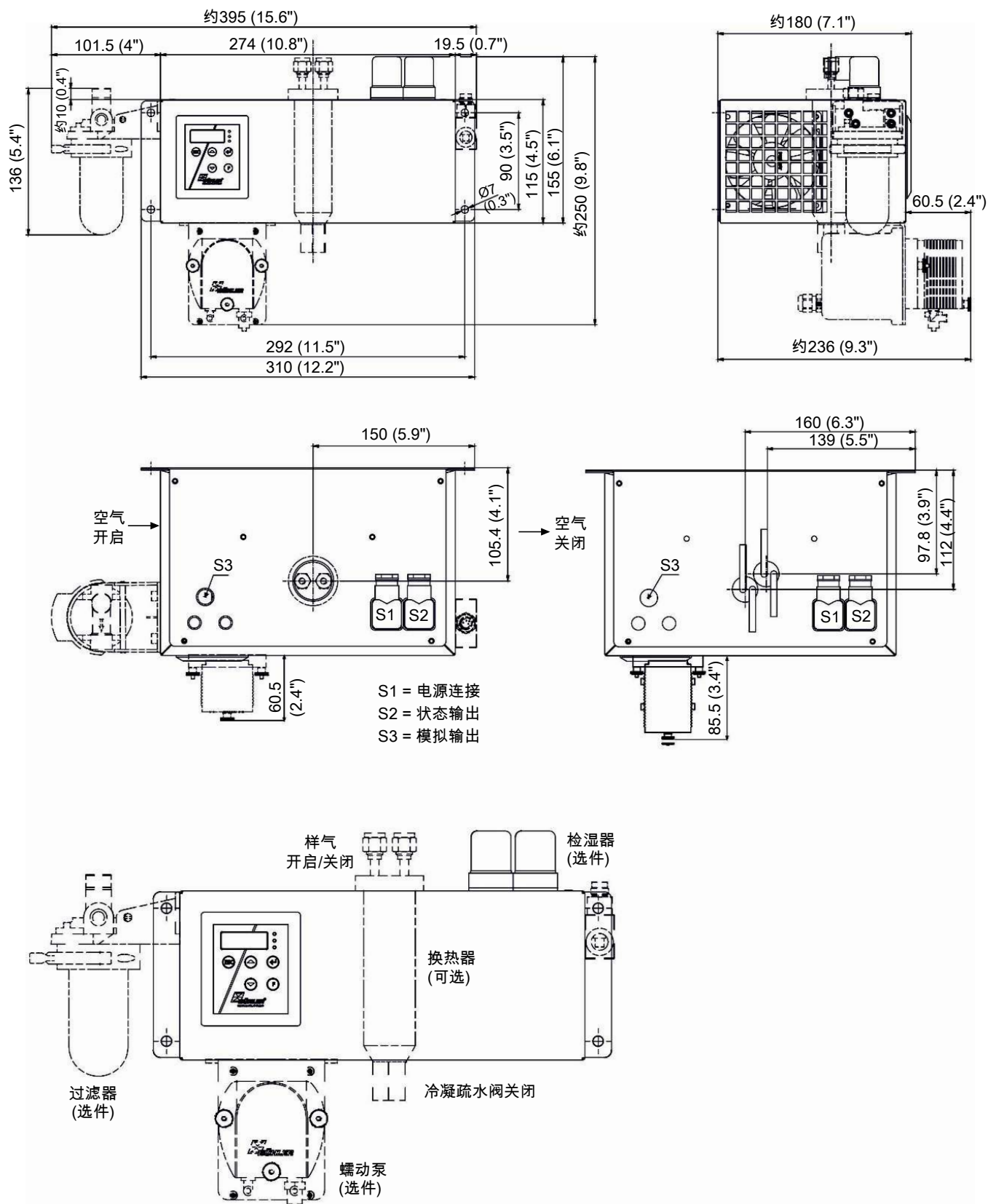
²⁾ 带I的型号带有NPT螺纹或英制管。

³⁾ 对于换热器MTG-2，不能通过自动疏水罐或收集容器被动排水。对于换热器MTV-2，应使用至少7 mm的自由通道的螺杆（见附件）用于被动排水。

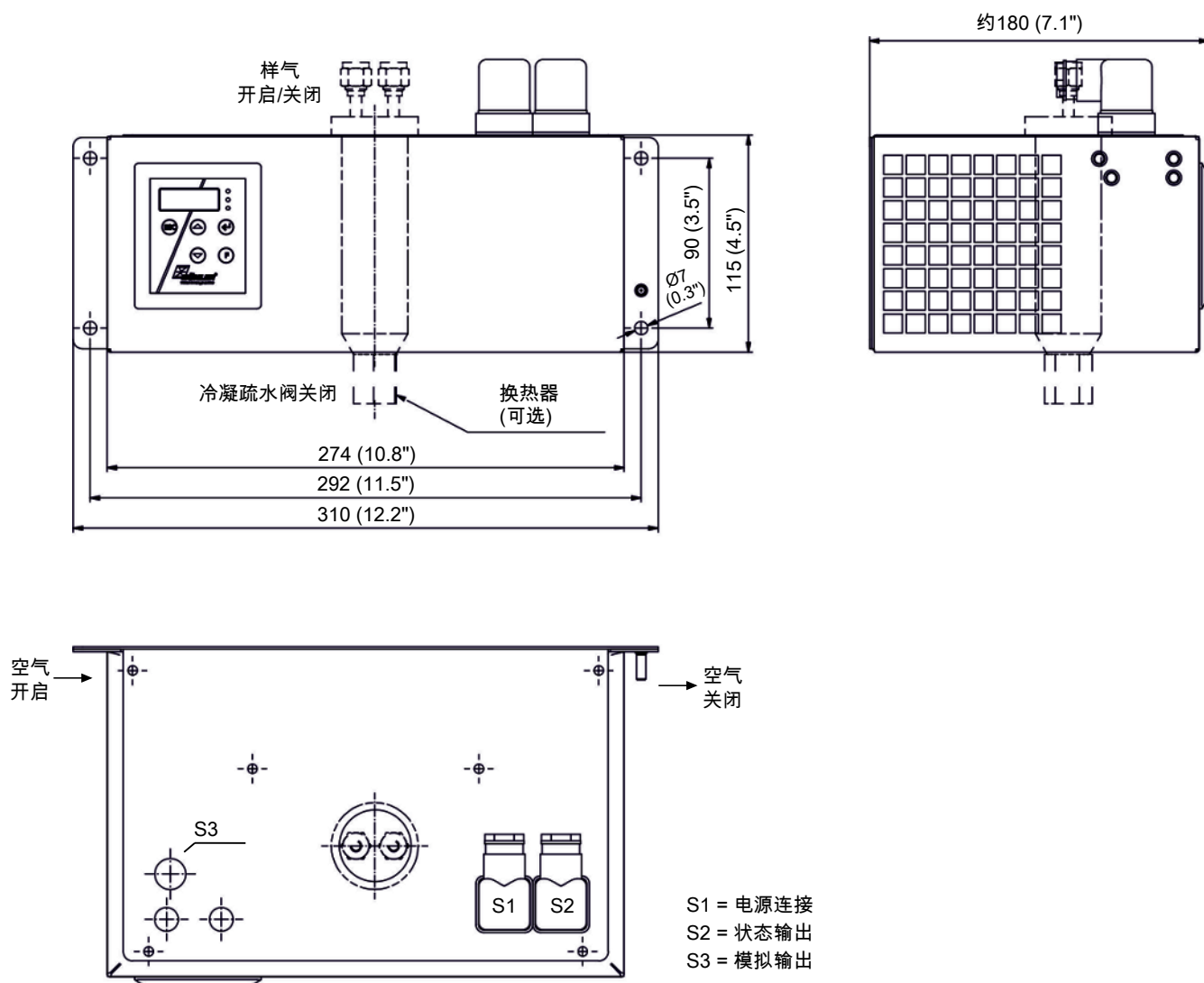
⁴⁾ 内径密封环。

9.6 尺寸 (mm)

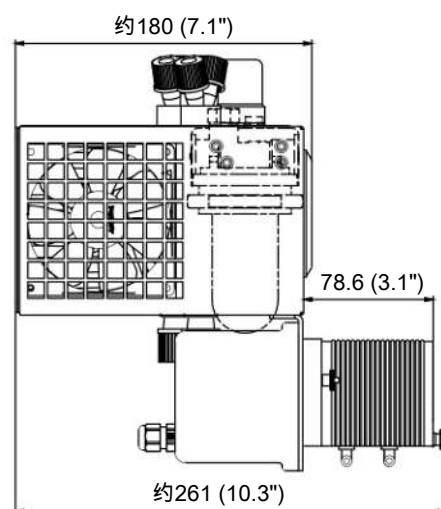
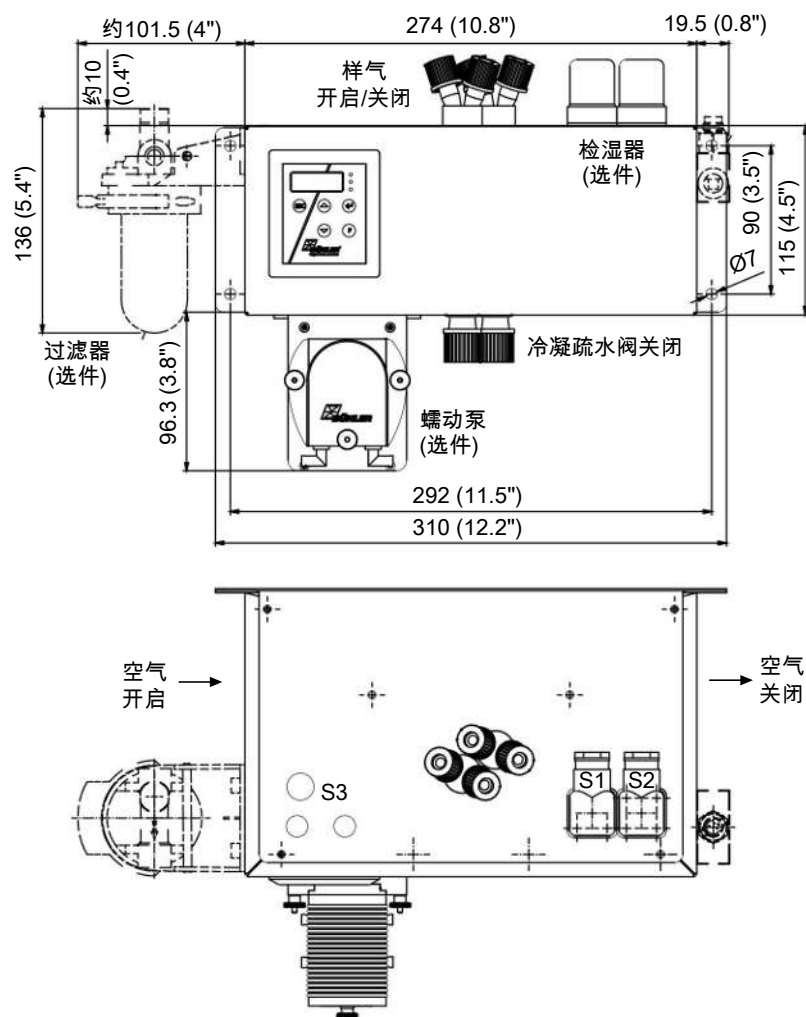
TC-Standard



带换热器-H2/-O2的TC-Standard



TC-Standard+



S1 = 电源连接
S2 = 状态输出
S3 = 模拟输出

10 随附文档

- 符合性声明
- O₂声明（换热器）
- 认证
- RMA -去污声明

EU-Konformitätserklärung EU-declaration of conformity



Hiermit erklärt Bühler Technologies GmbH, dass die nachfolgenden Produkte den wesentlichen Anforderungen der Richtlinie

Herewith declares Bühler Technologies GmbH that the following products correspond to the essential requirements of Directive

2014/34/EU
(Atex)

in ihrer aktuellen Fassung entsprechen.

in its actual version.

Produkt / products: Messgaskühler / Sample gas cooler
Typ / type: TC-Standard X2, TC-MIDI X2, TC-Double X2
TC-Standard+ X2, TC-MIDI+ X2, TC-Double+ X2

Die Produkte werden entsprechend der derzeit gültigen Atex-Richtlinie innerhalb der internen Fertigungskontrolle folgendermaßen gekennzeichnet:

The products are marked according to the currently valid Atex directive during internal control of production:

Atex:  II 3 G Ex ec nC IIC T4 Gc
IECEx: Ex ec nC IIC T4 Gc

Die Eignung dieses Produkts für die Zone 2 wurde durch eine Baumusterprüfbescheinigung mit der Nummer FM18ATEX0012X festgestellt.

Die Betriebsanleitung zu diesem Produkt beinhaltet besondere Installations- und Betriebsbedingungen und sind für die sichere Anwendung zu beachten.

This product's suitability for Zone 2 was determined by type-examination certificate number FM18ATEX0012X.

The operating instructions for this product contains special installation and operating conditions and must be observed to ensure safe operation.

Zur Beurteilung der Konformität wurden folgende harmonisierte Normen herangezogen:
For the assessment of conformity the following standards have been used:

EN 60079-0:2012 + A11:2013

EN 60079-7:2015+A1:2018

EN 60079-15:2018

Der Hersteller hat die Übereinstimmung des Gerätes mit aktuelleren Normenausgaben als in der Baumusterprüfbescheinigung aufgeführt geprüft und die Konformität festgestellt:

The manufacturer has checked the compliance of the device with more current standards than those listed in the type examination certificate and has established conformity:

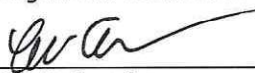
EN IEC 60079-0:2018

EN IEC 60079-7:2015 + A1:2018

Dokumentationsverantwortlicher für diese Konformitätserklärung ist Herr Stefan Eschweiler mit Anschrift am Firmensitz.

The person authorised to compile the technical file is Mr. Stefan Eschweiler located at the company's address.

Ratingen, den 01.03.2021


Stefan Eschweiler
Geschäftsführer – Managing Director


Frank Pospiech
Geschäftsführer – Managing Director

O2-Erklärung *O2 Declaration*

**Wärmetauscher für den Einsatz mit
hochreinem Sauerstoff optimiert**

*Heat Exchanger optimised for use with
high-purity oxygen*

Applikationen mit Sauerstoff: Partikel-, Öl- und Fettfreiheit

Mit dieser Erklärung bestätigen wir, dass alle medienberührenden Flächen der nachfolgenden Produkte in Anlehnung an die Vorgaben der EIGA Doc 33/18 und des VDA-Band 19 gereinigt und gefertigt sind.

Applications with oxygen: free of particles, oil and grease

With this declaration, we confirm that all surfaces of the following products that come into contact with media have been cleaned and manufactured in accordance with the specifications of EIGA Doc 33/18 and VDA Volume 19.

Produkt / Products	Wärmetauscher / Heat Exchanger	Art-Nr. / Item no.:
Typen / Types:	PTS-O2	4447999-O2
	PTS-I-O2	4448999I-O2
	TS-O2	4510023-O2
	TS-I-O2	4510025I-O2
	DTS-O2	4501026-O2
	DTS-I-O2	4501026I-O2

Ratingen, den 25.04.2024

Bühler Technologies GmbH



Heat exchanger optimized for use with high-purity oxygen

Applications with oxygen: Free from particles, oil and grease



For use with high-purity oxygen, the product requires special cleaning to ensure that it is free from oil and grease, as oxygen is a strong oxidising agent. Under unfavourable conditions, oxygen can cause spontaneous combustion of organic substances such as particles, oils and fats, and generally promotes the combustion of substances. Oils and fats can even react explosively on contact with oxygen. We use special cleaning and production processes to ensure the safe use of our products with high-purity oxygen and to avoid the above-mentioned undesirable reactions.

With this declaration, we confirm that all surfaces of the following products that come into contact with media have been cleaned and manufactured in accordance with the requirements of EIGA Doc 33/18 and VDA Volume 19.

Product:	Heat exchanger	Item no.
Models:	PTS-O2	4447999-O2
	PTS-I-O2	4448999I-O2
	TS-O2	4510023-O2
	TS-I-O2	4510025I-O2
	DTS-O2	4501026-O2
	DTS-I-O2	4501026I-O2

The material used for the “O2” heat exchangers is high-quality stainless steel, which has been tested by Bühler Technologies for its suitability for oxygen applications.

All components in contact with the medium undergo a special cleaning process to reliably remove impurities (such as oil, grease and particles). This process is documented by a comprehensive delivery specification to the service provider and compliance with the limits is verified with regular analyses by an independent, accredited laboratory.

The contamination limits of the surfaces in contact with media are defined as follows (as in EIGA Doc 33/18 Cleaning of Equipment for oxygen service):

	Contamination limits
Non-volatile organic or inorganic impurities:	$\leq 220 \text{ mg/m}^2$ for non-volatile impurities
Particles:	$\leq 22 \text{ particles/m}^2$ between $500 \mu\text{m}$ and $1000 \mu\text{m}$

The component groups of the heat exchangers are cleaned by an external service provider and then manufactured into the end product at Bühler Technologies. After these production steps, the heat exchanger undergoes final cleaning by the service provider before delivery in order to remove any contamination from the production process.

Compliance with the contamination limits is documented by the external service provider by means of factory test certificates (free of oil and grease) and a test report (free of dust and dirt). After cleaning, the heat exchangers are packed in airtight and dustproof packaging and clearly labeled “Cleaned for oxygen service. Do not open until ready for use”.

All described cleaning properties are lost if the product comes into contact with oily or greasy media or is otherwise contaminated from the outside.



CERTIFICATE OF CONFORMITY



1. **HAZARDOUS LOCATION ELECTRICAL EQUIPMENT PER CANADIAN REQUIREMENTS**
2. **Certificate No:** FM18CA0010X
3. **Equipment:** TC-Standard X2; TC-Standard+ X2; TC-MIDI X2; TC MIDI+ X2; TC-Double X2 & TC-Double+ X2
(Type Reference and Name) Sample Gas Cooler
4. **Name of Listing Company:** Bühler Technologies GmbH
5. **Address of Listing Company:** Harkortstrasse 29
Ratingen, D-40880
Germany
6. The examination and test results are recorded in confidential report number:

3062014 dated 4th October 2018
7. FM Approvals LLC, certifies that the equipment described has been found to comply with the following Approval standards and other documents:

CSA-C22.2 No. 213-15, CAN/CSA-C22.2 No. 61010-1:2012
8. If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.
9. This certificate relates to the design, examination and testing of the products specified herein. The FM Approvals surveillance audit program has further determined that the manufacturing processes and quality control procedures in place are satisfactory to manufacture the product as examined, tested and Approved.
10. **Equipment Ratings:**

TC-Standard Models:

Non-incendive for Class I, Division 2, Groups A, B, C and D; T4 hazardous locations with an ambient temperature rating of 0°C of up to 50°C.

Certificate issued by:

J.E. Marquedant
VP, Manager, Electrical Systems

4 October 2018

Date

To verify the availability of the Approved product, please refer to www.approvalguide.com

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE

FM Approvals LLC, 1151 Boston-Providence Turnpike, Norwood, MA 02062 USA
T: +1 (1) 781 762 4300 F: +1 (1) 781 762 9375 E-mail: information@fmapprovals.com www.fmapprovals.com

SCHEDULE



Canadian Certificate Of Conformity No: FM18CA0010X

TC-MIDI and TC-Double Models:

Non-incendive for Class I, Division 2, Groups A, B, C and D; T4 hazardous (classified) locations with an ambient temperature rating of 0°C of up to 60°C.

11. The marking of the equipment shall include:

TC-Standard Models:

Class I Division 2, Groups A, B, C, D; T4 Ta = 0°C to 50°C

TC-MIDI and TC-Double Models:

Class I Division 2, Groups A, B, C, D; T4 Ta = 0°C to 60°C

12. **Description of Equipment:**

General - The TC-6 sample gas chillers are intended to cool and dry the sample gas before going into the gas analysers. Sample gases contain vapour which has to be withdrawn before it reaches the gas analyser. The Gas flows through a heat exchanger (impinger) inserted into a cooling block. The latter then is cooled to a preset temperature (5°C mostly).

Depending on the required cooling capacity the size of the heat exchanger and therefore chiller is chosen and depending on the kind of gas to be cooled different heat exchanger materials are provided (stainless steel, glass or PVDF).

A gas cooler (chiller) might be prepared for more than one heat exchanger. The cooling block is cooled by different combinations of Peltier-elements. The temperature is sensed by an RTD.

Construction – The equipment is housed in a brushed stainless steel IP20 enclosure.

Ratings - TC-Standard operate at 24VDC, 115 VAC or 230 VAC, selectable by ordering, with an ambient temperature rating of 0°C of up to 50°C. and TC-MIDI and TC-Double Models operate at 115 VAC or 230 VAC, selectable by ordering, with an ambient temperature rating of 0°C of up to 60°C.

4496 211b2d1fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 1 heat exchangers)

- b = Gas cooler model: 1 or 2
- d, = Supply voltage; 1, 2 or 4
- f & g = Heat exchanger; 10, 15, 20, 25, 30, or 35
- h = Peristaltic Pumps; 0, 1, 3
- j & k = Moisture detector / Filter; 00, 01, 10, or 11
- l = Status Outputs; 0 or 1
- n = Delta T control; 0 or 1

4496 212b2d2fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 2 heat exchangers)

- b = Gas cooler model: 1 or 2
- d = Supply voltage; 1, 2 or 4
- f & g = Heat exchanger; 10, 15, 20, 25, 30, or 35
- h = Peristaltic Pumps; 0, 2, or 4
- j & k = Moisture detector / Filter; 00, 01, 02, 10, 11, 20, 21, 22

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE

SCHEDULE



Canadian Certificate Of Conformity No: FM18CA0010X

- l = Status Outputs; 0 or 1
- n = Delta T control; 0 or 1

4496 212b2d2fgh0jkl0n0 TC-Standard+ X2 - Sample Gas Cooler (with 2 heat exchangers in series)

- b = Gas cooler model: 1 or 2
- d = Supply voltage; 1, 2 or 4
- f & g = Heat exchanger; 22, 27, 32 & 37
- h = Peristaltic Pumps; 0, 2, 4
- j & k = Moisture detector / Filter; 00, 01, 10, or 11
- l = Status Outputs; 0 or 1
- n = no value assigned.

4496 311 b2defghijklmno Thermoelectric Cooler, TC-MIDI + X2(fitted with 1 heat exchangers)

- b = Gas cooler types 1 or 2
- d = Supply Voltage; 1 or 2
- e = Gas paths; 1 or 2
- f,g = Heat exchangers; 60, 61, 65, 66, 70, 75, 80 or 85
- h = Peristaltic pumps; 0, 2, or 4
- i = Sample gas pumps; 0, 1, 2, 6, or 7
- j,k = Moisture detector / Filter; 00, 01, 02, 10, 11, 20 21, or 22
- l,m = Status output; 00 or 10
- n,o = Delta T control; 00 or 10

4496 312 b2d1fghijklm00 Thermoelectric Cooler, TC-MIDI + X2(fitted with 2 heat exchangers)

- b = Gas cooler types 1 or 2
- d = Supply Voltage; 1 or 2
- f,g = Heat exchangers; 22, 27, 32, or 37
- h = Peristaltic pumps; 0, 2, or 4
- i = Sample gas pumps; 0, 1, 2, 6, or 7
- j,k = Moisture detector / Filter; 00, 01, 02, 10, or 11
- l,m = Status output; 00 or 10

4496 611a2c1efghijkl000 Thermoelectric Cooler, TC-Double X2

- a = Gas cooler types 1 or 2
- c = Voltage; 1 or 2
- e,f = Heat exchangers; 10, 15, 20, 25, 30, or 35
- g = Peristaltic pumps; 0, 2, or 4
- h = Sample gas pumps; 0, 1, or 2
- i,j = Moisture Detector/Filter; 00, 01, 10, or 11
- k,l = Status output; 00 or 10

4496 611a2c1efghijkl000 Thermoelectric Cooler, TC-Double+ X2

- a = Gas cooler types 1 or 2
- c = Voltage; 1 or 2
- e,f = Heat exchangers; 22, 27, 32, or 37
- g = Peristaltic pumps; 0, 2, or 4
- h = Sample gas pumps; 0, 1, or 2
- i,j = Moisture Detector/Filter; 00, 01, 10, or 11
- k,l = Status output; 00 or 10

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE

SCHEDULE



Canadian Certificate Of Conformity No: FM18CA0010X

13. Specific Conditions of Use:

1. *When installed as Class I Division 2 equipment, the thermoelectric cooler shall be mounted within a tool-secured IP54 enclosure.*

14. Test and Assessment Procedure and Conditions:

This Certificate has been issued in accordance with FM Approvals Canadian Certification Scheme.

15. Schedule Drawings

A copy of the technical documentation has been kept by FM Approvals.

16. Certificate History

Details of the supplements to this certificate are described below:

Date	Description
4 th October 2018	Original Issue.

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE

FM Approvals LLC. 1151 Boston-Providence Turnpike, Norwood, MA 02062 USA
T: +1 (1) 781 762 4300 F: +1 (1) 781 762 9375 E-mail: information@fmaprovals.com www.fmaprovals.com

CERTIFICATE OF CONFORMITY

1. HAZARDOUS LOCATION ELECTRICAL EQUIPMENT PER CANADIAN REQUIREMENTS

2. Certificate No: FM18CA0010X
3. Equipment:
(Type Reference and Name) TC-Standard X2; TC-Standard+ X2; TC-MIDI X2; TC-MIDI+ X2; TC-Double X2 & TC-Double+ X2 Sample Gas cooler
4. Name of Listing Company: Bühler Technologies GmbH
5. Address of Listing Company: Harkortstraße 29, Ratingen D-40880, Germany
6. The examination and test results are recorded in confidential report number:

3062014 dated 4th October 2018

7. FM Approvals LLC, certifies that the equipment described has been found to comply with the following Approval standards and other documents:

CSA C22.2 No. 213:2021, CSA C22.2 No. 61010-1:2019

8. If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.
9. This certificate relates to the design, examination and testing of the products specified herein. The FM Approvals surveillance audit program has further determined that the manufacturing processes and quality control procedures in place are satisfactory to manufacture the product as examined, tested and Approved.
10. Equipment Ratings:

TC-Standard

Nonincendive for Class I Division 2, Groups A, B, C, D; T4 Ta = 0°C to 50°C

TC-Midi & TC Double

Nonincendive for Class I Division 2, Groups A, B, C, D; T4 Ta = 0°C to 60°C

Certificate issued by:



J.E. Marquedant
VP, Manager - Electrical Systems

9 October 2024

Date

To verify the availability of the Approved product, please refer to www.approvalguide.com

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SCHEDULE

Canadian Certificate of Conformity No: FM18CA0010X

11. The marking of the equipment shall include:

TC-Standard

Class I Division 2, Groups A, B, C, D; T4 Ta = 0°C to 50°C

TC-Midi & TC Double

Class I Division 2, Groups A, B, C, D; T4 Ta = 0°C to 60°C

12. Description of Equipment:

General - The TC- Standard; TC-MIDI & TC-Double sample gas chillers are intended to cool and dry the sample gas before going into the gas analyzers. Sample gases contain vapor which has to be withdrawn before it reaches the gas analyzer. The Gas flows through a heat exchanger (impinger) inserted into a cooling block. The latter then is cooled to a pre-set temperature (5°C mostly). Depending on the required cooling capacity the size of the heat exchanger and therefore chiller is chosen and depending on the kind of gas to be cooled different heat exchanger materials are provided (stainless steel, glass or PVDF).

A gas cooler (chiller) might be prepared for more than one heat exchanger. The cooling block is cooled by different combinations of Peltier-elements. The temperature is sensed by an RTD.

The TC-Standard X2 / TC-MIDI X2 series of sample coolers are designed specifically for high cooling capacities and high ambient temperatures.

The TC-Standard+ X2 / TC-MIDI+ X2 series are designed specifically for the requirements in automated measuring systems (AMS) according to EN 15267-3. The series connection of the heat exchangers will cool in two cycles to minimize wash out effects.

The TC-Double X2 series are designed specifically for high cooling capacities, high ambient temperatures and to cool in two cycles to minimize wash out effects.

The TC-Double+ X2 incorporates two cooling blocks that can be set do different temperatures.

Construction – The equipment is housed in a brushed stainless-steel IP20 enclosure.

Ratings - TC-Standard operate at 24VDC, 115 VAC or 230 VAC, selectable by ordering, with an ambient temperature rating of 0°C of up to 50°C. and TC-MIDI and TC-Double Models operate at 115 VAC or 230 VAC, selectable by ordering, with an ambient temperature rating of 0°C of up to 60°C.

See Annex for Model Codes

13. Specific Conditions of Use:

1. When installed as Class I Division 2 equipment, the thermoelectric cooler shall be mounted within a tool-secured IP54 enclosure which is capable of accepting one or more of the Class I Division 2 wiring methods per the Canadian Electric Code (CSA C22.1).

To verify the availability of the Approved product, please refer to www.approvalguide.com

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE

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SCHEDULE

Canadian Certificate of Conformity No: FM18CA0010X

14. Test and Assessment Procedure and Conditions:

This Certificate has been issued in accordance with FM Approvals Canadian Certification Scheme.

15. Schedule Drawings

A copy of the technical documentation has been kept by FM Approvals.

16. Certificate History

Details of the supplements to this certificate are described below:

Date	Description
4th October 2018	Original Issue.
9 October 2024	<u>Supplement 1:</u> Report Reference: RR242035 dated 9 October 2024. Description of the Change(s): 1. Addition of product variants due to changes to electronics 2. CSA C22.2 No. 213:2015 updated to CSA C22.2 No. 213:2021 3. CSA C22.2 No. 61010-1:2012 updated to CSA C22.2 No. 61010-1:2019

To verify the availability of the Approved product, please refer to www.approvalguide.com

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SCHEDULE

Canadian Certificate of Conformity No: FM18CA0010X

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ANNEX

4496 211b2d1fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 1 heat exchangers)

Description of Equipment:

b = Gas cooler model: 1 or 2
d = Supply voltage; 1, 2 or 4
f & g = Heat exchanger; 10, 15, 20, 25, 30, or 35
h = Condensate drain; 00, 10 or 30
j & k = Moisture detector/Filter; 00, 01, 10, or 11
l = Status Outputs; 00 or 10
n = Delta T control; 00 or 10

4496 211b2d1fg0000l0n0p TC-Standard X2 - Sample Gas Cooler (fitted with 1 heat exchanger for H2/O2 applications)

Description of Equipment:

b = Gas cooler model: 1 or 2
d = Supply voltage; 1 or 2
f, g = Heat exchanger; 10, 15, 10 or 15
l = Status Outputs; 00 or 10
n = Delta T control; 00 or 10
p = heat exchanger optimized for high-purity hydrogen/oxygen; -H2 or -O2

4496 212b2d2fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 2 heat exchangers)

Description of Equipment:

b = Gas cooler model: 1 or 2
d = Supply voltage; 1, 2 or 4
f & g = Heat exchanger; 10, 15, 20, 25, 30, or 35
h = Condensate drain; 0, 2, or 4
j & k = Moisture detector/Filter; 00, 01, 02, 10, 11, 20, 21, 22
l = Status Outputs; 0 or 1
n = Delta T control; 0 or 1

To verify the availability of the Approved product, please refer to www.approvalguide.com

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Canadian Certificate of Conformity No: FM18CA0010X

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4496 212b2d2fgh0jkl0n0 TC-Standard+ X2 - Sample Gas Cooler (with 2 heat exchangers in series)

Description of Equipment:

b = Gas cooler model: 1 or 2
d = Supply voltage; 1, 2 or 4
f & g = Heat exchanger; 22, 27, 32 or 37
h = Condensate drain; 0, 2, 4
j & k = Moisture detector/Filter; 00, 01, 10, or 11
l = Signal Outputs; 0 or 1
n = no value assigned.

4496 311 b2defghijklmno TC-MIDI X2(fitted with 1 heat exchangers)

Description of Equipment:

b = Gas cooler types 1 or 2
d = Supply Voltage; 1 or 2
e = Gas path; 1 or 2
f,g = Heat exchangers; 10, 15, 20, 25, 30 or 35
h = Condensate drain; 0, 1 or 3
i = Sample gas pumps; 0, 1, 2, 6, or 7
j,k = Moisture detector/Filter; 00, 01, 10 or 11
l,m = Signal output; 00 or 10
n,o = Delta T control; 00 or 10

4496 311 b2defg0000lmnop TC-MIDI X2 (fitted with 1 heat exchangers for H2/O2 applications)

Description of Equipment:

b = Gas cooler types 1 or 2
d = Supply Voltage; 1 or 2
e = Gas path; 1 or 2
f,g = Heat exchangers; 10, 15, 60, 65
l,m = Signal output; 00 or 10
n,o = Delta T control; 00 or 10
p = heat exchanger optimized for high-purity hydrogen/oxygen; -H2 or -O2

To verify the availability of the Approved product, please refer to www.approvalguide.com

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F 348 (Jul 24)



SCHEDULE

Canadian Certificate of Conformity No: FM18CA0010X

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4496 312 b2d1fghijklm00 TC-MIDI + X2(fitted with 2 heat exchangers)

Description of Equipment:

b = Gas cooler types 1 or 2
d = Supply Voltage; 1 or 2
f,g = Heat exchangers; 60, 65, 61, 66, 70, 75, 80 or 85
h = Condensate drain; 0, 2, or 4
i = Sample gas pumps; 0, 1, 2, 6, or 7
j,k = Moisture detector/Filter; 00, 01, 02, 10, 11, 20, 21 or 22
l,m = Signal outputs; 00 or 10
n, o = Delta T Control; 00 or 10

4496 611a2c1efghijkl000 TC-Double X2

Description of Equipment:

a = Gas cooler types 1 or 2
c = Voltage; 1 or 2
e,f = Heat exchangers; 10, 15, 20, 25, 30 or 35
g = Condensate drain; 0, 2, or 4
h = Sample gas pumps; 0, 1, or 2
i,j = Humidity sensor/Filter; 00, 01, 10, or 11
k,l = Signal outputs; 00 or 10

4496 611a2c1efghijkl000 TC-Double+ X2

Description of Equipment:

a = Gas cooler types 1 or 2
c = Voltage; 1 or 2
e,f = Heat exchangers; 22, 27, 32, or 37
g = Peristaltic pumps; 0, 2, or 4
h = Sample gas pumps; 0, 1, or 2
i,j = Moisture Detector/Filter; 00, 01, 10, or 11
k,l = Status output; 00 or 10

To verify the availability of the Approved product, please refer to www.approvalguide.com

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CERTIFICATE OF CONFORMITY



1. **HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT PER US REQUIREMENTS**
2. **Certificate No:** FM18US0021X
3. **Equipment:** C-Standard X2; TC-Standard+ X2; TC-MIDI X2; TC MIDI+ X2;
(Type Reference and Name) TC-Double X2 & TC-Double+ X2
Sample Gas cooler
4. **Name of Listing Company:** Bühler Technologies GmbH
5. **Address of Listing Company:** Harkortstrasse 29
Ratingen, D-40880
Germany
6. The examination and test results are recorded in confidential report number:

3062014 dated 4th October 2018
7. FM Approvals LLC, certifies that the equipment described has been found to comply with the following Approval standards and other documents:

FM Class 3600:2018, FM Class 3611:2018, FM Class 3810:2018,
ANSI/ISA-12.12.01-2015, ANSI/ISA 61010-1:2012
8. If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.
9. This certificate relates to the design, examination and testing of the products specified herein. The FM Approvals surveillance audit program has further determined that the manufacturing processes and quality control procedures in place are satisfactory to manufacture the product as examined, tested and Approved.
10. **Equipment Ratings:**

TC-Standard Models:

Non-incendive for Class I, Division 2, Groups A, B, C and D; T4 hazardous (classified) locations with an ambient temperature rating of 0°C to 50°C.

Certificate issued by:



J.E. Marquedant
VP, Manager, Electrical Systems

4 October 2018

Date

To verify the availability of the Approved product, please refer to www.approvalguide.com

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SCHEDULE



US Certificate Of Conformity No: FM18US0021X

TC-MIDI and TC-Double Models:

Non-incendive for Class I, Division 2, Groups A, B, C and D; T4 hazardous (classified) locations with an ambient temperature rating of 0°C to 60°C.

11. The marking of the equipment shall include:

TC-Standard Models:

Class I Division 2, Groups A, B, C, D; T4 Ta = 0°C to 50°C

TC-MIDI and TC-Double Models:

Class I Division 2, Groups A, B, C, D; T4 Ta = 0°C to 60°C

12. **Description of Equipment:**

General - The TC- Standard; TC-Midi & TC-Double sample gas chillers are intended to cool and dry the sample gas before going into the gas analyzers. Sample gases contain vapor which has to be withdrawn before it reaches the gas analyzer. The Gas flows through a heat exchanger (impinger) inserted into a cooling block. The latter then is cooled to a pre-set temperature (5°C mostly).

Depending on the required cooling capacity the size of the heat exchanger and therefore chiller is chosen and depending on the kind of gas to be cooled different heat exchanger materials are provided (stainless steel, glass or PVDF).

A gas cooler (chiller) might be prepared for more than one heat exchanger. The cooling block is cooled by different combinations of Peltier-elements. The temperature is sensed by an RTD.

The TC-Standard X2 / TC-Midi X2 series of sample coolers are designed specifically for high cooling capacities and high ambient temperatures.

The TC-Standard+ X2 / TC-Midi+ X2 series are designed specifically for the requirements in automated measuring systems (AMS) according to EN 15267-3. The series connection of the heat exchangers will cool in two cycles to minimize wash out effects.

The TC-Double X2 series are designed specifically for high cooling capacities, high ambient temperatures and to cool in two cycles to minimize wash out effects.

The TC-Double+ X2 incorporates two cooling blocks that can be set do different temperatures.

Construction – The equipment is housed in a brushed stainless IP20 enclosure.

Ratings - TC-Standard operate at 24VDC, 115 VAC or 230 VAC, selectable by ordering, with an ambient temperature rating of 0°C up to 50°C. and TC-MIDI and TC-Double Models operate at 115 VAC or 230 VAC, selectable by ordering, with an ambient temperature rating of 0°C up to 60°C.

4496 211b2d1fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 1 heat exchangers)

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US Certificate Of Conformity No: FM18US0021X

- b = Gas cooler model: 1 or 2
- d, = Supply voltage; 1, 2 or 4
- f & g = Heat exchanger; 10, 15, 20, 25, 30, or 35
- h = Peristaltic Pumps; 0, 1, 3
- j & k = Moisture detector / Filter; 00, 01, 10, or 11
- l = Status Outputs; 0 or 1
- n = Delta T control; 0 or 1

4496 212b2d2fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 2 heat exchangers)

- b = Gas cooler model: 1 or 2
- d = Supply voltage; 1, 2 or 4
- f & g = Heat exchanger; 10, 15, 20, 25, 30, or 35
- h = Peristaltic Pumps; 0, 2, or 4
- j & k = Moisture detector / Filter; 00, 01, 02, 10, 11, 20, 21, 22
- l = Status Outputs; 0 or 1
- n = Delta T control; 0 or 1

4496 212b2d2fgh0jkl0n0 TC-Standard+ X2 - Sample Gas Cooler (with 2 heat exchangers in series)

- b = Gas cooler model: 1 or 2
- d = Supply voltage; 1, 2 or 4
- f & g = Heat exchanger; 22, 27, 32 & 37
- h = Peristaltic Pumps; 0, 2, 4
- j & k = Moisture detector / Filter; 00, 01, 10, or 11
- l = Status Outputs; 0 or 1
- n = no value assigned.

4496 311 b2defghijklmno Thermoelectric Cooler, TC-MIDI + X2(fitted with 1 heat exchangers)

- b = Gas cooler types 1 or 2
- d = Supply Voltage; 1 or 2
- e = Gas paths; 1 or 2
- f, g = Heat exchangers; 60, 61, 65, 66, 70, 75, 80 or 85
- h = Peristaltic pumps; 0, 2, or 4
- i = Sample gas pumps; 0, 1, 2, 6, or 7
- j, k = Moisture detector / Filter; 00, 01, 02, 10, 11, 20, 21, or 22
- l, m = Status output; 00 or 10
- n, o = Delta T control; 00 or 10

4496 312 b2d1fghijklm00 Thermoelectric Cooler, TC-MIDI + X2(fitted with 2 heat exchangers)

- b = Gas cooler types 1 or 2
- d = Supply Voltage; 1 or 2
- f, g = Heat exchangers; 22, 27, 32, or 37
- h = Peristaltic pumps; 0, 2, or 4
- i = Sample gas pumps; 0, 1, 2, 6, or 7
- j, k = Moisture detector / Filter; 00, 01, 02, 10, or 11
- l, m = Status output; 00 or 10

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SCHEDULE



US Certificate Of Conformity No: FM18US0021X

4496 611a2c1efghijkl000 Thermoelectric Cooler, TC-Double X2

- a = Gas cooler types 1 or 2
- c = Voltage; 1 or 2
- e,f = Heat exchangers; 10,15, 20,25,30, or 35
- g = Peristaltic pumps; 0, 2, or 4
- h = Sample gas pumps; 0, 1, or 2
- i,j = Moisture Detector/Filter; 00, 01, 10, or 11
- k,l = Status output; 00 or 10

4496 611a2c1efghijkl000 Thermoelectric Cooler, TC-Double+ X2

- a = Gas cooler types 1 or 2
- c = Voltage; 1 or 2
- e,f = Heat exchangers; 22, 27, 32, or 37
- g = Peristaltic pumps; 0, 2, or 4
- h = Sample gas pumps; 0, 1, or 2
- i,j = Moisture Detector/Filter; 00, 01, 10, or 11
- k,l = Status output; 00 or 10

13. Specific Conditions of Use:

1. *When installed as Class I Division 2 equipment, the thermoelectric cooler shall be mounted within a tool-secured IP54 enclosure which is capable of accepting one or more of the Class I Division 2 wiring methods per the National Electric Code (ANSI/NFPA 70).*

14. Test and Assessment Procedure and Conditions:

This Certificate has been issued in accordance with FM Approvals US Certification Requirements.

15. Schedule Drawings

A copy of the technical documentation has been kept by FM Approvals.

16. Certificate History

Details of the supplements to this certificate are described below:

Date	Description
4 th October 2018	Original Issue.

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE

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CERTIFICATE OF CONFORMITY



1. **HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT PER US REQUIREMENTS**

2. **Certificate No:** FM18US0021X

3. **Equipment:** TC-Standard X2; TC-Standard+ X2; TC-MIDI X2; TC MIDI+ X2; TC-Double X2 & TC-Double+ X2

(Type Reference and Name)

4. **Name of Listing Company:** Sample Gas cooler
Bühler Technologies GmbH

5. **Address of Listing Company:** Harkortstrasse 29
Ratingen, D-40880
Germany

6. The examination and test results are recorded in confidential report number:

3062014 dated 4th October 2018

7. FM Approvals LLC, certifies that the equipment described has been found to comply with the following Approval standards and other documents:

FM Class 3600:2018, FM Class 3611:2018, FM Class 3810:2018,
ANSI/ISA-12.12.01-2015, ANSI/ISA 61010-1:2012

8. If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.

9. This certificate relates to the design, examination and testing of the products specified herein. The FM Approvals surveillance audit program has further determined that the manufacturing processes and quality control procedures in place are satisfactory to manufacture the product as examined, tested and Approved.

10. Equipment Ratings:

TC-Standard Models:

Non-incendive for Class I, Division 2, Groups A, B, C and D; T4 hazardous (classified) locations with an ambient temperature rating of 0°C to 50°C.

Certificate issued by:

J.E. Marquedant
VP, Manager - Electrical Systems

25 January 2021

Date

To verify the availability of the Approved product, please refer to www.approvalguide.com

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SCHEDULE



US Certificate Of Conformity No: FM18US0021X

TC-MIDI and TC-Double Models:

Non-incendive for Class I, Division 2, Groups A, B, C and D; T4 hazardous (classified) locations with an ambient temperature rating of 0°C to 60°C.

11. The marking of the equipment shall include:

TC-Standard Models:

Class I Division 2, Groups A, B, C, D; T4 Ta = 0°C to 50°C

TC-MIDI and TC-Double Models:

Class I Division 2, Groups A, B, C, D; T4 Ta = 0°C to 60°C

12. **Description of Equipment:**

General - The TC- Standard; TC-Midi & TC-Double sample gas chillers are intended to cool and dry the sample gas before going into the gas analyzers. Sample gases contain vapor which has to be withdrawn before it reaches the gas analyzer. The Gas flows through a heat exchanger (impinger) inserted into a cooling block. The latter then is cooled to a pre-set temperature (5°C mostly).

Depending on the required cooling capacity the size of the heat exchanger and therefore chiller is chosen and depending on the kind of gas to be cooled different heat exchanger materials are provided (stainless steel, glass or PVDF).

A gas cooler (chiller) might be prepared for more than one heat exchanger. The cooling block is cooled by different combinations of Peltier-elements. The temperature is sensed by an RTD.

The TC-Standard X2 / TC-Midi X2 series of sample coolers are designed specifically for high cooling capacities and high ambient temperatures.

The TC-Standard+ X2 / TC-Midi+ X2 series are designed specifically for the requirements in automated measuring systems (AMS) according to EN 15267-3. The series connection of the heat exchangers will cool in two cycles to minimize wash out effects.

The TC-Double X2 series are designed specifically for high cooling capacities, high ambient temperatures and to cool in two cycles to minimize wash out effects.

The TC-Double+ X2 incorporates two cooling blocks that can be set do different temperatures.

Construction – The equipment is housed in a brushed stainless steel IP20 enclosure.

Ratings - TC-Standard operate at 24VDC, 115 VAC or 230 VAC, selectable by ordering, with an ambient temperature rating of 0°C of up to 50°C. and TC-MIDI and TC-Double Models operate at 115 VAC or 230 VAC, selectable by ordering, with an ambient temperature rating of 0°C of up to 60°C.

4496 211b2d1fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 1 heat exchangers)

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US Certificate Of Conformity No: FM18US0021X

- b = Gas cooler model: 1 or 2
- d, = Supply voltage; 1, 2 or 4
- f & g = Heat exchanger; 10, 15, 20, 25, 30, or 35
- h = Peristaltic Pumps; 0, 1, 3
- j & k = Moisture detector / Filter; 00, 01, 10, or 11
- l = Status Outputs; 0 or 1
- n = Delta T control; 0 or 1

4496 212b2d2fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 2 heat exchangers)

- b = Gas cooler model: 1 or 2
- d = Supply voltage; 1, 2 or 4
- f & g = Heat exchanger; 10, 15, 20, 25, 30, or 35
- h = Peristaltic Pumps; 0, 2, or 4
- j & k = Moisture detector / Filter; 00, 01, 02, 10, 11, 20, 21, 22
- l = Status Outputs; 0 or 1
- n = Delta T control; 0 or 1

4496 212b2d2fgh0jkl0n0 TC-Standard+ X2 - Sample Gas Cooler (with 2 heat exchangers in series)

- b = Gas cooler model: 1 or 2
- d = Supply voltage; 1, 2 or 4
- f & g = Heat exchanger; 22, 27, 32 & 37
- h = Peristaltic Pumps; 0, 2, 4
- j & k = Moisture detector / Filter; 00, 01, 10, or 11
- l = Status Outputs; 0 or 1
- n = no value assigned.

4496 311 b2defghijklmno Thermoelectric Cooler, TC-MIDI X2(fitted with 1 heat exchangers)

- b = Gas cooler types 1 or 2
- d = Supply Voltage; 1 or 2
- e = Gas paths; 1 or 2
- f,g = Heat exchangers; 60, 61, 65, 66, 70, 75, 80 or 85
- h = Peristaltic pumps; 0, 2, or 4
- i = Sample gas pumps; 0, 1, 2, 6, or 7
- j,k = Moisture detector / Filter; 00, 01, 02, 10, 11, 20, 21, or 22
- l,m = Status output; 00 or 10
- n,o = Delta T control; 00 or 10

4496 312 b2d1fghijklm00 Thermoelectric Cooler, TC-MIDI + X2(fitted with 2 heat exchangers)

- b = Gas cooler types 1 or 2
- d = Supply Voltage; 1 or 2
- f,g = Heat exchangers; 22, 27, 32, or 37
- h = Peristaltic pumps; 0, 2, or 4
- i = Sample gas pumps; 0, 1, 2, 6, or 7
- j,k = Moisture detector / Filter; 00, 01, 02, 10, or 11
- l,m = Status output; 00 or 10

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SCHEDULE



US Certificate Of Conformity No: FM18US0021X

4496 611a2c1efghijkl000 Thermoelectric Cooler, TC-Double X2

- a = Gas cooler types 1 or 2
- c = Voltage; 1 or 2
- e,f = Heat exchangers; 10, 15, 20, 25, 30, or 35
- g = Peristaltic pumps; 0, 2, or 4
- h = Sample gas pumps; 0, 1, or 2
- i,j = Moisture Detector/Filter; 00, 01, 10, or 11
- k,l = Status output; 00 or 10

4496 611a2c1efghijkl000 Thermoelectric Cooler, TC-Double+ X2

- a = Gas cooler types 1 or 2
- c = Voltage; 1 or 2
- e,f = Heat exchangers; 22, 27, 32, or 37
- g = Peristaltic pumps; 0, 2, or 4
- h = Sample gas pumps; 0, 1, or 2
- i,j = Moisture Detector/Filter; 00, 01, 10, or 11
- k,l = Status output; 00 or 10

13. Specific Conditions of Use:

1. *When installed as Class I Division 2 equipment, the thermoelectric cooler shall be mounted within a tool-secured IP54 enclosure which is capable of accepting one or more of the Class I Division 2 wiring methods per the National Electric Code (ANSI/NFPA 70).*

14. Test and Assessment Procedure and Conditions:

This Certificate has been issued in accordance with FM Approvals US Certification Requirements.

15. Schedule Drawings

A copy of the technical documentation has been kept by FM Approvals.

16. Certificate History

Details of the supplements to this certificate are described below:

Date	Description
4 th October 2018	Original Issue.
25 th January 2021	Supplement 1: Report Reference: RR226270 dated 25 th January 2021. Description of the Change: Add digital interface and correct typo in model code to remove + for TC-MIDI fitted with 1 heat exchanger.

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SCHEDULE



US Certificate Of Conformity No: FM18US0021X

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CERTIFICATE OF CONFORMITY

1. HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT PER US REQUIREMENTS

2. Certificate No: FM18US0021X
3. Equipment:
(Type Reference and Name) TC-Standard X2; TC-Standard+ X2; TC-MIDI X2; TC-MIDI+ X2; TC-Double X2 & TC-Double+ X2
Sample Gas cooler
4. Name of Listing Company: Bühler Technologies GmbH
5. Address of Listing Company: Harkortstraße 29, Ratingen D-40880, Germany
6. The examination and test results are recorded in confidential report number:

3062014 dated 4th October 2018

7. FM Approvals LLC, certifies that the equipment described has been found to comply with the following Approval standards and other documents:

FM 3600:2022, FM 3611:2021, FM 3810:2021, ANSI/UL 61010-1:2019, ANSI/UL 121201:2021

8. If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.
9. This certificate relates to the design, examination and testing of the products specified herein. The FM Approvals surveillance audit program has further determined that the manufacturing processes and quality control procedures in place are satisfactory to manufacture the product as examined, tested and Approved.
10. Equipment Ratings:

TC-Standard

Nonincendive for Class I Division 2, Groups A, B, C, D; T4 Ta = 0°C to 50°C

TC-Midi & TC Double

Nonincendive for Class I Division 2, Groups A, B, C, D; T4 Ta = 0°C to 60°C

Certificate issued by:



J.E. Marquedant
VP, Manager - Electrical Systems

9 October 2024

Date

To verify the availability of the Approved product, please refer to www.approvalguide.com

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F 347 (Jul 24)



SCHEDULE

US Certificate of Conformity No: FM18US0021X

11. The marking of the equipment shall include:

TC-Standard

Class I Division 2, Groups A, B, C, D; T4 Ta = 0°C to 50°C

TC-Midi & TC Double

Class I Division 2, Groups A, B, C, D; T4 Ta = 0°C to 60°C

12. Description of Equipment:

General - The TC- Standard; TC-MIDI & TC-Double sample gas chillers are intended to cool and dry the sample gas before going into the gas analyzers. Sample gases contain vapor which has to be withdrawn before it reaches the gas analyzer. The Gas flows through a heat exchanger (impinger) inserted into a cooling block. The latter then is cooled to a pre-set temperature (5°C mostly). Depending on the required cooling capacity the size of the heat exchanger and therefore chiller is chosen and depending on the kind of gas to be cooled different heat exchanger materials are provided (stainless steel, glass or PVDF).

A gas cooler (chiller) might be prepared for more than one heat exchanger. The cooling block is cooled by different combinations of Peltier-elements. The temperature is sensed by an RTD.

The TC-Standard X2 / TC-MIDI X2 series of sample coolers are designed specifically for high cooling capacities and high ambient temperatures.

The TC-Standard+ X2 / TC-MIDI+ X2 series are designed specifically for the requirements in automated measuring systems (AMS) according to EN 15267-3. The series connection of the heat exchangers will cool in two cycles to minimize wash out effects.

The TC-Double X2 series are designed specifically for high cooling capacities, high ambient temperatures and to cool in two cycles to minimize wash out effects.

The TC-Double+ X2 incorporates two cooling blocks that can be set do different temperatures.

Construction – The equipment is housed in a brushed stainless-steel IP20 enclosure.

Ratings - TC-Standard operate at 24VDC, 115 VAC or 230 VAC, selectable by ordering, with an ambient temperature rating of 0°C of up to 50°C. and TC-MIDI and TC-Double Models operate at 115 VAC or 230 VAC, selectable by ordering, with an ambient temperature rating of 0°C of up to 60°C.

See Annex for Model Codes

13. Specific Conditions of Use:

1. When installed as Class I Division 2 equipment, the thermoelectric cooler shall be mounted within a tool-secured IP54 enclosure which is capable of accepting one or more of the Class I Division 2 wiring methods per the National Electric Code (ANSI/NFPA 70).

To verify the availability of the Approved product, please refer to www.approvalguide.com

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE

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F 347 (Jul 24)



SCHEDULE

US Certificate of Conformity No: FM18US0021X

14. Test and Assessment Procedure and Conditions:

This Certificate has been issued in accordance with FM Approvals US Certification Requirements.

15. Schedule Drawings

A copy of the technical documentation has been kept by FM Approvals.

16. Certificate History

Details of the supplements to this certificate are described below:

Date	Description
4 October 2018	Original Issue.
25 January 2021	<u>Supplement 1:</u> Report Reference: RR226270 dated 25 th January 2021. Description of the Change: Add digital interface and correct typo in model code to remove + for TC-MIDI fitted with 1 heat exchanger.
9 October 2024	<u>Supplement 2:</u> Report Reference: RR242035 dated 9 October 2024. Description of the Change(s): 1. Addition of product variants due to changes to electronics 2. FM3600 updated to latest edition (2022) 3. FM3611 updated to latest edition (2021) 4. FM3810 updated to latest edition (2021) 5. ANSI/UL 121201:2015 updated to ANSI/UL 121201:2021 6. ANSI/ISA 61010-1:2012 updated to ANSI/UL 61010-1:2019

To verify the availability of the Approved product, please refer to www.approvalguide.com

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SCHEDULE

US Certificate of Conformity No: FM18US0021X

FM Approvals

ANNEX

4496 211b2d11gh0jkl0n0pTC-Standard X2 - Sample Gas Cooler (fitted with 1 heat exchanger)

Description of Equipment:

b = Gas cooler model: 1 or 2
d = Supply voltage; 1, 2 or 4
f & g = Heat exchanger; 10, 15, 20, 25, 30, or 35
h = Condensate drain; 00, 10 or 30
j & k = Moisture detector/Filter; 00, 01, 10, or 11
l = Status Outputs; 00 or 10
n = Delta T control; 00 or 10

4496 211b2d1fg0000l0n0p TC-Standard X2 - Sample Gas Cooler (fitted with 1 heat exchanger for H2/O2 applications)

Description of Equipment:

b = Gas cooler model: 1 or 2
d = Supply voltage; 1 or 2
f, g = Heat exchanger; 10, 15, 10 or 15
l = Status Outputs; 00 or 10
n = Delta T control; 00 or 10
p = heat exchanger optimized for high-purity hydrogen/oxygen; -H2 or -O2

4496 212b2d2fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 2 heat exchangers)

Description of Equipment:

b = Gas cooler model: 1 or 2
d = Supply voltage; 1, 2 or 4
f & g = Heat exchanger; 10, 15, 20, 25, 30, or 35
h = Condensate drain; 0, 2, or 4
j & k = Moisture detector/Filter; 00, 01, 02, 10, 11, 20, 21, 22
l = Status Outputs; 0 or 1
n = Delta T control; 0 or 1

To verify the availability of the Approved product, please refer to www.approvalguide.com

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SCHEDULE

US Certificate of Conformity No: FM18US0021X

FM Approvals

4496 212b2d2fgh0jkl0n0 TC-Standard+ X2 - Sample Gas Cooler (with 2 heat exchangers in series)

Description of Equipment:

b = Gas cooler model: 1 or 2
d = Supply voltage; 1, 2 or 4
f & g = Heat exchanger; 22, 27, 32 or 37
h = Condensate drain; 0, 2, 4
j & k = Moisture detector/Filter; 00, 01, 10, or 11
l = Signal Outputs; 0 or 1
n = no value assigned.

4496 311 b2defghijklmno TC-MIDI X2(fitted with 1 heat exchangers)

Description of Equipment:

b = Gas cooler types 1 or 2
d = Supply Voltage; 1 or 2
e = Gas path; 1 or 2
f,g = Heat exchangers; 10, 15, 20, 25, 30 or 35
h = Condensate drain; 0, 1 or 3
i = Sample gas pumps; 0, 1, 2, 6, or 7
j,k = Moisture detector/Filter; 00, 01, 10 or 11
l,m = Signal output; 00 or 10
n,o = Delta T control; 00 or 10

4496 311 b2defg0000lmnop TC-MIDI X2 (fitted with 1 heat exchangers for H2/O2 applications)

Description of Equipment:

b = Gas cooler types 1 or 2
d = Supply Voltage; 1 or 2
e = Gas path; 1 or 2
f,g = Heat exchangers; 10, 15, 60, 65
l,m = Signal output; 00 or 10
n,o = Delta T control; 00 or 10
p = heat exchanger optimized for high-purity hydrogen/oxygen; -H2 or -O2

To verify the availability of the Approved product, please refer to www.approvalguide.com

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F 347 (Jul 24)



SCHEDULE

US Certificate of Conformity No: FM18US0021X

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4496 312 b2d1fghijklm00 TC-MIDI + X2(fitted with 2 heat exchangers)

Description of Equipment:

b = Gas cooler types 1 or 2
d = Supply Voltage; 1 or 2
f,g = Heat exchangers; 60, 65, 61, 66, 70, 75, 80 or 85
h = Condensate drain; 0, 2, or 4
i = Sample gas pumps; 0, 1, 2, 6, or 7
j,k = Moisture detector/Filter; 00, 01, 02, 10, 11, 20, 21 or 22
l,m = Signal outputs; 00 or 10
n, o = Delta T Control; 00 or 10

4496 611a2c1efghijkl000 TC-Double X2

Description of Equipment:

a = Gas cooler types 1 or 2
c = Voltage; 1 or 2
e,f = Heat exchangers; 10, 15, 20, 25, 30 or 35
g = Condensate drain; 0, 2, or 4
h = Sample gas pumps; 0, 1, or 2
i,j = Humidity sensor/Filter; 00, 01, 10, or 11
k,l = Signal outputs; 00 or 10

4496 611a2c1efghijkl000 TC-Double+ X2

Description of Equipment:

a = Gas cooler types 1 or 2
c = Voltage; 1 or 2
e,f = Heat exchangers; 22, 27, 32, or 37
g = Peristaltic pumps; 0, 2, or 4
h = Sample gas pumps; 0, 1, or 2
i,j = Moisture Detector/Filter; 00, 01, 10, or 11
k,l = Status output; 00 or 10

To verify the availability of the Approved product, please refer to www.approvalguide.com

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F 347 (Jul 24)



1 TYPE EXAMINATION CERTIFICATE



2 Equipment or Protective systems intended for use in Potentially
Explosive Atmospheres - Directive 2014/34/EU

3 Type Examination Certificate No: FM18ATEX0012X

4 Equipment or protective system:
(Type Reference and Name) TC-Standard X2; TC-Standard+ X2; TC-MIDI X2;
TC MIDI+ X2; TC-Double X2 & TC-Double+ X2
Sample Gas Cooler

5 Name of Applicant: Bühler Technologies GmbH

6 Address of Applicant: Harkortstrasse 29
Ratingen, D-40880
Germany

7 This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and documents therein referred to.

8 FM Approvals Europe Ltd. certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report number:

3062014 dated 04th October 2018

9 Compliance with the Essential Health and Safety Requirements, with the exception of those identified in item 15 of the schedule to this certificate, has been assessed by compliance with the following documents:

EN 60079-0:2012+A11:2013, EN 60079-7:2015+A1:2018 & EN 60079-15:2018

10 If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.

11 This Type Examination certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance to the Directive 2014/34/EU. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

12 The marking of the equipment or protective system shall include:



II 3 G Ex ec nC IIC T4 Gc

Ta = 0°C to +40°C or 0°C to +50°C (TC-Standard X2 & TC-Standard+ X2 Models)

Ta = 0°C to +40°C or 0°C to +60°C (TC-MIDI X2 & TC-MIDI+ X2 and
TC-Double X2 & TC-Double+ X2 Models)


FM Approvals
Member of the FM Global Group

Digitally signed by Damien Mc Ardle
DN: cn=Damien Mc Ardle, o=FM
Approvals, ou=FM Approvals Europe
Ltd,
email=damien.mcardle@fmapproval
s.com, c=IE
Date: 2020.02.18 18:14:19 Z

Damien Mc Ardle
Certification Manager, FM Approvals Europe Ltd.

Issue date: 18th February 2020

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FM Approvals Europe Ltd. One Georges Quay Plaza, Dublin. Ireland. D02 E440
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SCHEDULE

to Type Examination Certificate No. FM18ATEX0012X

13 Description of Equipment or Protective System:

The TC- Standard; TC-Midi & TC-Double sample gas chillers are intended to cool and dry the sample gas before going into the gas analysers. Sample gases contain vapour which has to be withdrawn before it reaches the gas analyser. The Gas flows through a heat exchanger (impinger) inserted into a cooling block. The latter then is cooled to a pre-set temperature (5°C mostly).

Depending on the required cooling capacity the size of the heat exchanger and therefore chiller is chosen and depending on the kind of gas to be cooled different heat exchanger materials are provided (stainless steel, glass or PVDF).

A gas cooler (chiller) might be prepared for more than one heat exchanger. The cooling block is cooled by different combinations of Peltier-elements. The temperature is sensed by an RTD.

The TC-Standard X2 / TC-Midi X2 series of sample coolers are designed specifically for high cooling capacities and high ambient temperatures.

The TC-Standard+ X2 / TC-Midi+ X2 series are designed specifically for the requirements in automated measuring systems (AMS) according to EN 15267-3. The series connection of the heat exchangers will cool in two cycles to minimise wash out effects.

The TC-Double X2 series are designed specifically for high cooling capacities, high ambient temperatures and to cool in two cycles to minimise wash out effects.

The TC-Double+ X2 incorporates two cooling blocks that can be set do different temperatures.

TC-Standard X2 - Sample Gas Cooler (fitted with 1 or 2 heat exchangers)

Electrical data: Umax 24VDC, 115VAC or 230 VAC, 50/60 Hz, TC – Standard Models	130 W
TC – MIDI Models	290 W
TC – Double models	390 W

4496 211b2d1fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 1 heat exchangers)

b	= Gas cooler model: 1 or 2
d,	= Supply voltage; 1, 2 or 4
f,g	= Heat exchanger; 10, 15, 20, 25, 30, or 35
h	= Peristaltic Pumps; 0, 1, 3
j,k	= Moisture detector / Filter; 00, 01, 10, or 11
l	= Status Outputs; 0 or 1
n	= Delta T control; 0 or 1

4496 212b2d2fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 2 heat exchangers)

b	= Gas cooler model: 1 or 2
d	= Supply voltage; 1, 2 or 4
f,g	= Heat exchanger; 10, 15, 20, 25, 30, or 35
h	= Peristaltic Pumps; 0, 2, or 4
j,k	= Moisture detector / Filter; 00, 01, 02, 10, 11, 20, 21, 22
l	= Status Outputs; 0 or 1
n	= Delta T control; 0 or 1

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SCHEDULE

to Type Examination Certificate No. FM18ATEX0012X

4496 212b2d2fgh0jkl000 TC-Standard+ X2 - Sample Gas Cooler (with 2 heat exchangers in series)

b = Gas cooler model: 1 or 2
d = Supply voltage; 1, 2 or 4
f,g = Heat exchanger; 22, 27, 32 or 37
h = Peristaltic Pumps; 0, 2, 4
j,k = Moisture detector / Filter; 00, 01, 10, or 11
l = Status Outputs; 0 or 1

4496 311 b2defghijklmno Thermoelectric Cooler, TC-MIDI X2 (fitted with 1 gas path inside the heat exchanger)

b = Gas cooler types 1 or 2
d = Supply Voltage; 1 or 2
e = Gas paths; 1 or 2
f,g = Heat exchangers; 10, 15, 20, 25, 30, or 35
h = Peristaltic pumps; 0, 1, or 3
i = Sample gas pumps; 0, 1, 2, 6, or 7
j,k = Moisture detector / Filter; 00, 01, 10, or 11
l,m = Status output; 00 or 10
n,o = Delta T control; 00 or 10

4496 311 b2defghijklmno Thermoelectric Cooler, TC-MIDI X2 (fitted with 2 gas paths inside the heat exchanger)

b = Gas cooler types 1 or 2
d = Supply Voltage; 1 or 2
e = Gas paths; 1 or 2
f,g = Heat exchangers; 60, 61, 65, 66, 70, 75, 80 or 85
h = Peristaltic pumps; 0, 2, or 4
i = Sample gas pumps; 0, 1, 2, 6, or 7
j,k = Moisture detector / Filter; 00, 01, 02, 10, 11, 20, 21, or 22
l,m = Status output; 00 or 10
n,o = Delta T control; 00 or 10

4496 312 b2d1fghijklmno Thermoelectric Cooler, TC-MIDI X2 (fitted with 2 heat exchangers)

b = Gas cooler types 1 or 2
d = Supply Voltage; 1 or 2
f,g = Heat exchangers; 22, 27, 32, or 37
h = Peristaltic pumps; 0, 2, or 4
i = Sample gas pumps; 0, 1, 2, 6, or 7
j,k = Moisture detector / Filter; 00, 01, 10, or 11
l,m = Status output; 00 or 10
n,o = Delta T control; 00 or 10

4496 312 b2d1fghijklm00 Thermoelectric Cooler, TC-MIDI + X2 (fitted with 2 heat exchangers in series)

b = Gas cooler types 1 or 2
d = Supply Voltage; 1 or 2
f,g = Heat exchangers; 22, 27, 32, or 37
h = Peristaltic pumps; 0, 2, or 4
i = Sample gas pumps; 0, 1, 2, 6, or 7
j,k = Moisture detector / Filter; 00, 01, 10, or 11
l,m = Status output; 00 or 10

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SCHEDULE

to Type Examination Certificate No. FM18ATEX0012X

4496 611a2c1efghijk000 Thermoelectric Cooler, TC-Double X2 (fitted with 2 heat exchangers in series)

- a = Gas cooler types 1, 2, 3 or 4
- c = Voltage; 1 or 2
- e,f = Heat exchangers; 10,15, 20,25,30, or 35
- g = Peristaltic pumps; 0, 2, or 4
- h = Sample gas pumps; 0, 1, or 2
- i,j = Moisture Detector/Filter; 00, 01, 10, or 11
- k = Status output; 0 or 1

4496 611a2c1efghijk000 Thermoelectric Cooler, TC-Double+ X2

- a = Gas cooler types 1 or 2
- c = Voltage; 1 or 2
- e,f = Heat exchangers; 22, 27, 32, or 37
- g = Peristaltic pumps; 0, 2, or 4
- h = Sample gas pumps; 0, 1, or 2
- i,j = Moisture Detector/Filter; 00, 01, 10, or 11

14 Specific Conditions of Use:

1. *The equipment shall be mounted in an enclosure providing a minimum degree of protection of IP54 in accordance with EN 60079-15, and in a tool-secured enclosure which meets the requirements of EN 60079-0 and EN 60079-15.*

15 Essential Health and Safety Requirements:

The relevant EHSRs that have not been addressed by the standards listed in this certificate have been identified and assessed in the confidential report identified in item 8.

16 Test and Assessment Procedure and Conditions:

This Type Examination Certificate is the result of testing of a sample of the product submitted, in accordance with the provisions of the relevant specific standard(s), and assessment of supporting documentation. It does not imply an assessment of the whole production.

Whilst this certificate may be used in support of a manufacturer's claim for CE Marking, FM Approvals Europe Ltd accepts no responsibility for the compliance of the equipment against all applicable Directives in all applications.

This Certificate has been issued in accordance with FM Approvals Europe Ltd's ATEX Certification Scheme.

17 Schedule Drawings

A list of the significant parts of the technical documentation is annexed to this certificate and a copy has been kept by FM Approvals Europe Ltd.

18 Certificate History

Details of the supplements to this certificate are described below:

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE

SCHEDULE

to Type Examination Certificate No. FM18ATEX0012X

Date	Description
15 th October 2018	Original Issue.
18 th February 2020	<u>Supplement 1:</u> Report Reference: RR222218 dated 17 th February 2020. Description of the Change: 1. A correction of typographical errors in model code section and the electrical power ratings. 2. Certificate transferred from FM Approvals Ltd., notified body no. 1725, to FM Approvals Europe Ltd., notified body no. 2809 3. Update CDL

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1 TYPE EXAMINATION CERTIFICATE

2 Equipment or Protective systems intended for use in Potentially
Explosive Atmospheres - Directive 2014/34/EU

3 Type Examination Certificate No: FM18ATEX0012X

4 Equipment or protective system:
(Type Reference and Name) TC-Standard X2; TC-Standard+ X2; TC-MIDI X2;
TC MIDI+ X2; TC-Double X2 & TC-Double+ X2
Sample Gas Cooler

5 Name of Applicant: Bühler Technologies GmbH

6 Address of Applicant: Harkortstrasse 29
Ratingen, D-40880
Germany

7 This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and documents therein referred to.

8 FM Approvals Europe Ltd. certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report number:

3062014 dated 04th October 2018

9 Compliance with the Essential Health and Safety Requirements, with the exception of those identified in item 15 of the schedule to this certificate, has been assessed by compliance with the following documents:

EN 60079-0:2012+A11:2013, EN 60079-7:2015+A1:2018 and EN 60079-15:2018

10 If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.

11 This Type Examination certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance to the Directive 2014/34/EU. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

12 The marking of the equipment or protective system shall include:



II 3 G Ex ec nC IIC T4 Gc

Ta = 0°C to +40°C or 0°C to +50°C (TC-Standard X2 & TC-Standard+ X2 Models)

Ta = 0°C to +40°C or 0°C to +60°C (TC-MIDI X2 & TC-MIDI+ X2 and
TC-Double X2 & TC-Double+ X2 Models)

Damien McArdle

Damien Mc Ardle
Certification Manager, FM Approvals Europe Ltd.

Issue date: 26th January 2021

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FM Approvals Europe Ltd. One Georges Quay Plaza, Dublin. Ireland. D02 E440
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SCHEDULE

to Type Examination Certificate No. FM18ATEX0012X

13 Description of Equipment or Protective System:

The TC- Standard; TC-Midi & TC-Double sample gas chillers are intended to cool and dry the sample gas before going into the gas analysers. Sample gases contain vapour which has to be withdrawn before it reaches the gas analyser. The Gas flows through a heat exchanger (impinger) inserted into a cooling block. The latter then is cooled to a pre-set temperature (5°C mostly).

Depending on the required cooling capacity the size of the heat exchanger and therefore chiller is chosen and depending on the kind of gas to be cooled different heat exchanger materials are provided (stainless steel, glass or PVDF).

A gas cooler (chiller) might be prepared for more than one heat exchanger. The cooling block is cooled by different combinations of Peltier-elements. The temperature is sensed by an RTD.

The TC-Standard X2 / TC-Midi X2 series of sample coolers are designed specifically for high cooling capacities and high ambient temperatures.

The TC-Standard+ X2 / TC-Midi+ X2 series are designed specifically for the requirements in automated measuring systems (AMS) according to EN 15267-3. The series connection of the heat exchangers will cool in two cycles to minimise wash out effects.

The TC-Double X2 series are designed specifically for high cooling capacities, high ambient temperatures and to cool in two cycles to minimise wash out effects.

The TC-Double+ X2 incorporates two cooling blocks that can be set do different temperatures.

TC-Standard X2 - Sample Gas Cooler (fitted with 1 or 2 heat exchangers)

Electrical data: Umax 24VDC, 115VAC or 230 VAC, 50/60 Hz, TC – Standard Models	130 W
TC – MIDI Models	290 W
TC – Double models	390 W

4496 211b2d1fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 1 heat exchangers)

b	= Gas cooler model: 1 or 2
d,	= Supply voltage; 1, 2 or 4
f,g	= Heat exchanger; 10, 15, 20, 25, 30, or 35
h	= Peristaltic Pumps; 0, 1, 3
j,k	= Moisture detector / Filter; 00, 01, 10, or 11
l	= Status Outputs; 0 or 1
n	= Delta T control; 0 or 1

4496 212b2d2fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 2 heat exchangers)

b	= Gas cooler model: 1 or 2
d	= Supply voltage; 1, 2 or 4
f,g	= Heat exchanger; 10, 15, 20, 25, 30, or 35
h	= Peristaltic Pumps; 0, 2, or 4
j,k	= Moisture detector / Filter; 00, 01, 02, 10, 11, 20, 21, 22
l	= Status Outputs; 0 or 1
n	= Delta T control; 0 or 1

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE

SCHEDULE

to Type Examination Certificate No. FM18ATEX0012X

4496 212b2d2fgh0jkl000 TC-Standard+ X2 - Sample Gas Cooler (with 2 heat exchangers in series)

- b = Gas cooler model: 1 or 2
- d = Supply voltage; 1, 2 or 4
- f,g = Heat exchanger; 22, 27, 32 or 37
- h = Peristaltic Pumps; 0, 2, 4
- j,k = Moisture detector / Filter; 00, 01, 10, or 11
- l = Status Outputs; 0 or 1

4496 311 b2defghijklmno Thermoelectric Cooler, TC-MIDI X2 (fitted with 1 gas path inside the heat exchanger)

- b = Gas cooler types 1 or 2
- d = Supply Voltage; 1 or 2
- e = Gas paths; 1 or 2
- f,g = Heat exchangers; 10, 15, 20, 25, 30, or 35
- h = Peristaltic pumps; 0, 1, or 3
- i = Sample gas pumps; 0, 1, 2, 6, or 7
- j,k = Moisture detector / Filter; 00, 01, 10, or 11
- l,m = Status output; 00 or 10
- n,o = Delta T control; 00 or 10

4496 311 b2defghijklmno Thermoelectric Cooler, TC-MIDI + X2 (fitted with 2 gas paths inside the heat exchanger)

- b = Gas cooler types 1 or 2
- d = Supply Voltage; 1 or 2
- e = Gas paths; 1 or 2
- f,g = Heat exchangers; 60, 61, 65, 66, 70, 75, 80 or 85
- h = Peristaltic pumps; 0, 2, or 4
- i = Sample gas pumps; 0, 1, 2, 6, or 7
- j,k = Moisture detector / Filter; 00, 01, 02, 10, 11, 20, 21, or 22
- l,m = Status output; 00 or 10
- n,o = Delta T control; 00 or 10

4496 312 b2d1fghijklmno Thermoelectric Cooler, TC-MIDI X2 (fitted with 2 heat exchangers)

- b = Gas cooler types 1 or 2
- d = Supply Voltage; 1 or 2
- f,g = Heat exchangers; 22, 27, 32, or 37
- h = Peristaltic pumps; 0, 2, or 4
- i = Sample gas pumps; 0, 1, 2, 6, or 7
- j,k = Moisture detector / Filter; 00, 01, 10, or 11
- l,m = Status output; 00 or 10
- n,o = Delta T control; 00 or 10

4496 312 b2d1fghijklm00 Thermoelectric Cooler, TC-MIDI + X2 (fitted with 2 heat exchangers in series)

- b = Gas cooler types 1 or 2
- d = Supply Voltage; 1 or 2
- f,g = Heat exchangers; 22, 27, 32, or 37
- h = Peristaltic pumps; 0, 2, or 4
- i = Sample gas pumps; 0, 1, 2, 6, or 7
- j,k = Moisture detector / Filter; 00, 01, 10, or 11
- l,m = Status output; 00 or 10

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SCHEDULE

to Type Examination Certificate No. FM18ATEX0012X

4496 611a2c1efghijk000 Thermoelectric Cooler, TC-Double X2 (fitted with 2 heat exchangers in series)

- a = Gas cooler types 1, 2, 3 or 4
- c = Voltage; 1 or 2
- e,f = Heat exchangers; 10, 15, 20, 25, 30, or 35
- g = Peristaltic pumps; 0, 2, or 4
- h = Sample gas pumps; 0, 1, or 2
- i,j = Moisture Detector/Filter; 00, 01, 10, or 11
- k = Status output; 0 or 1

4496 611a2c1efghijk000 Thermoelectric Cooler, TC-Double+ X2

- a = Gas cooler types 1 or 2
- c = Voltage; 1 or 2
- e,f = Heat exchangers; 22, 27, 32, or 37
- g = Peristaltic pumps; 0, 2, or 4
- h = Sample gas pumps; 0, 1, or 2
- i,j = Moisture Detector/Filter; 00, 01, 10, or 11

14 Specific Conditions of Use:

1. *The equipment shall be mounted in an enclosure providing a minimum degree of protection of IP54 in accordance with EN 60079-15, and in a tool-secured enclosure which meets the requirements of EN 60079-0 and EN 60079-15.*

15 Essential Health and Safety Requirements:

The relevant EHSRs that have not been addressed by the standards listed in this certificate have been identified and assessed in the confidential report identified in item 8.

16 Test and Assessment Procedure and Conditions:

This Type Examination Certificate is the result of testing of a sample of the product submitted, in accordance with the provisions of the relevant specific standard(s), and assessment of supporting documentation. It does not imply an assessment of the whole production.

Whilst this certificate may be used in support of a manufacturer's claim for CE Marking, FM Approvals Europe Ltd accepts no responsibility for the compliance of the equipment against all applicable Directives in all applications.

This Certificate has been issued in accordance with FM Approvals Europe Ltd's ATEX Certification Scheme.

17 Schedule Drawings

A list of the significant parts of the technical documentation is annexed to this certificate and a copy has been kept by FM Approvals Europe Ltd.

18 Certificate History

Details of the supplements to this certificate are described below:

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE

SCHEDULE

to Type Examination Certificate No. FM18ATEX0012X

Date	Description
15 th October 2018	Original Issue.
18 th February 2020	<u>Supplement 1:</u> Report Reference: RR222218 dated 17 th February 2020. Description of the Change: 1. A correction of typographical errors in model code section and the electrical power ratings. 2. Certificate transferred from FM Approvals Ltd., notified body no. 1725, to FM Approvals Europe Ltd., notified body no. 2809 3. Update CDL
26 th January 2021	<u>Supplement 2:</u> Report Reference: RR226270 dated 25 th January 2021. Description of the Change: Add digital interface and correct typo in model code to remove + for TC-MIDI fitted with 1 heat exchanger.

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE



1. TYPE EXAMINATION CERTIFICATE

2. Equipment or Protective systems intended for use in Potentially Explosive Atmospheres - Directive 2014/34/EU

3. Type Examination Certificate No: FM18ATEX0012X

4. Equipment or protective system:
(Type Reference and Name) TC-Standard X2; TC-Standard+ X2; TC-MIDI X2;
TC-MIDI+ X2; TC-Double X2 & TC-Double+ X2
Sample Gas Cooler

5. Name of Applicant: Bühler Technologies GmbH

6. Address of Applicant Harkortstraße 29, Ratingen D-40880, Germany

7. This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and documents therein referred to.

8. FM Approvals Europe Ltd, certifies that this component has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report number:

3062014 dated 4th October 2018

9. Compliance with the Essential Health and Safety Requirements, with the exception of those identified in item 15 of the schedule to this certificate, has been assessed by compliance with the following documents:

EN IEC 60079-0:2018, EN 60079-7:2015+A1:2018, EN IEC 60079-15:2019

10. If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.

11. This Type Examination certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance to the Directive 2014/34/EU. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

Certificate issued by:

Certification Manager, FM Approvals Europe Ltd.

Date 10 October 2024

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to Type Examination Certificate No. FM18ATEX0012X

12. The marking of the equipment or protective system shall include:



TC-Standard

II 3 G Ex ec nC IIC T4 Gc

Ta = 0°C to +40°C or 0°C to +50°C

TC-MIDI & TC Double

II 3 G Ex ec nC IIC T4 Gc

Ta = 0°C to +40°C or 0°C to +60°C

13. **Description of Equipment or Protective System:**

The TC- Standard; TC-MIDI & TC-Double sample gas chillers are intended to cool and dry the sample gas before going into the gas analyzers. Sample gases contain vapor which has to be withdrawn before it reaches the gas analyzer. The Gas flows through a heat exchanger (impinger) inserted into a cooling block. The latter then is cooled to a pre-set temperature (5°C mostly).

Depending on the required cooling capacity the size of the heat exchanger and therefore chiller is chosen and depending on the kind of gas to be cooled different heat exchanger materials are provided (stainless steel, glass or PVDF).

A gas cooler (chiller) might be prepared for more than one heat exchanger. The cooling block is cooled by different combinations of Peltier-elements. The temperature is sensed by an RTD.

The TC-Standard X2 / TC-MIDI X2 series of sample coolers are designed specifically for high cooling capacities and high ambient temperatures.

The TC-Standard+ X2 / TC-MIDI+ X2 series are designed specifically for the requirements in automated measuring systems (AMS) according to EN 15267-3. The series connection of the heat exchangers will cool in two cycles to minimize wash out effects.

The TC-Double X2 series are designed specifically for high cooling capacities, high ambient temperatures and to cool in two cycles to minimize wash out effects.

The TC-Double+ X2 incorporates two cooling blocks that can be set do different temperatures.

TC-Standard X2 - Sample Gas Cooler (fitted with 1 or 2 heat exchangers)

Electrical data: Umax 24VDC, 115VAC or 230 VAC, 50/60 Hz

TC – Standard Models 130 W

TC – MIDI Models 290 W

TC – Double models 390 W

See Annex for Model Codes

14. **Specific Conditions of Use:**

1. The equipment shall be installed within a tool-secured enclosure providing a minimum degree of protection of IP54 and meeting the requirements of EN 60079-0 or certified as Ex e and in

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to Type Examination Certificate No. FM18ATEX0012X

compliance with the enclosure, mounting, spacing and segregation requirements of the ultimate application.

15. Essential Health and Safety Requirements:

The relevant EHSRs that have not been addressed by the standards listed in this certificate have been identified and assessed in the confidential report identified in item 8.

16. Test and Assessment Procedure and Conditions:

This Type Examination Certificate is the result of testing of a sample of the product submitted, in accordance with the provisions of the relevant specific standard(s), and assessment of supporting documentation. It does not imply an assessment of the whole production.

Whilst this certificate may be used in support of a manufacturer's claim for CE Marking, FM Approvals Europe Ltd accepts no responsibility for the compliance of the equipment against all applicable Directives in all applications.

This Certificate has been issued in accordance with FM Approvals Europe Ltd's ATEX Certification Scheme.

17. Schedule Drawings

A list of the significant parts of the technical documentation is annexed to this certificate and a copy has been kept by FM Approvals Europe Ltd.

18. Certificate History

Details of the supplements to this certificate are described below:

Date	Description
15 October 2018	Original Issue.
18 February 2020	<u>Supplement 1:</u> Report Reference: RR222218 dated 17 th February 2020. Description of the Change: 1. A correction of typographical errors in model code section and the electrical power ratings. 2. Certificate transferred from FM Approvals Ltd., notified body no. 1725, to FM Approvals Europe Ltd., notified body no. 2809 3. Update CDL
26 January 2021	<u>Supplement 2:</u> Report Reference: RR226270 dated 25 th January 2021. Description of the Change: Add digital interface and correct typo in model code to remove + for TC-MIDI fitted with 1 heat exchanger.
10 October 2024	<u>Supplement 3:</u> Report Reference: RR242035 dated 9 October 2024. Description of the Change(s): 1. Addition of product variants due to changes to electronics 2. EN 60079-0:2012+A11:2013 updated to EN IEC 60079-0:2018

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ANNEX

4496 211b2d1fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 1 heat exchangers)

Description of Equipment:

b = Gas cooler model: 1 or 2
d = Supply voltage; 1, 2 or 4
f & g = Heat exchanger; 10, 15, 20, 25, 30, or 35
h = Condensate drain; 00, 10 or 30
j & k = Moisture detector/Filter; 00, 01, 10, or 11
l = Status Outputs; 00 or 10
n = Delta T control; 00 or 10

4496 211b2d1fg0000l0n0p TC-Standard X2 - Sample Gas Cooler (fitted with 1 heat exchanger for H₂/O₂ applications)

Description of Equipment:

b = Gas cooler model: 1 or 2
d = Supply voltage; 1 or 2
f, g = Heat exchanger; 10, 15, 10 or 15
l = Status Outputs; 00 or 10
n = Delta T control; 00 or 10
p = heat exchanger optimized for high-purity hydrogen/oxygen; -H₂ or -O₂

4496 212b2d2fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 2 heat exchangers)

Description of Equipment:

b = Gas cooler model: 1 or 2
d = Supply voltage; 1, 2 or 4
f & g = Heat exchanger; 10, 15, 20, 25, 30, or 35
h = Condensate drain; 0, 2, or 4
j & k = Moisture detector/Filter; 00, 01, 02, 10, 11, 20, 21, 22
l = Status Outputs; 0 or 1
n = Delta T control; 0 or 1

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4496 212b2d2fgh0jkl0n0 TC-Standard+ X2 - Sample Gas Cooler (with 2 heat exchangers in series)

Description of Equipment:

b = Gas cooler model: 1 or 2
d = Supply voltage; 1, 2 or 4
f & g = Heat exchanger; 22, 27, 32 or 37
h = Condensate drain; 0, 2, 4
j & k = Moisture detector/Filter; 00, 01, 10, or 11
l = Signal Outputs; 0 or 1
n = no value assigned.

4496 311 b2defghijklmno TC-MIDI X2(fitted with 1 heat exchangers)

Description of Equipment:

b = Gas cooler types 1 or 2
d = Supply Voltage; 1 or 2
e = Gas path; 1 or 2
f,g = Heat exchangers; 10, 15, 20, 25, 30 or 35
h = Condensate drain; 0, 1 or 3
i = Sample gas pumps; 0, 1, 2, 6, or 7
j,k = Moisture detector/Filter; 00, 01, 10 or 11
l,m = Signal output; 00 or 10
n,o = Delta T control; 00 or 10

4496 311 b2defg0000lmnop TC-MIDI X2 (fitted with 1 heat exchangers for H2/O2 applications)

Description of Equipment:

b = Gas cooler types 1 or 2
d = Supply Voltage; 1 or 2
e = Gas path; 1 or 2
f,g = Heat exchangers; 10, 15, 60, 65
l,m = Signal output; 00 or 10
n,o = Delta T control; 00 or 10
p = heat exchanger optimized for high-purity hydrogen/oxygen; -H2 or -O2

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4496 312 b2d1fghijklm00 TC-MIDI + X2(fitted with 2 heat exchangers)

Description of Equipment:

b = Gas cooler types 1 or 2
d = Supply Voltage; 1 or 2
f,g = Heat exchangers; 60, 65, 61, 66, 70, 75, 80 or 85
h = Condensate drain; 0, 2, or 4
i = Sample gas pumps; 0, 1, 2, 6, or 7
j,k = Moisture detector/Filter; 00, 01, 02, 10, 11, 20, 21 or 22
l,m = Signal outputs; 00 or 10
n, o = Delta T Control; 00 or 10

4496 611a2c1efghijkl000 TC-Double X2

Description of Equipment:

a = Gas cooler types 1 or 2
c = Voltage; 1 or 2
e,f = Heat exchangers; 10, 15, 20, 25, 30 or 35
g = Condensate drain; 0, 2, or 4
h = Sample gas pumps; 0, 1, or 2
i,j = Humidity sensor/Filter; 00, 01, 10, or 11
k,l = Signal outputs; 00 or 10

4496 611a2c1efghijkl000 TC-Double+ X2

Description of Equipment:

a = Gas cooler types 1 or 2
c = Voltage; 1 or 2
e,f = Heat exchangers; 22, 27, 32, or 37
g = Peristaltic pumps; 0, 2, or 4
h = Sample gas pumps; 0, 1, or 2
i,j = Moisture Detector/Filter; 00, 01, 10, or 11
k,l = Status output; 00 or 10

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE



1. TYPE EXAMINATION CERTIFICATE

2. Equipment or Protective systems intended for use in Potentially Explosive Atmospheres - Directive 2014/34/EU

3. Type Examination Certificate No: FM18ATEX0012X

4. Equipment or protective system:
(Type Reference and Name) TC-Standard X2; TC-Standard+ X2; TC-MIDI X2;
TC-MIDI+ X2; TC-Double X2 & TC-Double+ X2
Sample Gas Cooler

5. Name of Applicant: Bühler Technologies GmbH

6. Address of Applicant Harkortstraße 29, Ratingen D-40880, Germany

7. This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and documents therein referred to.

8. FM Approvals Europe Ltd, certifies that this component has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report number:

3062014 dated 4th October 2018

9. Compliance with the Essential Health and Safety Requirements, with the exception of those identified in item 15 of the schedule to this certificate, has been assessed by compliance with the following documents:

EN IEC 60079-0:2018, EN 60079-7:2015+A1:2018, EN IEC 60079-15:2019

10. If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.

11. This Type Examination certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance to the Directive 2014/34/EU. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

Certificate issued by:

6 December 2024

Certification Manager, FM Approvals Europe Ltd.

Date

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F ATEX 029 (Jul/2024)



12. The marking of the equipment or protective system shall include:



TC-Standard

II 3 G Ex ec nC IIC T4 Gc
Ta = 0°C to +40°C or 0°C to +50°C

TC-MIDI & TC Double

II 3 G Ex ec nC IIC T4 Gc
Ta = 0°C to +40°C or 0°C to +60°C

13. Description of Equipment or Protective System:

The TC- Standard; TC-MIDI & TC-Double sample gas chillers are intended to cool and dry the sample gas before going into the gas analyzers. Sample gases contain vapor which has to be withdrawn before it reaches the gas analyzer. The Gas flows through a heat exchanger (impinger) inserted into a cooling block. The latter then is cooled to a pre-set temperature (5°C mostly).

Depending on the required cooling capacity the size of the heat exchanger and therefore chiller is chosen and depending on the kind of gas to be cooled different heat exchanger materials are provided (stainless steel, glass or PVDF).

A gas cooler (chiller) might be prepared for more than one heat exchanger. The cooling block is cooled by different combinations of Peltier-elements. The temperature is sensed by an RTD.

The TC-Standard X2 / TC-MIDI X2 series of sample coolers are designed specifically for high cooling capacities and high ambient temperatures.

The TC-Standard+ X2 / TC-MIDI+ X2 series are designed specifically for the requirements in automated measuring systems (AMS) according to EN 15267-3. The series connection of the heat exchangers will cool in two cycles to minimize wash out effects.

The TC-Double X2 series are designed specifically for high cooling capacities, high ambient temperatures and to cool in two cycles to minimize wash out effects.

The TC-Double+ X2 incorporates two cooling blocks that can be set do different temperatures.

TC-Standard X2 - Sample Gas Cooler (fitted with 1 or 2 heat exchangers)

Electrical data: Umax 24VDC, 115VAC or 230 VAC, 50/60 Hz

TC – Standard Models 130 W

TC – MIDI Models 290 W

TC – Double models 390 W

See Annex for Model Codes

14. Specific Conditions of Use:

1. The equipment shall be installed within a tool-secured enclosure providing a minimum degree of protection of IP54 and meeting the requirements of EN 60079-0 or certified as Ex e and in

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to Type Examination Certificate No. FM18ATEX0012X

compliance with the enclosure, mounting, spacing and segregation requirements of the ultimate application.

15. Essential Health and Safety Requirements:

The relevant EHSRs that have not been addressed by the standards listed in this certificate have been identified and assessed in the confidential report identified in item 8.

16. Test and Assessment Procedure and Conditions:

This Type Examination Certificate is the result of testing of a sample of the product submitted, in accordance with the provisions of the relevant specific standard(s), and assessment of supporting documentation. It does not imply an assessment of the whole production.

Whilst this certificate may be used in support of a manufacturer's claim for CE Marking, FM Approvals Europe Ltd accepts no responsibility for the compliance of the equipment against all applicable Directives in all applications.

This Certificate has been issued in accordance with FM Approvals Europe Ltd's ATEX Certification Scheme.

17. Schedule Drawings

A list of the significant parts of the technical documentation is annexed to this certificate and a copy has been kept by FM Approvals Europe Ltd.

18. Certificate History

Details of the supplements to this certificate are described below:

Date	Description
15 October 2018	Original Issue.
18 February 2020	<u>Supplement 1:</u> Report Reference: RR222218 dated 17 th February 2020. Description of the Change: 1. A correction of typographical errors in model code section and the electrical power ratings. 2. Certificate transferred from FM Approvals Ltd., notified body no. 1725, to FM Approvals Europe Ltd., notified body no. 2809 3. Update CDL
26 January 2021	<u>Supplement 2:</u> Report Reference: RR226270 dated 25 th January 2021. Description of the Change: Add digital interface and correct typo in model code to remove + for TC-MIDI fitted with 1 heat exchanger.

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE

SCHEDULE
to Type Examination Certificate No. FM18ATEX0012X

Date	Description
10 October 2024	<u>Supplement 3:</u> Report Reference: RR242035 dated 10 October 2024. Description of the Change(s): 1. Addition of product variants due to changes to electronics 2. EN 60079-0:2012+A11:2013 updated to EN IEC 60079-0:2018
6 December 2024	<u>Supplement 4:</u> Report Reference: RR243713 dated 5 December 2024. Description of the Change(s): Document Updates

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ANNEX

4496 211b2d1fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 1 heat exchangers)

Description of Equipment:

b = Gas cooler model: 1 or 2
d = Supply voltage; 1, 2 or 4
f & g = Heat exchanger; 10, 15, 20, 25, 30, or 35
h = Condensate drain; 00, 10 or 30
j & k = Moisture detector/Filter; 00, 01, 10, or 11
l = Status Outputs; 00 or 10
n = Delta T control; 00 or 10

4496 211b2d1fg0000l0n0p TC-Standard X2 - Sample Gas Cooler (fitted with 1 heat exchanger for H2/O2 applications)

Description of Equipment:

b = Gas cooler model: 1 or 2
d = Supply voltage; 1 or 2
f, g = Heat exchanger; 10, 15, 10 or 15
l = Status Outputs; 00 or 10
n = Delta T control; 00 or 10
p = heat exchanger optimized for high-purity hydrogen/oxygen; -H2 or -O2

4496 212b2d2fgh0jkl0n0 TC-Standard X2 - Sample Gas Cooler (fitted with 2 heat exchangers)

Description of Equipment:

b = Gas cooler model: 1 or 2
d = Supply voltage; 1, 2 or 4
f & g = Heat exchanger; 10, 15, 20, 25, 30, or 35
h = Condensate drain; 0, 2, or 4
j & k = Moisture detector/Filter; 00, 01, 02, 10, 11, 20, 21, 22
l = Status Outputs; 0 or 1
n = Delta T control; 0 or 1

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE

4496 212b2d2fgh0jkl0n0 TC-Standard+ X2 - Sample Gas Cooler (with 2 heat exchangers in series)

Description of Equipment:

b = Gas cooler model: 1 or 2
d = Supply voltage; 1, 2 or 4
f & g = Heat exchanger; 22, 27, 32 or 37
h = Condensate drain; 0, 2, 4
j & k = Moisture detector/Filter; 00, 01, 10, or 11
l = Signal Outputs; 0 or 1
n = no value assigned.

4496 311 b2defghijklmno TC-MIDI X2(fitted with 1 heat exchangers)

Description of Equipment:

b = Gas cooler types 1 or 2
d = Supply Voltage; 1 or 2
e = Gas path; 1 or 2
f,g = Heat exchangers; 10, 15, 20, 25, 30 or 35
h = Condensate drain; 0, 1 or 3
i = Sample gas pumps; 0, 1, 2, 6, or 7
j,k = Moisture detector/Filter; 00, 01, 10 or 11
l,m = Signal output; 00 or 10
n,o = Delta T control; 00 or 10

4496 311 b2defg0000lmnop TC-MIDI X2 (fitted with 1 heat exchangers for H2/O2 applications)

Description of Equipment:

b = Gas cooler types 1 or 2
d = Supply Voltage; 1 or 2
e = Gas path; 1 or 2
f,g = Heat exchangers; 10, 15, 60, 65
l,m = Signal output; 00 or 10
n,o = Delta T control; 00 or 10
p = heat exchanger optimized for high-purity hydrogen/oxygen; -H2 or -O2

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE

4496 312 b2d1fghijklm00 TC-MIDI + X2(fitted with 2 heat exchangers)

Description of Equipment:

b = Gas cooler types 1 or 2
d = Supply Voltage; 1 or 2
f,g = Heat exchangers; 60, 65, 61, 66, 70, 75, 80 or 85
h = Condensate drain; 0, 2, or 4
i = Sample gas pumps; 0, 1, 2, 6, or 7
j,k = Moisture detector/Filter; 00, 01, 02, 10, 11, 20, 21 or 22
l,m = Signal outputs; 00 or 10
n, o = Delta T Control; 00 or 10

4496 611a2c1efghijkl000 TC-Double X2

Description of Equipment:

a = Gas cooler types 1 or 2
c = Voltage; 1 or 2
e,f = Heat exchangers; 10, 15, 20, 25, 30 or 35
g = Condensate drain; 0, 2, or 4
h = Sample gas pumps; 0, 1, or 2
i,j = Humidity sensor/Filter; 00, 01, 10, or 11
k,l = Signal outputs; 00 or 10

4496 611a2c1efghijkl000 TC-Double+ X2

Description of Equipment:

a = Gas cooler types 1 or 2
c = Voltage; 1 or 2
e,f = Heat exchangers; 22, 27, 32, or 37
g = Peristaltic pumps; 0, 2, or 4
h = Sample gas pumps; 0, 1, or 2
i,j = Moisture Detector/Filter; 00, 01, 10, or 11
k,l = Status output; 00 or 10

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE

RMA-Formular und Erklärung über Dekontaminierung

RMA-去污表格和声明



RMA-Nr./ 商品退货 授权号码

Die RMA-Nr. bekommen Sie von Ihrem Ansprechpartner im Vertrieb oder Service. Bei Rücksendung eines Altgeräts zur Entsorgung tragen Sie bitte in das Feld der RMA-Nr. "WEEE" ein./ 从销售或服务处的联系人那里可获得商品退货授权 (RMA) 号码。当寄还旧设备以废弃处理时, 请于RMA号码栏中输入"WEEE"。

Zu diesem Rücksendeschein gehört eine Dekontaminierungserklärung. Die gesetzlichen Vorschriften schreiben vor, dass Sie uns diese Dekontaminierungserklärung ausgefüllt und unterschrieben zurücksenden müssen. Bitte füllen Sie auch diese im Sinne der Gesundheit unserer Mitarbeiter vollständig aus./ 请将退货单, 去污声明和货运单一同装在透明套中, 粘在包装外。否则您的维修委托将不予处理。

Firma/ 公司

Firma/ 公司

Straße/ 街道

PLZ, Ort/ 邮政编码, 地点

Land/ 国家

Gerät/ 设备

Anzahl/ 数量

Auftragsnr./ 订单号码

Ansprechpartner/ 联系人

Name/ 姓名

Abt./ 部门

Tel./ 电话

E-Mail

Serien-Nr./ 序列号

Artikel-Nr./ 商品编号

Grund der Rücksendung/ 寄回原因

- ☐ Kalibrierung/ 校准 ☐ Modifikation/ 修改
☐ Reklamation/ 投诉 ☐ Reparatur/ 修复
☐ Elektroaltgerät/ 废旧电子设备 (WEEE)
☐ andere/ 其他的

bitte spezifizieren/ 请注明

Ist das Gerät möglicherweise kontaminiert?/ 设备是否具有污染性?

- ☐ Nein, da das Gerät nicht mit gesundheitsgefährdenden Stoffen betrieben wurde./ 否, 因为该设备已被正确清洁和消毒。
☐ Nein, da das Gerät ordnungsgemäß gereinigt und dekontaminiert wurde./ 否, 因为未以有损健康的物质运行该设备。
☐ Ja, kontaminiert mit:/ 是, 污染物为:



☐
explosiv/
易爆的



☐
entzündlich/
易燃的



☐
brandfördernd/
助燃的



☐
komprimierte
Gase/
压缩气体



☐
ätzend/
腐蚀性的



☐
giftig,
Lebensgefahr/
有毒的, 致命危
险



☐
gesundheitsge-
fährdend/
危害健康的



☐
gesund-
heitsschädlich/
对人体有害的



☐
umweltge-
fährdend/
对环境有害的

Bitte Sicherheitsdatenblatt beilegen!/ 请附上《安全数据表》!

Das Gerät wurde gespült mit:/ 该设备已被冲洗:

Diese Erklärung wurde korrekt und vollständig ausgefüllt und von einer dazu befugten Person unterschrieben. Der Versand der (dekontaminierten) Geräte und Komponenten erfolgt gemäß den gesetzlichen Bestimmungen.

按法律规定寄回 (已去污的) 设备和组件

Falls die Ware nicht gereinigt, also kontaminiert bei uns eintrifft, muss die Firma Bühler sich vorbehalten, diese durch einen externen Dienstleister reinigen zu lassen und Ihnen dies in Rechnung zu stellen.

如果产品没有被清洁, 即我们收到时受了污染, 比勒公司保留委托一外部的服务提供商清理的权利并向您收取费用。

Firmenstempel/ 公司印章

Datum/ 日期

rechtsverbindliche Unterschrift/ 具法律约束力的签名

DC000011

12/2022

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Vermeiden von Veränderung und Beschädigung der einzusendenden Baugruppe

Die Analyse defekter Baugruppen ist ein wesentlicher Bestandteil der Qualitätssicherung der Firma Bühler Technologies GmbH. Um eine aussagekräftige Analyse zu gewährleisten muss die Ware möglichst unverändert untersucht werden. Es dürfen keine Veränderungen oder weitere Beschädigungen auftreten, die Ursachen verdecken oder eine Analyse unmöglich machen.

Umgang mit elektrostatisch sensiblen Baugruppen

Bei elektronischen Baugruppen kann es sich um elektrostatisch sensible Baugruppen handeln. Es ist darauf zu achten, diese Baugruppen ESD-gerecht zu behandeln. Nach Möglichkeit sollten die Baugruppen an einem ESD-gerechten Arbeitsplatz getauscht werden. Ist dies nicht möglich sollten ESD-gerechte Maßnahmen beim Austausch getroffen werden. Der Transport darf nur in ESD-gerechten Behältnissen durchgeführt werden. Die Verpackung der Baugruppen muss ESD-konform sein. Verwenden Sie nach Möglichkeit die Verpackung des Ersatzteils oder wählen Sie selber eine ESD-gerechte Verpackung.

Einbau von Ersatzteilen

Beachten Sie beim Einbau des Ersatzteils die gleichen Vorgaben wie oben beschrieben. Achten Sie auf die ordnungsgemäße Montage des Bauteils und aller Komponenten. Versetzen Sie vor der Inbetriebnahme die Verkabelung wieder in den ursprünglichen Zustand. Fragen Sie im Zweifel beim Hersteller nach weiteren Informationen.

Einsenden von Elektroaltgeräten zur Entsorgung

Wollen Sie ein von Bühler Technologies GmbH stammendes Elektroprodukt zur fachgerechten Entsorgung einsenden, dann tragen Sie bitte in das Feld der RMA-Nr. „WEEE“ ein. Legen Sie dem Altgerät die vollständig ausgefüllte Dekontaminierungserklärung für den Transport von außen sichtbar bei. Weitere Informationen zur Entsorgung von Elektroaltgeräten finden Sie auf der Webseite unseres Unternehmens.

避免修改和损坏要寄送的组件

对有缺陷的组件的分析是比勒科技有限公司的质量保证的一个重要组成部分。为了确保分析有说服力，必须尽可能地保持原样来检查产品。不能发生任何改变或进一步的损害，这样可能会掩盖原因或阻碍分析。

处理静电敏感组件

若有电子组件，则可能是静电敏感组件。必须注意以符合ESD标准的方式处理这些组件。如果可能，应在符合ESD标准的工作场所更换组件。如果不可能，在更换过程中应采取符合ESD标准的措施。只能在符合ESD标准的容器中运输。组件的封装必须符合ESD标准。如果可能，请使用备件的包装或自选一符合ESD标准的包装。

安装替换件

在安装备件时，请遵守上述说明。确保配件和所有组件的正确组装。调试前将电缆移回原来状态。如有疑问，请访问制造商了解更多信息。

将废旧电子设备寄送废弃处理

如果您想寄送来自Bühler Technologies GmbH的电子产品以进行妥善废弃处理，请于RMA号码栏中输入"WEEE"。将完整填写的去污声明附于废旧设备上，以便运输时从外部即可见。有关废弃电气和电子设备废弃处理的更多信息，请访问我司的网站。

