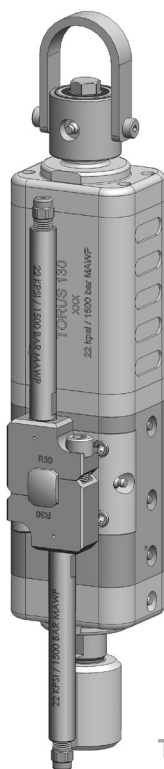
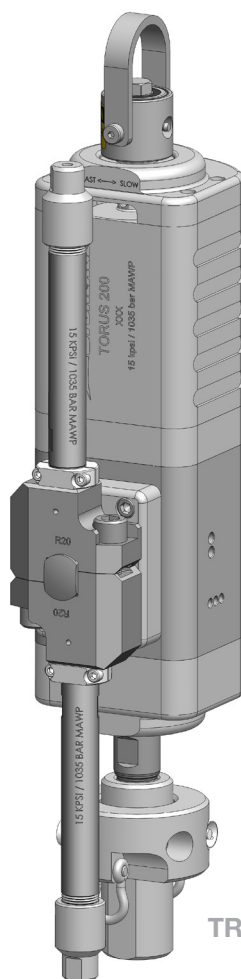


TORUS

3D 槽罐清洗头 产品使用说明书



TR-130



TR-200

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使用者需在遵循所有国家法律法规制度下，使用该产品使用说明手册。
该使用说明手册是产品的重要部分，需要妥善保管，直至产品依据国家法律进行拆解后方可作废。

最新产品使用手册可至本公司官网下载：
<https://www.stoneagetools.com/manuals>

Torus 产品型号与明细		
	TR-130	TR-200
压力范围	2–22k psi (138–1500 bar)	8–15k psi (550–1035 bar)
流量范围	10-81 gpm (38-307 l/min)	50-220 gpm (190-830 l/min)
功率范围	30-1000 hp	30-1900 hp
旋转周期	4-24 分钟	10-88 分钟
转速	可调节	可调节
入口连接型式	3/4" NPT, 1" NPT, 3/4 MP, 1 MP, M24	P16 (最高 10K PSI MAWP) M16 (最高 15K PSI MAWP)
流量模块喷嘴孔尺寸	G12	G16
孔径	1/4" NPT (P4)	3/4" NPT (P12)
喷嘴类型	OCV 硬质合金	OC8
直径	5.12 in. (130 mm)	8.0 in. (200 mm)
长度	17 in. (432 mm)	22.8 in. (579 mm)
重量	35 lbs (16 kg)	100 lbs (45kg)
最高水温	160°F (70° C)	160°F (70° C)

产品特点:

- 互换型接头和流量模块 – 一个清洗头可适用于多种压力与流量等级，性价比高。
- 外置型速度调控装置 – 清洗过程中，外置型转速装置，调节转速精确清除各类污垢，无需停机打开或拆卸清洗头进行调节，操作简单。
- 快速更换高压密封，外置润滑剂接头，降低日常维护时间。
- 可在施工现场维修，无需返厂，缩短停机时间，无运输费用。

⚠ 危险

TR-130与TR-200型号的TORUS清洗头均含有多个高能量的稀土磁铁，可产生超过10高斯的磁场。佩戴心脏起搏器或其他电子医用装置的人员在使用或靠近TORUS清洗设备时，必须非常谨慎。建议TORUS清洗头与其他任何电子医用装置始终保持至少 6 INCHES (152MM)的距离。

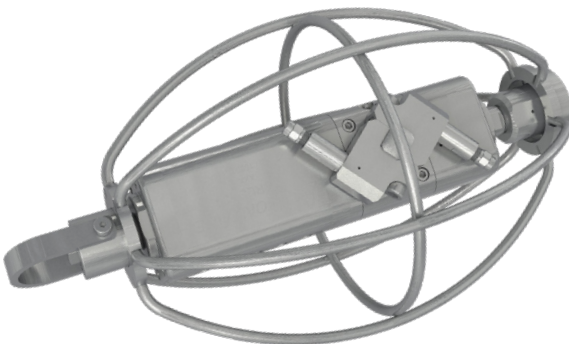
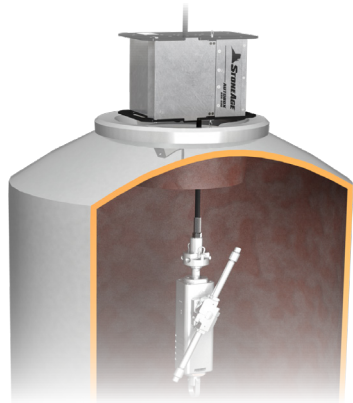
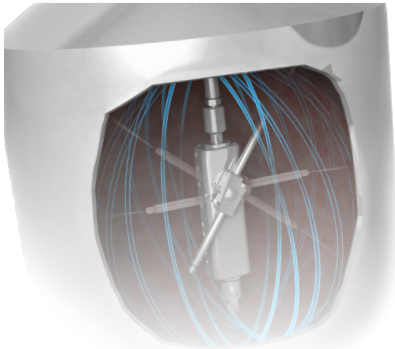
⚠ 警告

操作运行该设备具有很多潜在危险。运行设备和使用清洗工具必须时刻注意安全，保持警惕。请仔细阅读并遵照以下安全指引，配合WJTA Recommended Practices安全使用手册一同使用，请浏览 www.wjta.org。不遵循安全指引与安全使用手册的操作将导致严重受伤或死亡。

- 不可超过系统内任一部件所能承受的最大压力。必须标注出危险工作区域，未培训人员不可进入。
- 溢流阀是最为重要的安全设备。每一位操作员必须并且能够使用各自的溢流阀，在必要时立刻关闭水压。
- 检查设备与喷嘴是否出现老化、损坏迹象，安装方式是否正确。如有损坏请勿使用，需先进行维修。确认所有螺纹连接处连接紧密无滴漏。
- 所有操作员及靠近设备的工作人员必须穿戴个人防护装置，包括对身体、手部、脚部、脸部、耳部、眼部及呼吸系统的认证防护。详细信息请参考WJTA建议操作指引第六章。
- 高压水压力超过 20,000 psi (1379 bar) 时，水温可高达 200°F (93°C)，会对人员造成烫伤或灼伤。请务必佩戴面部护具、高压水防护服，及手套等保护装置，防止人员受伤。
- 设备运行结束后，清洗头拉环一侧温度可高至160°F，建议操作员佩戴手套后再接触清洗头。
- 检查高压胶管是否受损。必须使用合格耐高压的高压胶管。胶管最大压力不可低于系统工作压力。尽可能使用较大尺寸高压胶管，以减少胶管内的压降损失。

产品说明与用途 (TR-130):

Torus TR-130 3D Tool三维旋转清洗头，专业清洗槽罐、大型容器、高压釜、大型管道及反应釜内部。最大工作压力为22,000 psi (1500 bar)，流量范围10 至 80 gpm。通过更换四种不同流量模块改变流量大小：高流量(R30)、中流量(R50)、低流量(R90)、特低流量(R150)。免维护型磁力制动装置有效控制清洗头转速。请注意，清洗头开始运行后，伴随机体温度不断上升至工作温度，转速也会相对变快。Torus 清洗头旋转周期在4至30分钟之间，实际运行周期由清洗头转速决定。清洗头转速由工作压力、流量比、喷嘴孔径、流量模块的选择与制动系统设置而决定。清洗头自转 92 次为一个完整的清洗周期。高压流量模块自转周期为清洗头主体自传周期的2.36倍。使用三维头清洗大型槽罐时，可安装延长杆降低清洗靶距，延长杆可安装最大长度为36 inches。可选择使用高压胶管或安装拉环配件悬挂将 Torus 清洗头悬挂与槽罐中。建议在每次作业结束后，利用压缩空气将清洗头上的喷嘴、溢流孔和入口连接处残留的水分吹干。



设备运行:

- 1. 使用之前, 请先确定清洗头上的流量模块与所设定工作压力及流量相匹配。安装不匹配的流量模块: 清洗头旋转过快, 损坏内部零件; 或清洗头旋转非常缓慢甚至不旋转。
- 2. 选择流量模块与喷嘴。请参考以下表格, 选出不同压力流量参数下所需使用的流量模块。必须确保安装的两个喷嘴尺寸相同, 射流状态良好, 否则将导致清洗头旋转不规律、过快或不转。
- 3. 使用表格: 首先在表格左纵列选择工作压力。然后从左向右, 找到最接近所需流量的数值。该流量数值下方所显示的为所需配备的流量模块型号, 该型号纵列的上方为合适喷嘴型号。若已知压力与喷嘴孔径, 从左纵列选择压力参数, 再从表格上方选择最接近的喷嘴孔径。两个参数相交处即为所需配备的流量比与流量模块型号。

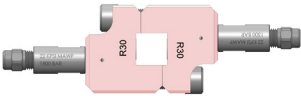
下表为通用高压水清洗所需流量模块及喷嘴孔径参数选择。未考量高压胶管尺寸因素。
使用 StoneAge 高压水清洗APP获取更精确的流量模块及喷嘴孔径参数。

<http://jetting.stoneagetools.com>

流量模块、喷嘴孔径、压力等级、流量比参数列表																
OCV 硬质合金喷嘴孔径																
喷嘴孔径		.036	.039	.043	.047	.055	.062	.067	.073	.078	.089	.093	.106	.125	.140	.156
压力 & 流量 & 流量模块尺寸	2k psi 138 bar	gpm													48	58
		l/min													182	220
		流量模块													R150	R150
	5k psi 345 bar	gpm							20	24	30	35	44	58		
		l/min							76	91	114	133	167	220		
		流量模块							R150	R150	R90	R90	R90	R90		
	10k psi 690 bar	gpm				12	16	20	24	28	32	42	46	60	66	
		l/min				45	61	76	91	106	121	159	174	230	250	
		流量模块				R150	R150	R150	R90	R90	R90	R50	R50	R50	R30	
	15k psi 1035 bar	gpm		10	11	13	19	23	30	33	37	48	58	70		
		l/min		38	42	49	72	87	114	125	140	182	220	265		
		流量模块		R150	R150	R150	R90	R90	R50	R50	R50	R50	R30	R30		
	20k psi 1380 bar	gpm	11	12	14	17	24	30	34	40	46	60	66			
		l/min	42	45	53	64	91	129	114	151	174	227	250			
		流量模块	R150	R150	R150	R90	R90	R50	R50	R50	R50	R30	R30			

TR130 240-RXX-X 流量模块型号

Torus共有四种流量模块类型; 根据清洗应用类型, 选择合适流量模块。
可选安装不同长度喷嘴延长杆。



R30	R50	R90	R150
50-80 gpm (190-303 lpm)	28-55 gpm (106-208 lpm)	16-30 gpm (61-114 lpm)	10-18 gpm (38-68 lpm)

入口连接转换接头:

入口连接转换接头两端均为阴螺纹。接头一端带有一个O型圈面密封，用于密封入口连接轴芯。另一端接头型号可选 3/4" NPT, 1" NPT, 3/4" 中压, 或 1" 中压。

选择转换接头

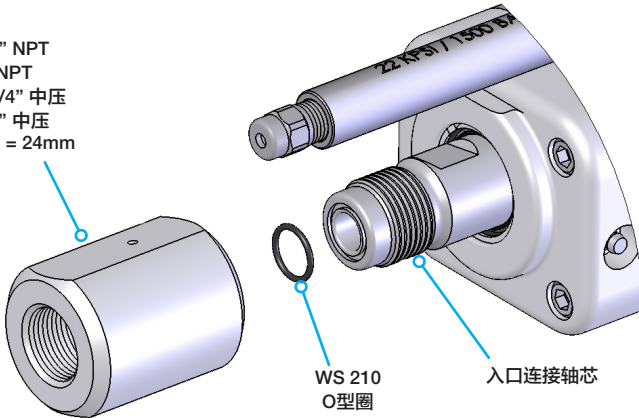
TR 230-P12 = 3/4" NPT

TR 230-P16 = 1" NPT

TR 230-MP12 = 3/4" 中压

TR 230-MP16 = 1" 中压

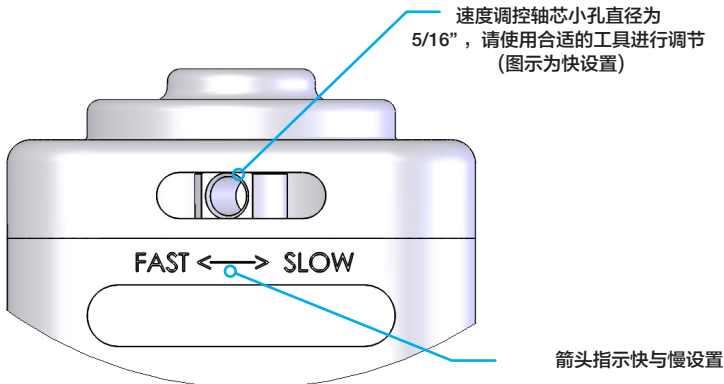
TR 230-M24 x 1.5 = 24mm

**调节转速:**

清洗头另一端配有速度调控轴芯，可改变 Torus 喷头转速。轴芯可设定在快与慢之间的任一位置上。调节转速时，可使用任何合适的工具，伸入壳体狭槽，插入速度调控轴芯的小孔内。将轴芯向左移动大约50°，则可将喷头转速由慢调至快。壳体上有速度标识，指示清洗头转速。将清洗头转速由“慢”调节到“快”转速会增加三倍(例如:慢10rpm, 快30rpm)。清洗头实际转速由工作压力所产生的扭力、流量、流量模块型号与制动装置决定。十字轴芯平均转速范围大约为：慢8-16rpm、快25-50rpm。

请注意

请注意：调节转速时，无需拆除拉环组件。



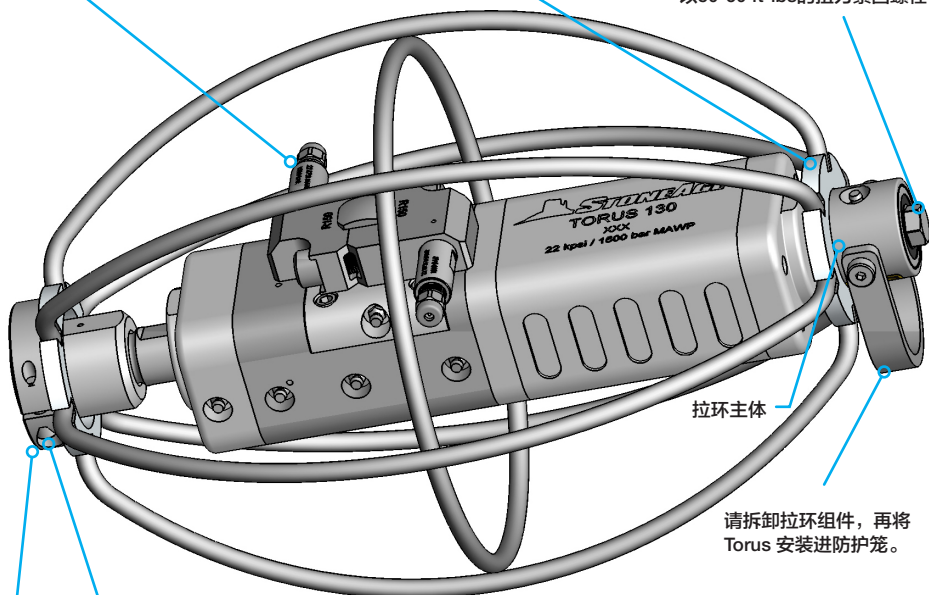
TORUS TR-130 配件

安装 TR130 408-SS 防护笼:

请注意，使用防护笼时
Torus 必须安装 2" 延长
喷嘴

如图所示，防护笼的末端面板需安装在拉
环主体以内，两者间保留约1/8"间距。否
则，Torus 在工作中无法正常旋转。

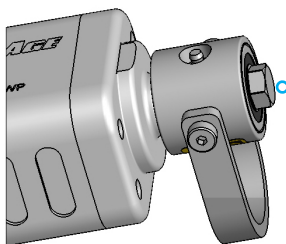
安装之前，在拉环螺栓螺纹上涂抹
Blue Loctite® 242
(StoneAge 产品编号GP 180)
以50-60 ft-lbs的扭力紧固螺栓。



参数(2) GS 331-04-24 (内六角螺栓 5/16-24 UNF x 1.0 长)

安装时，请拆下防护笼夹钳项圈一半活动件，然后将
Torus 放入防护笼内。

安装 HC 090 拉环组件:



安装之前，在拉环螺栓螺纹上涂抹
Blue Loctite® 242
(StoneAge产品编号GP 180)
以50-60 ft-lbs的扭力紧固螺栓。

维护部件	维护频率	维护要求
高压密封 (详细请参阅本使用说明书高压密封更换章节)	当水从靠近入口连接处的溢流孔流出时	Torus 有两个高压密封, 一个在入口连接轴芯, 一个在十字轴芯。这两个密封功能相同。低压下(低于1000 psi) 会出现溢流; 正常工作压力下密封受损, 会出现持续漏水。若靠近入口连接的溢流孔发生溢流, 则表示入口连接密封已损坏。若远离入口连接的溢流孔发生溢流, 表示十字轴芯密封已损坏, 应当及时更换。
润滑与储藏	每运行100小时后	建议每使用100小时后为清洗头涂抹润滑剂。可使用任何品牌多功能 NLGI 2 润滑剂。在壳体外部有五处润滑剂接头。过度注入润滑不会损坏清洗头, 只是操作员会发现带压运行中, 轴芯密封附近会有多余的润滑剂溢出。同时建议在每次使用结束后, 用压缩空气吹干喷嘴、溢流孔及入口连接处的水分, 可以延长内部零件使用寿命。
磁力制动装置	必要时	磁力制动装置无需润滑或维护。若磁力制动组件出现故障, 应寄回StoneAge维修中心维修或替换。
高压连接螺纹	每次使用前/后	为防止螺纹出现粘连, 所有管螺纹接头请使用Parker Thread Mate 螺纹防粘剂(StoneAge 产品编号 GP047)及fluorocarbon 胶带。其他高压连接螺纹只需使用金属防咬合剂。StoneAge 建议使用 Swagelok Blue Goop (StoneAge 产品编号 GP043)。
螺纹紧固件	必要时	所有螺纹紧固件必须遵循以下组装程序: A) 标记有Blue Loctite(GP 180)的紧固件需要按照标识重新组装及紧固。 B) 所有其他紧固件需用Blue Goop(GP 043)重新组装, 如有特殊说明, 需按说明紧固。

警告

清洗头带压工作下, 拉环末端壳体温度可达160°F, 建议操作者佩戴手套再接触清洗头或拉环组件。请等待清洗头冷却后, 才可进行拆卸维护步骤。

MOBIL® 是 Exxon Mobil Corporation 注册商标。
Blue Goop® 是 Swagelok 注册商标。
Loctite® 是 Henkel Corporation 注册商标。
Threadmate™ 是 Parker Hannifin Corporation 注册商标。

TORUS 维护信息

维护 Torus 需要经过专业培训并使用合适的工具。如无法对清洗头进行正确的维护，请将清洗头交给本公司授权经销商进行维护。清洗头维护请小心谨慎，防止设备内部进入砂砾、飞絮或污染物。不当操作将造成清洗头永久性损坏。

工具列表:

- 撬杆
- 一字螺丝刀
- 手动润滑剂注射枪
- 内六角扳手
1/8", 1/4", 3/16", 5/16", 5/32", 2.5mm 与 3mm

材料列表:

- 干净无绒布与纸巾
- Swagelock Blue Goop 金属防粘剂或相同类型产品
- Mobil SHC PM 460 合成润滑剂或相同类型产品

请注意

请勿使用气动或电动润滑剂注射枪为 Torus 灌注润滑剂。因为过量润滑剂将在短时间内进入制动装置组件，导致密封受损，清洗头无法旋转。StoneAge建议
使用手动润滑剂注射枪。

TORUS TR-130 产品维护资源信息

TR130 600 – 服务包		TR130 610 – 组装机	
GP 043 BLUE GOOP, 2 OZ	1	BJ 007 轴承, 斜面接触, BECBY	2
GP 180 Loctite, 242 Blue .5ml 瓶	1	BR 196 紧固圈, HD 外部 1.188	1
HC 012-TO 高压密封组件	2	CJ 009 轴承	1
MJ 011-C 硬质合金密封座 (带涂层)	2	GP 043 Blue Goop, 2 oz	1
PL 556 Torus 产品使用说明书	1	GP 180 Loctite, 242 Blue .5ml 瓶	1
SA 059 O型圈, G12	2	GP 805 容器, 带密封盖塑料容器 1¼	2
TR 245 高压密封, 流量模块	2	HC 012-TO 高压密封组件	2
WS 210 O型圈	1	MJ 008 O型圈	1
		MJ 011-C 硬质合金密封座 (带涂层)	2
		PL 556 Torus 系列产品使用说明书	1
		PTL 078 紧固圈, SS	1
		SA 059 O型圈, G12	2
		SG 009 球形密封	1
		TR 134 密封	2
		TR 136 轴承, 滚针	2
		TR 138 紧固圈, SS Spiral Int .968	2
		TR 245 高压密封, 流量模块	2
		TR130 105 O型圈	4
		TR130 113 密封	2
		TR130 114 紧固圈, SS Spiral Int 1.56	2
		TR130 230 轴承, 球型	2
		TR130 233 O型圈	2
		TR130 234 紧固圈, SS 外部 17mm	2
		WS 029 密封, 大	1
		WS 210 O型圈	1

零件颜色代码

TR130 600 Service Kit = 服务包中包含件

TR130 610 Overhaul Kit = 组装机中包含件

MOBIL® 是 Exxon Mobil Corporation 注册商标。

Blue Goop® 是 Swagelock 注册商标。

Loctite® 是 Henkel Corporation 注册商标。

TR-130 组件

TR-130 中子组件在下图中以**加粗字体**标记，会增加分解零部件详细信息。

零件颜色代码

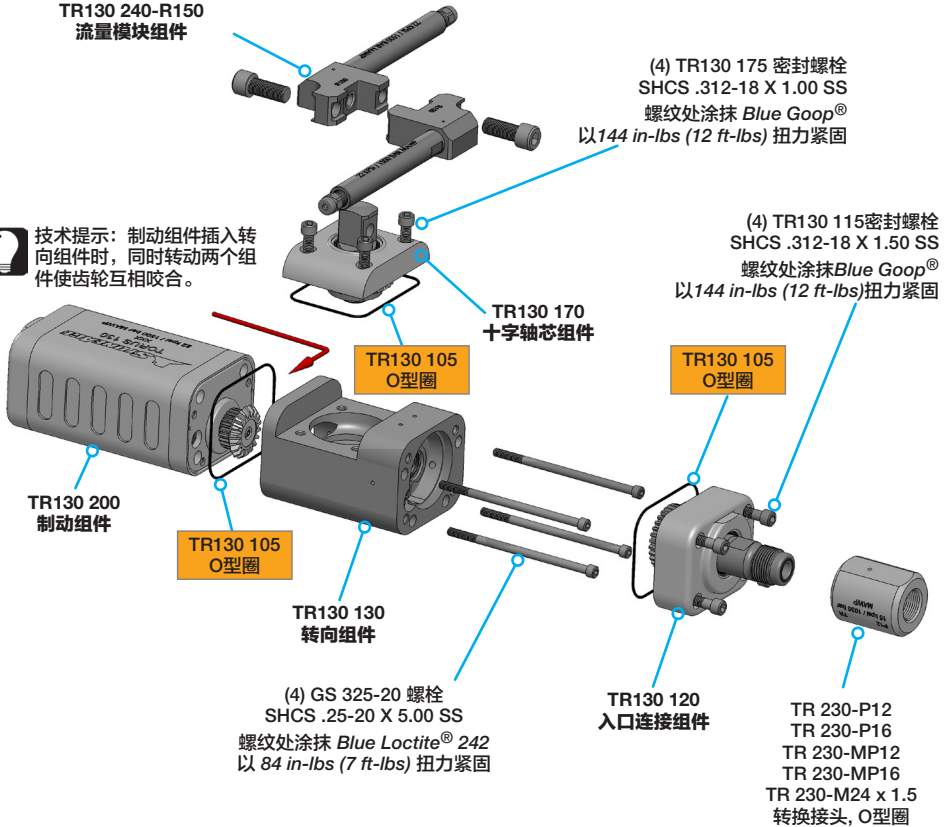
TR130 600 Service Kit = 服务包中包含件

TR130 610 Overhaul Kit = 组装机中包含件

TR130 240-R30
TR130 240-R50
TR130 240-R90
TR130 240-R150
流量模块组件

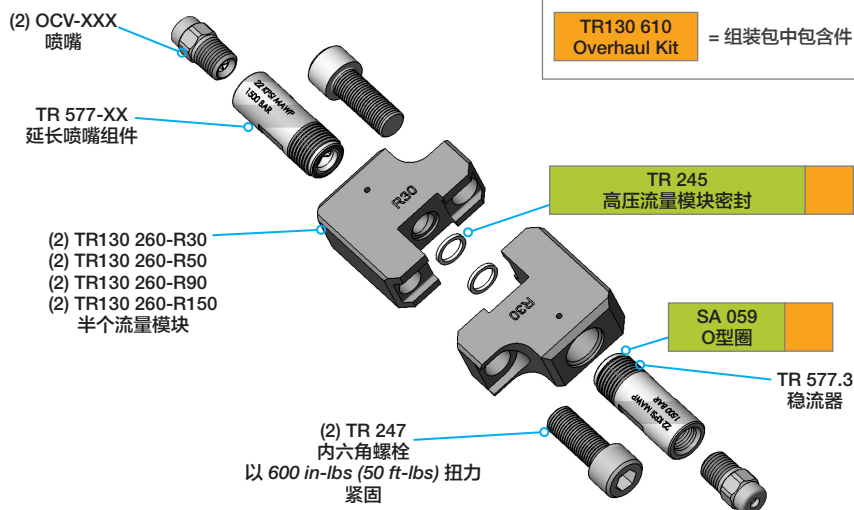


技术提示：制动组件插入转向组件时，同时转动两个组件使齿轮互相咬合。

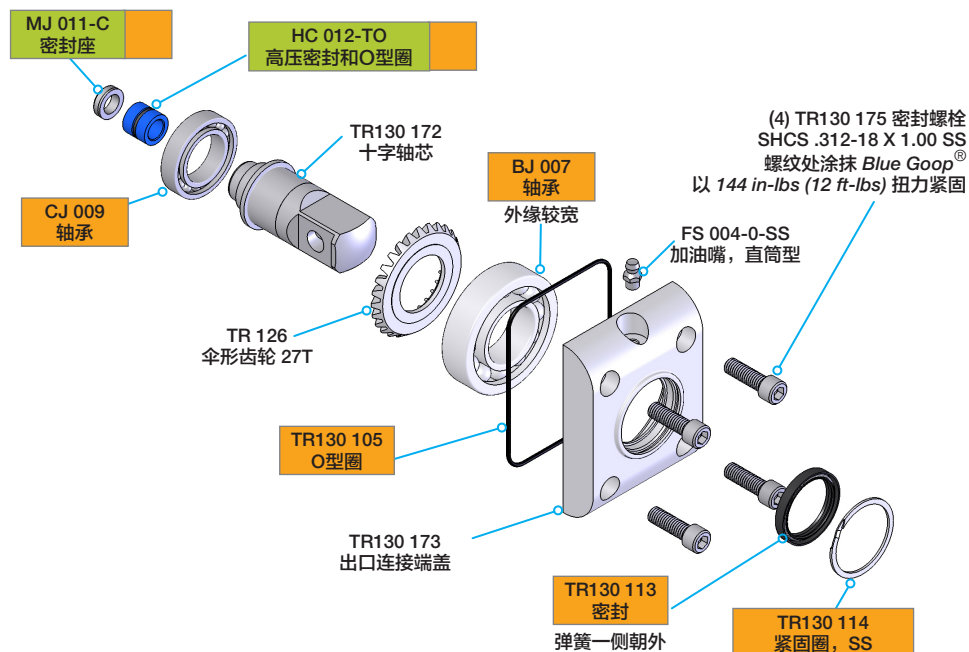


TORUS TR-130 设备维护

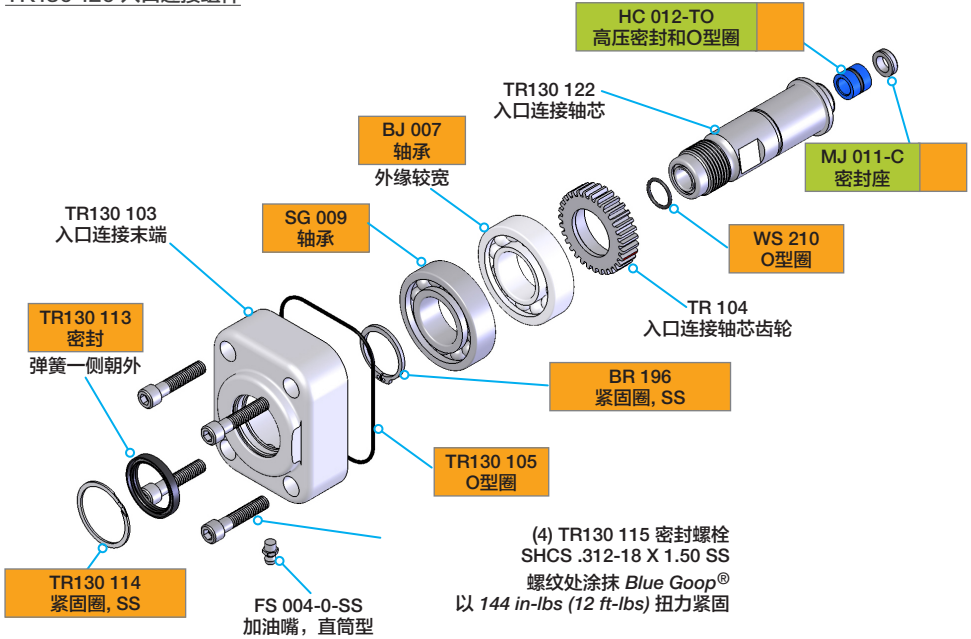
TR130 240-RXX-X 流量模块组件



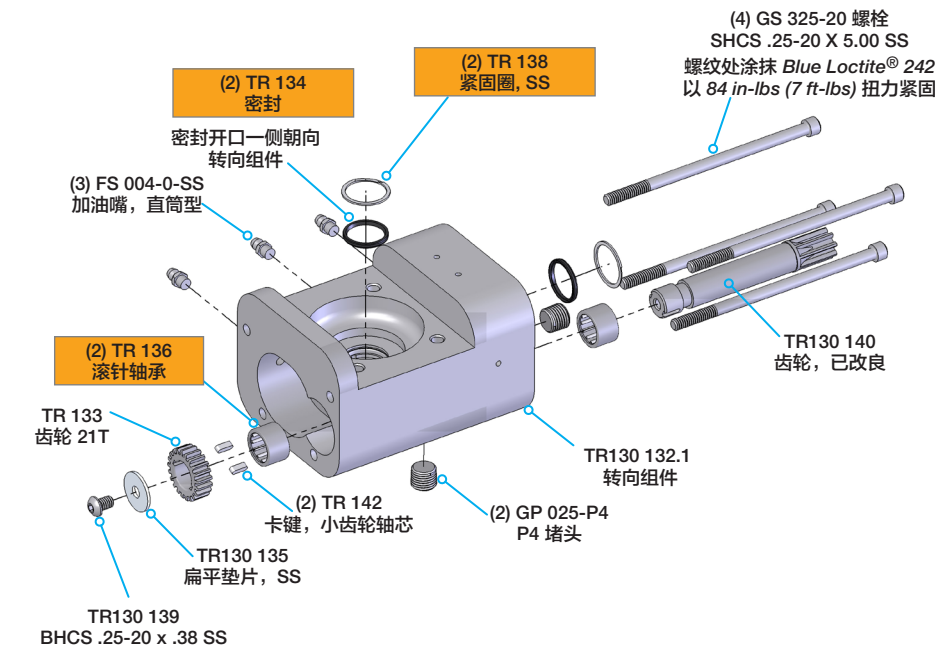
TR130 170 十字轴芯组件



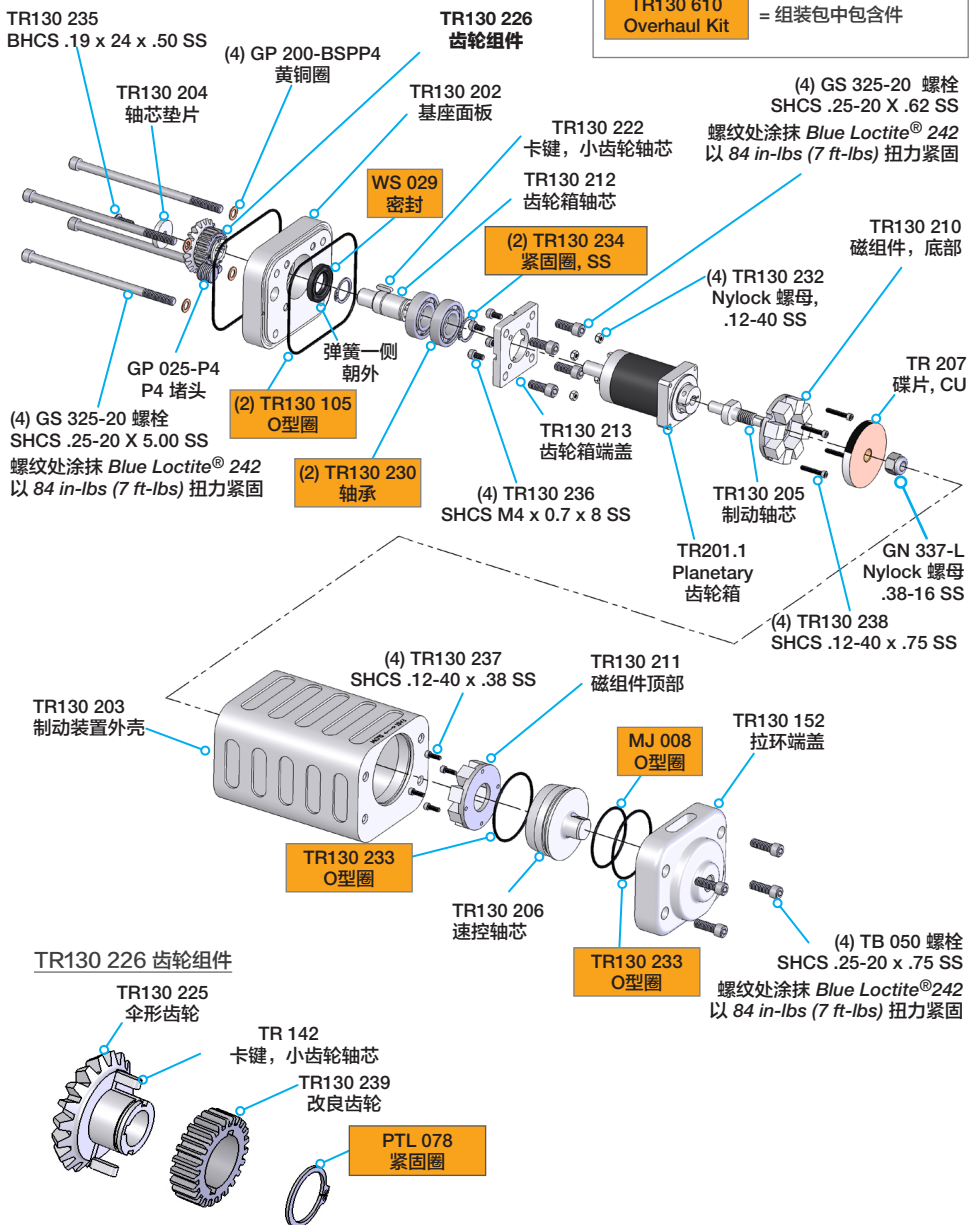
TR130 120 入口连接组件



TR130 130 转向组件



TR130 200 制动装置组件



TR-130 高压密封维护

Torus 有两个高压密封。低压状态下，高压密封会溢流，当压力上升超过1000 psi时，滴漏停止，密封开始工作。

更换 TR130 120 入口连接组件内的轴芯密封：

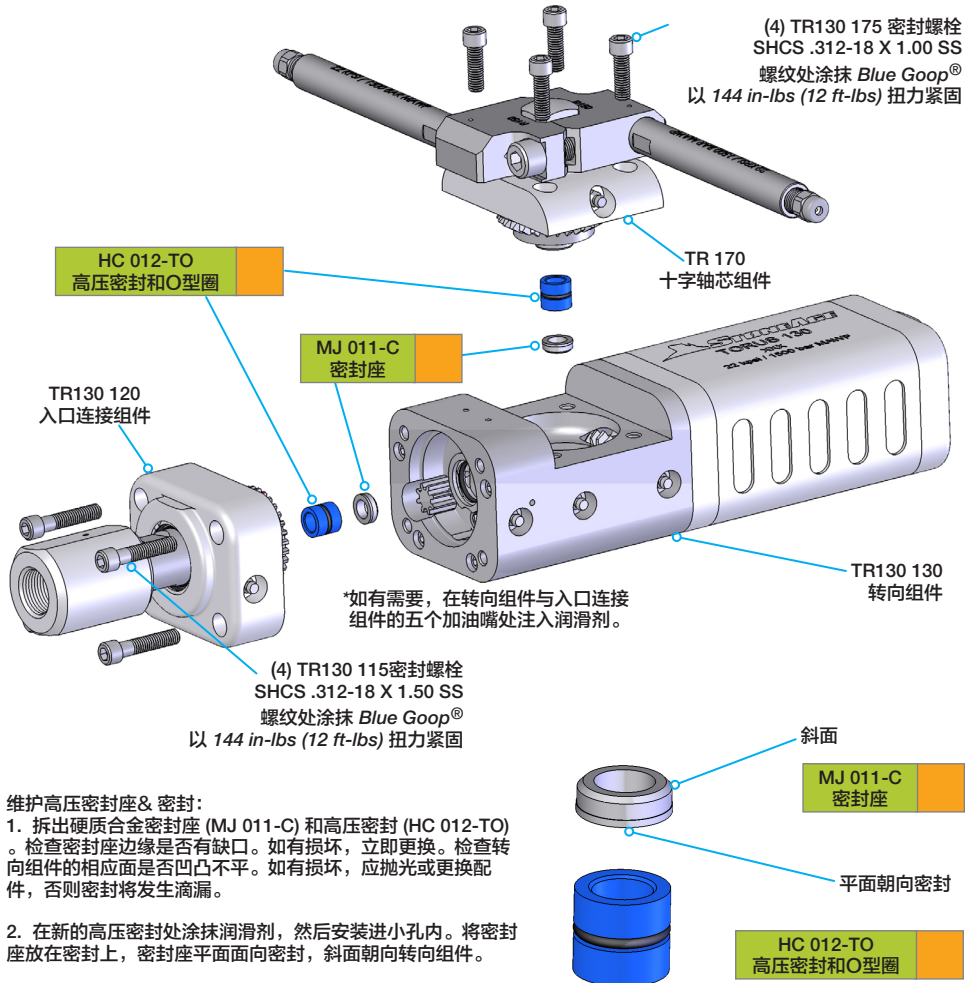
1. 拆出固定入口连接组件 (TR130 120) 与转向组件的四枚内六角螺栓。拆分入口连接组件与转向组件，密封处于入口连接轴芯末端。可直接更换密封，无须继续拆卸清洗头。

更换十字轴芯密封：

1. 旋转半个流量模块，拆出固定十字轴芯组件 (TR130 170) 与转向组件的四枚内六角螺栓。拆分十字轴芯组件与转向组件。密封位于十字轴芯的末端。可直接更换密封，无须继续拆卸清洗头。

警告

清洗头带压工作下，拉环末端壳体温度可达160°F，建议操作者佩戴手套再接触清洗头或拉环组件。请等待清洗头冷却后，才可进行拆卸维护步骤。



维护高压密封座 & 密封：

1. 拆出硬质合金密封座 (MJ 011-C) 和高压密封 (HC 012-TO)。检查密封座边缘是否有缺口。如有损坏，立即更换。检查转向组件的相应面是否凹凸不平。如有损坏，应抛光或更换配件，否则密封将发生滴漏。

2. 在新的密封处涂抹润滑剂，然后安装进小孔内。将密封座放在密封上，密封座平面面向密封，斜面朝向转向组件。

TORUS TR-130 安装紧固件

TR-130 安装紧固组件

(4) TB 050 螺栓
SHCS .25-20 x .75 SS
螺纹处涂抹 Blue Loctite® 242
以 84 in-lbs (7 ft-lbs) 扭力紧固

(4) GP 200-BSPP4 铜圈

(4) TR130 175 密封螺栓
SHCS .312-18 X 1.00 SS
螺纹处涂抹 Blue Goop®
以 144 in-lbs (12 ft-lbs) 扭力紧固

(4) GS 325-20 螺栓
SHCS .25-20 X 5.00 SS
螺纹处涂抹 Blue Loctite® 242
以 84 in-lbs (7 ft-lbs) 扭力紧固

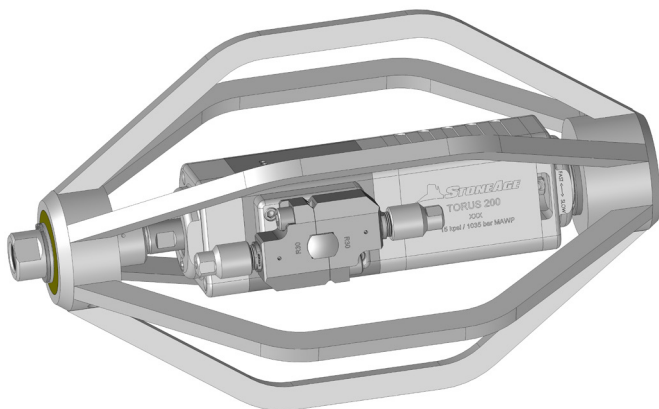
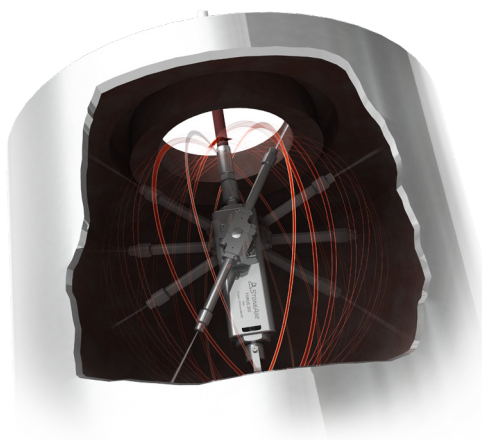
(4) GS 325-20 螺栓
SHCS .25-20 X 5.00 SS
螺纹处涂抹 Blue Loctite® 242
以 84 in-lbs (7 ft-lbs) 扭力紧固

(4) TR130 115 密封螺栓
SHCS .312-18 X 1.50 SS
螺纹处涂抹 Blue Goop®
以 144 in-lbs (12 ft-lbs) 扭力紧固

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产品说明与用途 (TR-200):

Torus TR-200 3D Tool三维旋转清洗头，专业清洗槽罐、大型容器、高压釜、大型管道及反应釜内部。最大工作压力为 15,000 psi (1035 bar)，流量范围 50 至 220 gpm。七种不同流量模块匹配不同流量参数，每一款均刻有相应的偏心数值(例如，R30)。免维护型磁力制动装置用于控制清洗头转速。请注意，清洗头带压运行后，伴随机体温度不断上升，转速也会相对变快。Torus 清洗头旋转周期在10 至 88 分钟之间，其确切周期由清洗头转速决定。清洗头转速由工作压力、流量比、喷嘴孔径、流量模块型号与制动装置设置而决定。在大多数工作状态下，流量模块轴芯自转 440 次(主体自转 136 次)，形成规律型的清洗路径。可继续运行清洗头，完善清洗路径。流量模块自转 1426 次(主体自转 441 次)为一个完整的清洗周期。高压流量模块自转周期为清洗头主体自转的3.23倍。清洗大型槽罐时，可使用喷嘴延长杆降低靶距，延长杆最大长度为36 inches。可使用高压胶管或安装拉环组件悬挂Torus清洗头进行清洗作业。建议在每次工作结束后，利用压缩空气将清洗头的喷嘴、溢流孔和入口连接处残留的水分吹干。



设备运行:

1. 使用之前, 请先确定清洗头上的流量模块与所设定工作压力及流量相匹配。安装不匹配的流量模块: 清洗头旋转过快, 损坏内部零件; 或清洗头旋转非常缓慢甚至不旋转。
2. 选择**流量模块与喷嘴**。请参考以下表格, 选出不同压力流量参数下所需使用的流量模块。必须确保安装的两个喷嘴尺寸相同, 射流状态良好, 否则将导致清洗头旋转不规律、过快或不转。
3. 使用表格: 首先在表格左纵列选择工作压力。然后从左向右, 找到最接近所需流量的数值。该流量数值下方所显示的为所需配备的流量模块型号, 该型号纵列的上方为合适喷嘴型号。若已知压力与喷嘴孔径, 从左纵列选择压力参数, 再从表格上方选择最接近的喷嘴孔径。两个参数相交处即为所需配备的流量比与流量模块型号。

下表为**通用**高压水清洗所需流量模块及喷嘴孔径参数选择。未考量高压胶管尺寸因素。

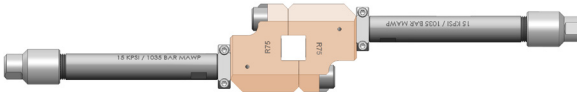
使用 StoneAge 高压水清洗APP获取更精确的流量模块及喷嘴孔径参数。

<http://jetting.stoneagetools.com>

流量模块、喷嘴孔径、压力等级、流量比参数列表											
OCV 硬质合金喷嘴孔径											
Nozzle Size		.085	.095	.105	.125	.145	.165	.175	.190	.200	.215
压力 & 流量 & 流量模块尺寸	8k psi 552 bar	gpm			76	100	130	146	172	190	218
		l/min			288	379	492	553	651	719	825
		流量模块			R75	R60	R45	R35	R30	R25	R20
	10k psi 690 bar	gpm		60	84	112	146	164	192	212	
		l/min		227	318	424	553	621	727	803	
		流量模块		R75	R60	R45	R35	R30	R25	R20	
	12k psi 827 bar	gpm	52	66	92	124	160	178	210		
		l/min	197	250	348	469	606	674	795		
		流量模块	R75	R60	R45	R35	R30	R25	R20		
	15k psi 1035 bar	gpm	48	60	72	102	138	178	200		
		l/min	182	227	273	386	522	674	757		
		流量模块	R75	R60	R45	R35	R30	R25	R20		

TR200 240-RXX-X 流量模块

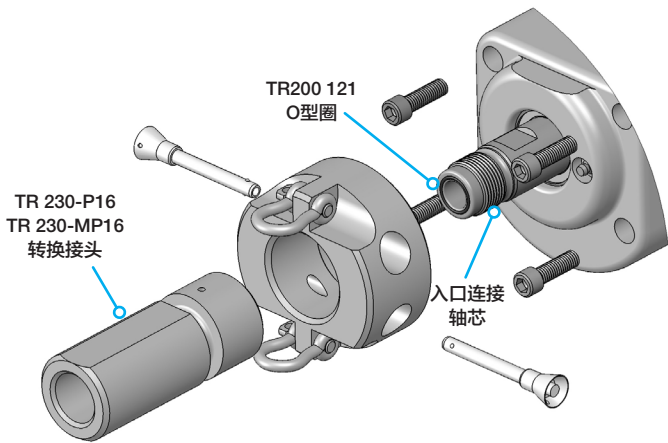
共有七种流量模块类型; 根据清洗应用类型, 选择合适流量模块。
可选安装不同长度喷嘴延长杆。



R75	R60	R45	R35	R30	R25	R20
48-76 gpm (182-288 lpm)	60-100 gpm (227-379 lpm)	72-130 gpm (273-492 lpm)	102-146 gpm (386-553 lpm)	138-172 gpm (522-651 lpm)	178-190 gpm (674-719 lpm)	200-218 gpm (757-825 lpm)

入口连接转换接头:

入口连接转换接头两端均为阴螺纹。接头一端带有一个O型圈面密封，用于密封入口连接轴芯。另一端接头型号可选 1" NPT 或 1" 中压。

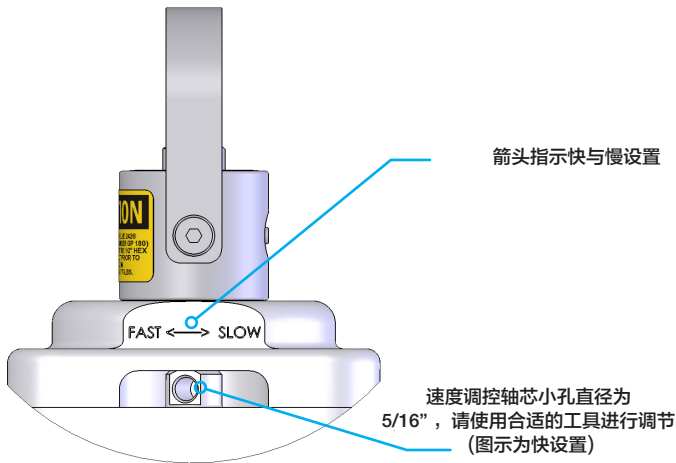


调节转速:

清洗头另一端配有速度调控轴芯，可改变 Torus 喷头转速。轴芯可设定在快与慢之间的任一位置上。调节转速时，可使用任何合适的工具，伸入壳体狭槽，插入速度调控轴芯的小孔内。将轴芯向左移动大约50°，则可将喷头转速由慢调至快。壳体上有速度标示，指示清洗头转速。将清洗头转速由“慢”调节到“快”转速会增加三倍(例如:慢5 rpm; 快30 rpm)。清洗头实际转速由工作压力所产生的扭力、流量、流量模块型号与制动装置决定。十字轴芯平均转速范围大约为：慢5-8 rpm、快30-45 rpm。

请注意

请注意：调节转速时，无需拆除拉环组件。



维护部件	维护频率	维护要求
高压密封 (详细请参阅本使用说明书高压密封更换章节)	当水从靠近入口连接处的溢流孔流出时	Torus 有两个高压密封, 一个在入口连接轴芯, 一个在十字轴芯。这两个密封功能相同。低压下(低于1000 psi) 会出现溢流; 正常工作压力下密封受损, 会出现持续漏水。若靠近入口连接的溢流孔发生溢流, 则表示入口连接密封已损坏。若远离入口连接的溢流孔发生溢流, 表示十字轴芯密封已损坏, 应当及时更换。
润滑与储藏	每运行100小时后	建议每使用100小时后为清洗头涂抹润滑剂。可使用任何品牌多功能 NLGI 2 润滑剂。在壳体外部有五处润滑剂接头。过度注入润滑不会损坏清洗头, 只是操作员会发现带压运行中, 轴芯密封附近会有多余的润滑剂溢出。同时建议在每次使用结束后, 用压缩空气吹干喷嘴、溢流孔及入口连接处的水分, 可以延长内部零件使用寿命。
磁力制动装置	必要时	磁力制动装置无需润滑或维护。若磁力制动组件出现故障, 应寄回StoneAge维修中心维修或替换。
高压连接螺纹	每次使用前/后	为防止螺纹出现粘连, 所有管螺纹接头请使用Parker Thread Mate 螺纹防粘剂(StoneAge 产品编号 GP047)及fluorocarbon 胶带。其他高压连接螺纹只需使用金属防咬合剂。StoneAge 建议使用 Swagelok Blue Goop (StoneAge 产品编号 GP043)。
螺纹紧固件	必要时	所有螺纹紧固件必须遵循以下组装程序: A) 标记有Blue Loctite(GP 180)的紧固件需要按照标识重新组装及紧固。 B) 所有其他紧固件需用Blue Goop(GP 043)重新组装, 如有特殊说明, 需按说明紧固。

警告

清洗头带压工作下, 拉环末端壳体温度可达160°F, 建议操作者佩戴手套再接触清洗头或拉环组件。请等待清洗头冷却后, 才可进行拆卸维护步骤。

MOBIL® 是 Exxon Mobil Corporation 注册商标。

Blue Goop® 是 Swagelok 注册商标。

Loctite® 是 Henkel Corporation 注册商标。

Threadmate™ 是 Parker Hannifin Corporation 注册商标。

TORUS TR-200 设备维护资源信息

TORUS 维护信息

维护 Torus 需要经过专业培训并使用合适的工具。如无法对清洗头进行正确的维护，请将清洗头交给本公司授权经销商进行维护。清洗头维护请小心谨慎，防止设备内部进入砂砾、飞絮或污染物。不当操作将造成清洗头永久性损坏。

工具列表:

- 撬杆
- 一字螺丝刀
- 手动润滑剂注射枪
- 内六角扳手

材料列表:

- 干净无绒布与纸巾
- Swagelock Blue Goop 金属防粘剂或相同类型产品
- Mobil SHC PM 460 合成润滑剂或相同类型产品

请注意

请勿使用气动或电动润滑剂注射枪为 Torus 灌注润滑剂。因为过量润滑剂将在短时间内进入制动装置组件，导致密封受损，清洗头无法旋转。StoneAge建议
使用手动润滑剂注射枪。

TORUS TR-200 产品维护资源信息

TR200 600 – 服务包		TR200 610 – 组装机	
BJ 072 O型圈	2	BJ 008 O型圈	1
GP 043 BLUE GOOP, 2 OZ	1	BJ 072 O型圈	2
PL 556 Torus 产品使用说明书	1	CY 015 密封	2
SM 011 硬质合金密封座	2	GP 043 Blue Goop, 2 oz	1
SM 012-O 高压密封 & O型圈	2	GP 180 Loctite, 242 Blue .5ml 瓶	1
TR200 121 O型圈	1	MJ 007 球形轴承	1
TR200 245 高压密封, 流量模块	2	PL 556 产品使用说明书	1
		PTL 078 紧固圈, SS	1
		RJ 040-K O型圈	2
		SG 007 大密封	1
		SM 009 轴承, 6307 JEM	1
		SM 011 硬质金属合金密封座	2
		SM 012-O 高压密封 & O型圈	2
		TR200 007 轴承	2
		TR200 038 紧固圈, SS 内部 Inv 1.5	2
		TR200 105 O型圈	3
		TR200 116 紧固圈, SS 外部 1.375	2
		TR200 118 紧固圈, SS HD 内部 1.81	2
		TR200 121 O型圈	1
		TR200 136 滚针轴承	2
		TR200 175 入口连接末端O型圈	1
		TR200 213 入口连接O型圈	1
		TR200 224 紧固圈, SS 外部 1.00	1
		TR200 245 高压密封, 流量模块	2

零件颜色代码键

TR200 600 Service Kit = 维护包中有替换零件

TR200 610 Overhaul Kit = 检修包中有替换零件

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Blue Goop® 是 Swagelock 注册商标。

Loctite® 是 Henkel Corporation 注册商标。

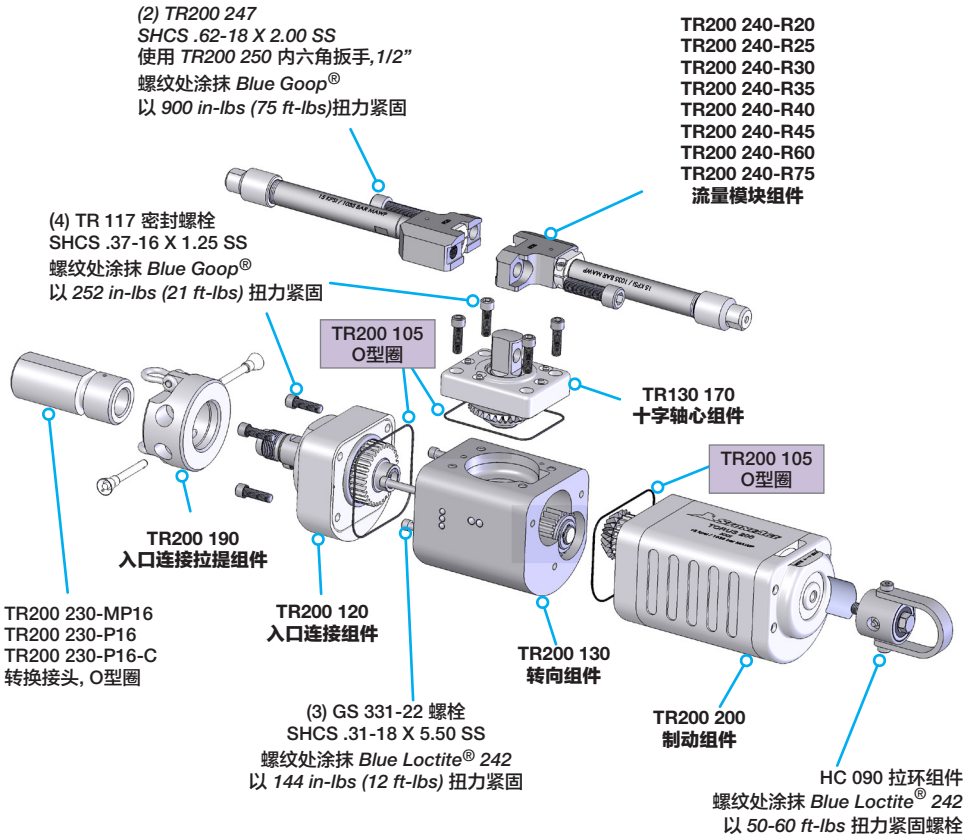
TR-200 组件

TR-200 中子组件在下图中以**加粗字体**标记，会增加分解零部件详细信息。

零件颜色代码

TR200 600 Service Kit = 服务包中包含件

TR200 610 Overhaul Kit = 组装机中包含件



技术提示: 制动组件插入转向组件时, 同时转动两个组件使齿轮互相咬合。

TORUS TR-200 设备维护

TR200 240-RXX-X 流量模块组件

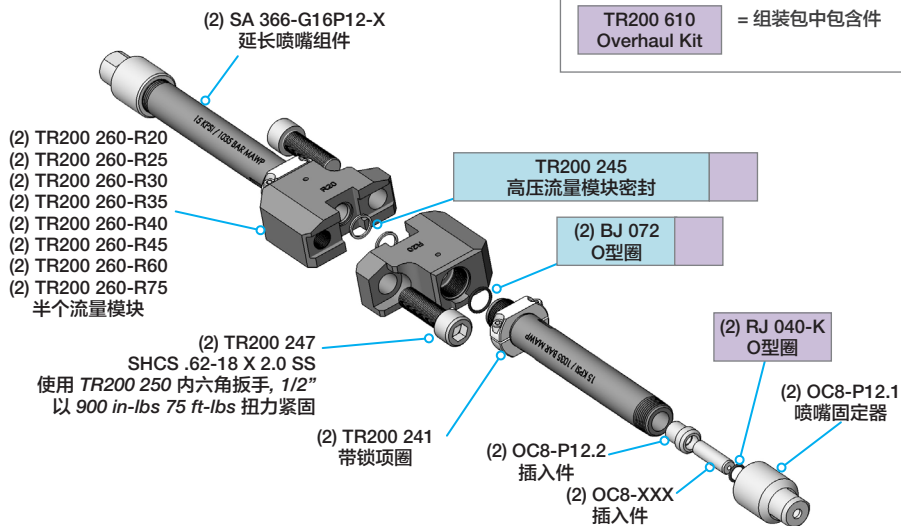
零件颜色代码

TR200 600
Service Kit

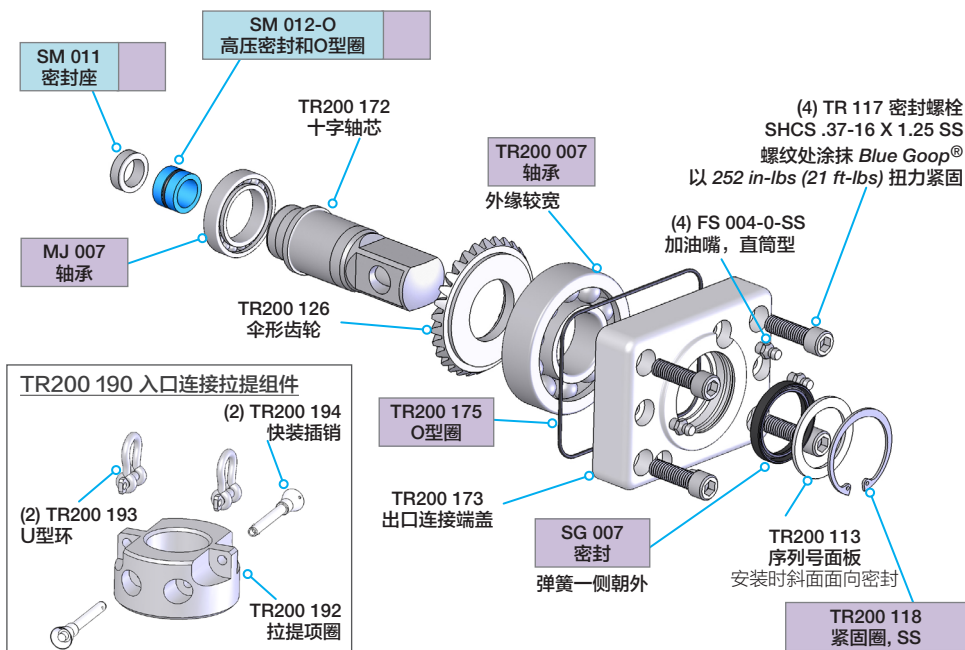
= 服务包中包含件

TR200 610
Overhaul Kit

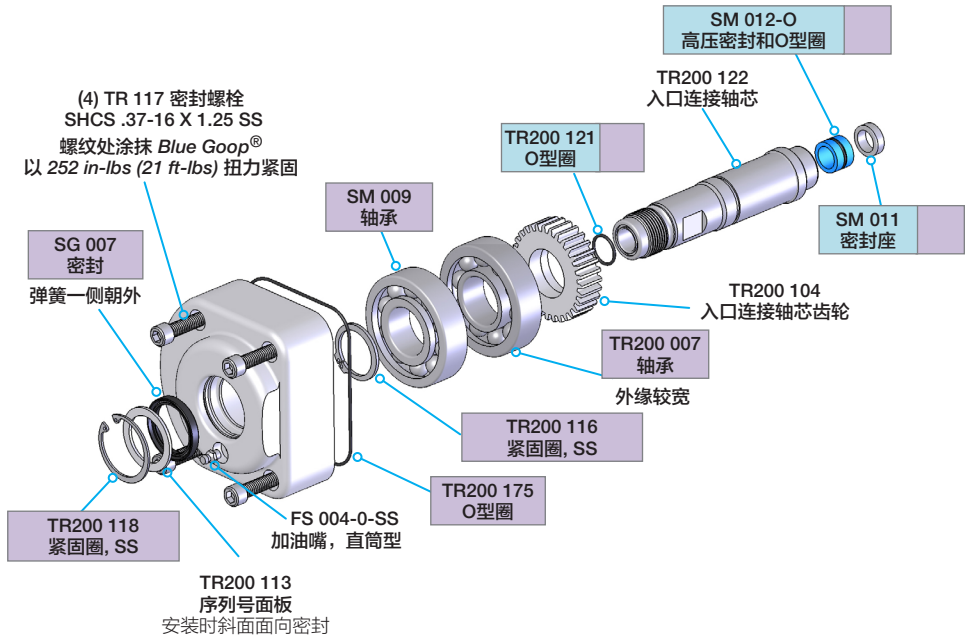
= 组装包中包含件



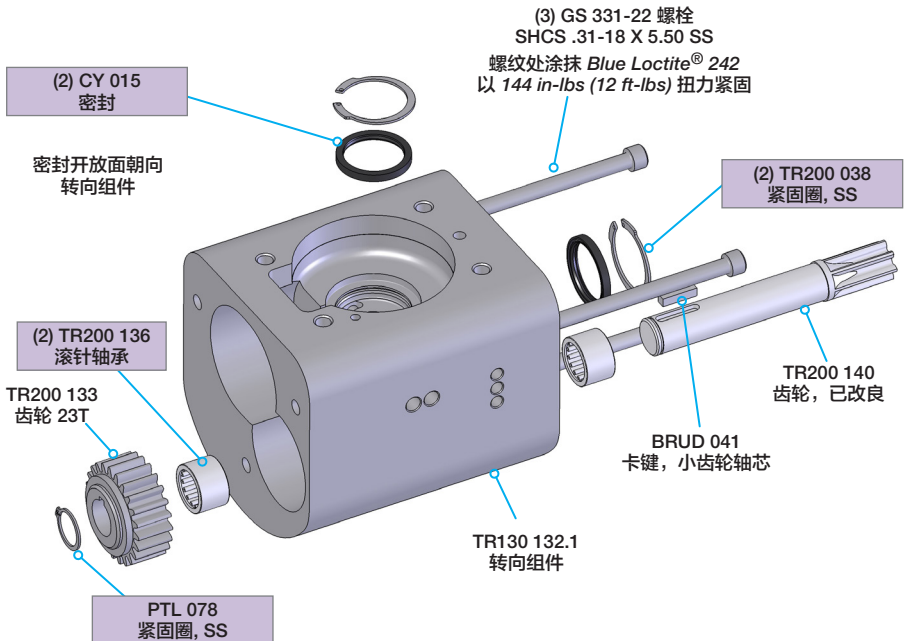
TR200 170 十字轴芯组件



TR200 120 入口连接组件

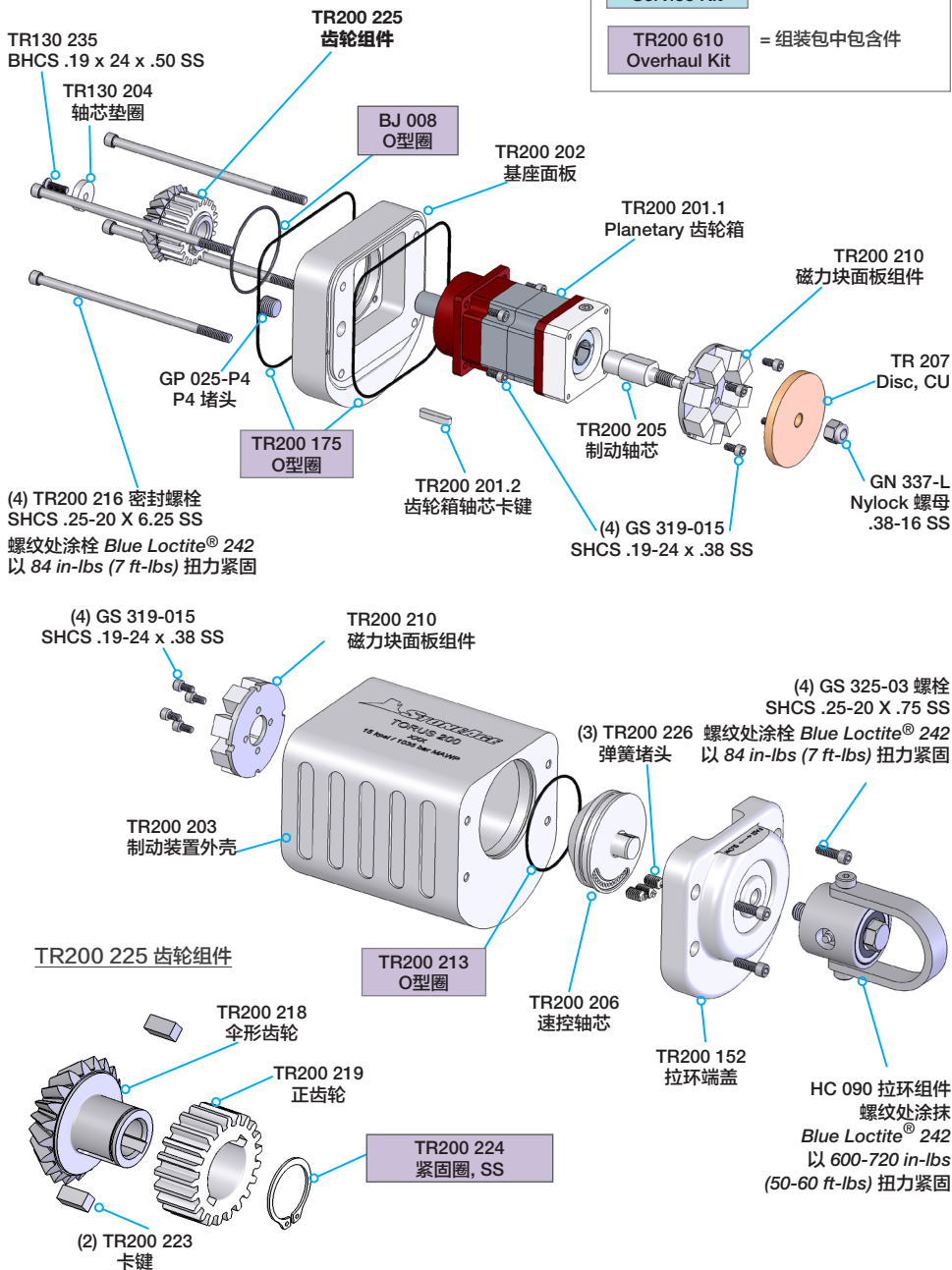


TR200 130 转向组件



TORUS TR-200 设备维护

TR200 200 制动组件



TR-200 高压密封维护

Torus 有两个高压密封。低压状态下，高压密封会溢流，当压力上升超过1000 psi时，滴漏停止，密封开始工作。

更换 TR200 120 入口连接组件内轴芯密封:

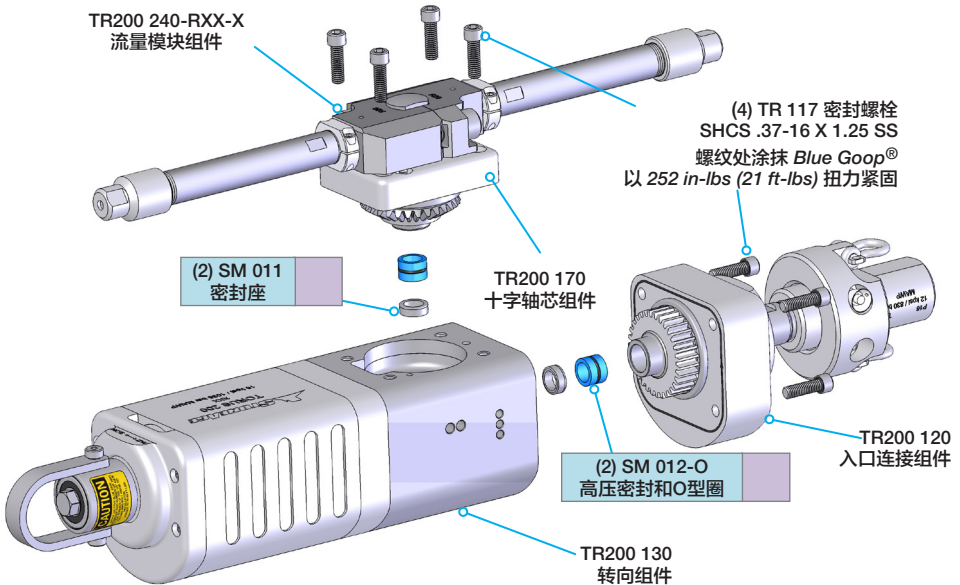
1. 拆出固定入口连接组件(TR200 120)与转向组件的四枚密封内六角螺栓。拆分入口连接组件与转向组件，密封处于入口连接轴芯末端。可直接更换密封，无须继续拆卸清洗头。

更换十字轴芯密封:

1. 旋转半个流量模块，拆出固定十字轴芯组件 (TR200 170) 与转向组件的四枚密封内六角螺栓。拆分十字轴芯组件与转向组件。密封位于十字轴芯的末端。可直接更换密封，无须继续拆卸清洗头。

警告

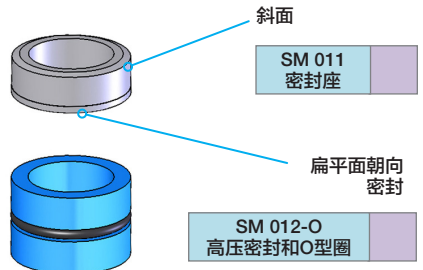
清洗头带压工作下，拉环末端壳体温度可达160°F，建议操作者佩戴手套再接触清洗头或拉环组件。请等待清洗头冷却后，才可进行拆卸维护步骤。



维护高压密封座&密封:

1. 拆出硬质合金密封座 (SM 011) 和高压密封 (SM 012-O)。检查密封座边缘是否有缺口。如有损坏，立即更换。检查转向组件的相应面是否凹凸不平。如有损坏，应抛光或更换配件，否则密封将发生滴漏。

2. 在新的密封处涂抹润滑剂，然后安装进孔内。将密封座安装至密封上，密封座平面朝向密封，斜面向转向组件。



TORUS TR-200 安装紧固件

TR-200 安装紧固组件

(4) GS 325-03 螺栓
SHCS .25-20 X .75 SS
螺纹处涂抹 *Blue Loctite® 242*
以 84 in-lbs (7 ft-lbs) 扭力紧固

(4) TR200 216 密封螺栓
SHCS .25-20 x 6.25 SS
螺纹处涂抹 *Blue Goop®*
以 144 in-lbs (12 ft-lbs) 扭力紧固

(4) TR 117 密封螺栓
SHCS .37-16 X 1.25 SS
螺纹处涂抹 *Blue Goop®*
以 252 in-lbs (21 ft-lbs) 扭力紧固

(3) GS 331-22 螺栓
SHCS .31-18 X 5.50 SS
螺纹处涂抹 *Blue Loctite® 242*
以 144 in-lbs (12 ft-lbs) 扭力紧固

(4) TR 117 密封螺栓
SHCS .37-16 X 1.25 SS
螺纹处涂抹 *Blue Goop®*
以 252 in-lbs (21 ft-lbs) 扭力紧固

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1. Acceptance of Terms and Conditions. Receipt of these Terms and Conditions of Sale ("Terms and Conditions") shall operate as the acceptance by StoneAge, Inc. ("Seller") of the order submitted by the purchaser ("Buyer"). Such acceptance is made expressly conditional on assent by Buyer to these Terms and Conditions. Such assent shall be deemed to have been given unless written notice of objection to any of these Terms and Conditions (including inconsistencies between Buyer's purchase order and this acceptance) is given by Buyer to Seller promptly on receipt hereof.

Seller desires to provide Buyer with prompt and efficient service. However, to individually negotiate the terms of each sales contract would substantially impair Seller's ability to provide such service. Accordingly, the product(s) furnished by Seller are sold only according to the terms and conditions stated herein and with the terms and conditions stated in any effective StoneAge Dealer Agreement or StoneAge Reseller Agreement, if applicable. Notwithstanding any terms and conditions on Buyer's order, Seller's performance of any contract is expressly made conditional on Buyer's agreement to these Terms and Conditions unless otherwise specifically agreed to in writing by Seller. In the absence of such agreement, commencement of performance, shipment and/or delivery shall be for Buyer's convenience only and shall not be deemed or construed to be an acceptance of Buyer's terms and conditions.

2. Payment/Prices. Unless other arrangements have been made in writing between Seller and Buyer, payment for the product(s) shall be made upon receipt of invoice. The prices shown on the face hereof are those currently in effect. Prices invoiced shall be per pricelist in effect at the time of shipment. Prices are subject to increase for inclusion of any and all taxes which are applicable and which arise from the sale, delivery or use of the product(s), and the collection of which Seller is or may be responsible to provide to any governmental authority, unless acceptable exemption certificates are provided by Buyer in accordance with applicable law. Buyer shall pay all charges for transportation and delivery and all excise, order, occupation, use or similar taxes, duties, levies, charges or surcharges applicable to the product(s) being purchased, whether now in effect or hereafter imposed by any governmental authority, foreign or domestic.

3. Warranty. SELLER MAKES NO WARRANTIES OR REPRESENTATIONS AS TO THE PERFORMANCE OF ANY PRODUCT EXCEPT AS SET FORTH IN THE STONEAGE LIMITED WARRANTY PROVIDED WITH THE PRODUCT.

4. Delivery. Seller is not obligated to make delivery by a specified date, but will always use its best efforts to make delivery within the time requested. The proposed shipment date is an estimate. Seller will notify Buyer promptly of any material delay and will specify the revised delivery date as soon as practicable. UNDER NO CIRCUMSTANCES SHALL SELLER HAVE ANY LIABILITY WHATSOEVER FOR LOSS OF USE OR FOR ANY DIRECT OR CONSEQUENTIAL DAMAGES RESULTING FROM DELAY REGARDLESS OF THE REASON(S).

All product(s) will be shipped F.O.B. point of origin, unless specifically agreed otherwise, and Buyer shall pay all shipping costs and insurance costs from that point. Seller, in its sole discretion, will determine and arrange the means and manner of transportation of the product(s). Buyer shall bear all risk of loss commencing with the shipment or distribution of the product(s) from Seller's warehouse. Order shortages or errors must be reported within fifteen (15) business days from receipt of shipment to secure adjustment. No product(s) may be returned without securing written approval from Seller.

5. Modification. These Terms and Conditions are intended by Seller and Buyer to constitute a final, complete and exclusive expression of agreement relating to the subject matter hereof and cannot be supplemented or amended without Seller's prior written approval.

6. Omission. Seller's waiver of any breach or Seller's failure to enforce any of these Terms and Conditions at any time, shall not in any way affect, limit or waive Seller's right thereafter to enforce and compel strict compliance with every term and condition hereof.

7. Severability. If any provision of these Terms and Conditions is held to be invalid or unenforceable, such invalidity or unenforceability shall not affect the validity or enforceability of the other portions hereof.

8. Disputes. Seller and Buyer shall attempt in good faith to promptly resolve any dispute arising under these Terms and Conditions by negotiations between representatives who have authority to settle the controversy. If unsuccessful, Seller and Buyer shall further attempt in good faith to settle the dispute by nonbinding third-party mediation, with fees and expenses of such mediation apportioned equally to each side. Any dispute not so resolved by negotiation or mediation may then be submitted to a court of competent jurisdiction in accordance with the terms hereof. These procedures are the exclusive procedures for the resolution of all such disputes between the Seller and Buyer.

9. Governing Law. All sales, agreements for sale, offers to sell, proposals, acknowledgments and contracts of sale, including, but not limited to, purchase orders accepted by Seller, shall be considered a contract under the laws of the State of Colorado and the rights and duties of all persons, and the construction and effect of all provisions hereof shall be governed by and construed according to the laws of such state.

STONEAGE TRADEMARK LIST

View the list of StoneAge's trademarks and service marks and learn how the trademarks should be used. Use of StoneAge trademarks may be prohibited, unless expressly authorized.

<http://www.StoneAgetools.com/trademark-list/>

STONEAGE PATENT DATA

View the list of StoneAge's current U.S. patent numbers and descriptions.

<http://www.sapatents.com>

STONEAGE TERMS AND WARRANTY

View StoneAge's Terms and Warranty Conditions online.

<http://www.stoneagetools.com/terms>

<http://www.stoneagetools.com/warranty>

10. Jurisdiction and Venue. Seller and Buyer agree that the state or federal courts located within the City and County of Denver, Colorado shall have sole and exclusive jurisdiction over any litigation concerning any dispute arising under these Terms and Conditions not otherwise resolved pursuant to Section 9 as well as any alleged defects of any Products or damages sustained as a result of such alleged defects. Seller and Buyer further agree that should any litigation be commenced in connection with such a dispute, it shall only be commenced in such courts. Seller and Buyer agree to the exclusive jurisdiction of such courts and neither will raise any objection to the jurisdiction and venue of such courts, including as a result of inconvenience.

11. Attorney's Fees. If any litigation is commenced between Seller and Buyer, or their personal representatives, concerning any provision hereof, the party prevailing in the litigation shall be entitled, in addition to such other relief that is granted, to a reasonable sum as and for their attorneys' fees and costs in such litigation or mediation.

WARRANTY:

Warranties set forth herein extend only to End-Users, meaning customers acquiring, or that have previously acquired, a product manufactured by StoneAge ("Product") for their own use and not for resale, either directly from StoneAge Inc. ("StoneAge") or from a StoneAge Authorized Dealer or Reseller ("Dealer"). No warranty of any kind or nature is made by StoneAge beyond those expressly stated herein.

1. LIMITED WARRANTY PERIOD. Subject to the limitations and conditions hereinafter set forth, StoneAge warrants its Product to be free from defects in workmanship and material for a period of one (1) year from the date of purchase by the End-User, provided that the end of the limited warranty period shall not be later than eighteen (18) months from the date of shipment of the Product to the Dealer or the End-User by StoneAge ("Limited Warranty Period"). All replacement parts which are furnished under this Limited Warranty and properly installed shall be warranted to the same extent as the original Product under this Limited Warranty if, and only if, the original parts were found to be defective within the original Limited Warranty Period covering the original Product. Replacement parts are warranted for the remainder of the original Limited Warranty Period. This Limited Warranty does not cover any component part of any Product not manufactured by StoneAge. Any such component part is subject exclusively to the component manufacturer's warranty terms and conditions.

2. LIMITED WARRANTY COVERAGE. StoneAge's sole obligation under this Limited Warranty shall be, at StoneAge's option and upon StoneAge's inspection, to repair, replace or issue a credit for any Product which is determined by StoneAge to be defective in material or workmanship. StoneAge reserves the right to examine the alleged defective Product to determine whether this Limited Warranty is applicable, and final determination of limited warranty coverage lies solely with StoneAge. No statement or recommendation made by a StoneAge representative, Dealer or agent to End-User shall constitute a warranty by StoneAge or a waiver or modification to any of the provisions hereof or create any liability for StoneAge.

3. WARRANTY SERVICE PROVIDERS. Service and repair of the Product is to be performed only by StoneAge authorized service representatives, including Dealers who are authorized repair centers, with StoneAge approved parts. Information about StoneAge authorized service representatives can be obtained through the StoneAge website at www.stoneagetools.com/service. Unauthorized service, repair or

modification of the Product or use of parts not approved by StoneAge will void this Limited Warranty. StoneAge reserves the right to change or improve the material and design of the Product at any time without notice to End-User, and StoneAge is not obligated to make the same improvements during warranty service to any Product previously manufactured.

4. WARRANTY EXCLUSIONS. This Limited Warranty does not cover, and StoneAge shall not be responsible for the following, or damage caused by the following: (1) any Product that has been altered or modified in any way not approved by StoneAge in advance in writing; (2) any Product that has been operated under more severe conditions or beyond the rated capacity specified for that Product; (3) depreciation or damage caused by normal wear and tear, failure to follow operation or installation instructions, misuse, negligence or lack of proper protection during storage; (4) exposure to fire, moisture, water intrusion, electrical stress, insects, explosions, extraordinary weather and/or environmental conditions including, but not limited to lightning, natural disasters, storms, windstorms, hail, earthquakes, acts of God or any other force majeure event; (5) damage to any Product caused by any attempt to repair, replace, or service the Product by persons other than StoneAge authorized service representatives; (6) costs of normal maintenance parts and services; (7) damage sustained during unloading, shipment or transit of the Product; or (8) failure to perform the recommended periodic maintenance procedures listed in the Operator's Manual accompanying the Product.

5. REQUIRED WARRANTY PROCEDURES. To be eligible for warranty service, the End-User must: (1) report the Product defect to the entity where the Product was purchased (i.e. StoneAge or the Dealer) within the Limited Warranty Period specified in this Limited Warranty; (2) submit the original invoice to establish ownership and date of purchase; and (3) make the Product available to a StoneAge authorized service representative for inspection to determine eligibility for coverage under this Limited Warranty. This Limited Warranty shall not extend to any person or entity who fails to provide proof of original purchase from StoneAge or a Dealer. No Product may be returned for credit or adjustment without prior written permission from StoneAge.

6. **DISCLAIMER OF IMPLIED WARRANTIES AND OTHER REMEDIES.** EXCEPT AS EXPRESSLY STATED HEREIN (AND TO THE FULLEST EXTENT ALLOWED UNDER APPLICABLE LAW), STONEAGE HEREBY DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND ANY AND ALL WARRANTIES, REPRESENTATIONS OR PROMISES AS TO THE QUALITY, PERFORMANCE OR FREEDOM FROM DEFECT OF THE PRODUCT COVERED BY THIS LIMITED WARRANTY. STONEAGE FURTHER DISCLAIMS ALL IMPLIED INDEMNITIES.

7. **LIMITATION OF LIABILITY.** End-User specifically acknowledges that the Product may be operated at high speeds and/or pressures, and that as such it may be inherently dangerous if not used correctly. End-User shall familiarize itself with all operation materials provided by StoneAge and shall at all times use and require its agents, employees and contractors to use all necessary and appropriate safety devices, guards and proper safe operating procedures. In no event shall StoneAge be responsible for any injuries to persons or property caused directly or indirectly by the operation of the Product if End-User or any agent, employee, or contractor of End-User: (1) fails to use all necessary and appropriate safety devices, guards and proper safe operating procedures; (2) fails to maintain in good working order such safety devices and guards; (3) alters or modifies the Product in any way not approved by StoneAge in advance in writing; (4) allows the Product to be operated under more severe conditions or beyond the rated capacity specified for the Product; or (5) otherwise negligently operates the Product. End-User shall indemnify and hold StoneAge harmless from any and all liability or obligation incurred by or against StoneAge, including costs and attorneys' fees, to or by any person so injured.

TO THE FULL EXTENT ALLOWED BY APPLICABLE LAW, STONEAGE SHALL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR PUNITIVE DAMAGES (INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF GOODWILL, DIMINUTION OF VALUE, WORK STOPPAGE, INTERRUPTION OF BUSINESS, RENTAL OF SUBSTITUTE PRODUCT, OR OTHER COMMERCIAL LOSS EVEN TO THE EXTENT SUCH DAMAGES WOULD CONSTITUTE DIRECT DAMAGES), WITH RESPECT TO THE COVERED STONEAGE PRODUCT, OR OTHERWISE IN CONNECTION WITH THIS LIMITED WARRANTY, REGARDLESS OF WHETHER STONEAGE HAS BEEN

ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

IT IS UNDERSTOOD THAT STONEAGE'S LIABILITY, WHETHER IN CONTRACT, IN TORT, UNDER ANY WARRANTY, IN NEGLIGENCE, OR OTHERWISE SHALL NOT EXCEED THE AMOUNT OF THE PURCHASE PRICE PAID BY THE END-USER FOR THE PRODUCT. STONEAGE'S MAXIMUM LIABILITY SHALL NOT EXCEED, AND END-USER'S REMEDY IS LIMITED TO EITHER (1) REPAIR OR REPLACEMENT OF THE DEFECTIVE WORKMANSHIP OR MATERIAL OR, AT STONEAGE'S OPTION, (2) REFUND OF THE PURCHASE PRICE, OR (3) ISSUANCE OF A CREDIT FOR THE PURCHASE PRICE, AND SUCH REMEDIES SHALL BE END-USER'S ENTIRE AND EXCLUSIVE REMEDY.

YOU, THE END-USER, UNDERSTAND AND EXPRESSLY AGREE THAT THE FOREGOING LIMITATIONS ON LIABILITY ARE PART OF THE CONSIDERATION IN THE PRICE OF THE STONEAGE PRODUCT YOU PURCHASED.

Some jurisdictions do not allow the limitation or exclusion of liability for certain damages, so the above limitations and exclusions may not apply to you. This Limited Warranty gives you specific legal rights, and you may also have other rights which vary from jurisdiction to jurisdiction. If any provisions of this Limited Warranty is held to be invalid or unenforceable, such invalidity or unenforceability shall not affect the validity or enforceability of the other portions hereof.



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