

空气轴承 精密磨床

型号 30A



用户手册

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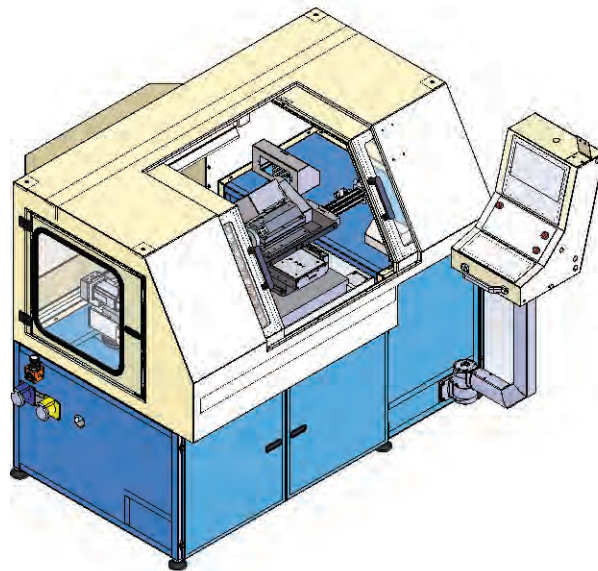


设备安装或操作前需仔细阅读本手册

MODEL 30A CNC 气动轴承精密磨床

Pride 30A 型空气轴承磨床是用于硬质合金模具打磨的最优选技术。30A 型磨床是比以往制造的任何磨床在一次拉伸和拉伸 (D & I) (两件) 机床上将实现更小的公差精度和更好的表面抛光。这是通过以下来实现；

- a. 采用保证径向跳动小于 1500 万分之一英寸 (0.4 微米) 的气动轴承磨轮头和工作头。
- b. 数字直接驱动电机是磨床的旋转机构，不含有将在模具径向上留下痕迹的齿轮、链条或万向接头。旋转机构和驱动电机对于拉伸模具地面半径是同一个机构，诸如 D & I 制罐机的再拉伸模具等。
- c. 在一块花岗石板上采用两个气动轴承和数字直接驱动旋转机构。
- d. 将通过气囊使花岗石板悬浮以避免关键零部件在高和低频率振动下损坏。
- e. 可进行 1 微寸或更小的表面抛光的变速磨轮。
- f. 随 Bosch Rexroth CNC 控制器一起提供的基于 Windows® 的操作窗口，可实现常见的运行操作
- g. 采用开放式架构，便于自身不带程序的部件的编程。
- h. 从不要基准或宽松位置的绝对标尺。



30A 型磨床安装与操作手册

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机器与安全性介绍



1. 机器与安全性介绍

1.1 用户手册介绍

本手册旨在提供有关 Pride 30A 型气动轴承磨床的初始设置、操作、部件识别与维护的信息。在进行主要现场维护之前，应咨询 Pride Engineering, LLC，明尼苏达州明尼阿波利斯，电话：+1 (763) 427-6250。



设备安装或操作前需仔细阅读本手册

用户手册制造帮助用户了解如何安全、有效地操作 Pride 30A 型气动轴承磨床。遵守本手册中说明能够降低安全风险，同时帮助有效操作设备。特别是本手册中涉及的建议维护项目旨在使机械的使用有效性最大化。



妥善保管用户手册，以备未来使用！

1.1.1 安全相关符号定义



表示阅读手册



表示一般警告，指示危害生命和四肢或重大机械损害



表示强制行动



表示电气危害



表示必须佩戴护目用具



表示重要信息



表示禁止行动



表示严禁拆卸防护装置



表示内部安全联锁



表示弧闪危害



表示切断/切割危害



表示缠绕危害



表示夹点危害



表示旋转轴危害



表示锁定机械装置



表示断开电源

1.2 机器技术特征

1.2.1 目标用途

Pride 30A 型空气轴承磨床旨在用于打磨硬质合金模具。设计实现较紧密公差以及更佳的模具表面，用于冲压和铁制（两片）罐制造流程。

模具最大直径：待打磨的 **7 英寸 (178 毫米)**

材料：仅硬质合金材料

1.2.2 设备改造

严禁改造设备。设备改造可能会影响为保证设备安全操作而采取的措施。

1.2.3 技术特征

重量：**3,640 磅 (1,650 公斤)**

高度：**70 英寸 (1,780 毫米)**

长度：**76 英寸 (1,880 毫米)**

宽度：**52 英寸 (1,320 毫米)**

工作条件：

空气温度：**68 F° +/- 2° (20 C° +/- 1°)**

相对湿度：**35 - 45%**

海拔高度：**0 -10,000 英尺 (0 -3,000 米)**

便于操作所需的近似空调占地面积（包括工作区域）为 8 英尺 × 10 英尺。

毗邻区域中的工厂设施必须包括 480 伏 3 相 60 安培电源和 10 CFM（280 升/分钟）气源。

注：用于气动轴承心轴的气源来自于工厂空气，至少为 **80 磅/平方英寸**，或 **6 巴**。

1.3 安全性

1.3.1 目标用途适当使用

机器设计用于储存罐制造业。

1.3.1.1 应用

机器设计仅用于下述应用：

- 打磨拉伸模具、再拉伸模具、再拉伸套筒、样品目录和两工件中使用的修剪机刀片实现工艺流程并由工件夹具设备固定。
- 机器仅设计用于打磨硬合金材料。
- 通过使用机器上安装的修整工具，修整机器中使用的磨轮。

1.3.1.2 工件固定

工件必须安全固定在机器一部分的夹具设备上。机器与六爪卡盘或磁性吸盘协作。

1.3.1.3 机器上可能装配的工具

下述磨轮建议用于目标应用：

- | | |
|------------------------------|------------|
| • 粗打磨： 800 周长， 63% 金刚石磨轮 | 零件号 9-143 |
| • 完成打磨： 1,000 周长， 100% 金刚石磨轮 | 零件号 9-178 |
| • 打磨 6/7" 卡盘盘爪： | 零件号 19-125 |
| • 打磨 6/7" 卡盘盘爪面：（杯形轮） | 零件号 19-126 |
| • 打磨磁性吸盘面： | 零件号 9-202 |

请参阅第 5 部分中附件表，了解兼容工具与附件完整表。

1.3.1.4 认可冷却液类型

机器设计使用 Pride 冷却液（混合 30 份水和 1 份冷却液）。

Pride 冷却液 零件号 9-124

1.3.1.5 认可润滑类型

机器设计使用 Mobil Vactra # 2 润滑油，润滑直型和球状丝杆。

1.3.1.6 检修

机器检修仅由经培训的合格维护人员执行。

1.3.2 使用不当

以下为机器不当、禁止用途：

- 使用已拆卸或绕开防护设备的机器。
- 使用已取下或不清晰安全警告标签的机器。
- 手动保持工件或工具时使用机器。
- 使用手持式磨轮修整工具。
- 使用未适当固定的机械装置。
- 使用带切割工具而非磨轮的机器。
- 无冷却液打磨。
- 打磨非预计材料。

1.3.3 用户安全

设备操作工执行此操作时需佩戴护目用具。操作工和维护人员在操作设备前需阅读用户数手册。仅允许经培训的维护人员对设备进行维护并依据有害能源控制流程（锁定-挂牌）确保安全执行维护操作。

参见第 1.1 部分了解机器上使用的安全警告标签含义。

1.3.4 残余风险

不可消除或设计措施中遇到的危害即为残余风险。本手册中记录了残余风险并用黄色三角形符号表示。第 1.1.1 部分中表述了专用符号含义。

示例： 

1.3.5 安全元件位置图

必须安装防护设备且功能正常。全部警告标签需清晰、易辨认。参阅第 5 部分，了解安全元件和安全标签位置图。



严禁绕开或取下防护设备。
必须使防护设备处于良好工作状态。
必须更换全部模糊不清或已取下的警告标签。

1.3.6 噪音测定

使用本设备期间产生的噪音低于 70 dB(A)。

1.3.7 安全设备悬吊

下述操作采用悬吊某些门安全设备，促进操作进程。这些操作步骤期间的轴移动仅限于下述最大速度：

X 轴： 1,200 毫米/分钟	A 轴： 1,200 毫米/分钟
Y 轴： 1,200 毫米/分钟	C 轴： 360 毫米/分钟
Z 轴： 1,200 毫米/分钟	

采用门安全设备悬浮操作：

磨床修整： 磨轮： 肉眼确定磨轮与修整材料之间的接触时可以打开右手侧操作门（磨轮头侧）。

卡盘维护： 肉眼确定磨轮与卡盘材料之间的接触时可以打开右手侧操作门（磨轮头侧）。

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产品安装与使用准备



2. 产品安装与使用准备



进一步操作前，请阅读说明了解完全卸载方面的信息。
仅允许合格人员移动本设备。

2.1 卸载、移动与拆包

设备包装包括未包装前运输、卸载和移动期间用于适当处理的包装外面上重要信息。包装技术可能因客户的地理位置和运输方式而异。最常见的包装技术将在本章中描述，其他则使用本章作为说明便可自行了解。磨床装载两个货箱中。用于计算机控制的操控台另外包装，与冷却系统一起包装在较小的货箱中。磨床的其余部件装载一个更大的货箱中。Pride 磨床服务工程师前来调试磨床时，将重新连接操控台和计算机的电气连接。将设备小心地移至其永久位置，从货盘上取下并检查是否有运输损坏。如有明显损坏，请通知运输承运人。

2.2 附件

随气动轴承磨床一起提供的附件有：

前置过滤器，冷却液（5 微米）	5-101	
心轴，短	6-182	
心轴，长	6-183	
千分表，转接头	9-106	
套筒扳手	9-109	
金刚石块	9-110	
卡盘修整块	9-111	
外壳，修整磨轮	9-114	
固定架，修整磨轮	9-115	
冷却液，5 加仑。	9-124	（混合 30 份水： 1 份冷却液）
金刚石磨轮	9-143	
金刚石修整器	9-149	
金刚石磨轮	9-201	
修整磨轮，卡盘	9-202	
过滤器，凝结器	19-106	
过滤器，活性炭	19-107	
浮动排水，自动 (2)	19-108	
过滤器，卷式	19-114	
磨床/断面磨轮转接头组件	19-124	
磨轮，6 爪卡盘打磨	19-125	
磨轮，6 爪卡盘端面	19-126	
工具球组件6 爪卡盘	19-127	

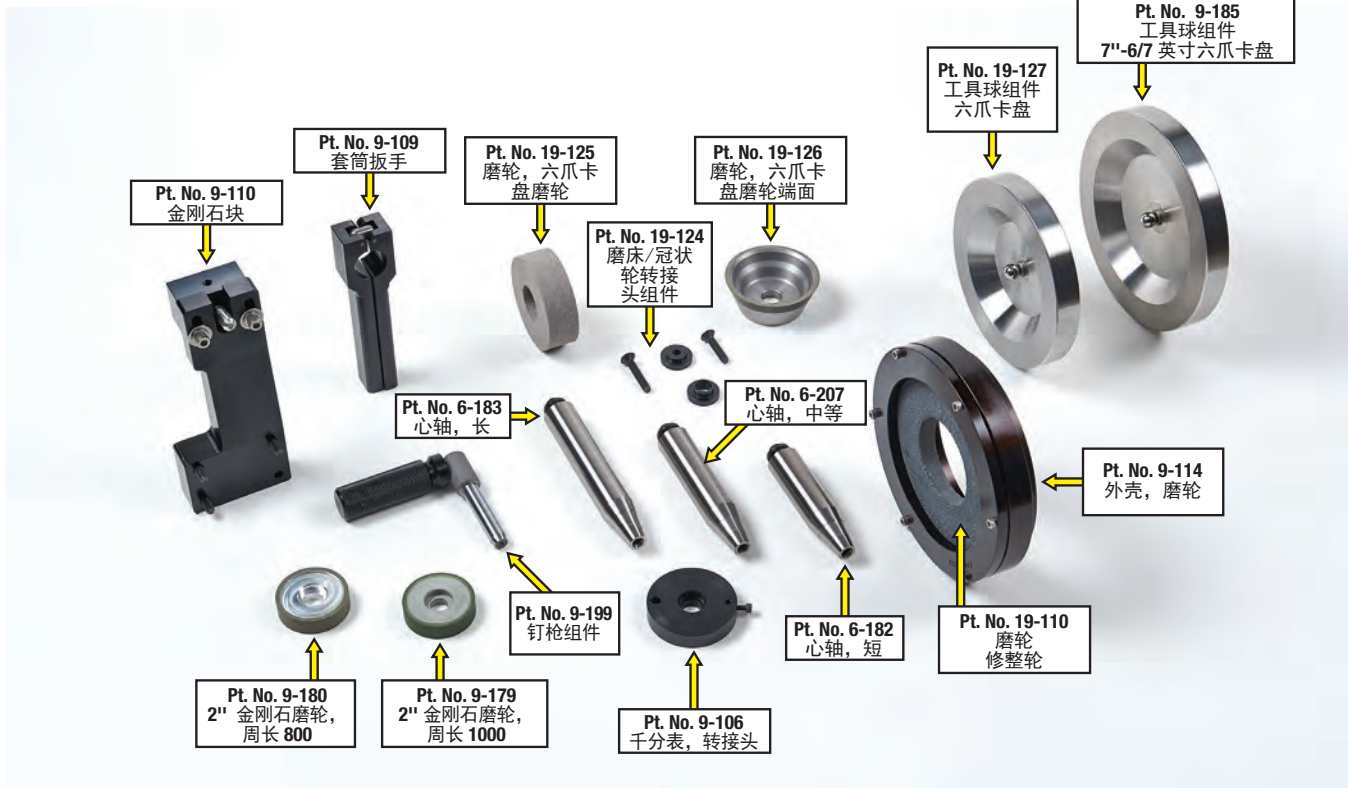
配有六爪卡盘的磨床配件



配有磁性吸盘的磨床配件



配有 6/7 英寸六爪卡盘的磨床配件



2.3 安装

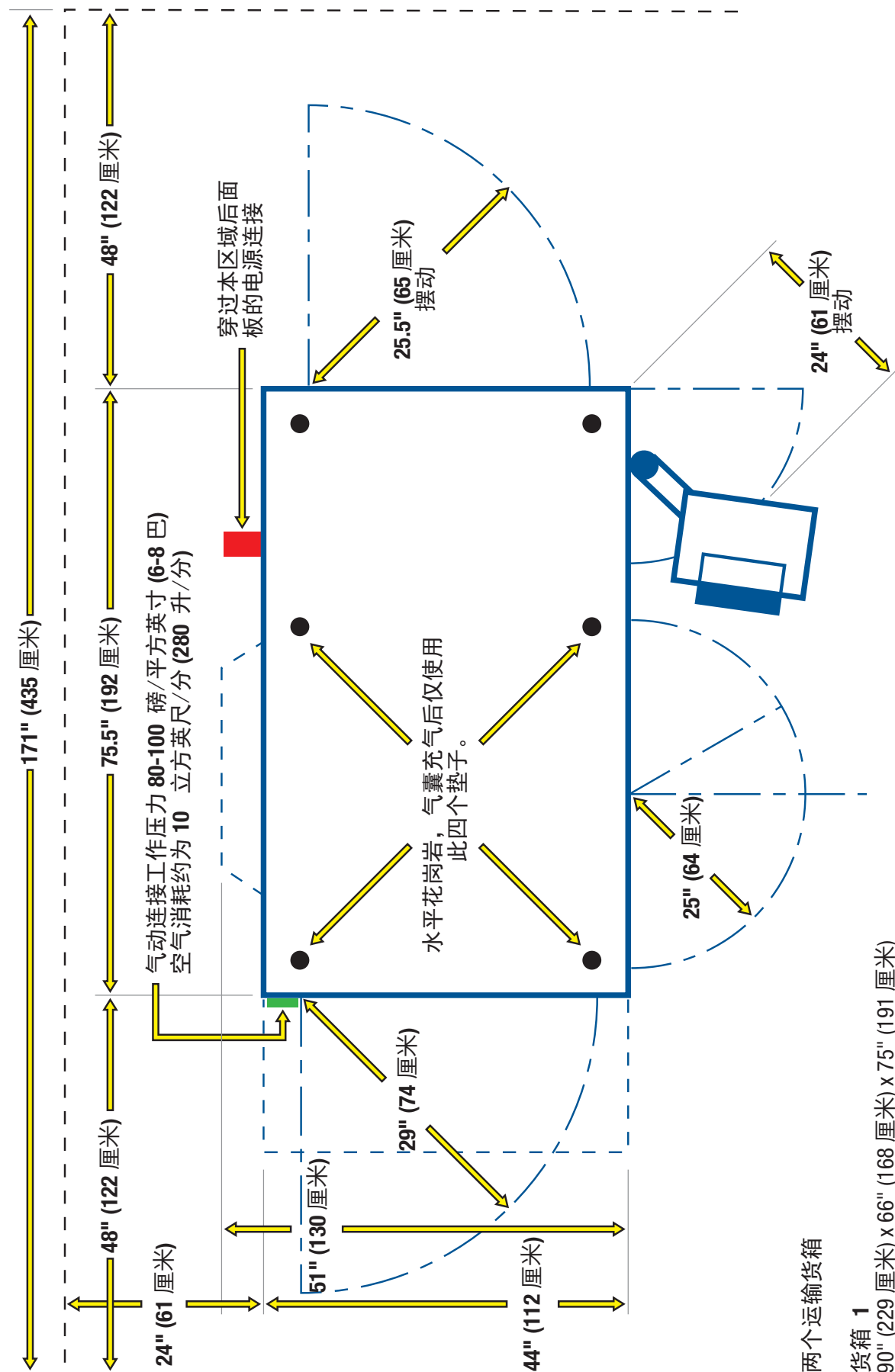


仅允许合格人员将电源连接至磨床。

将磨床组件从运输货盘上移下，放在干净、平面的地面上。有关地面布置和连接点的信息，请参见磨床基脚。

- 仅使用机器提升点标签上指示的提升点。
- 将 380-480, 3 相, 50/60 赫兹电源连接至机器的右侧。请参阅第 5.6 部分中的电气图。设备使用多接头变压器，需要根据您的输入电压进行变更。在磨床与工厂的电源接通前，必须完成所有内部电气连接。





两个运输货箱

货箱 1

90" (229 厘米) x 66" (168 厘米) x 75" (191 厘米)
运输重量 3,700 磅 (1,680 公斤)

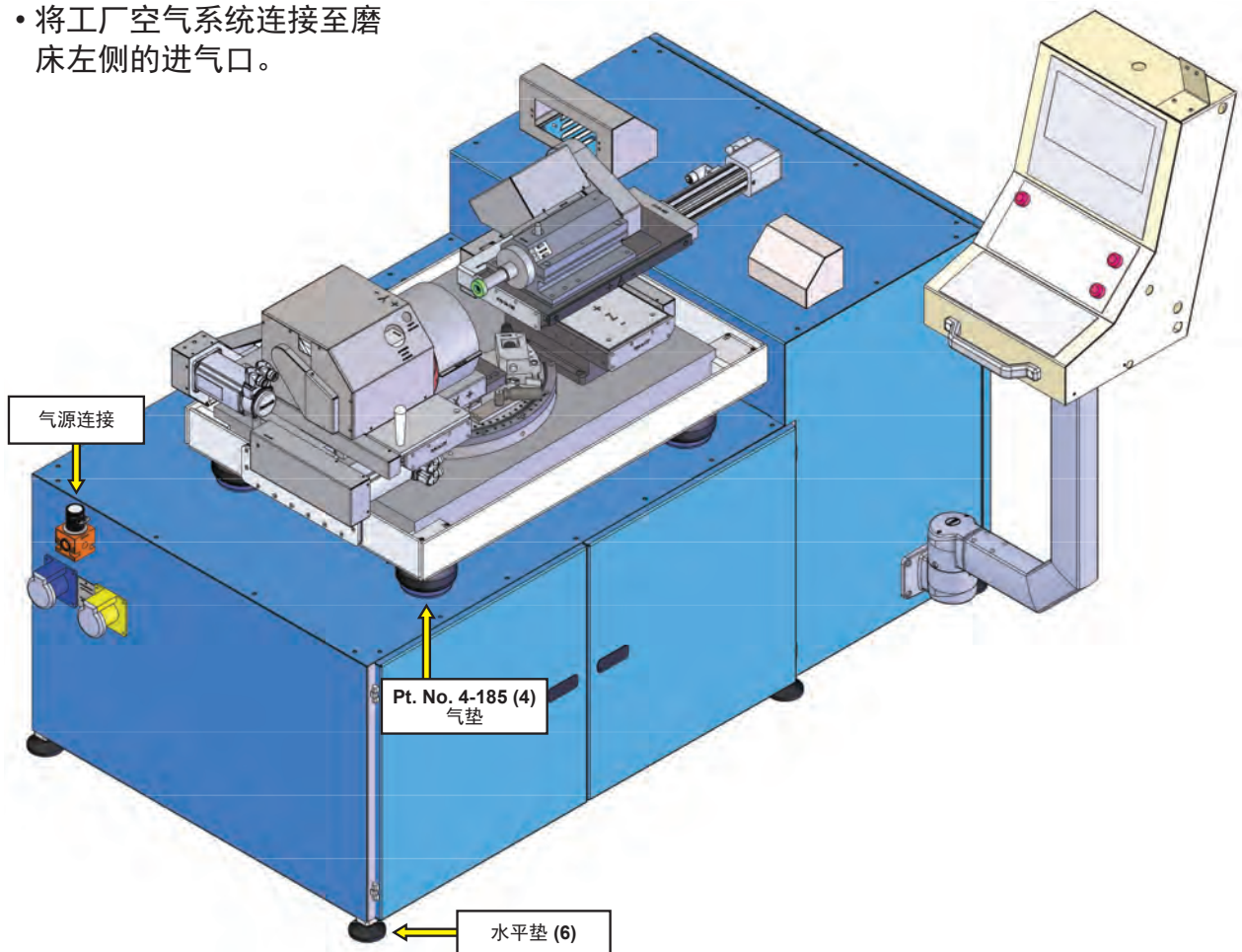
货箱 2

48" (122 厘米) x 46" (117 厘米) x 32" (82 厘米)
运输重量 450 磅

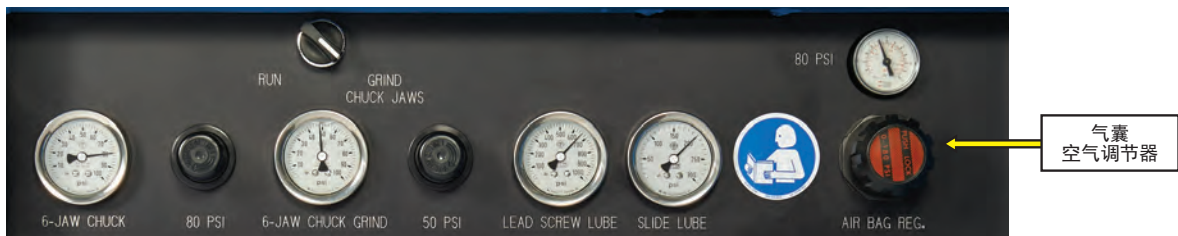
装配磨床总重量
3,640 磅 (1,650 公斤)

不要求特殊地基

- 将工厂空气系统连接至磨床左侧的进气口。



- 打开磨床机柜左侧的气源。当气压达到适当水平时，您会看到花岗石台提升。
- 打开机柜前门，您会看到空气控制阀。
- 以 70 至 80 磅/平方英寸（5.5 巴）的压力加压气垫（4 处）以使该花岗石板悬浮。



- 给位于花岗石块下方的气垫加压后，使用位于该花岗石块上的精密水平仪调整位于其每一个角的四 (4) 个水平调节脚。
- 前后左右并角对角调整花岗石块的水平。忽略控制阀下右端的两 (2) 个支脚，直到支撑花岗石板的四个较平垫为水平状态。

- 接下来从磨轮头和工作头轴承卸下驱动皮带。如果轴承无法自由转动，则必须以实验室级酒精冲洗。当其能够自由转动时，则更换驱动皮带。请勿过度拉紧皮带。
- 用提供的适当的冷却液注满冷却液储罐。混合比例是 30 份水与 1 份 Pride 冷却液。补充冷却液以 Pride 部件编号为 9-124 的 5 加仑容器提供。冷却液罐能储存大约 21 加仑（80 升）冷却液。因此，您需要添加 90 盎司（2.6 升）冷却液并向储罐内注水，使水与冷却液的混合比例为 30:1。



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磨床

操作说明



3. 操作说明

3.1 安全性

3.1.1 必需的个人防护设备



操作机器时需佩戴护目用具。

3.2 主电源开关

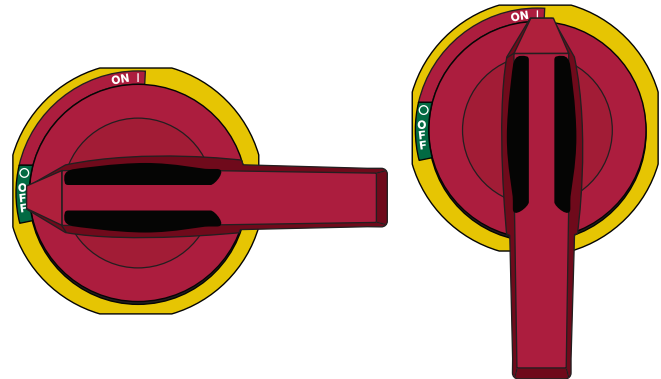


警告 - 带电部件产生的致命电击超过 50V!

针对带电部件作业前：切断装置电源并确保电源开关意外或非授权通电。

接触设备前，以及关闭电源电压后等待至少等待 **30** 分钟，进行放电。触碰部件前检查电压是否下降至 **50V** 以下！

主电源开关位于磨床右侧控制柜门上。本机器配有 NFPA79 断开装置。其特征是配有内部把手，面板门打开时允许断开开关。仅允许经培训的合格维护人员使用内部开关。



警告 - 带电部件产生的致命电击超过 50V!



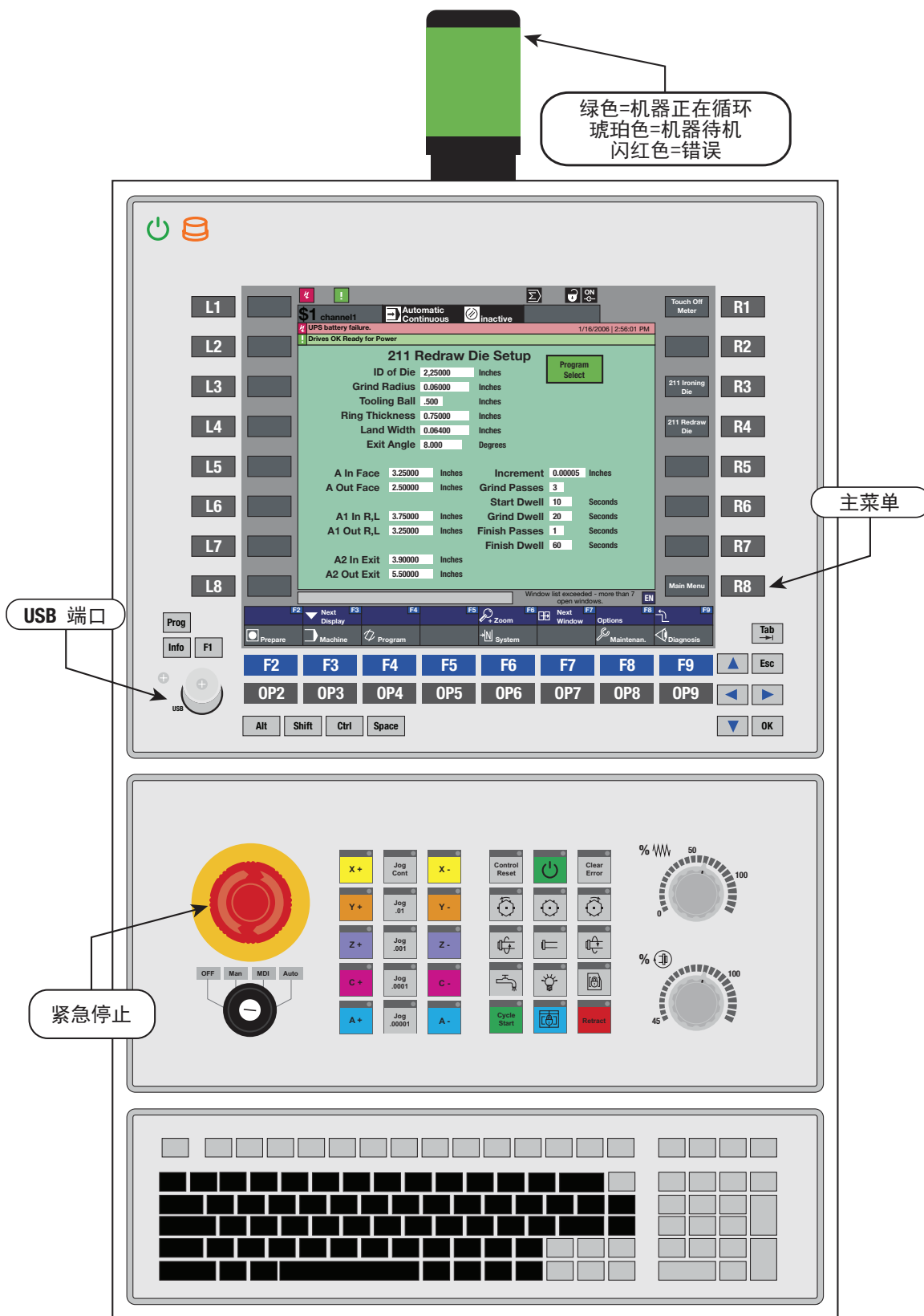
仅允许经培训的合格维护人员使用主电源开关超驰。若开关超驰，则电源保持开状态。

接触设备前，以及关闭电源电压后等待至少等待 **30** 分钟，进行放电。触碰部件前检查电压是否下降至 **50V** 以下！

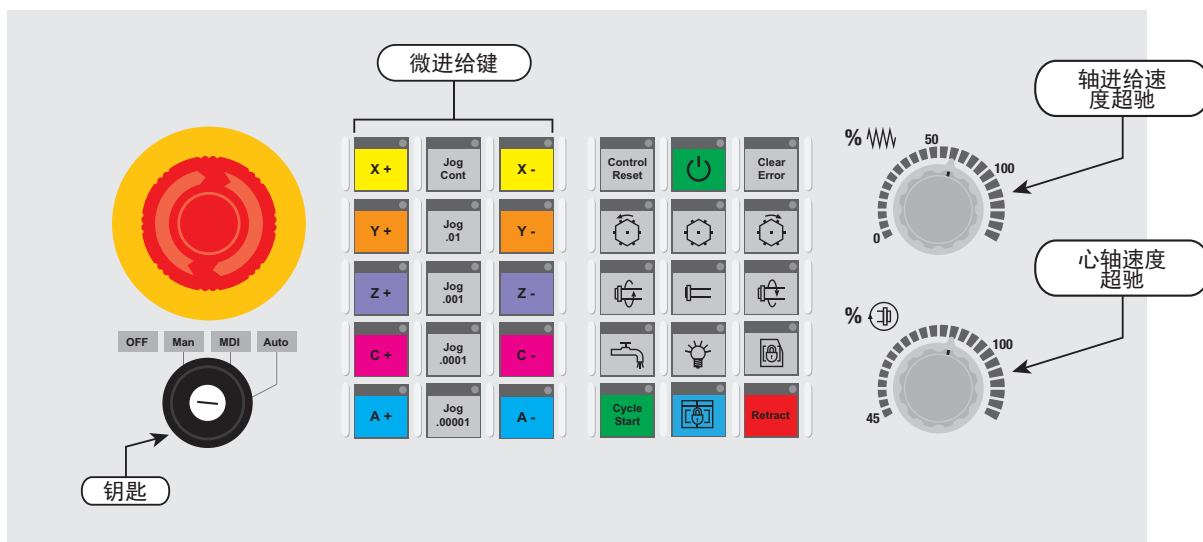
3.3 操控台、按钮和图标

熟悉操控台、操作员面板和屏幕。

操控台



控制面板



紧急停止开关下面的钥匙锁用于控制着控制器和磨轮的工作模式。

Man 模式用于手动微进给轴运动。

MDI 模式用于输入和执行代码行。

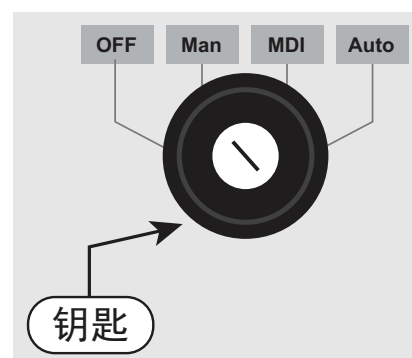
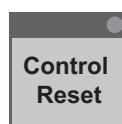
Auto 模式用于访问预设诸如“拉伸模”或“磨轮修整”的程序以及执行所选程序的菜单。

当磨床处于 **Auto** 模式时，这两个超驰旋钮用于允许操作工在不打扰程序的情况下更改心轴速度或进给速度。两个旋钮经过校准以调整从 0% 至 120% 的程序速度。Axis Feed Rate Override 控制所有驱动机的速度。Spindle Speed Override 控制“磨轮头”和“工作头”的速度。

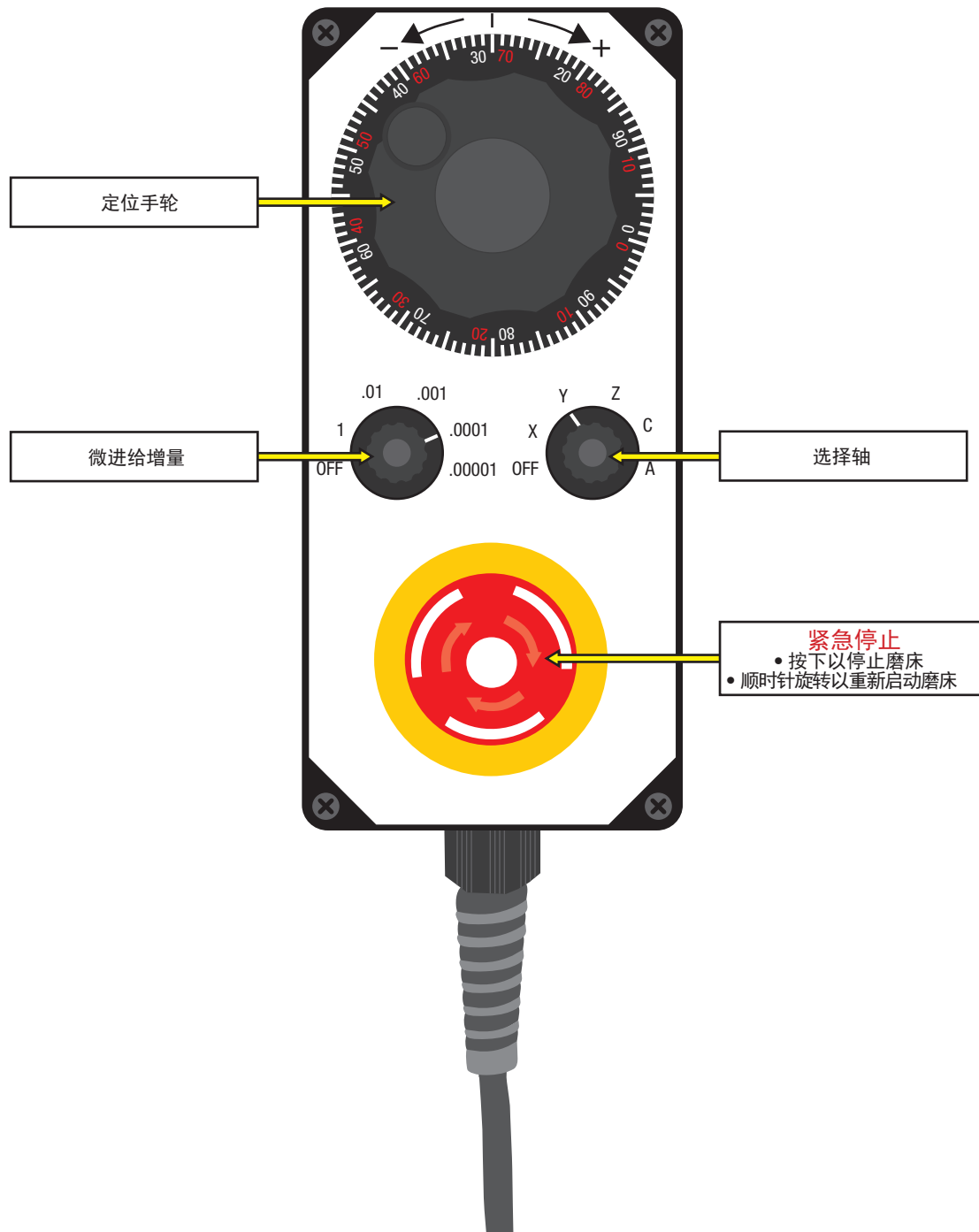
当键处于 Man 模式时，Jogging Keys 五个轴中各轴的运动。

Retract 按钮用于停止当前的操作。当按下“Retract”按钮时，磨轮将使材料后退 (Z-) 并从零件缩回。

按下“Control Reset”重新开始。



手轮



控制面板图标

	工作头顺时针移动		磨床指示状态 显示全部错误信息。
	工作头停止		显示根目录，包括项目列表
	工作头顺时针		下一个显示，切勿使用
	磨轮头心轴闭合		显示全部坐标位置和移动
	磨轮头逆时针		禁止轴移动
	磨轮头顺时针		自动运行程序 直至完成
	冷却剂开/关		变更通道，切勿使用
	机器 LED 灯开/关		主门互锁
	紧急停止 推动停止磨床/ 逆时针旋转以重启磨床		侧检修门互锁

3.4 入门指南 - WINDOWS

本章旨在提供 Pride 磨床的基本操作说明。全面阅读本章并尝试几次“空运行”，以使操作人员熟悉控制装置的位置。

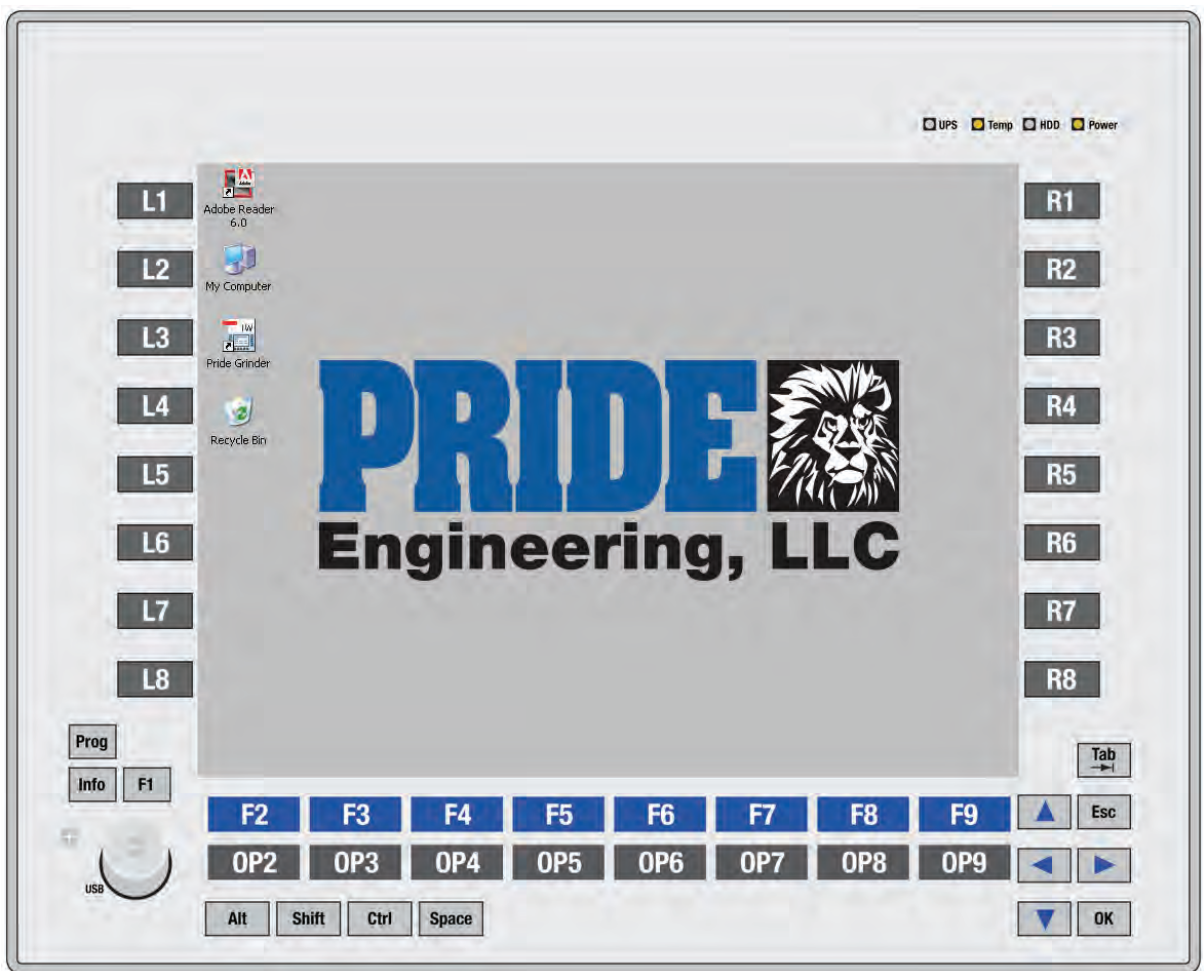
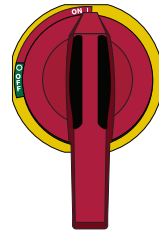


Pride 磨床具有保护特征，不会切断电气系统电源，除非两个气动轴承的气压达到 70 磅/平方英寸（4.8 巴）。

1. 确保工作区域清洁且没有任何障碍物。
2. 将气动轴承压力增加至 80 磅/平方英寸。（5.5 巴）
（稳压器和压力计位于前柜门内部）。



3. 确认气垫隔振机座压力为 90 磅/平方英寸。（5.5 巴）（稳压器和压力计位于前柜门内部）。
4. 检查以确保 紧急停止按钮未按下。顺时针旋转该按钮（向右旋），该按钮将会释放（弹出）。
5. 打开磨床机柜右侧的主电源开关。控制器将执行操作系统的开机序列。
6. 磨床控制器开机后，使用操控台右边的“跟踪球”突出显示开始屏幕上的“Pride Grinder”图标。



您将需要返回到开始屏幕以访问错误消息的定义、博世力士乐 MTX 控制的其他操作手册、IndraDives 和 NC 编程设计手册以及其他程序。可通过选择“维护”（OP8）、“关闭活动屏”（F9），然后选择“关闭 IndraWorks”（F9）返回到开始屏幕。

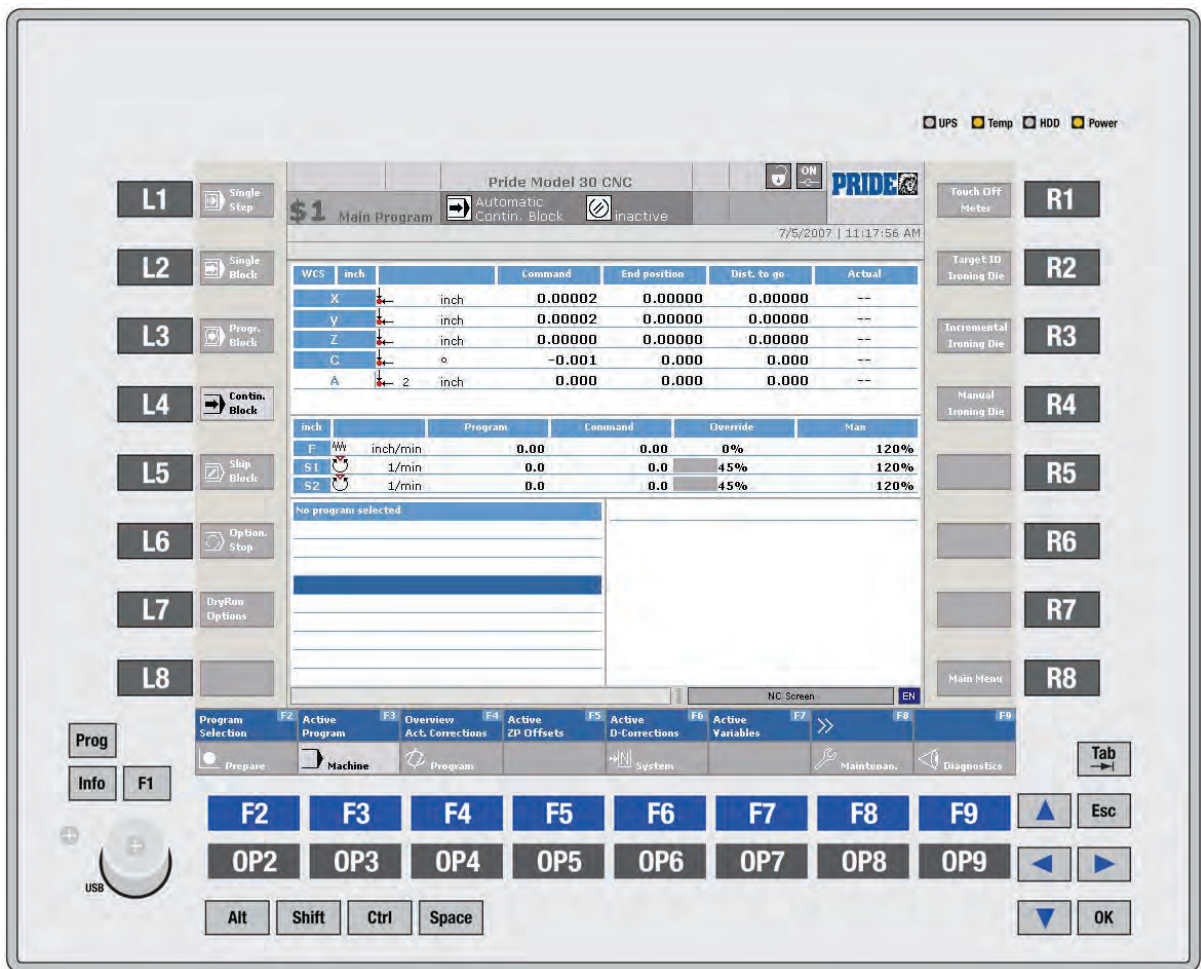
现在，您可以使用位于“紧急停止”正下方左侧的“键盘”锁选择工作模式：手动、MDI 或自动。

Man 用于手动移动（微进给“操作工控制面板”左边的按钮）轴向运动。在不使用 Pride Touch 寻找 Z 零位置的情况下需要。

MDI 用于输入和执行代码行。

Auto 用于执行所选程序。

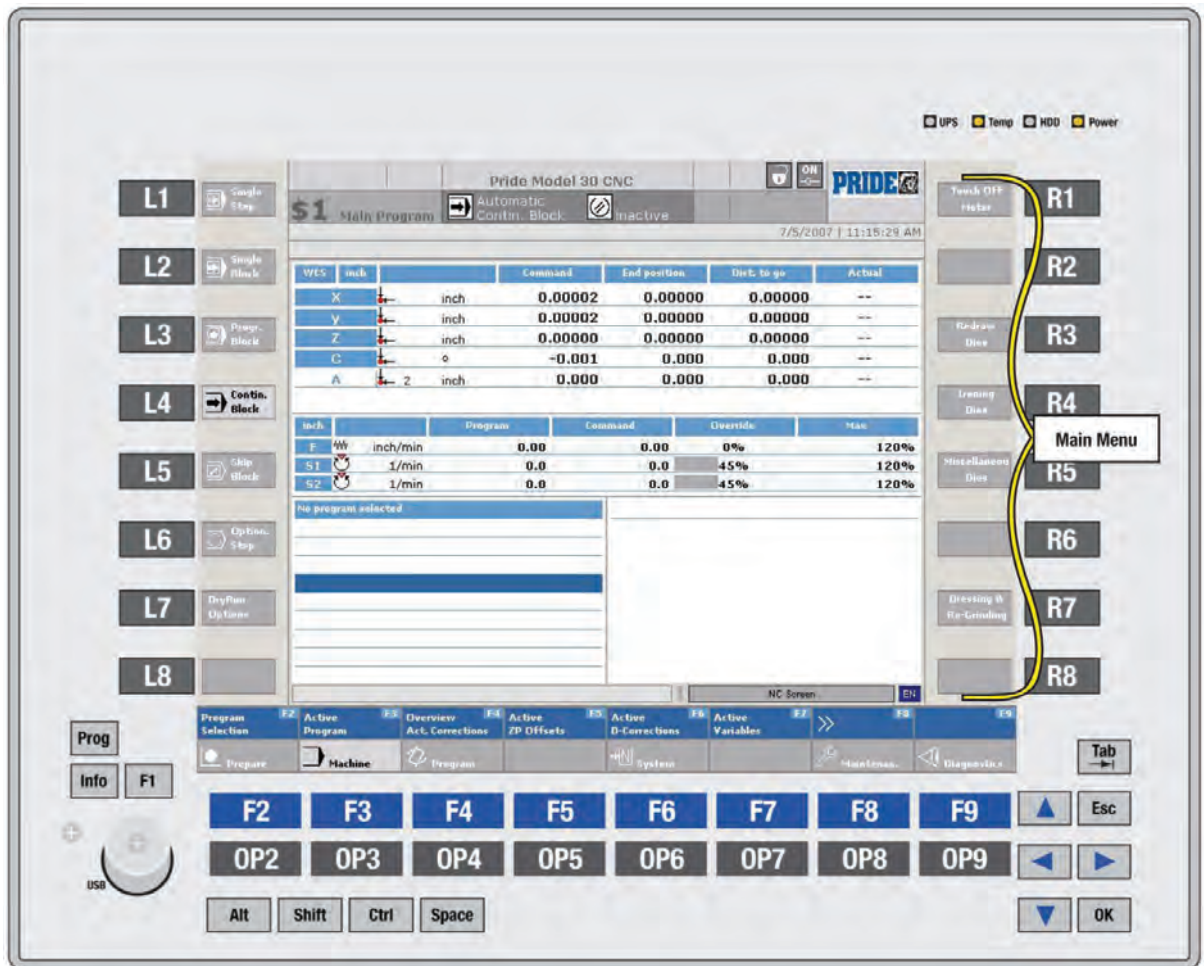
7. 如果希望运行一个程序，则选择自动。
8. 您将看见的下一个屏幕是“人机界面”（HMI）屏幕（下方），该屏幕将显示“轴”位置。HMI 屏幕将允许您监控正在运行的程序的进度和最后的命令。



9. 按下并按住直到该按钮右上角的小灯亮起。



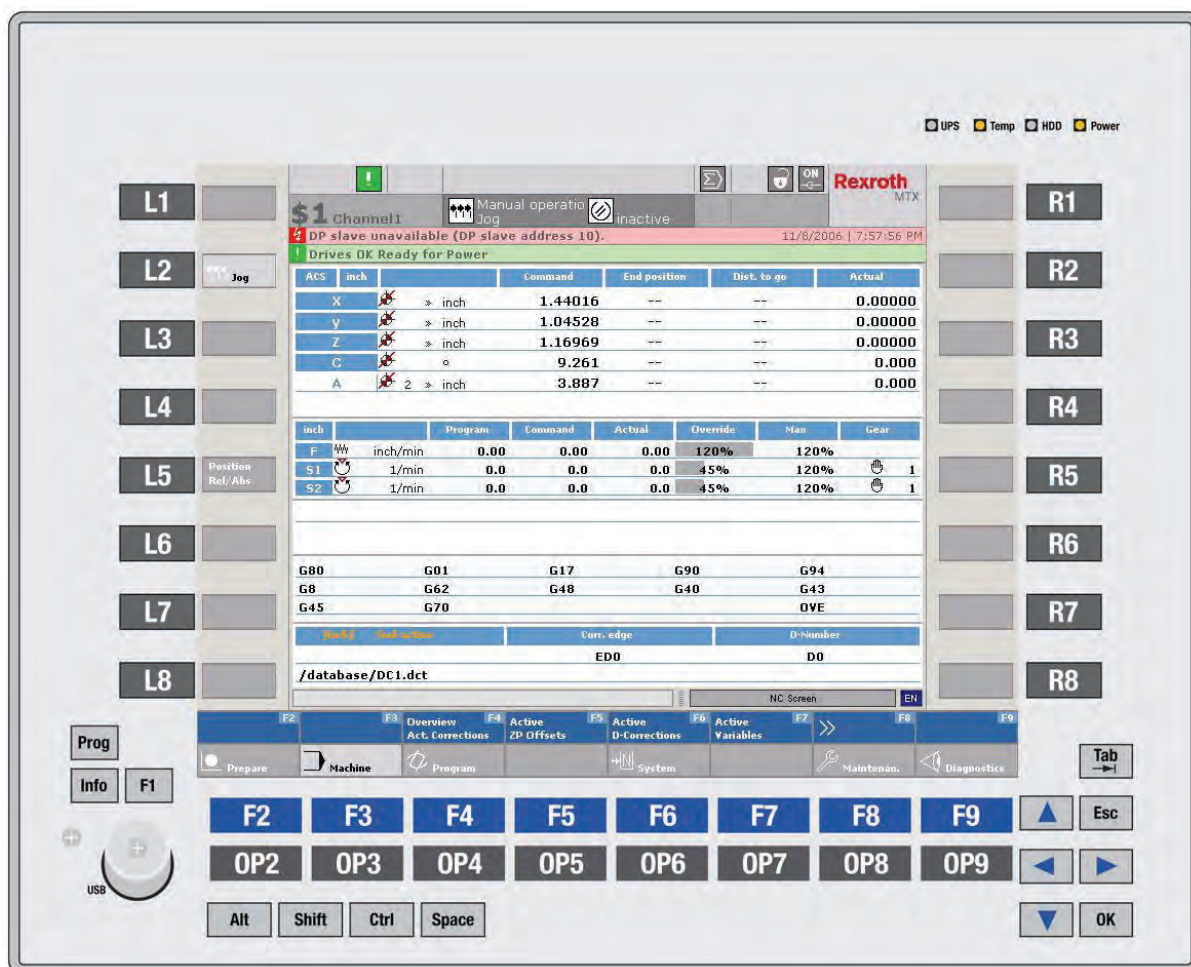
10. 如果您不在“主菜单”，请左击屏幕右下角的“主菜单”或按下位于“主菜单”右边屏幕之外的“R8”按钮。



11. 从屏幕右侧的备选方案中选择所需的窗口。请注意，上述屏幕中显示的备选方案为“接触测量表（磨轮头扭矩）、再拉伸模、拉伸模、其他模具和修整和重新打磨”。

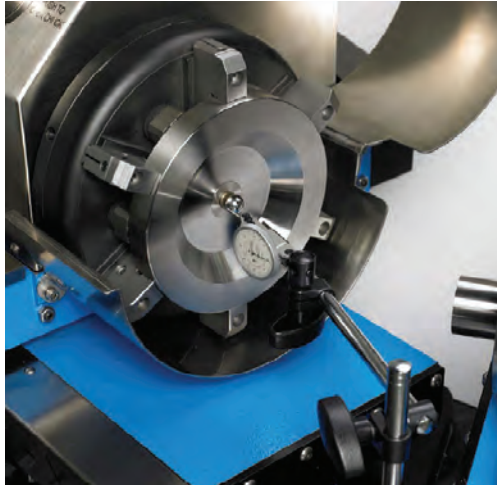
3.5 C、X 和 Y 轴工作头定位

1. 在开始屏幕中选择“磨床设置”。
2. 将钥匙拧至“Man”模式。该“Manual”将在其顶部显示“手动”。



3. 将 6 英寸工具球固定装置（零件号 19-127）设置在卡盘内。若使用六爪卡盘，则跳至步骤 6。磁性夹盘加电 25%。
4. 用千分表确定工具球的径向读数在 0.0001 英寸（2.5 μm ）内或更小。
5. 打开卡盘至全功率。
6. 将千分表从工具球处移开 0.5 英寸（12.7 毫米）作为在较平工具球摆点时的目视基准。
7. 手动操作“旋转”轴通过 90 度限度，并微进给“X”和“Y”工作头滑块，直到该工作球在目视居中。
8. 当工具球接近中点时，将千分表移到更靠近工具球的位置。最后，当“X”和“Y”调整目视接近时可让千分表接触到工具球。小心使用千分表。当千分表与工具球相接触时，您就可以进行最后调整。

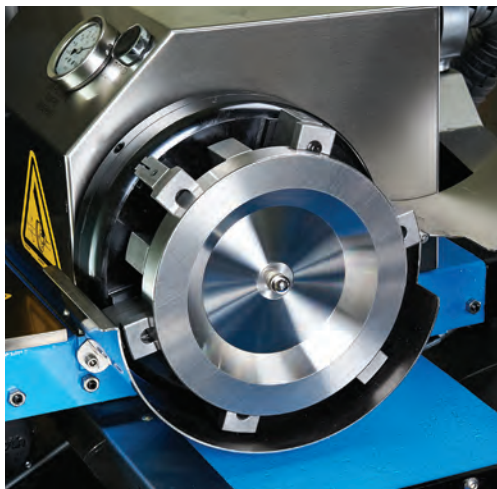
9. 这时，将千分表的尖头设置在工具球要旋转方向的中心高度和并与该方向成 90 度。
10. 继续微进给 “X” 和 “Y” 工作头滑块直到当转动 “旋转” 轴 90 度时千分表不再移动为止。



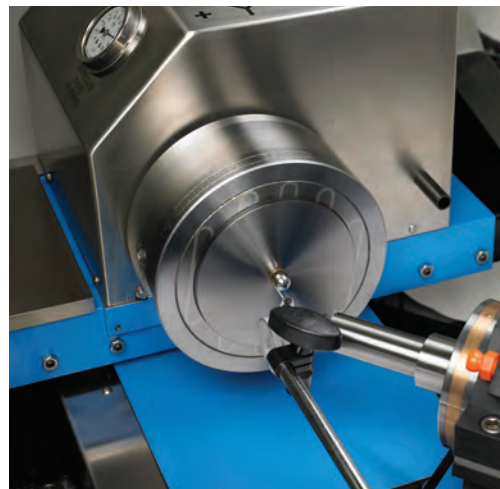
6 爪卡盘，带
6 英寸工具球



6/7 英寸 6 爪卡盘，带
6 英寸工具球



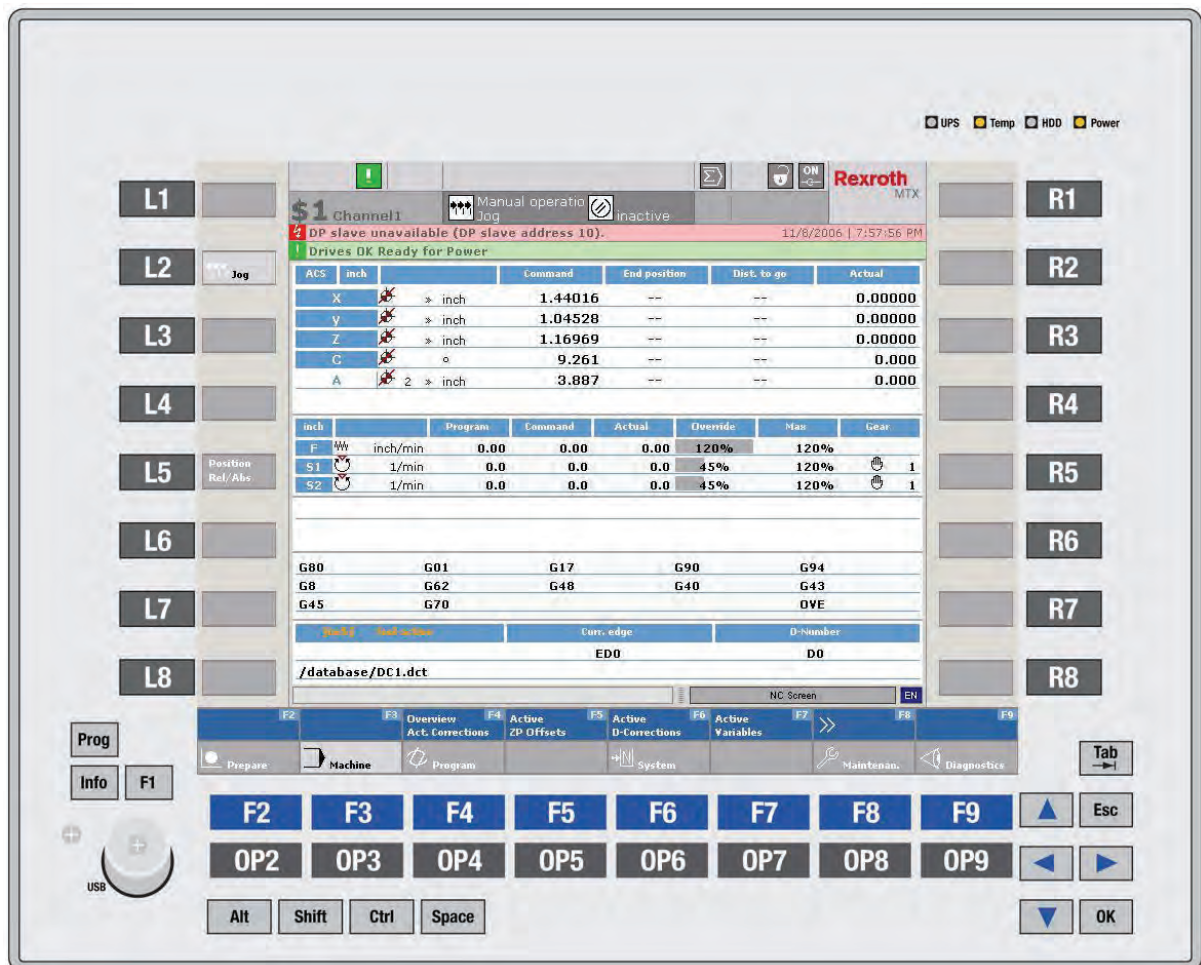
6/7 英寸 6 爪卡盘，带
7 英寸工具球



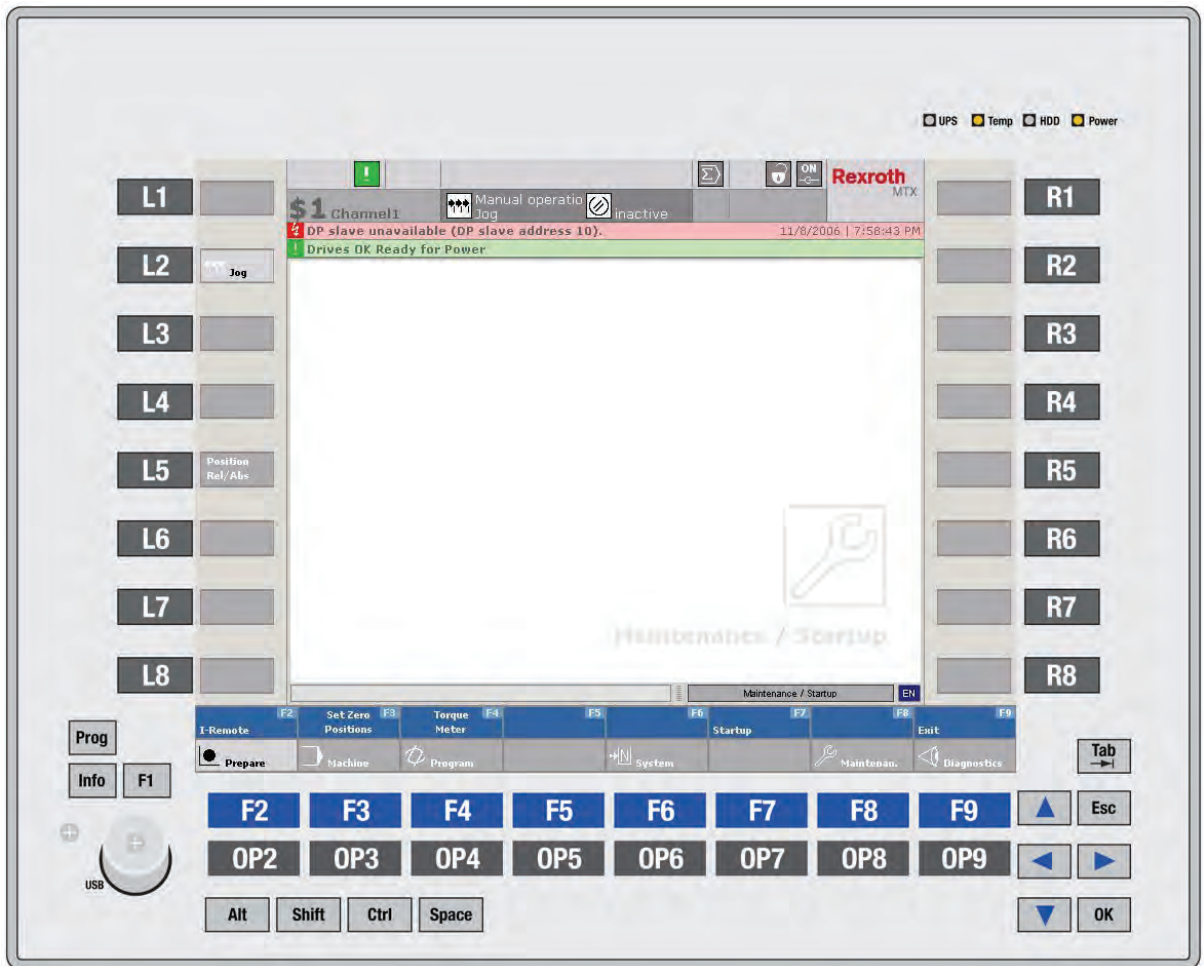
磁性吸盘，带
6 英寸工具球

11. 现在，您在 “Y” 轴正中央，恰好距离卡盘端面 0.5000 英寸（12.7 毫米）。这时候，您可设置为零。

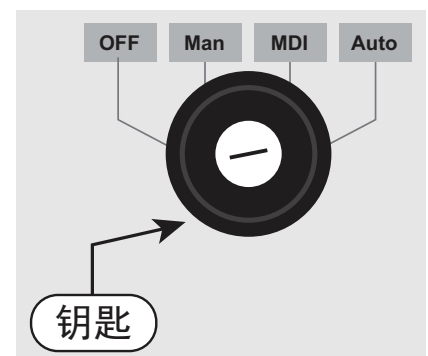
12. 选择屏幕右下方的“维护”图标。



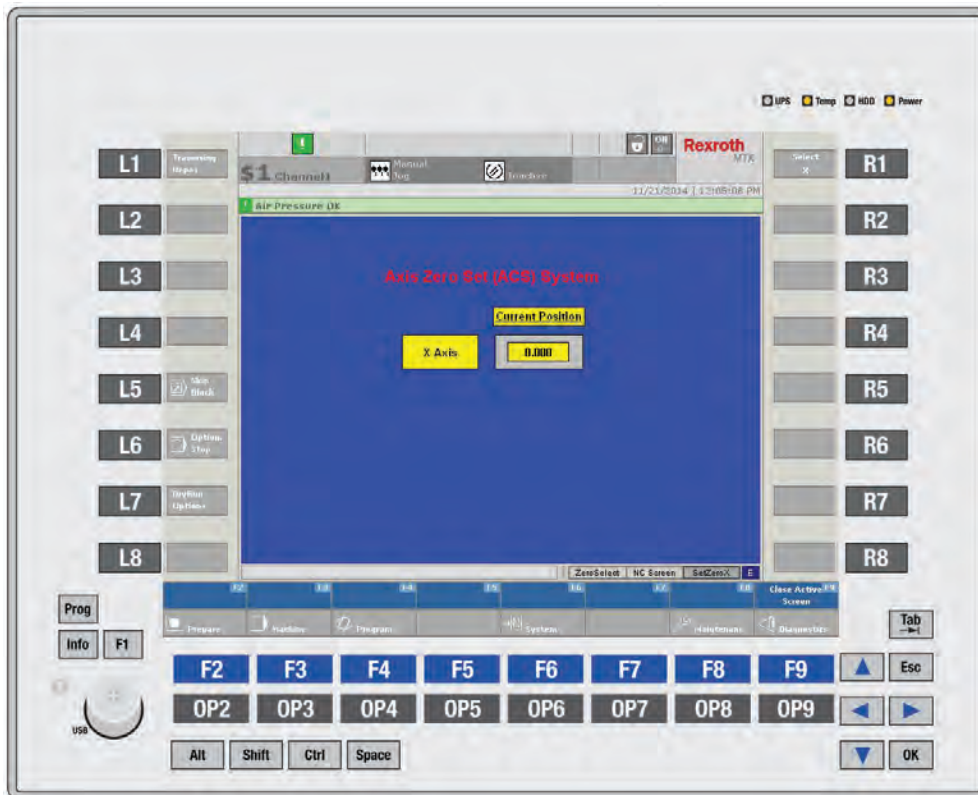
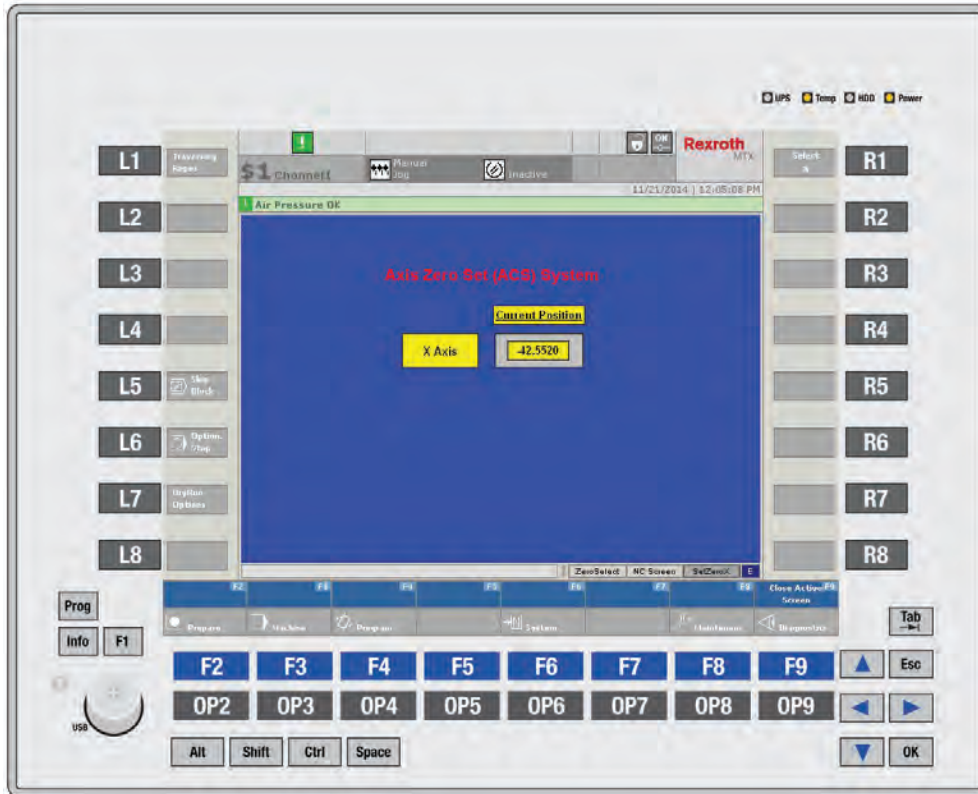
13. 选择屏幕左下方的“设置零位置”图标 (F3)。



14. 将钥匙拧至“Auto”模式。

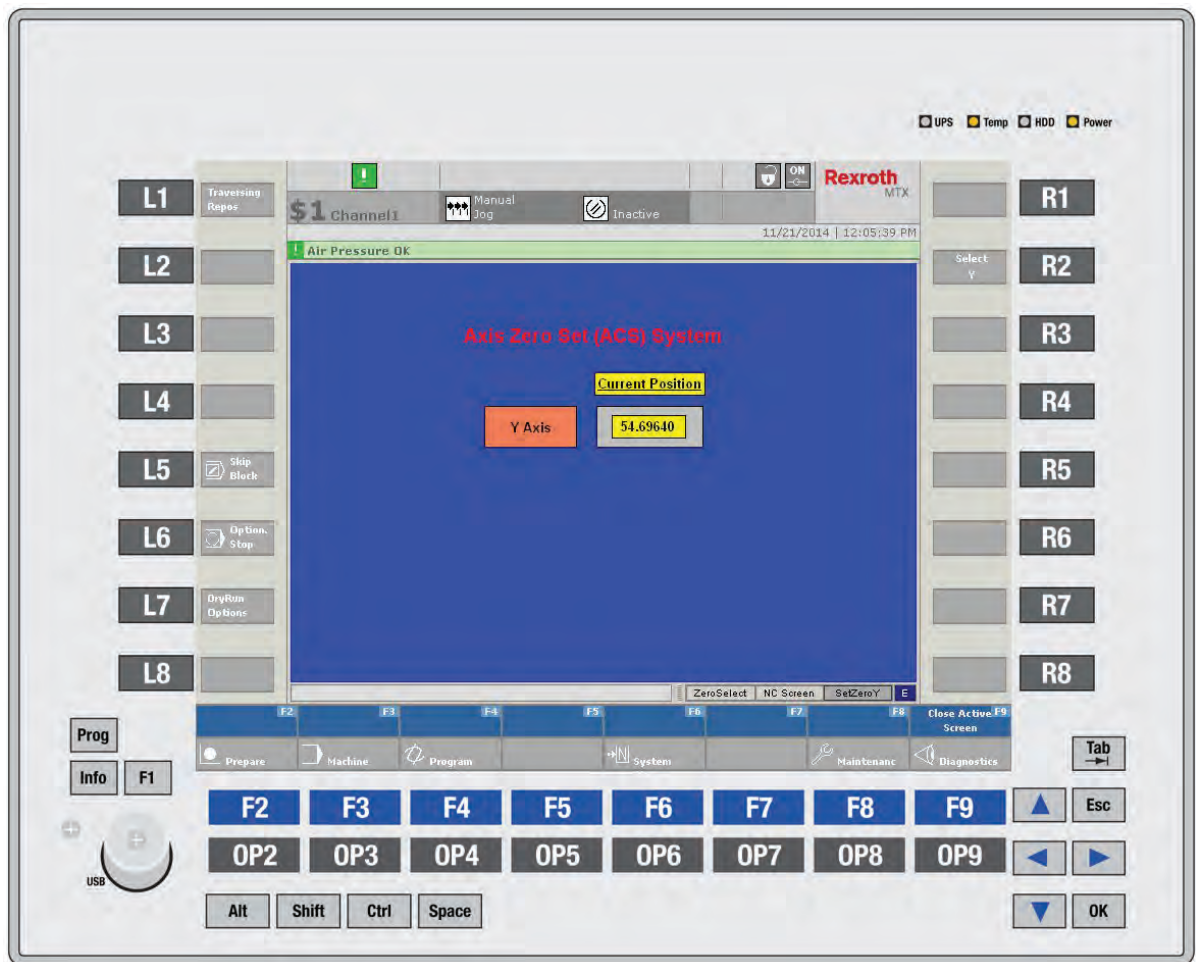


15. 通过按下屏幕右侧标有“Select X”的灰色图标来选择 X Axis。



请注意，按下“Select X”按钮后，X Axis“当前位置”自动复位为零。选择“Close Active Screen” (F9)。

16. 按下灰色图标 “Select Y” 而选择 Y 轴。按下灰色 “Select Y” 图标，该按钮自动将 Y 轴复位为零。选择 “Close Active Screen” (F9)。



现在，您已完成重新设置工具球。

若使用 6/7 英寸卡盘，则继续下一步：

17. 将 7 英寸工具球（零件号 9-185）设置至 7 英寸爪卡盘内。
18. 将 Y 轴保持在步骤 16 中设置的零位置处，C 轴保持在 0 度。
19. 选择 X 轴，因而能够查看当前位置并将 X 轴微进给大约 0.600 inches (15.24 mm) 至 X 方向。
20. 将千分表尖放在距离操作工最近的工具球侧。
21. 手动旋转 C 轴 90° 并观察千分表。微进给 X 轴，直至千分表保持在 ± 0.0001 inches (0.0025 mm) 以内。
22. 记录 X 轴当前位置值。任意 7 英寸再拉伸模具程序窗口中使用该值。

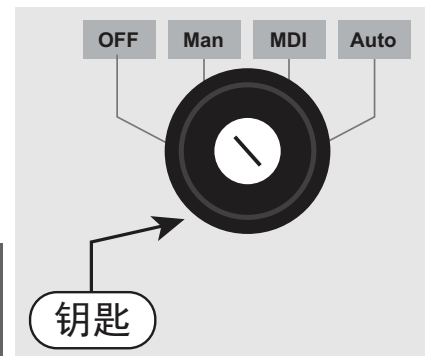
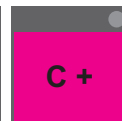
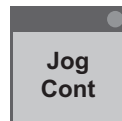
3.6 A 轴磨轮头定位

1. 在 A 方向微进给 A 轴，直至轴行走限制处于 0.25 inches（6 mm）范围内。
2. 选择维护图标 (OP8)。
3. 选择“设置零位置” (F3)
4. 将钥匙拧至“Auto”位置
5. 选择 A 轴 (R5)
6. 再次选择 A 轴 (R5)，将 A 轴设置为零。

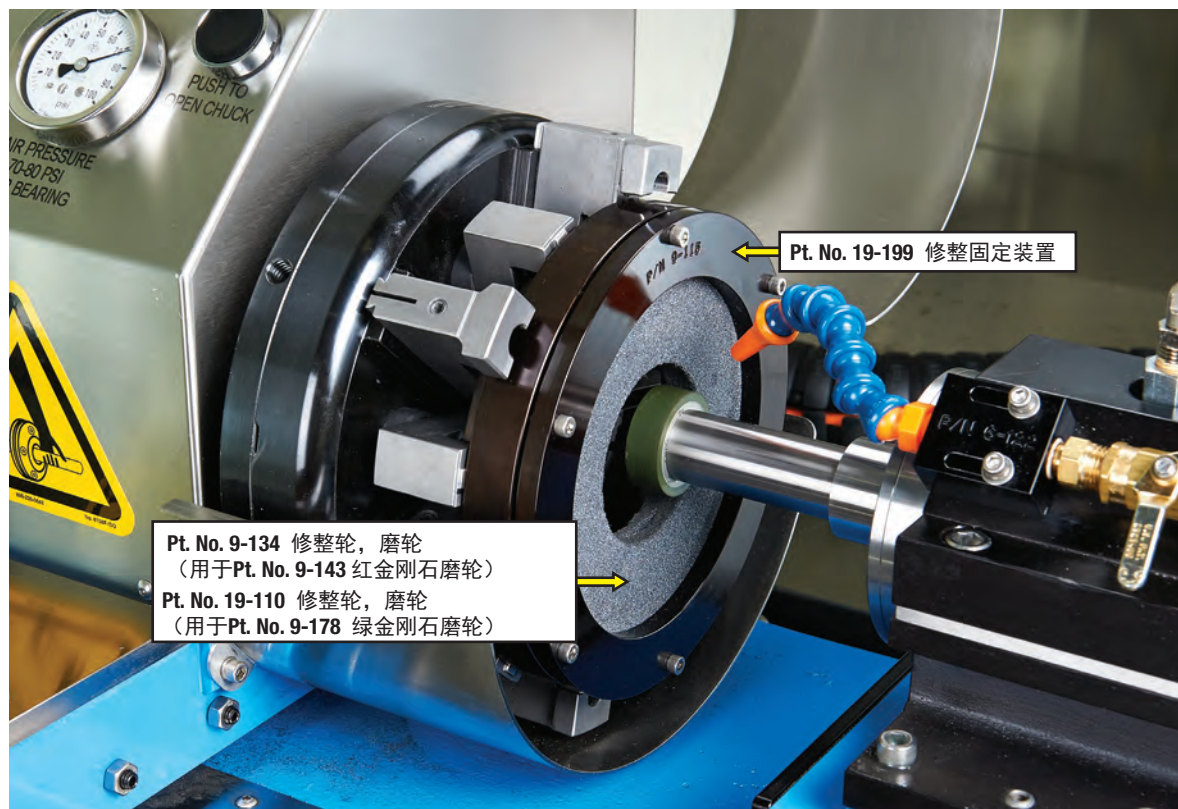
3.7 修整磨轮

启动新的磨床时要执行的首要任务之一是修整磨轮。修整模具磨轮是一种手动手轮操作，但首先您必须设置妥当。磨轮应在其行程的两端与修整磨轮轻微接触，这与打磨模具相反，磨轮应不会与模具轻微接触。

1. 选择并安装磨轮。建议尺寸：1-½” 直径 X ½” 宽 X ½” 孔。带 100% 金刚石粒密度的金刚石磨轮，视应用而定。
2. 将“钥匙”拧至“Man”
3. 使用“微进给”键将 C（旋转）轴移至零（0° 或 360°）度。



4. 与模具放在卡盘上相同，在卡盘上安装磨轮修整固定装置。



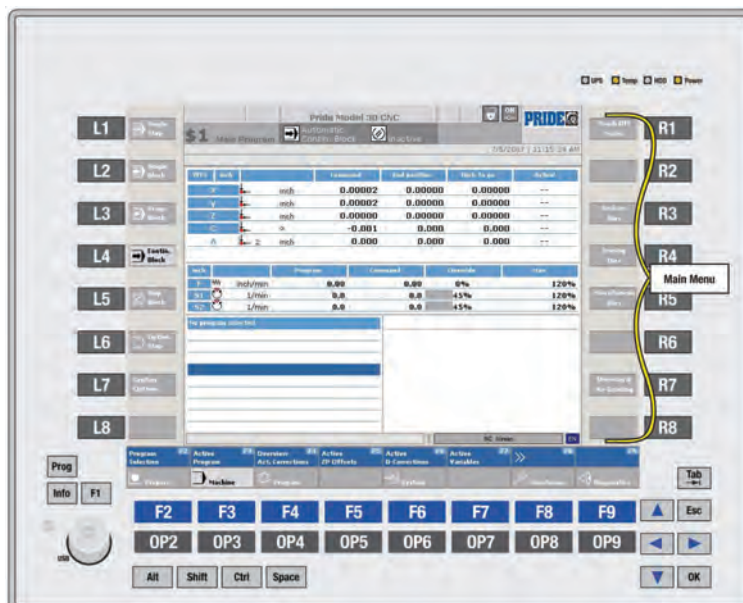
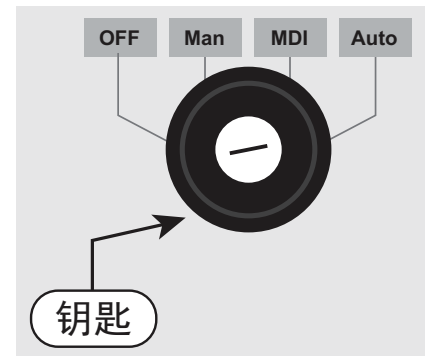
如果该磨床有磁性吸盘，则将卡盘加电至 50% 以便于较平固定装置并执行步骤 4a. 和 4b。如果该磨床有 6 爪卡盘，则跳至步骤 5。

- a. 转动卡盘，使用千分表确定修整固定装置同心率在总读数的 0.0002 英寸 (5 μm) 内。

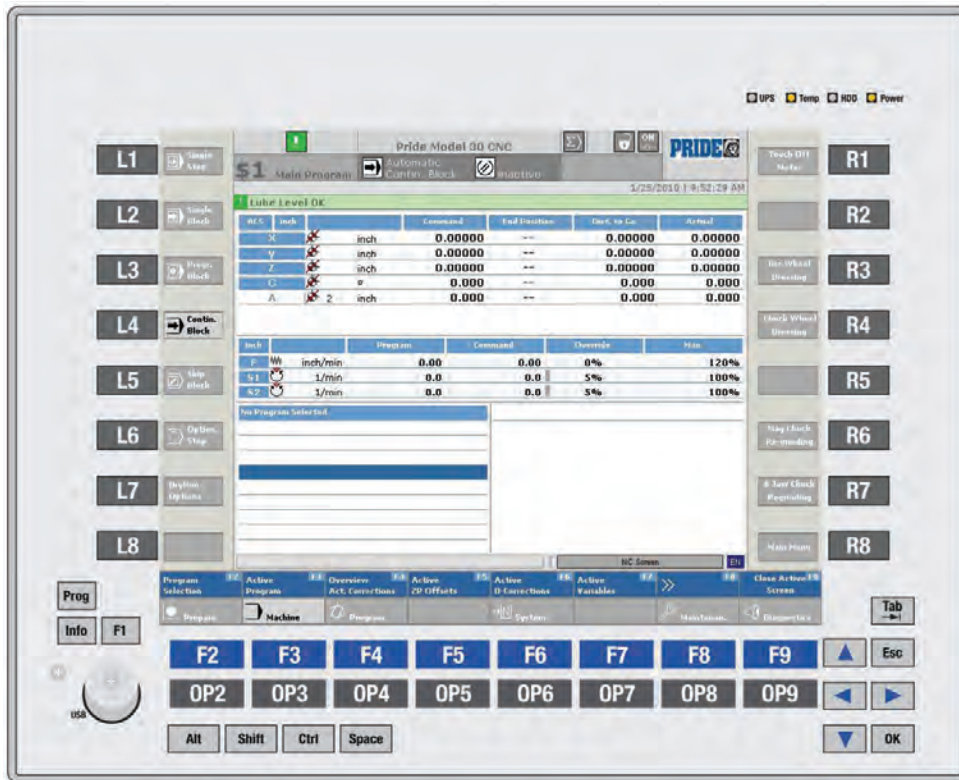


- b. 将磁性吸盘加电至全功率。

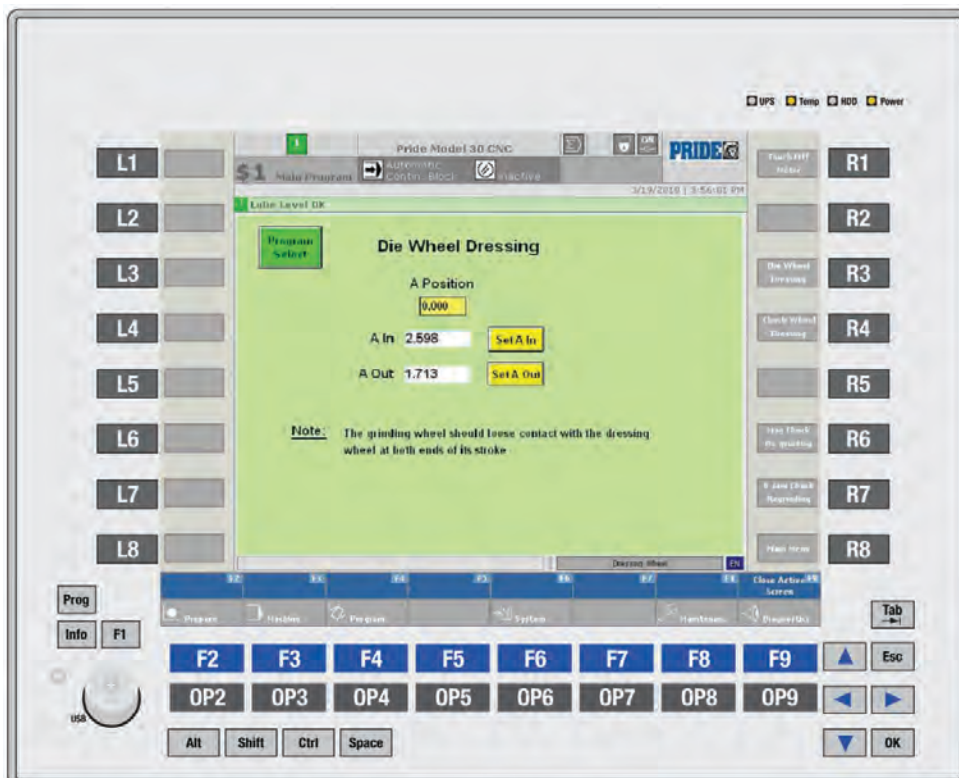
5. 将开关“钥匙”拧至“Auto”
6. 弹出主菜单 (R8)，并且将出现下面的屏幕。



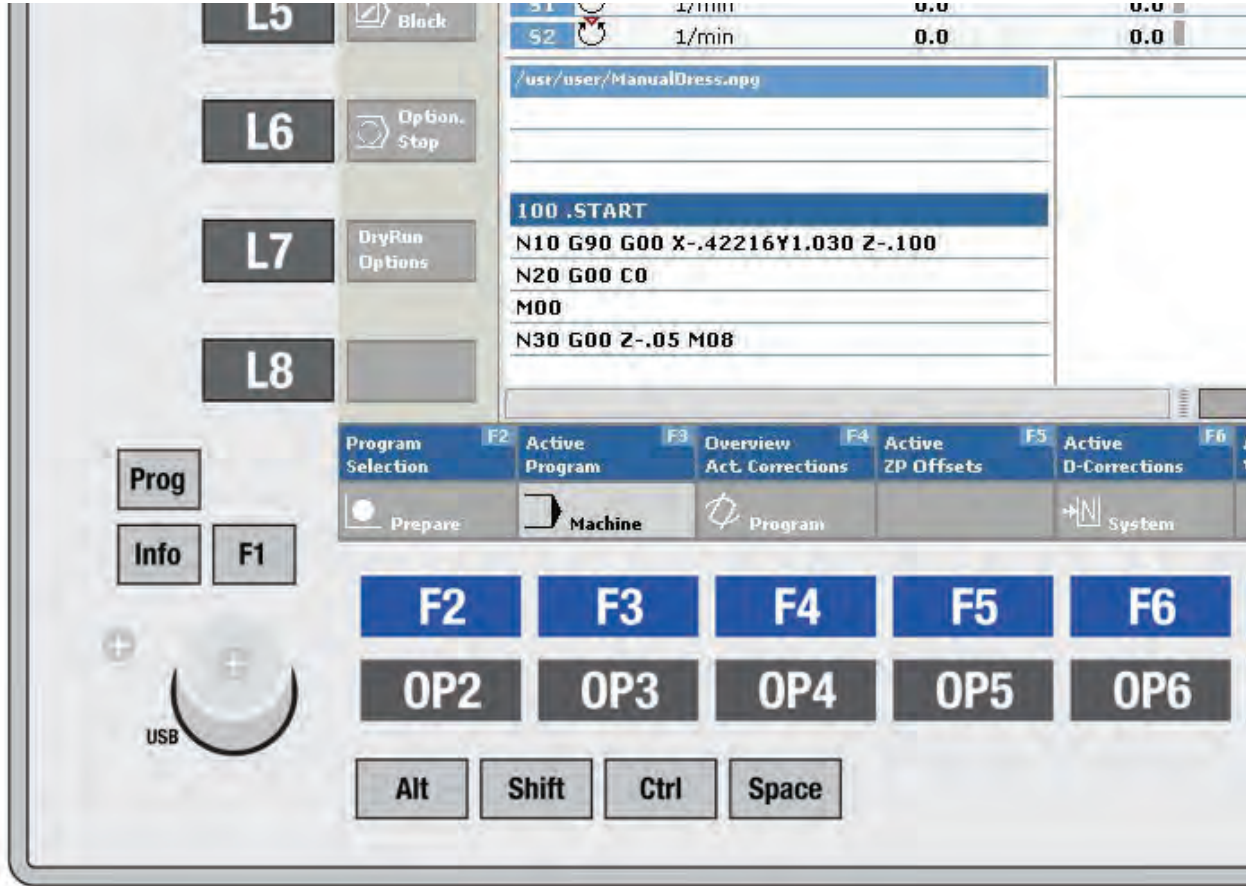
7. 通过使用“跟踪球”上的左按钮或按下右边的 **R7** 按钮选择修整和重新打磨（修整和重新打磨 **(R7)** 程序。将出现下面的屏幕。



8. 选择“模具磨轮修整” (R3)。将出现下面的屏幕。



9. 使用跟踪球，左击屏幕左上角中的“程序选择”框。使用跟踪球，按下并按住“程序选择”框上的左按钮。该“程序选择”框将变成红色，然后变成灰色。按住左跟踪球按钮，直到其变为灰色。
10. 选择 OP3 “机器”并验证左下框中的标题为：“/usr/user/ManualDress.ngp”，这是用于磨轮修整程序文件的文件名。

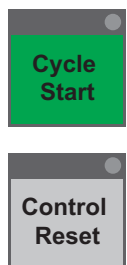
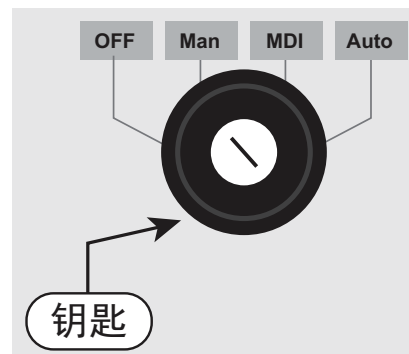


11. 如果“/usr/user/ManualDress.ngp”并未作为所选程序出现，则按“Cycle Start”一次。这将使修整固定装置定位在正确的 X 和 Y 位置。

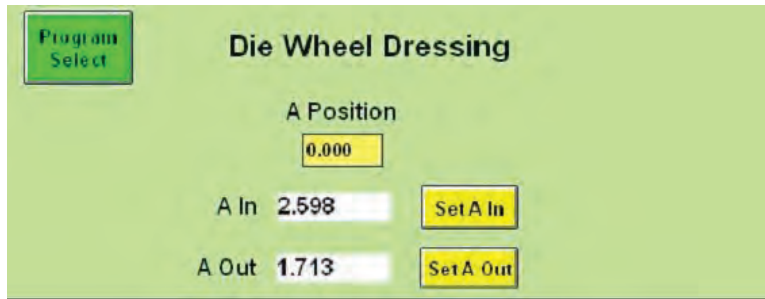
如果“/usr/user/ManualDress.ngp”并未出现，则按下操作面板上的“Control Reset”按钮，再次选择“Die Wheel Dressing” (R3) 并重复步骤 11 至 13。

12. 再次选择“Die Wheel Dressing” (R3)，这样便可设置“A 进入”和“A 离开”的位置。

13. 将钥匙锁开关切换至“Man”位置。



14. 使用操作面板上的微进给键，微进给 A 轴 (+) 直到金刚石磨轮的后缘离开修整石的后缘。当您对 **A In** 位置满意时，点击屏幕中“Set A In”按钮。这将该位置转换至“A In”框。



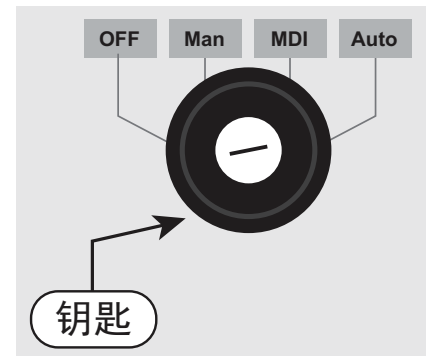
15. 使用操作面板上的微进给键重复该过程，微进给 A 以达到 A Out 位置。确保金刚石磨轮的前缘离开修整石前缘。当对该位置满意时，点击屏幕中的“Set A Out”按钮。这将该位置转换至“A Out”框。



需松弛磨轮与形成两端修整轮的接触。

16. 将钥匙锁开关返回“Auto Position”。

17. 您已准备好开始修整磨轮。选择 OP3 “Machine” 并验证左下框中的标题为：“/usr/user/ManualDress.ngp”，如下面的屏幕所示。





本程序采用手轮控制 **Z** 轴。

18. 直接将冷却液喷嘴放置在磨轮和修整石的接触点上。

19. 按下 “Cycle Start” 两次。心轴电机将启动且 A 轴将开始振动

20. 当 “金刚石磨轮” 在修整固定装置中来回振动时，再次按下 “Cycle Start”，这将启动 “手轮” 以便移动 Z Axis。



21. 使用 “手轮” 将右（轴选择）旋钮旋至 **Z** 位置。

22. 使用 “手轮” 将左（增量选择）旋钮旋至 **0.0001** 位置。

注：您可选择 **0.001** 增量，直到您靠近该工件，然后当您开始修整时，切换回 **0.0001** 增量。

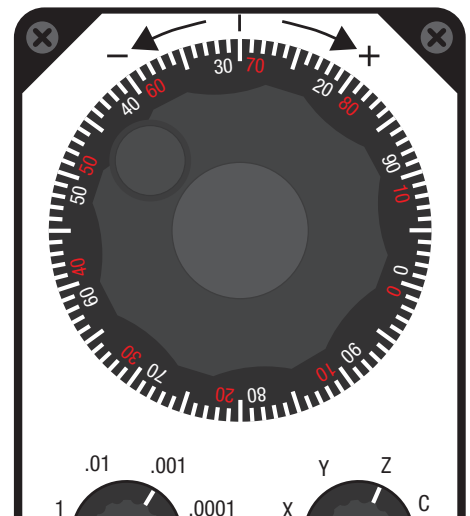
23. 使用手轮上的大旋钮将金刚石磨轮送进修整石，一次一或两下点击。直到模具磨轮修整完毕。

24. 当修整完成时，再次按下 “Cycle Start”。这将使 A 轴回到初始位置并停止心轴

25. 检查金刚石磨轮是否偏斜。如果金刚石磨轮不同心或不够整齐，则从步骤 20 开始再次运行修整程序。继续此步骤直到您认为磨轮已完全修整干净。



修整磨轮前，您可以标记磨轮表面。若磨轮完全清洁，则修整磨轮后无可视标记。



3.8 模具、套管与刀片打磨

说明书中使用下述符号执行目标打磨操作：



指定流程步骤。按照上述编号指示的顺序执行操作步骤。



表示您须使用控制器上的键盘输入数字。



表示您需按下箭头确认的按钮。



表示您需重复步骤。



表示您需检验箭头指定的项目。



相等符号。



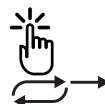
表示您需使用鼠标右键选择指示的项目。



不相等符号。



表示您需保持鼠标右键，直至项目达到注释的结果。



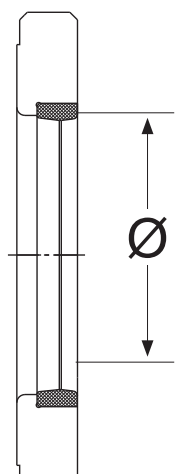
表示您需按下按钮直至达到箭头指示的结果。

磨轮/心轴选择

	工件卡盘类型	磨轮大小/心轴
Ironing Die	6 inch	1-1/2 inches/Short (6-182)
Ironing Die	6–7 inch	2 inches/Medium (6-207)
Pilot Die	6 inch	1-1/2 inches/Short (6-182)
Pilot Die	6–7 inch	2 inches/Medium (6-207)
Redraw Die 6 inch	6 inch	1-1/2 inches/Short (6-182)
Redraw Die 6 inch	6–7 inch	2 inches/Medium (6-207)
Redraw Die 7 inch	6–7 inch	2 inches/Medium (6-207)
Redraw Sleeve	6 inch	1-1/2 inches/Long (6-183)
Redraw Sleeve	6–7 inch	1-1/2 inches/Long (6-183)
Trimmer Blades	6 inch	1-1/2 inches/Medium (6-207)
Trimmer Blades	6–7 inch	1-1/2 inches/Medium (6-207)

3.8.1 设置“Z”零（位）

1

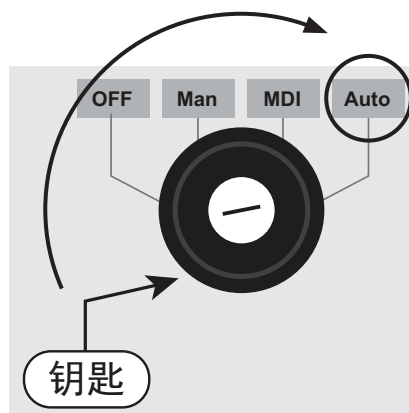


请注意这些说明采用
拉伸模具设置 Z 轴零
位置。

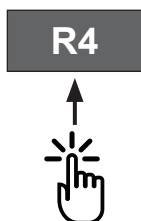
2



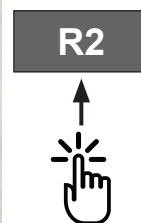
3



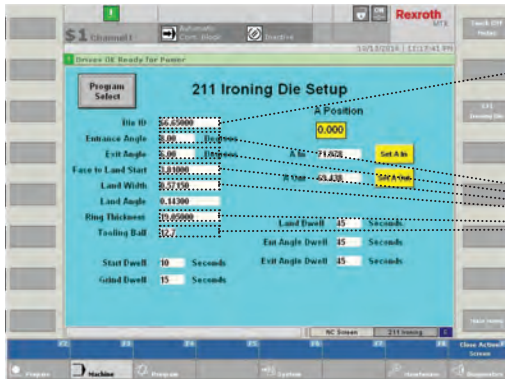
4



5



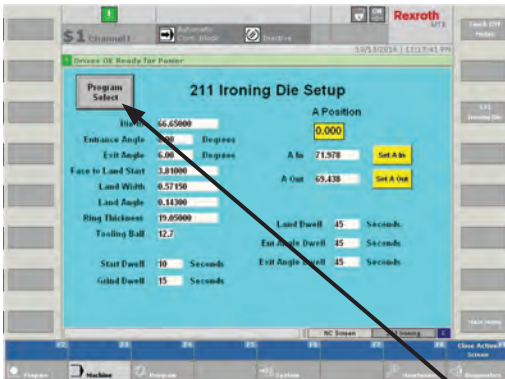
6



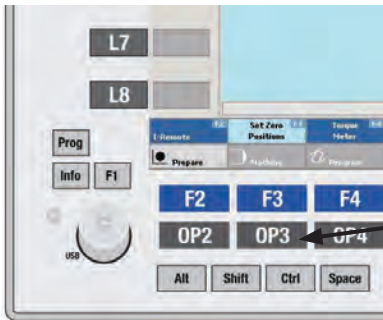
= Ø 实际 X.XXXXX

Mouse + Keyboard

7



8

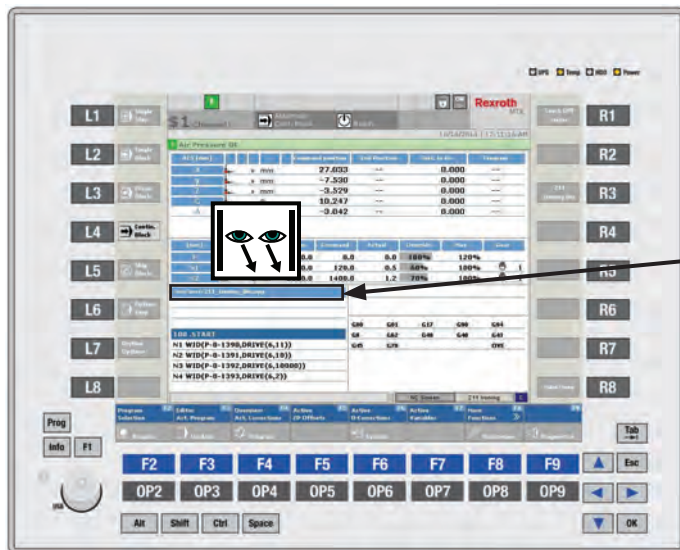


Program Select

Program Select

Program Select

9



7



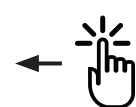
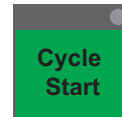
≠

=

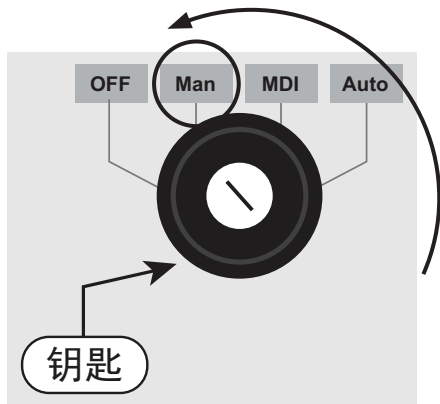


/usr/user/211_Ironing.npg ?

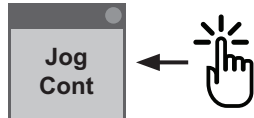
10



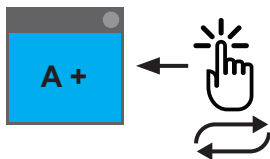
11



12

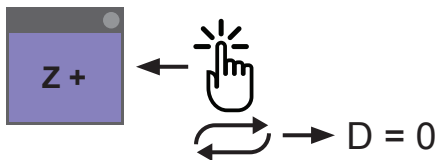


13



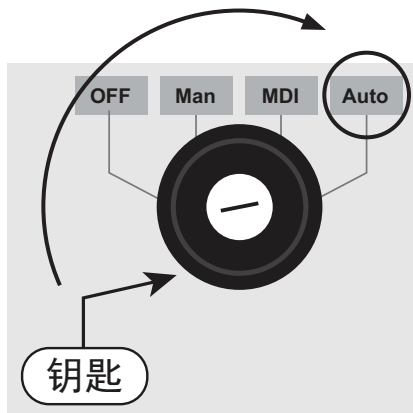
i 微进给 **A+** 至拉伸模具地面宽度中心上的中央磨轮处。

14

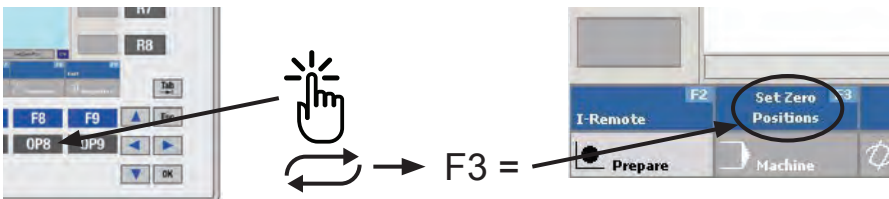


i 使用 **Z+** 微进给键时手动旋转工件，从而移动磨轮，直至磨轮接触工件并由于接触旋转的工件而开始旋转。

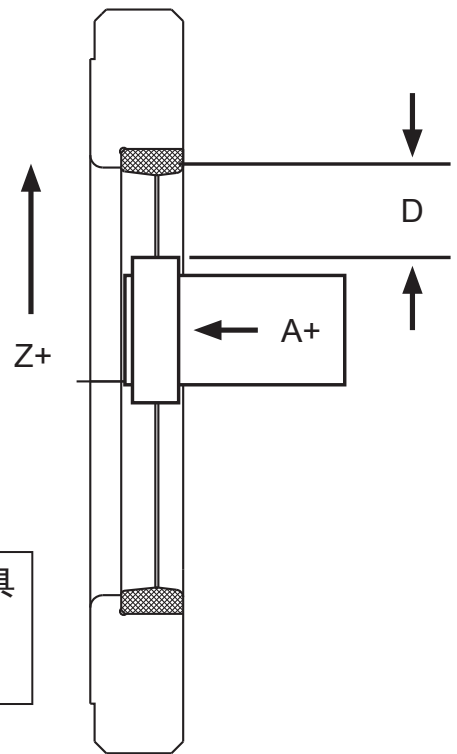
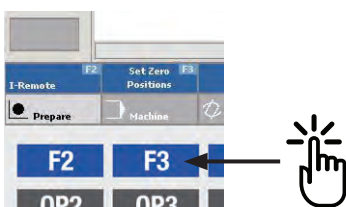
15

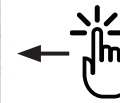
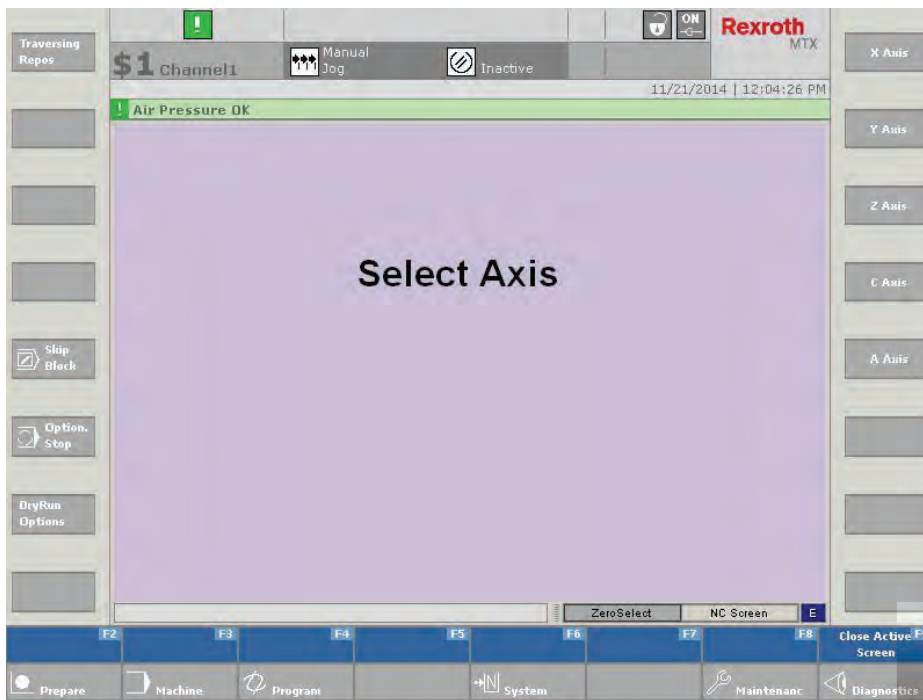


16

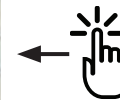
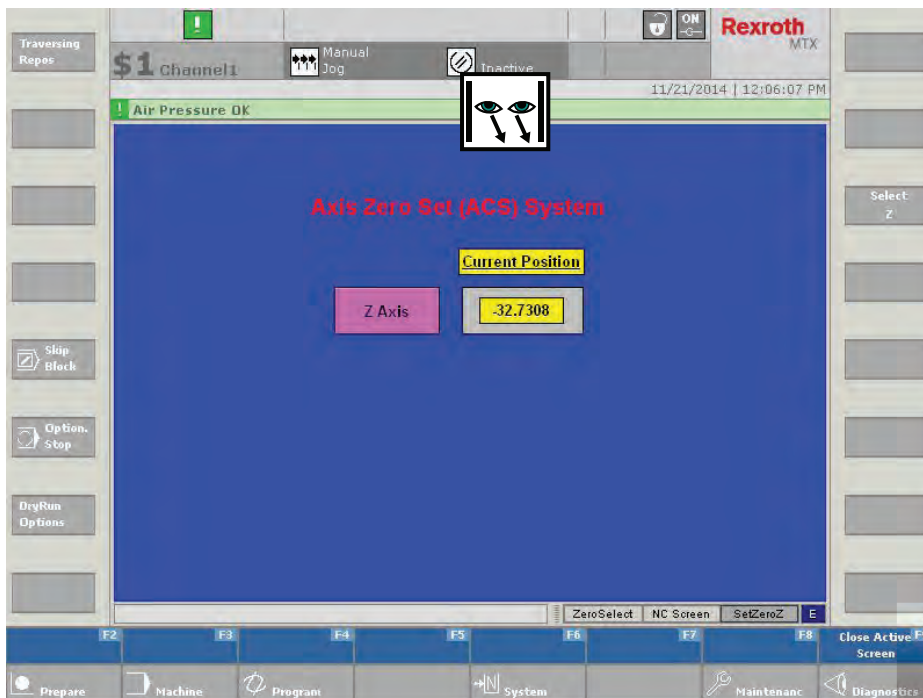


17





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Z ≠ 0

Z = 0

F9

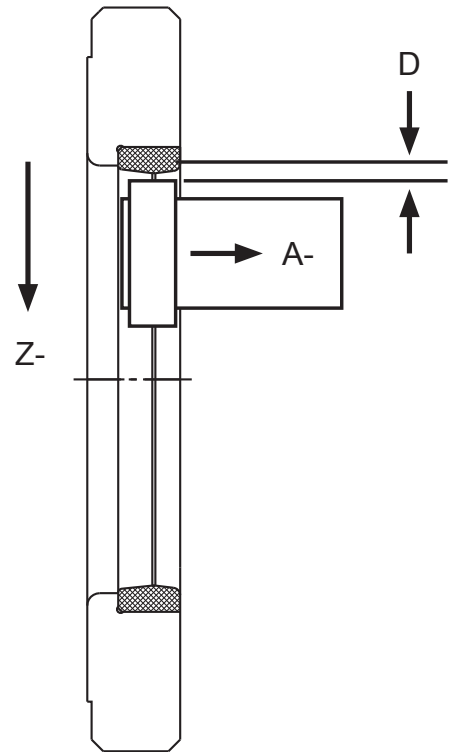
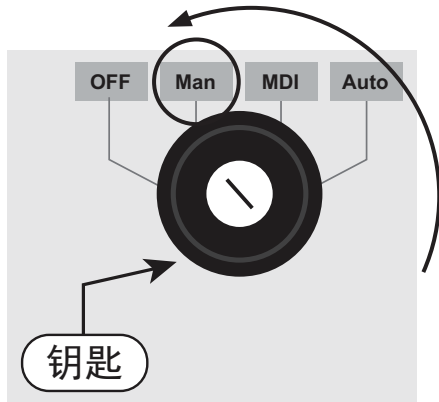


20

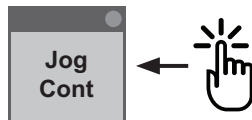


21

22



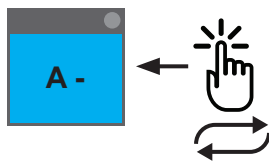
23



24

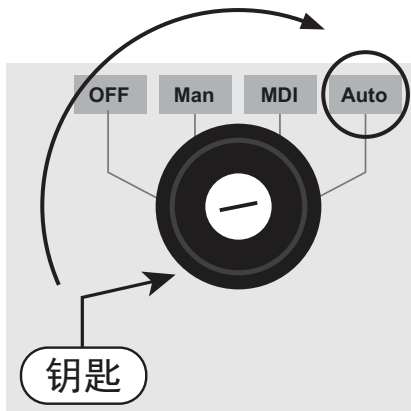


25

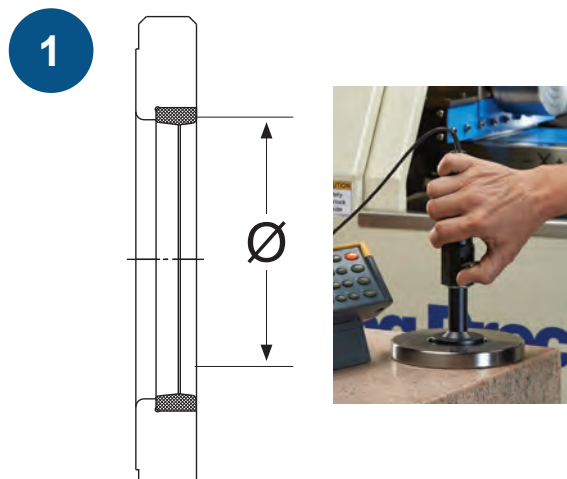


微进给 **A-** 直至停止。到达 **A** 轴行走端时，控制器可能会显示错误。

26

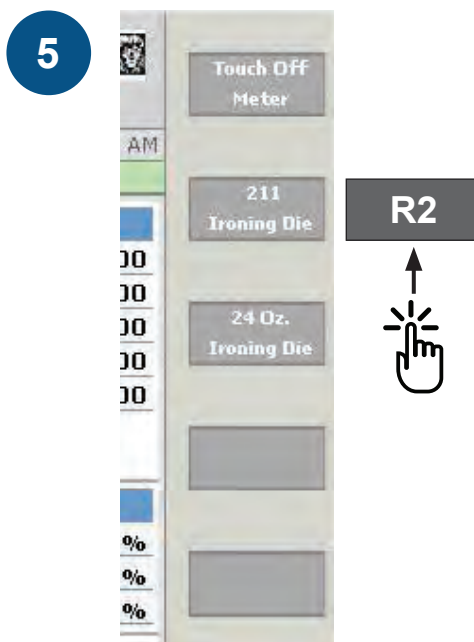
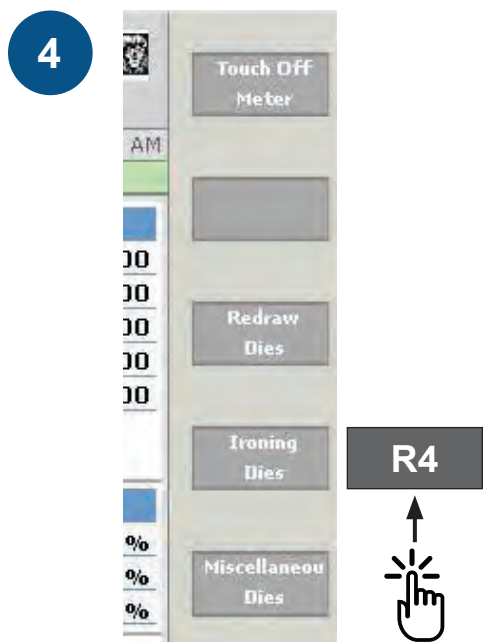
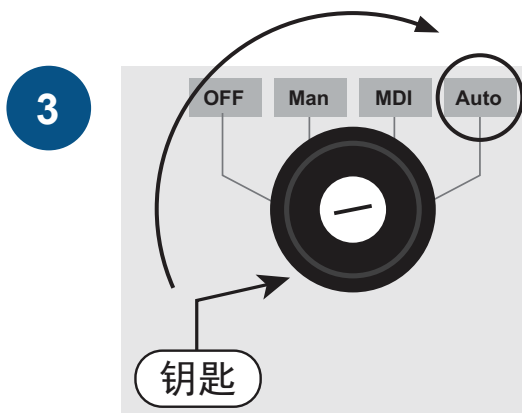


3.8.2.1 拉伸模打磨 - 设置



i 请注意这些说明以 **211** 拉伸模具为例。
需要针对您正在设置打磨的模具选择适当程序。

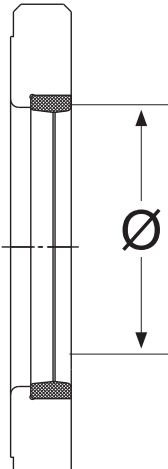
! 上述说明中步骤 **1** 执行前，**Z** 轴零位置必须已设置（请参阅第 **3.8.1** 部分）。



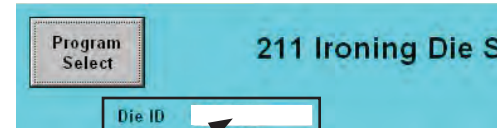
6



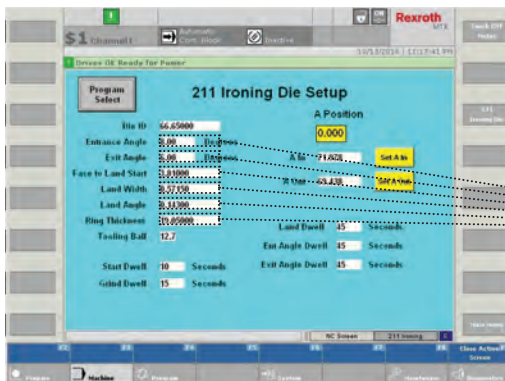
7



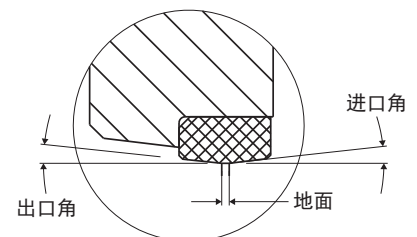
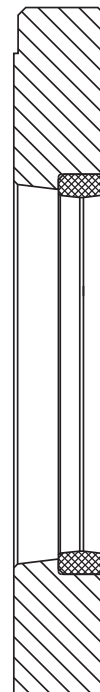
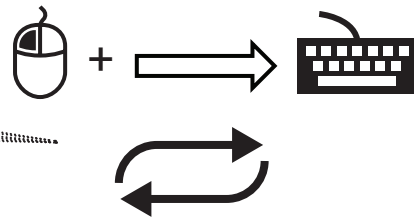
$$\varnothing + 0.015 \text{ mm (0.0006 in)} =$$



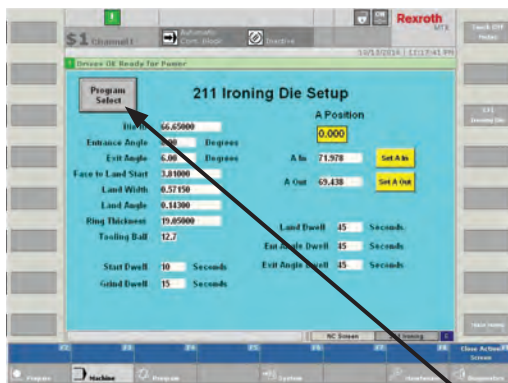
8



X.XXXXXX



9

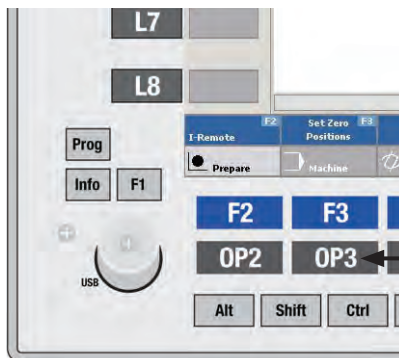


Program Select

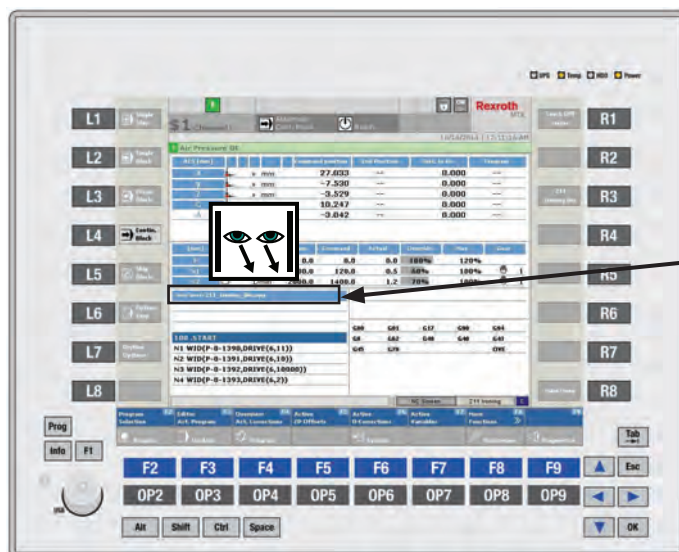
Program Select

Program Select

10



11



9

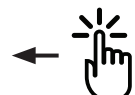
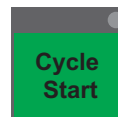


≠

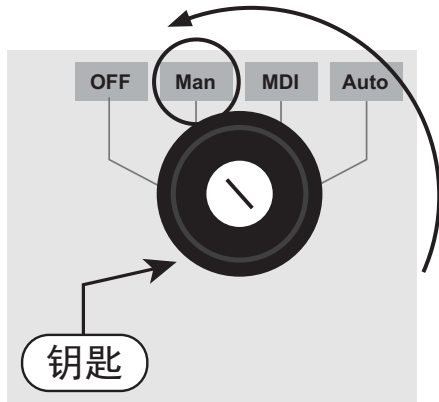
/usr/user/211_Ironing.npg ?



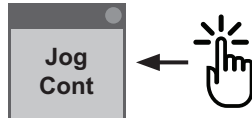
12



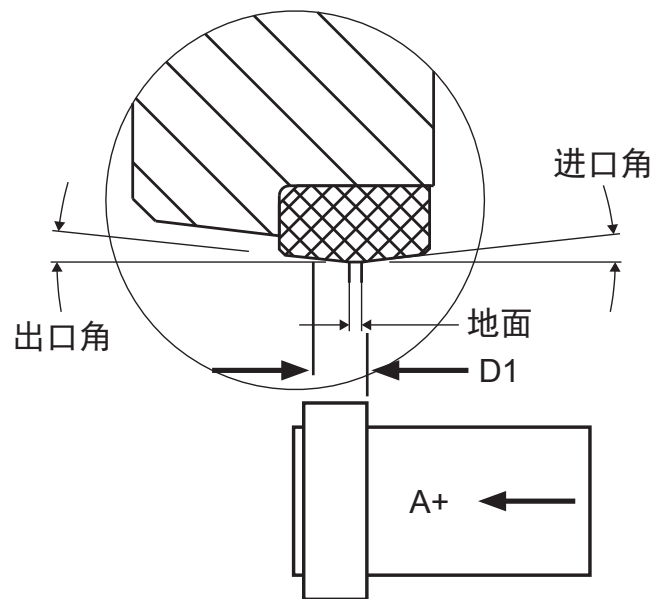
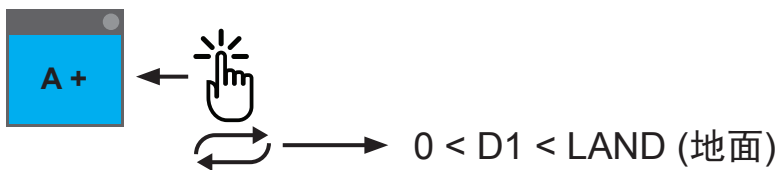
13



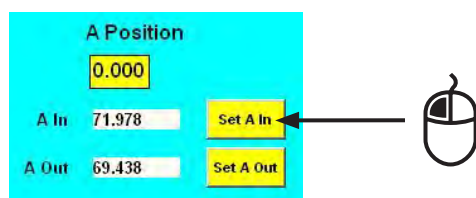
14



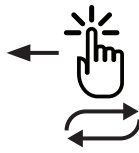
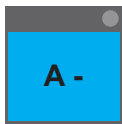
15



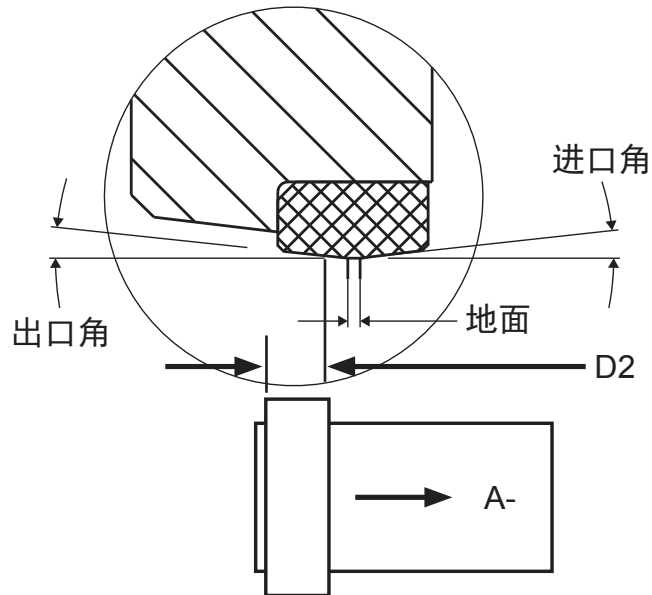
16



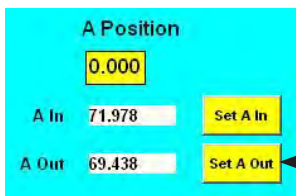
17



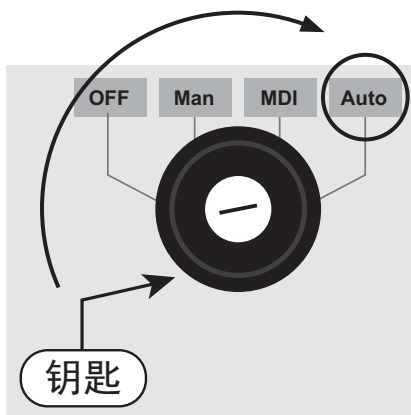
→ 0 < D2 < LAND (地面)



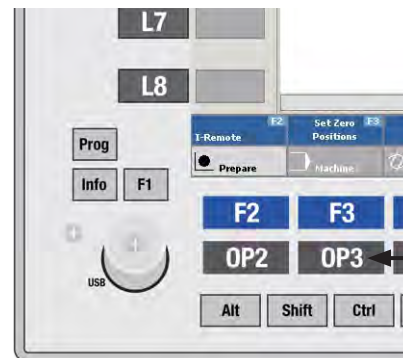
18



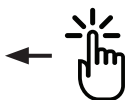
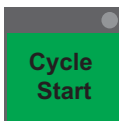
19



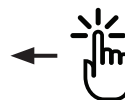
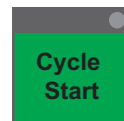
20



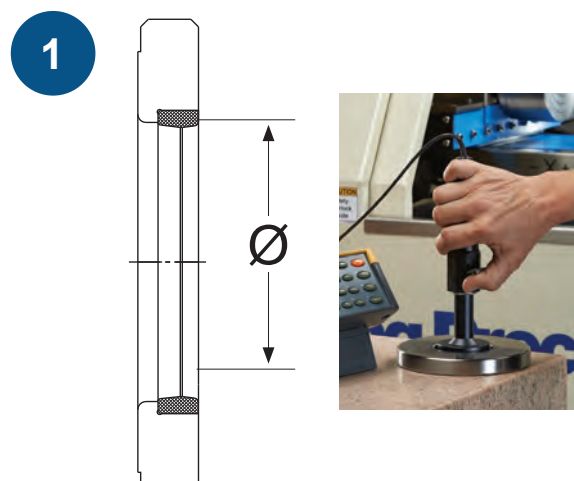
21



22

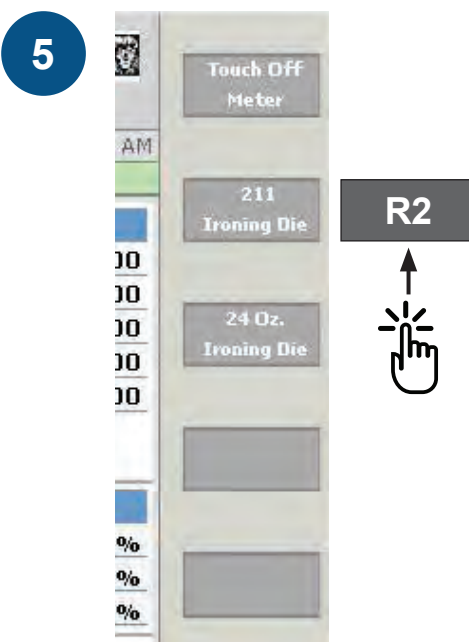
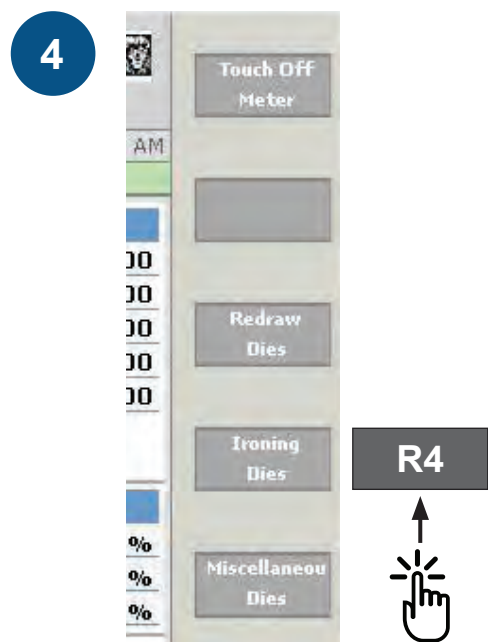
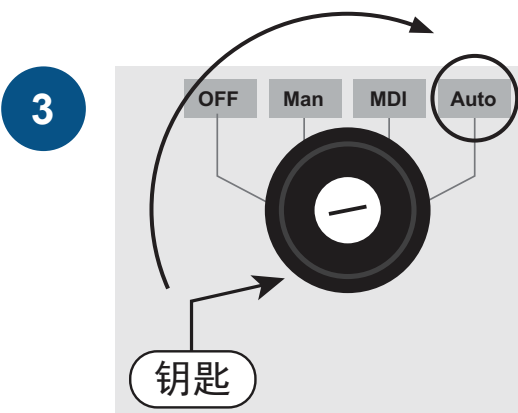


3.8.2.2 拉伸模打磨



i 请注意这些说明以 **211** 拉伸模具为例。
需要针对您正在设置打磨的模具选择适当程序。

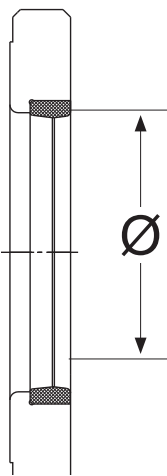
! 上述说明中步骤 **1** 执行前，**Z** 轴零位置必须已设置（请参阅第 **3.8.1** 部分）。



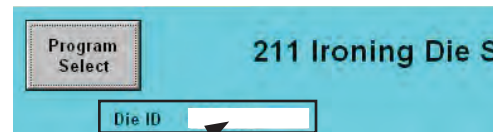
6



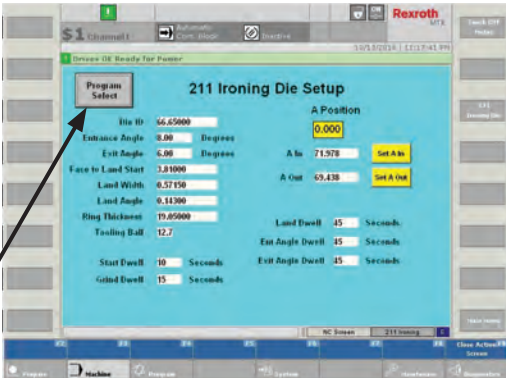
7



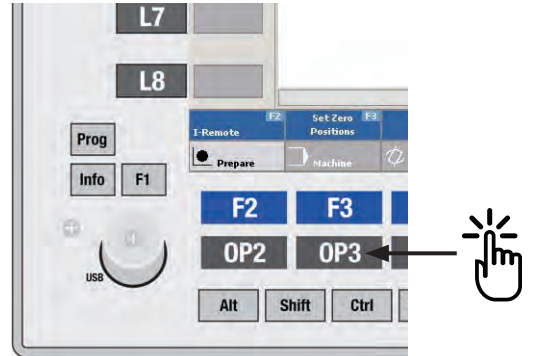
+ 0.0006 inches (0.015 mm)



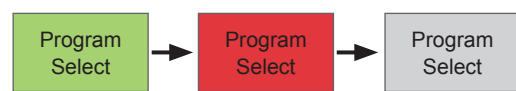
8



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8



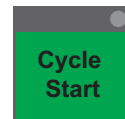
≠

/usr/user/211_Ironing.npg ?

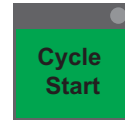
=



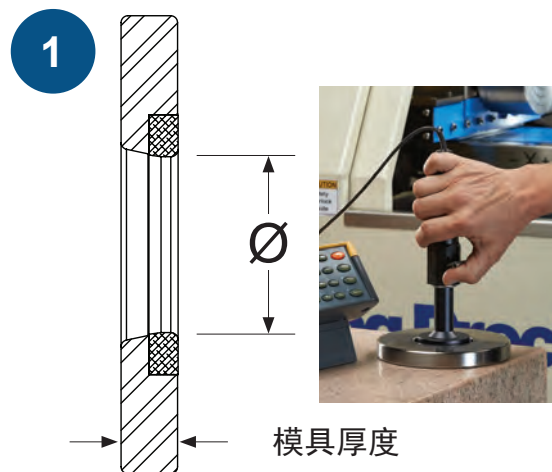
11



12

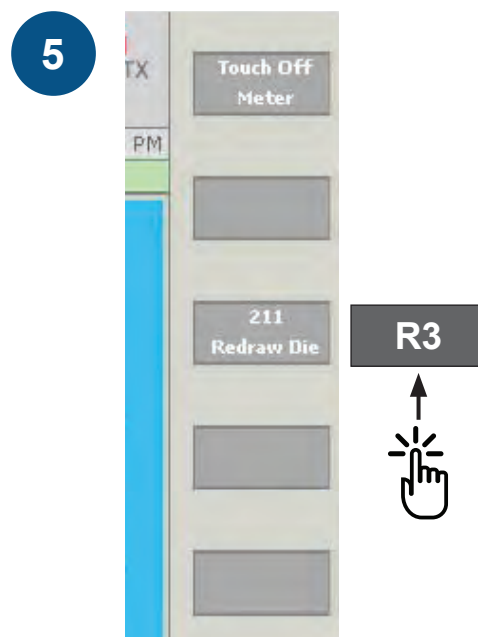
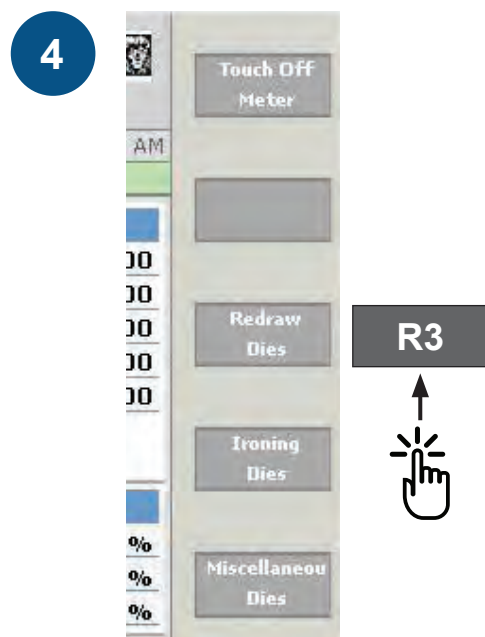
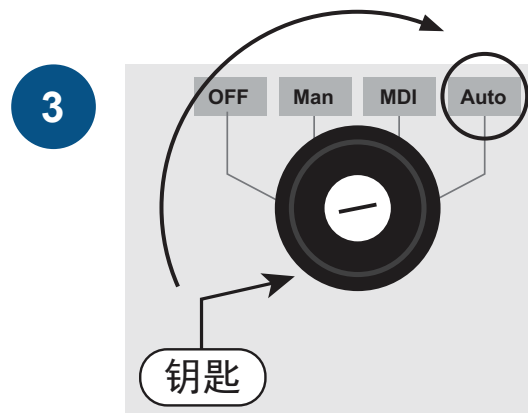


3.8.3.1 再拉伸模打磨 - 设置



i 请注意这些说明以 **211** 再拉伸模具为例。需要针对您正在设置打磨的模具选择适当程序。

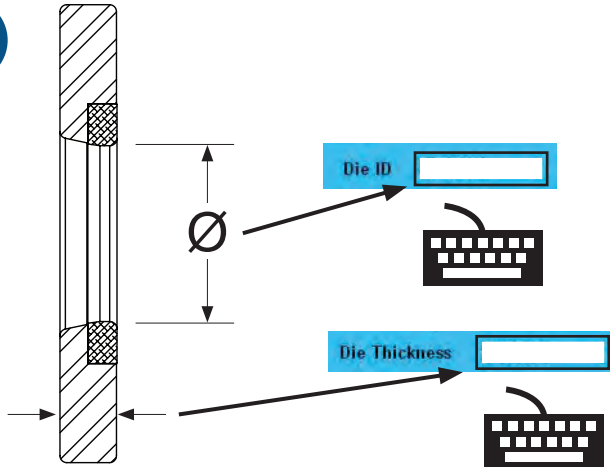
! 上述说明中步骤 **1** 执行前，**Z** 轴零位置必须已设置（请参阅第 **3.8.1** 部分）。



6

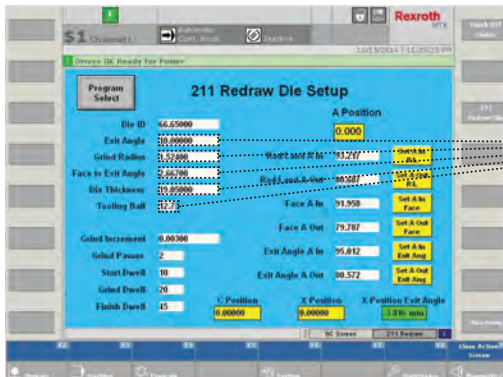


7



输入实际模具内径及模具厚度。
在镶硬合金齿区域测定模具厚度。

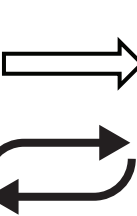
8



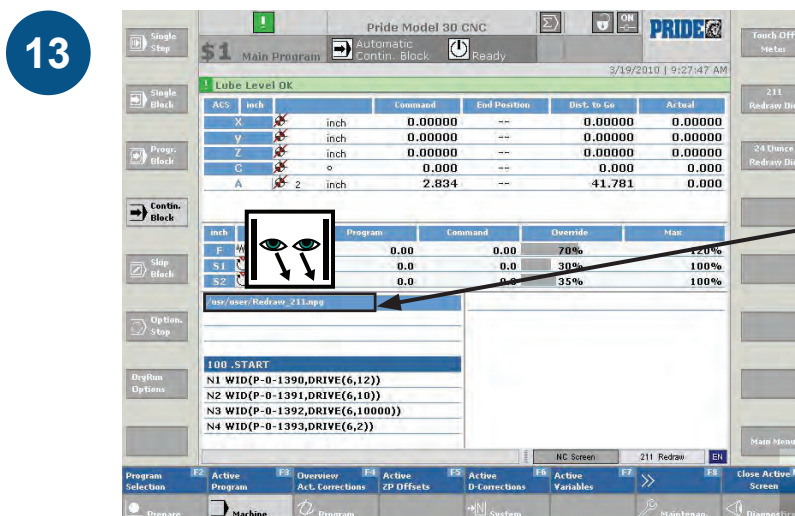
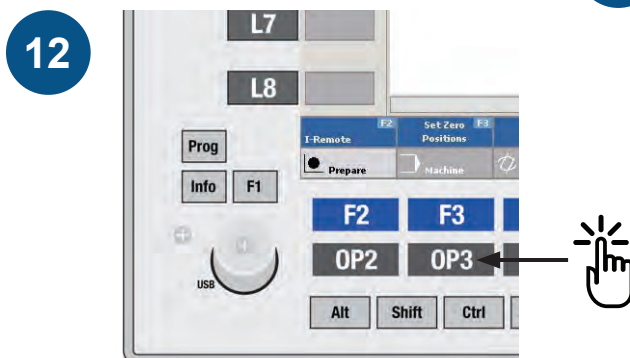
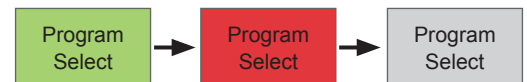
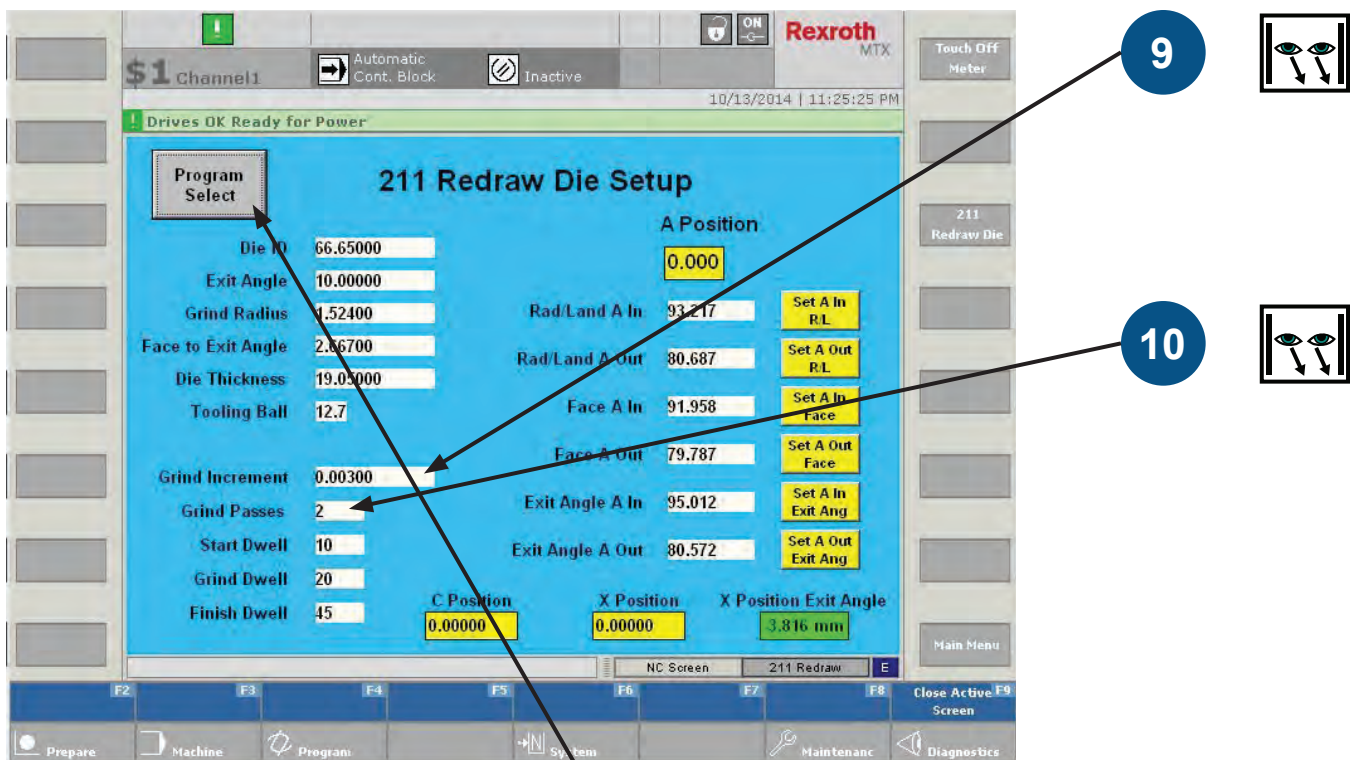
X.XXXXX



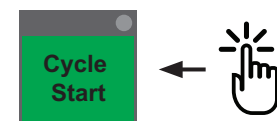
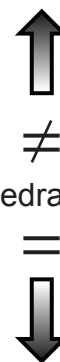
+

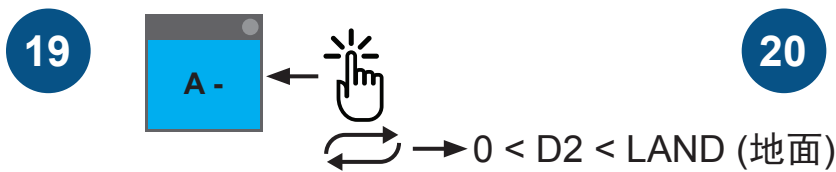
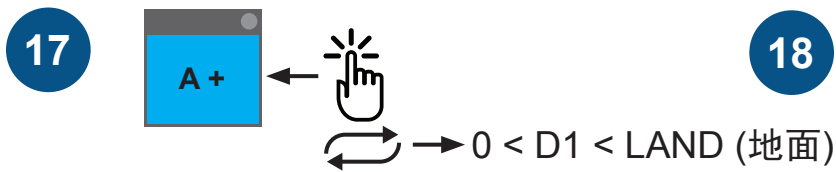
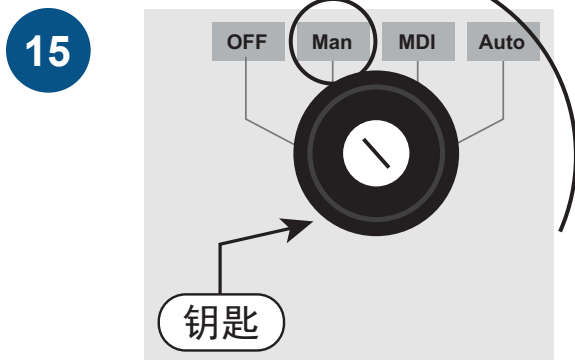


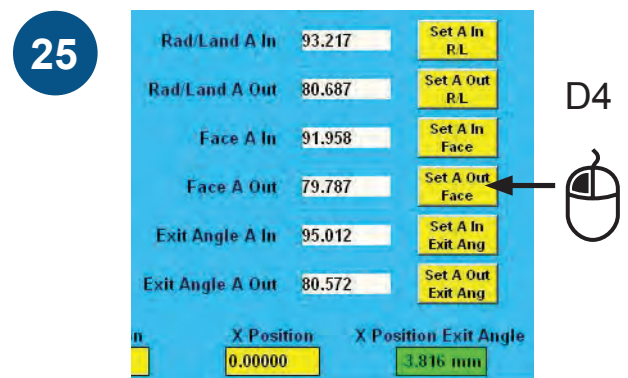
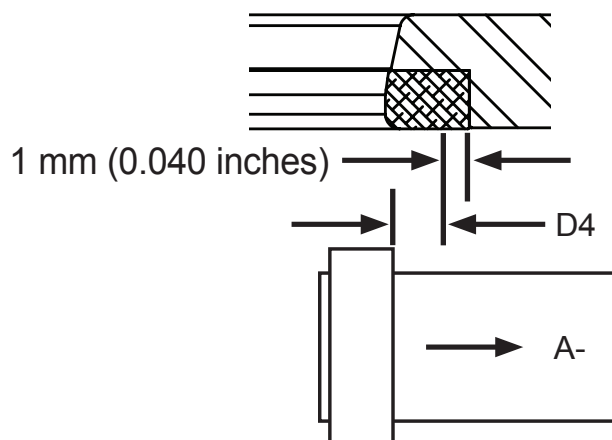
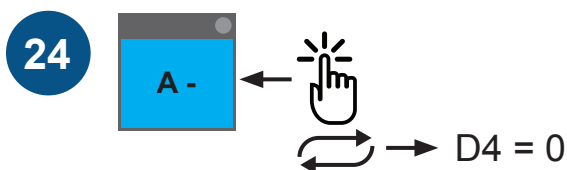
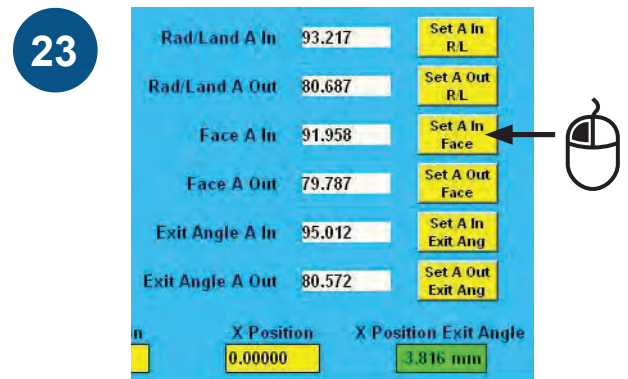
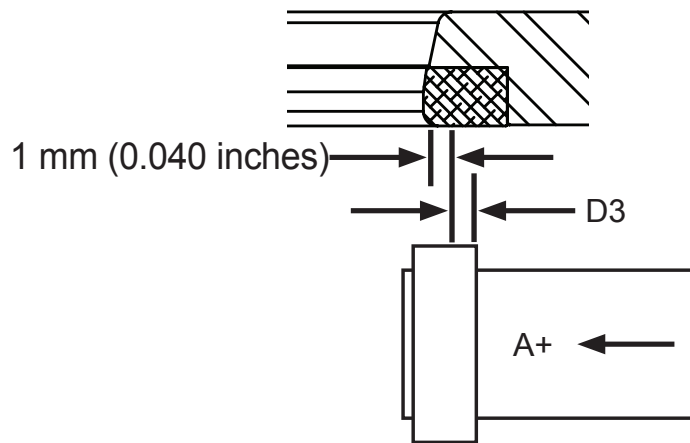
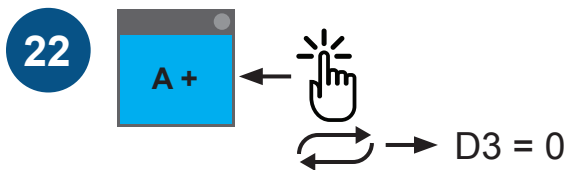
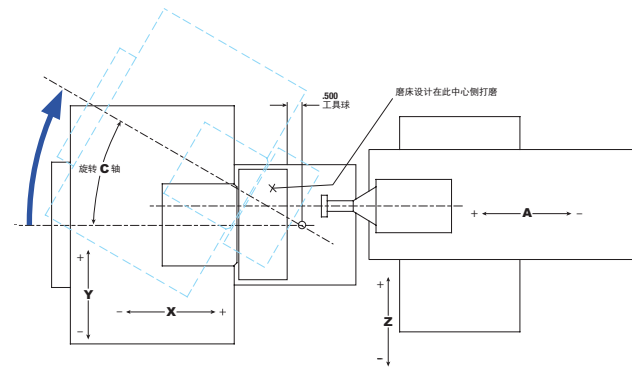
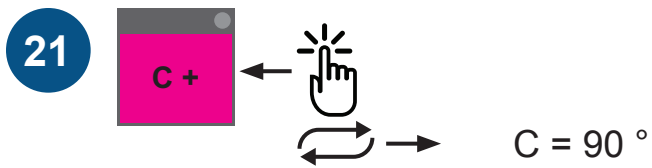
请注明我们建议取下足量材料，使模具内径增加 **0.0004 - 0.0006 inches (0.010-0.015 mm)**。



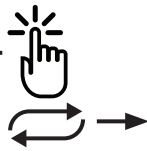
- /usr/user/Redraw_211.npg ?



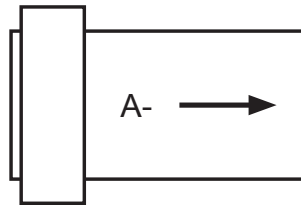




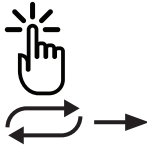
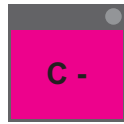
26



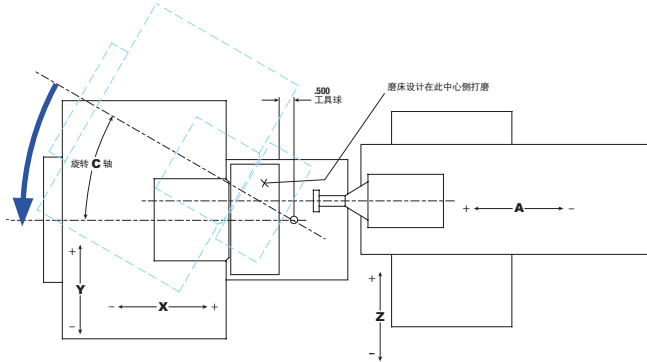
直至达到 A 轴零位置



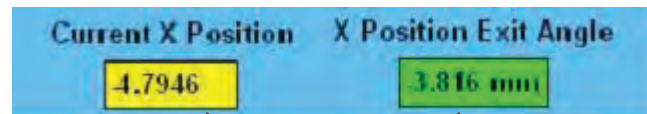
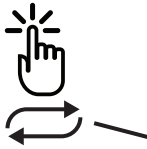
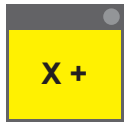
27



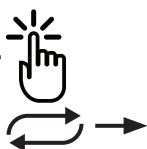
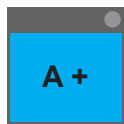
Exit Angle



28



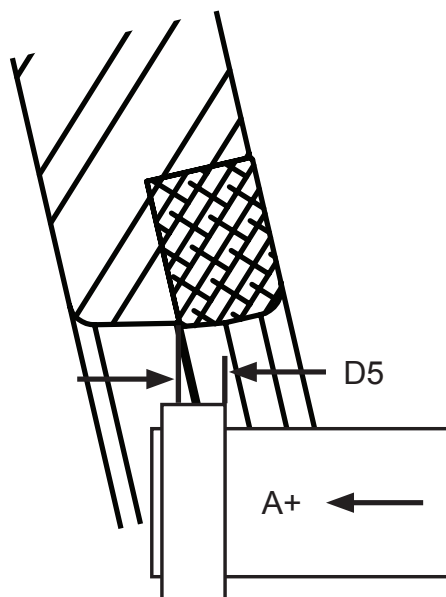
29



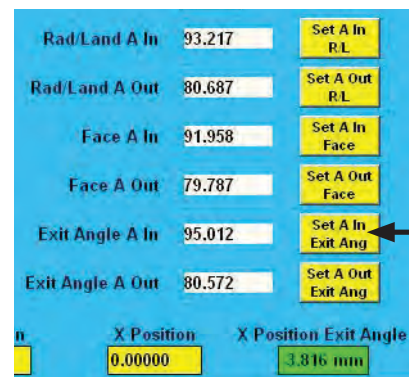
D5 = 0.040 inches (1 mm)



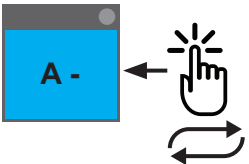
如果磨轮即将撞击卡盘，则停止前进。



30



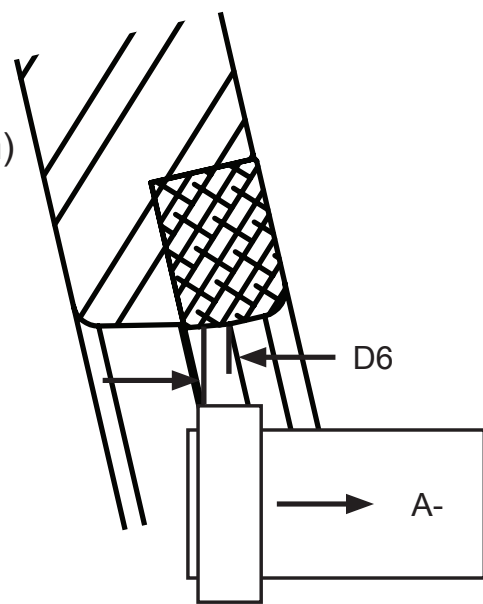
31



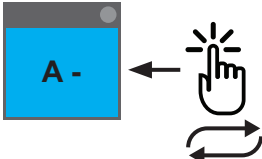
D6 = 0.040 inches (1 mm)

32

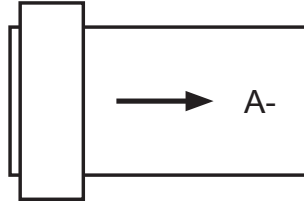
Rad/Land A In	93.217	Set A In R.L.
Rad/Land A Out	80.687	Set A Out R.L.
Face A In	91.958	Set A In Face
Face A Out	79.787	Set A Out Face
Exit Angle A In	95.012	Set A In Exit Ang
Exit Angle A Out	80.572	Set A Out Exit Ang
X Position	0.00000	X Position Exit Angle
		3.816 mm

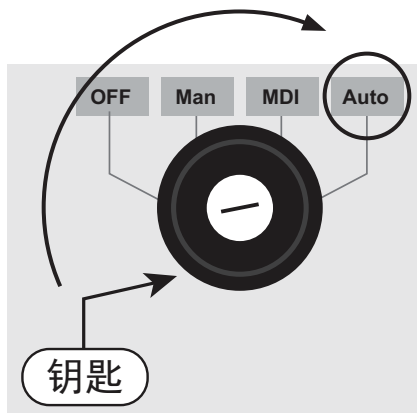
33



A = 0

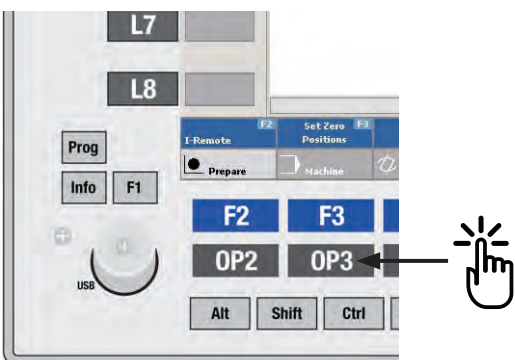


34

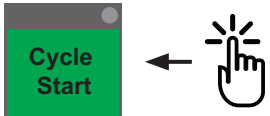


钥匙

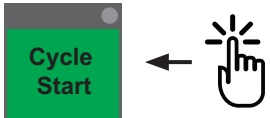
35

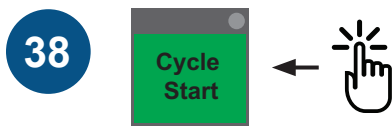


36

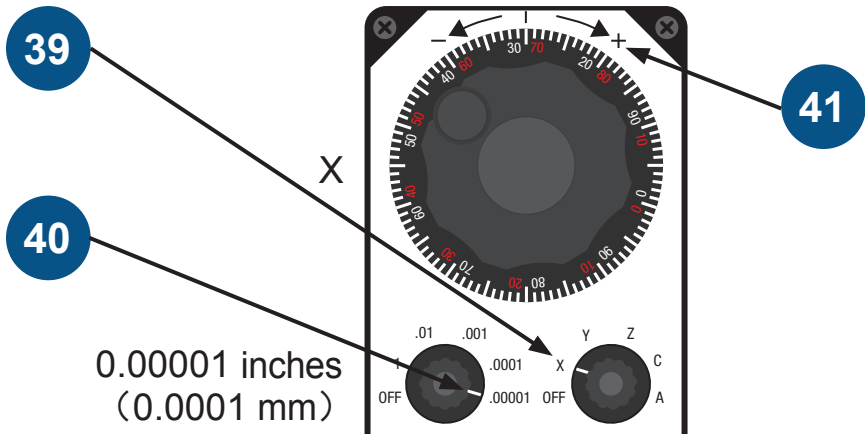


37



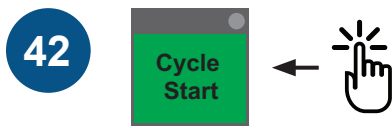


i 等待程序执行第一步，然后立即再次按“循环开始”激活手轮。

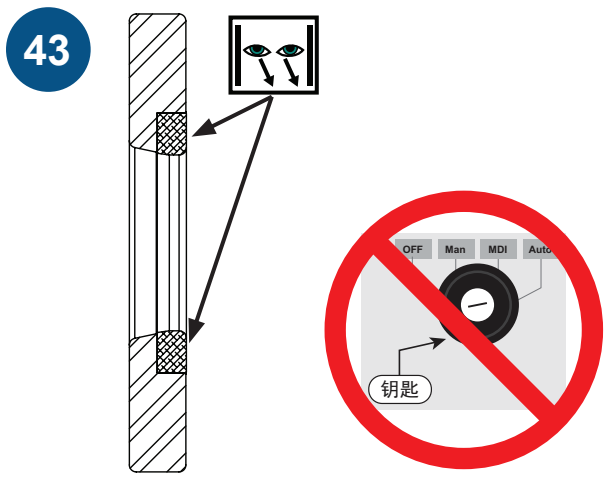


41

i 以 (+) 方向转动刻度盘，根据需要进行其他打磨操作，从而清理表面。



i 不激活手轮。轴移动至安全位置，运行检查模具表面。

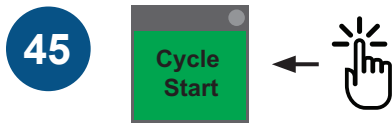


i 检查模具表面，确定会否需要其他打磨操作。

i 注意！切勿由“自动”位置移动钥匙。若您由此位置移动钥匙，则程序会重新开始。

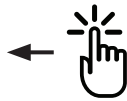
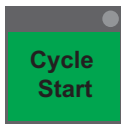


i 继续打磨程序。



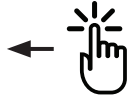
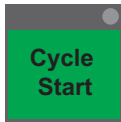
i 将磨轮进给至最后表面打磨位置。

44



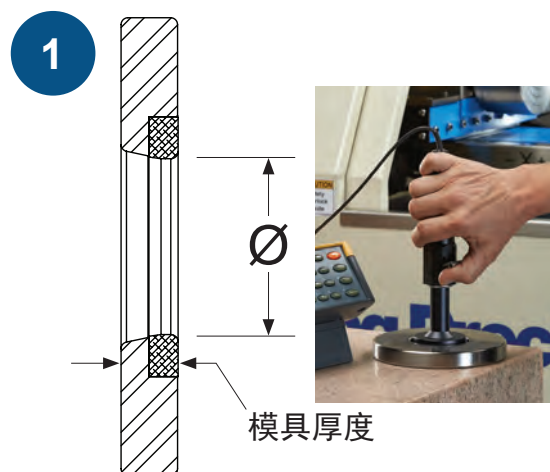
等待程序执行接下来的步骤，然后立即再次按“循环开始”激活手轮。根据需求使用手轮进行其他打磨。

45



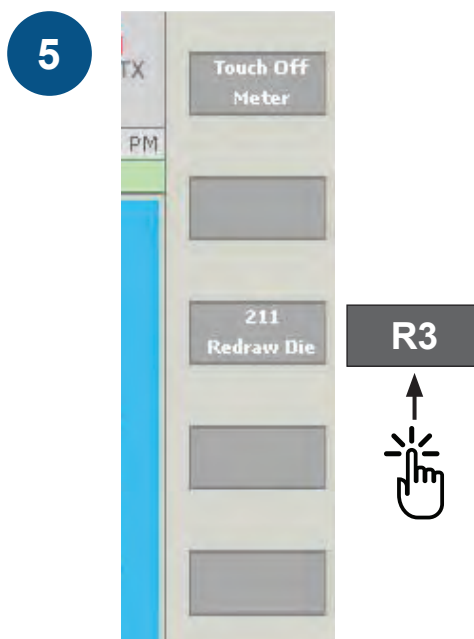
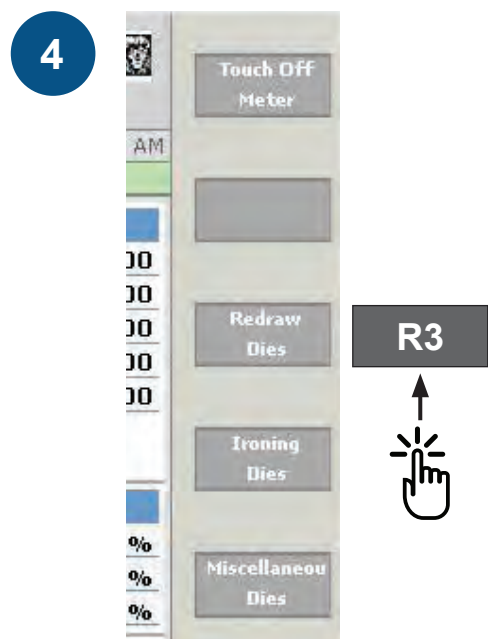
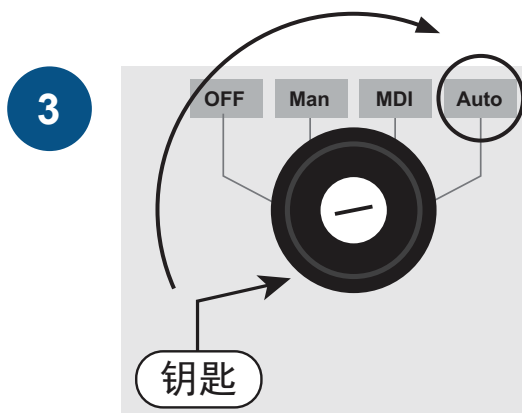
不激活手轮并完成打磨程序。

3.8.3.2 再拉伸模打磨



i 请注意这些说明以 **211** 再拉伸模具为例。需要针对您正在设置打磨的模具选择适当程序。

! 上述说明中步骤 **1** 执行前，**Z** 轴零位置必须已设置（请参阅第 **3.8.1** 部分）。

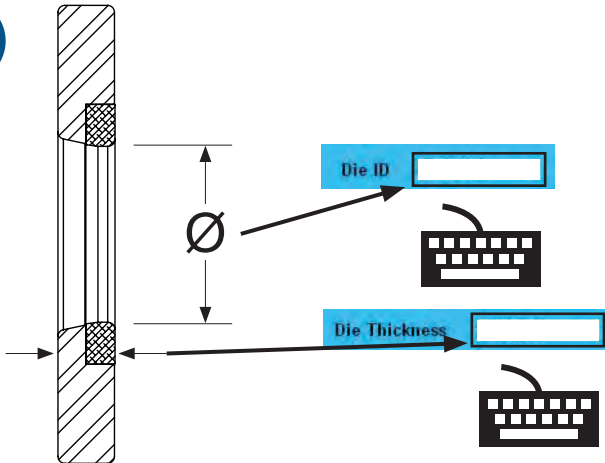


6

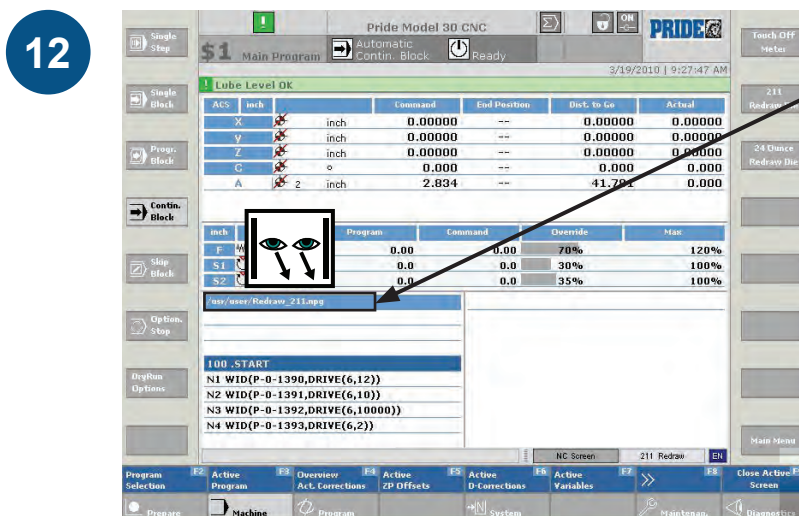
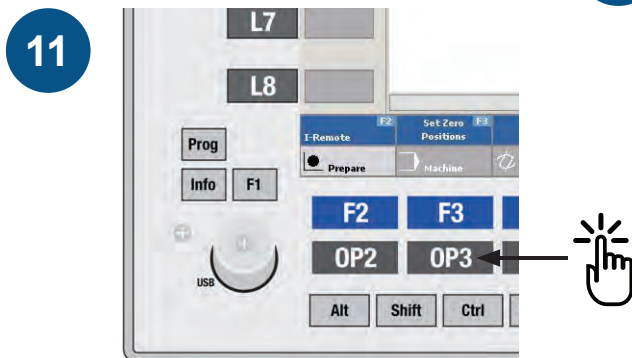
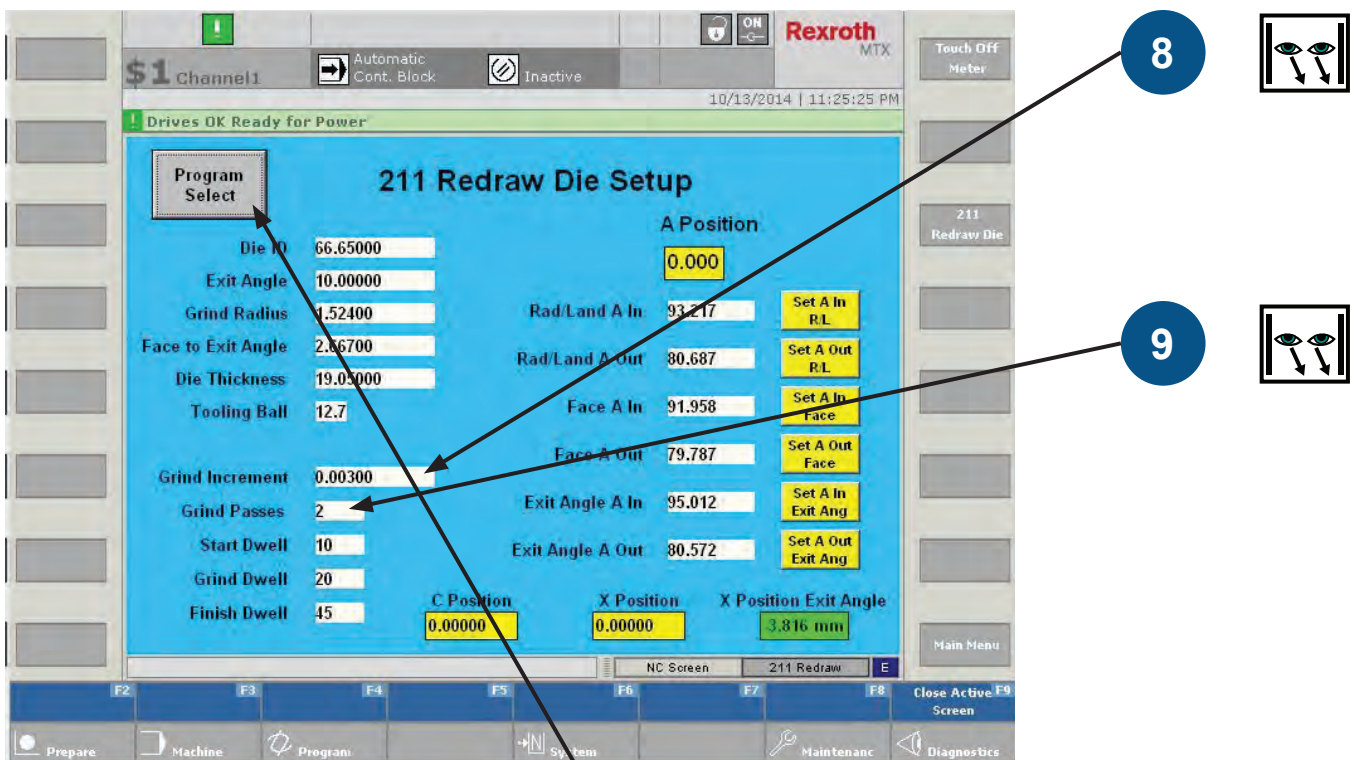
Program
Select

211 Redraw Die Setup

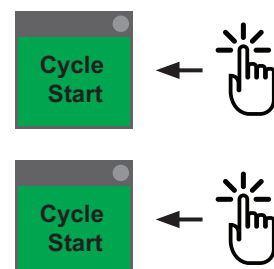
7

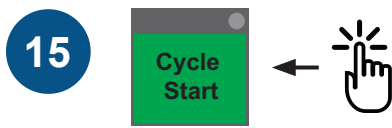


输入实际模具内径及模具厚度。
在镶硬合金齿区域测定模具
厚度。

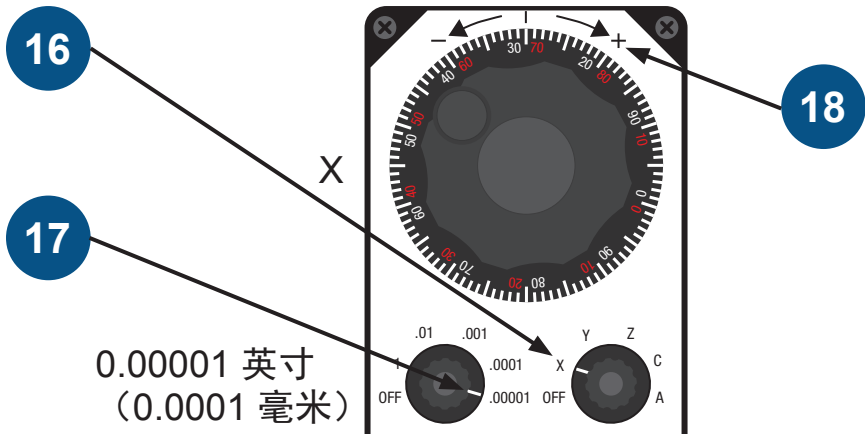


/usr/user/Redraw_211.npg ?

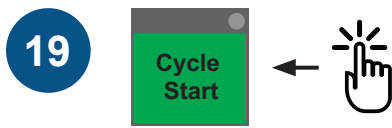




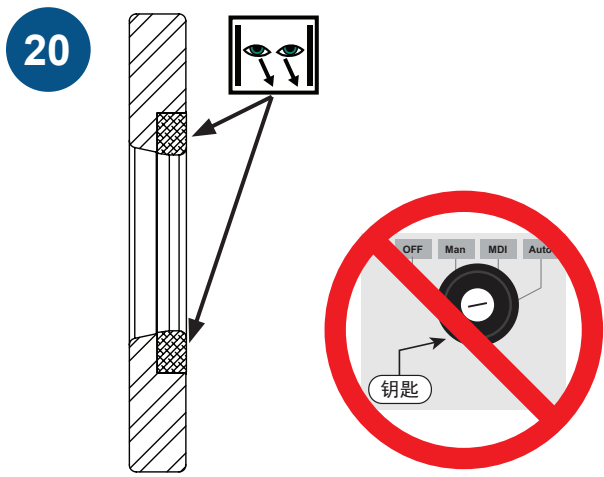
i 等待程序执行第一步，然后立即再次按“Cycle Start”激活手轮。



i 以 (+) 方向转动刻度盘，根据需要进行其他打磨操作，从而清理表面。



i 不激活手轮。轴移动至安全位置，运行检查模具表面。

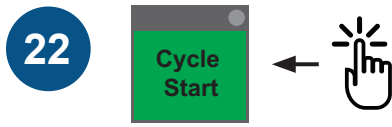


i 检查模具表面，确定会否需要其他打磨操作。

i 注意！切勿由“Auto”位置移动钥匙。若您由此位置移动钥匙，则程序会重新开始。

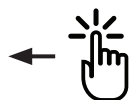
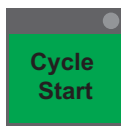


i 继续打磨程序。



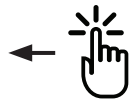
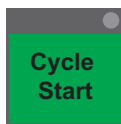
i 将磨轮进给至最后表面打磨位置。

44



等待程序执行接下来的步骤，然后立即再次按“Cycle Start”激活手轮。根据需求使用手轮进行其他打磨。

45



不激活手轮并完成打磨程序。

3.8.4.1 再拉伸套筒打磨 - 仅表面和半径范围

1

安装再拉伸套筒至打磨固定装置内。紧固星型螺栓，直至固定装置轻微保持再拉伸套筒。



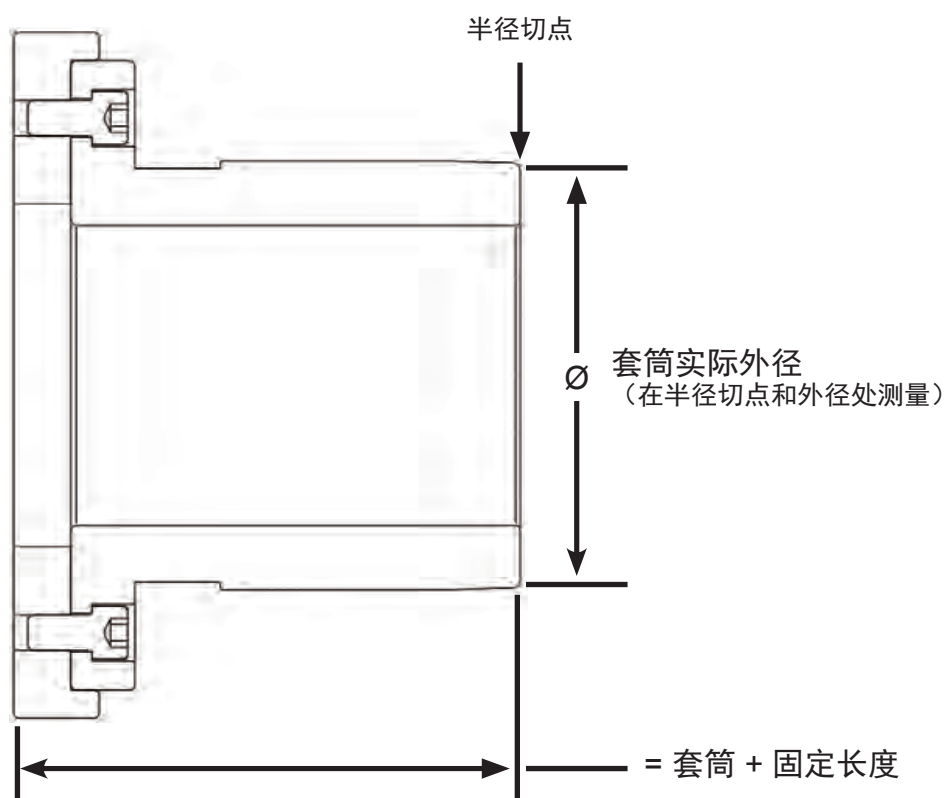
请注意这些说明以再拉伸套筒为例。需要针对您正在设置打磨的再拉伸套筒选择适当程序。

2

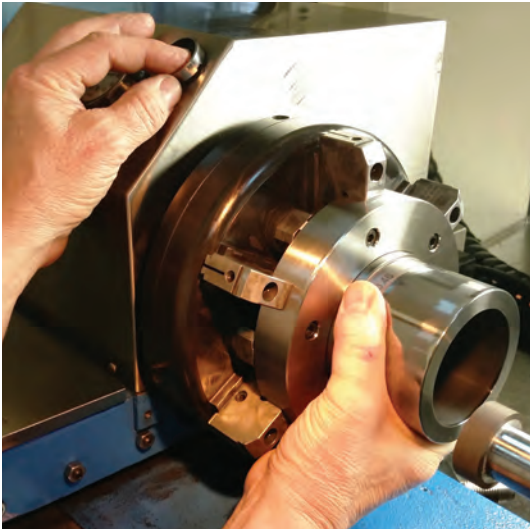
测量下述尺寸规格，输入再拉伸套筒程序。



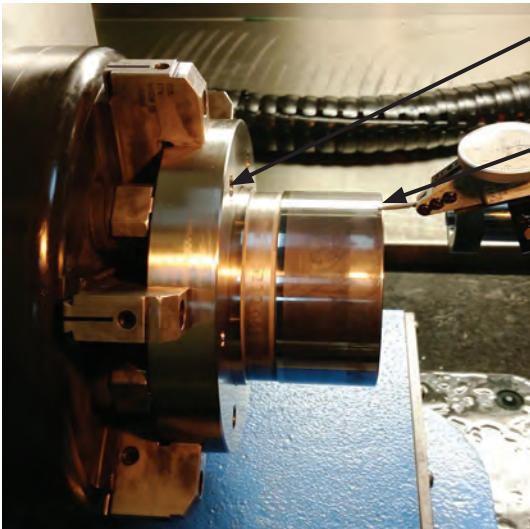
再拉伸套筒需要使用长心轴（Pt. No. 6-183）。



3



4



充分松弛固定装置螺丝，因而下推操作使套筒移动至固定装置内。

千分表触及套筒顶侧。

旋转套筒并注明高低点，然后确定千分表摆动的中点。

5



旋转至高点并近似推入中点。

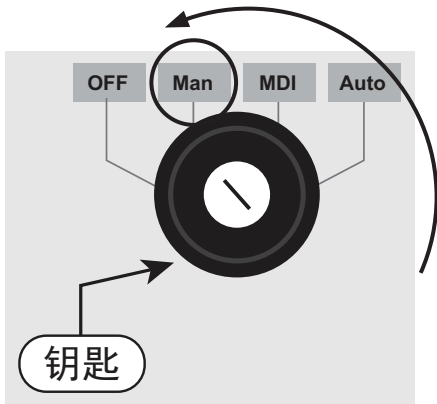
重复上述步骤，直至高低点之间的差异小于 0.0005 英寸 (0.013 毫米)。

旋转至高点并紧固最近的螺丝，直至千分表触及中点。

重复上述步骤，直至全部螺丝手动紧固且套筒运行至中心处。

注：稍微旋松螺丝提升低点。

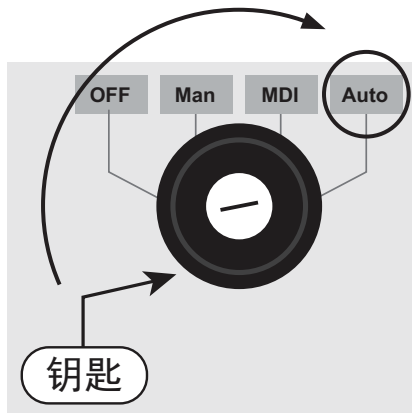
6



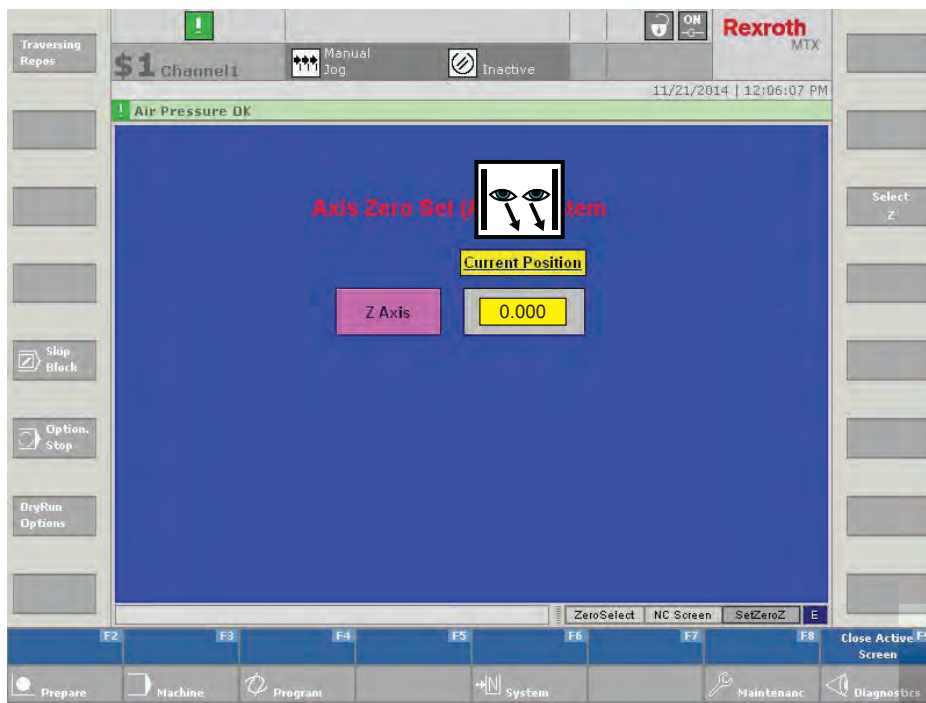
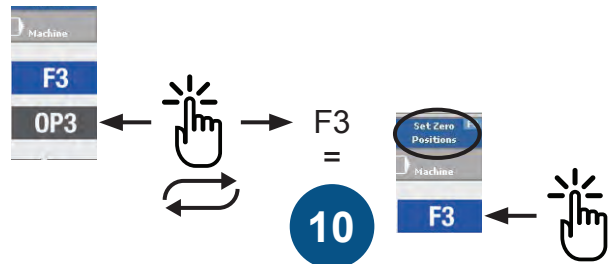
7



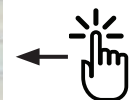
8



9



11



11

Z ≠ 0

Z = 0

12



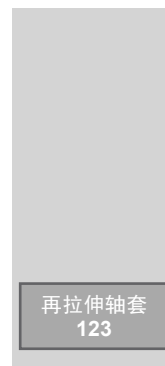
13



R5



14



R3



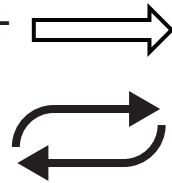
15

16

X.XXXXXX

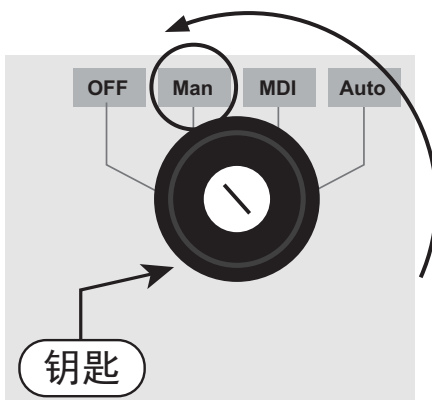


+

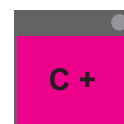


仅打磨表面和半径范围时，Sleeve OD = 套筒实际外径 + 0.002 inches (0.05 mm)。这一操作使磨轮通过外径区域。

17

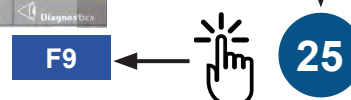
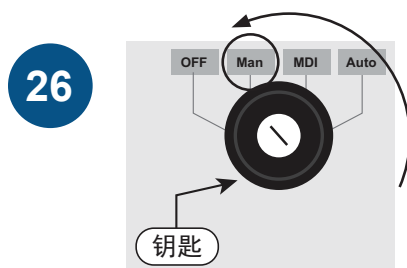
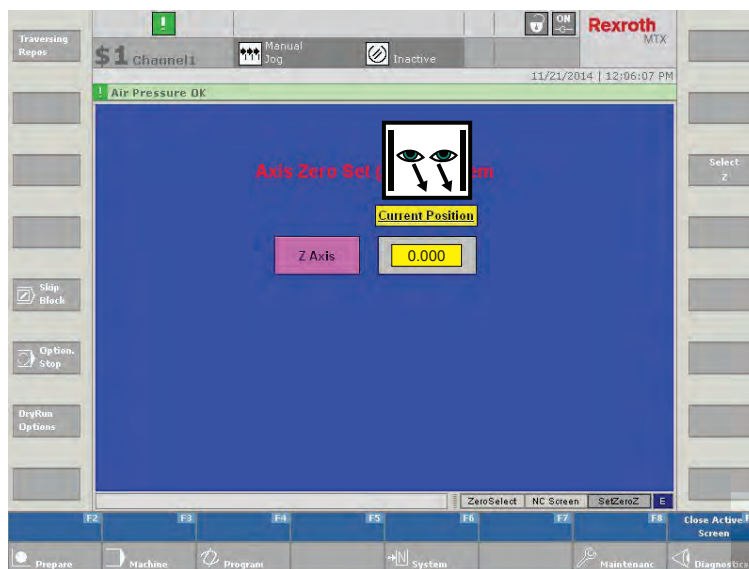
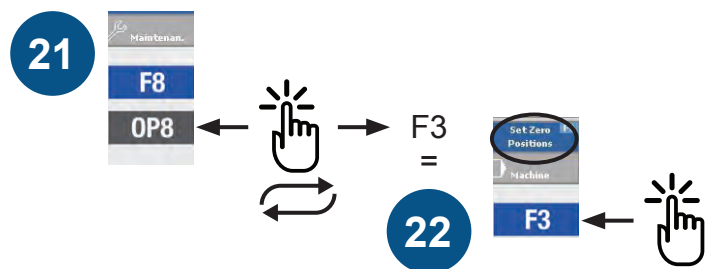
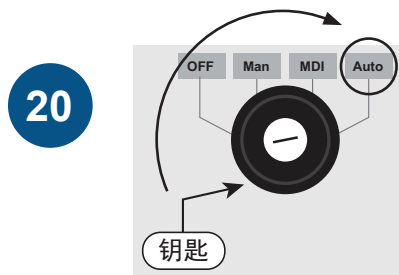
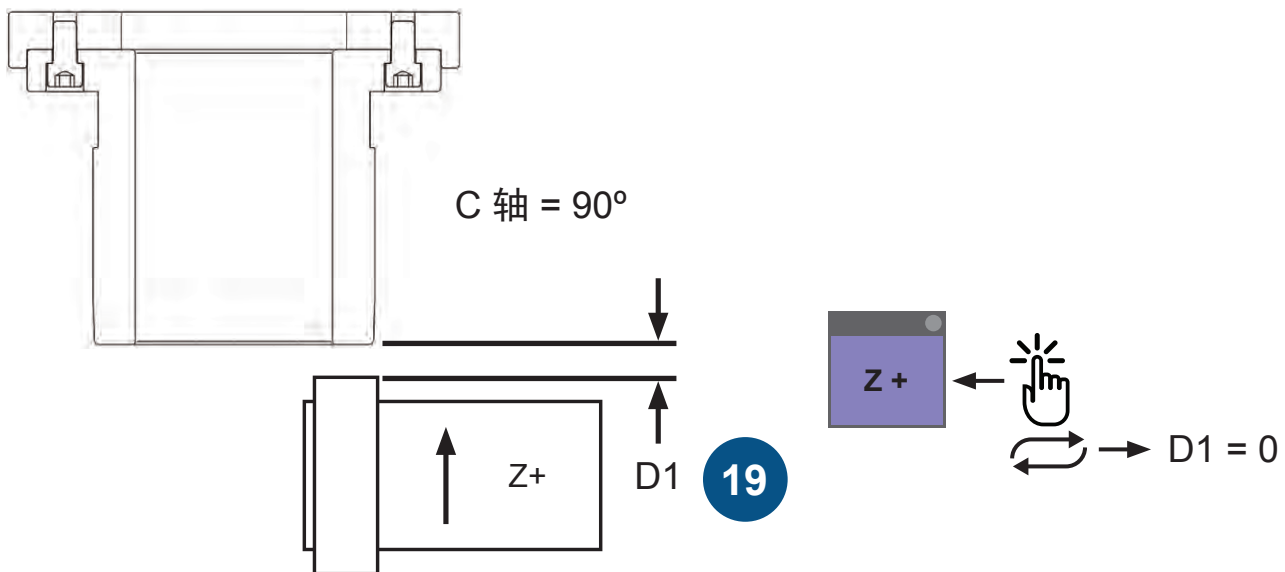


18

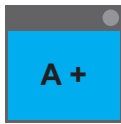


→

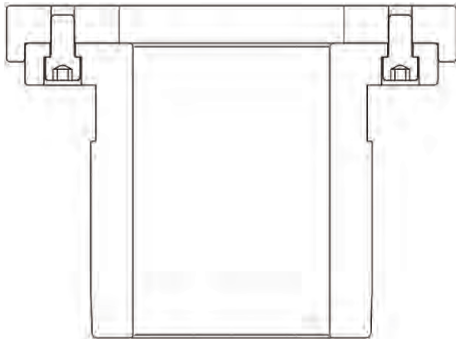
C = 90°



27

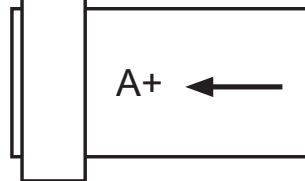


$D2 = 0$



1 mm (0.040 inches)

$D2$



Set A In Face

Set A Out Face

Set A In Radius

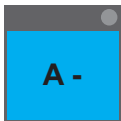
Set A Out Radius

Set A In OD

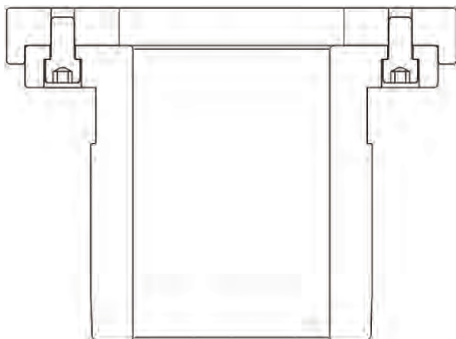
Set A Out OD



28

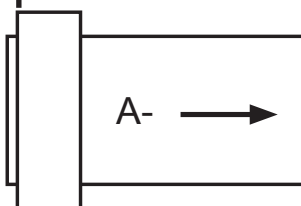


$D3 = 0$



1 mm (0.040 inches)

$D3$



Set A In Face

Set A Out Face

Set A In Radius

Set A Out Radius

Set A In OD

Set A Out OD

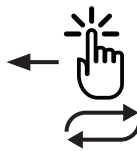
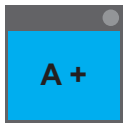


29

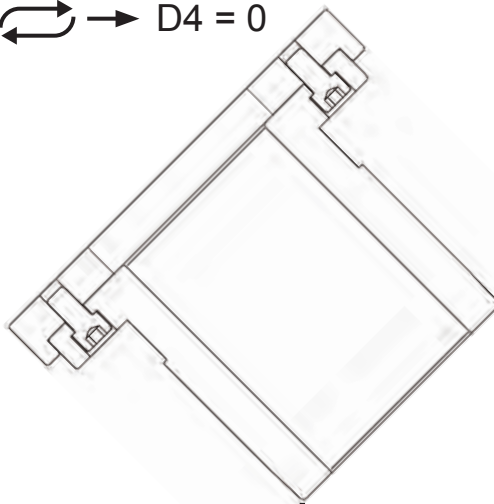


$40^\circ < C < 50^\circ$

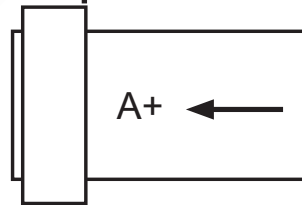
30



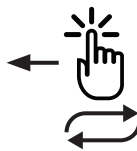
$D4 = 0$



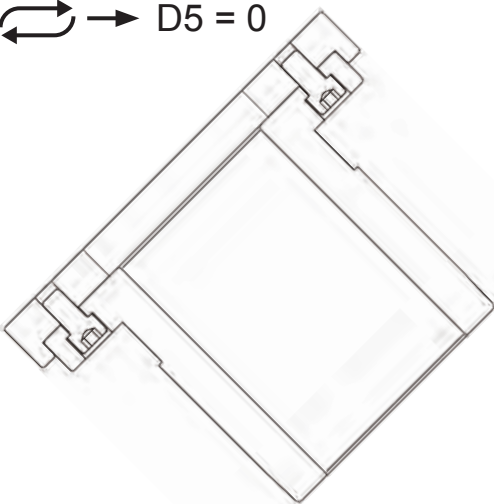
$D4$



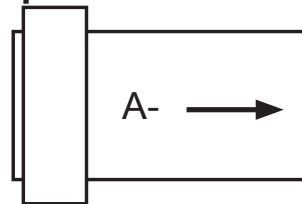
31



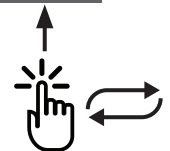
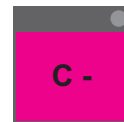
$D5 = 0$



$D5$

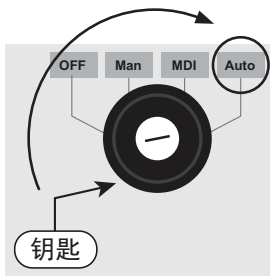


32



$C = 0^\circ$

33



Redraw Sleeve 123

Program Select F/R Program Select OD

Sleeve OD: ##### A Position: ####

Sleeve+Fix Length: ##### A In Face: ##### Set A In Face

Sleeve Radius: ##### A Out Face: ##### Set A Out Face

Tooling Ball: 12.7 A In Radius: ##### Set A In Radius

Taper: ##### Deg A Out Radius: ##### Set A Out Radius

Grind Increment: ##### A In OD: ##### Set A In OD

Grind Passes: ### A Out OD: ##### Set A Out OD

Grind Dwell: ###

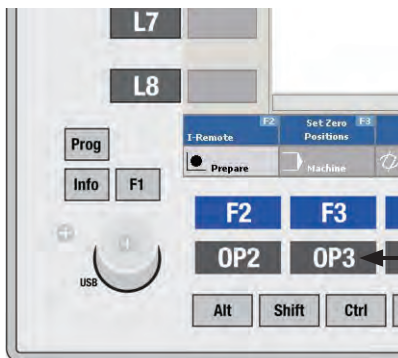
34



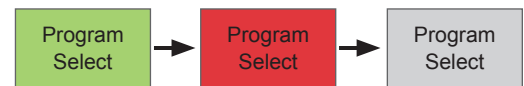
35



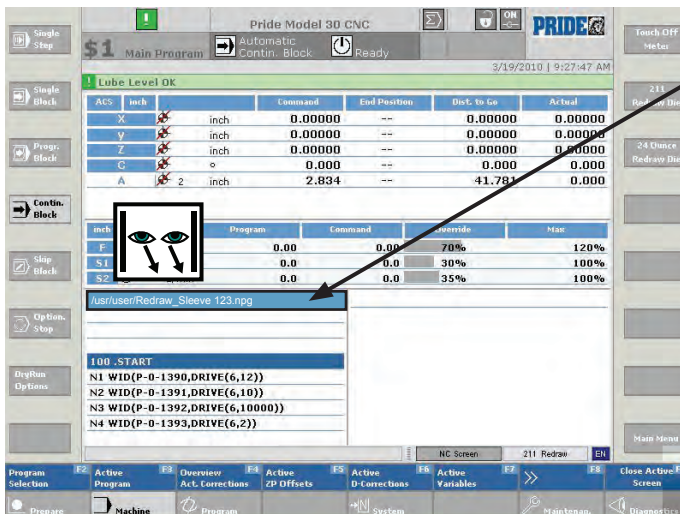
37



36



38



/usr/user/Redraw_Sleeve 123.ngp ?

36

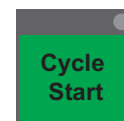


≠

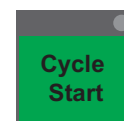
=

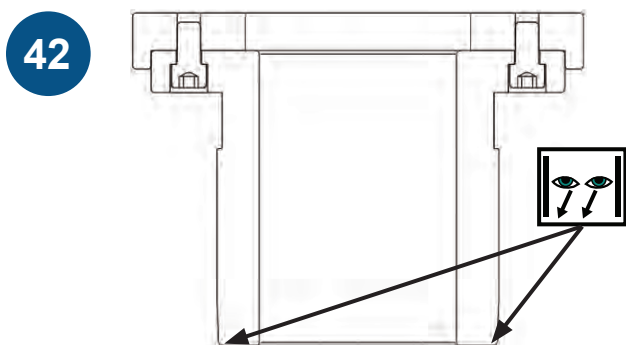
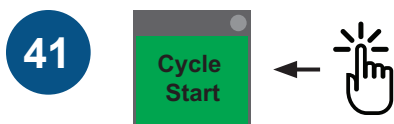


39

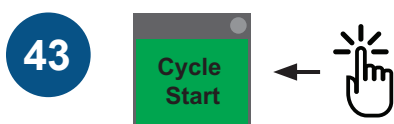


40

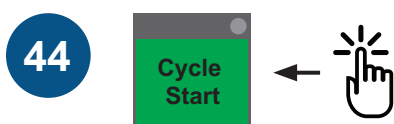




i 若需要其他打磨，则暂停机器循环，对表面进行检验。



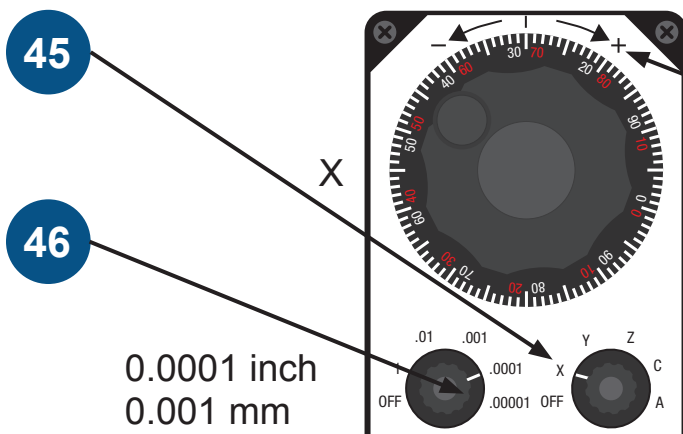
i 开始 A 轴振动，并将磨轮推动至再拉伸套筒表面。



i 这将启动手轮。

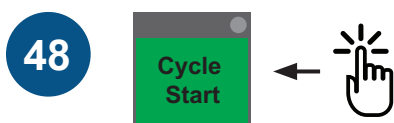


i 注意！切勿由“Auto”位置移动钥匙。若您由此位置移动钥匙，则程序会重新开始。



47

i 以 (+) 方向转动刻度盘，根据需要进行其他打磨操作，从而清理表面。



i 切断手轮电源并继续打磨程序直至完成。

3.8.4.2 再拉伸套筒打磨 - 表面和半径和外径范围

1

安装再拉伸套筒至打磨固定装置内。紧固星型螺栓，直至固定装置轻微保持再拉伸套筒。



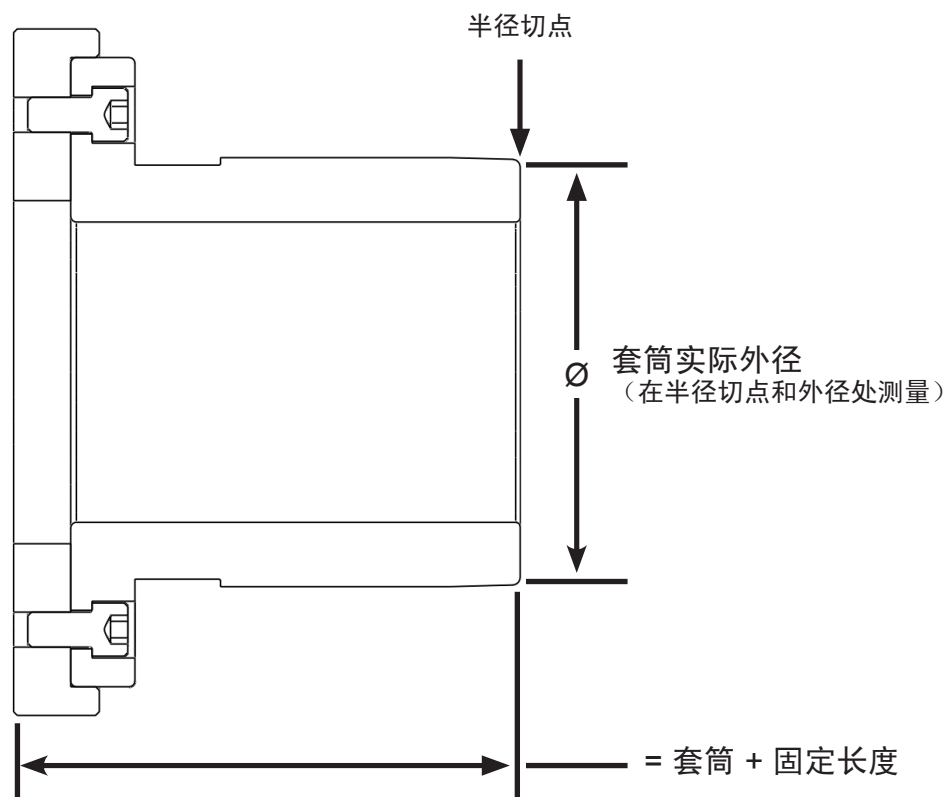
请注意这些说明以再拉伸套筒为例。需要针对您正在设置打磨的再拉伸套筒选择适当程序。

2

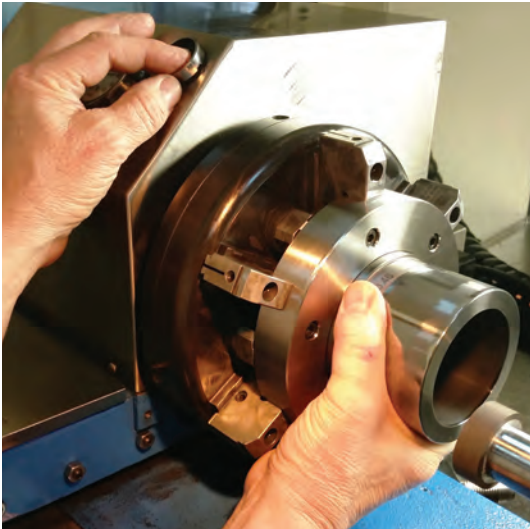
测量下述尺寸规格，输入再拉伸套筒程序。



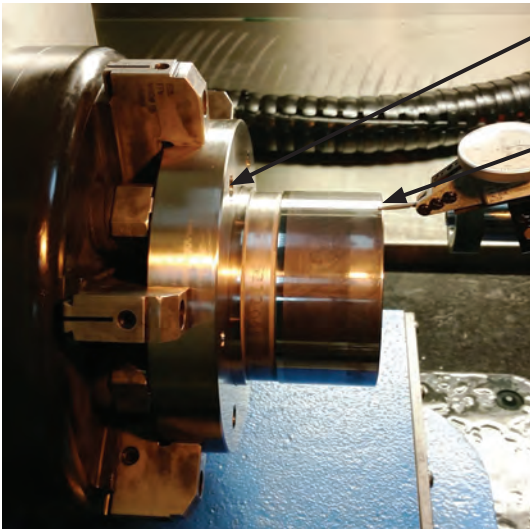
再拉伸套筒需要使用长心轴（Pt. No. 6-183）。



3



4



充分松弛固定装置螺丝，因而下推操作使套筒移动至固定装置内。

千分表触及套筒顶侧。

旋转套筒并注明高低点，然后确定千分表摆动中点。

5



旋转至高点并近似推入中点。

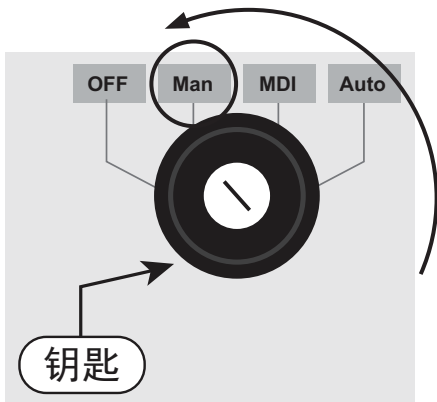
重复上述步骤，直至高低点之间的差异小于 0.0005 英寸 (0.013 毫米)。

旋转至高点并紧固最近的螺丝，直至千分表触及中点。

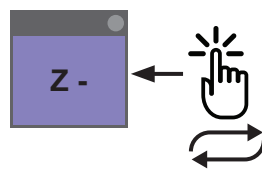
重复上述步骤，直至全部螺丝手动紧固且套筒运行至中心处。

注：稍微旋松螺丝提升低点。

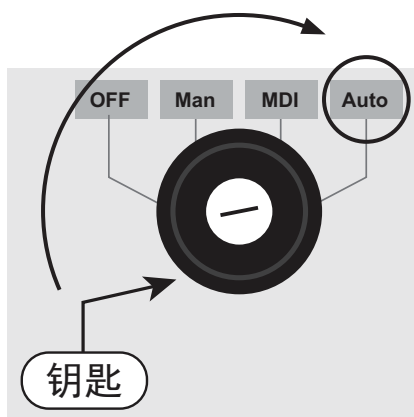
6



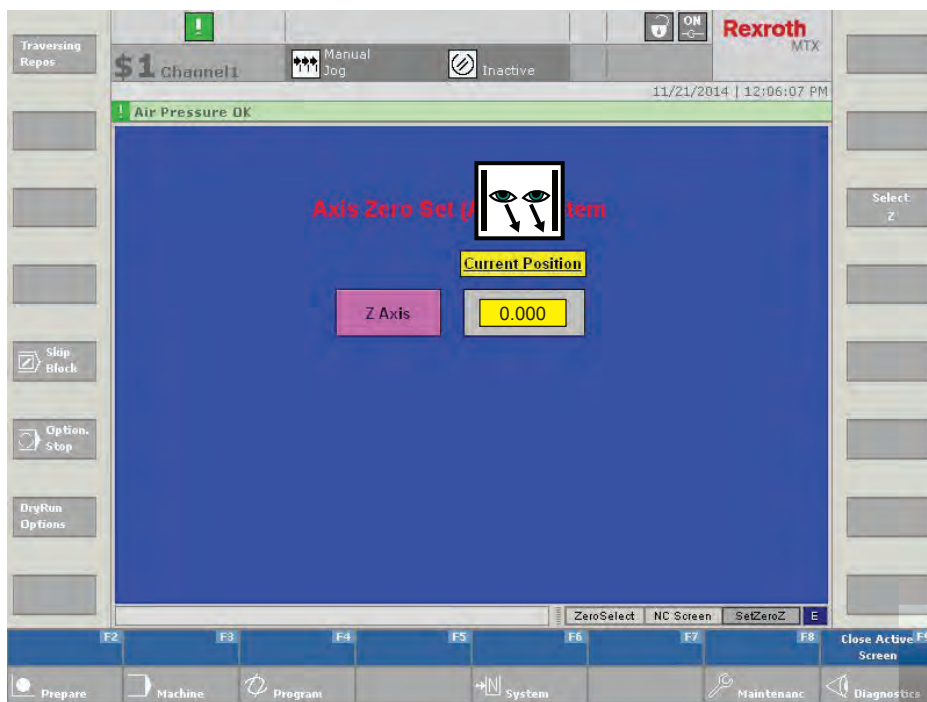
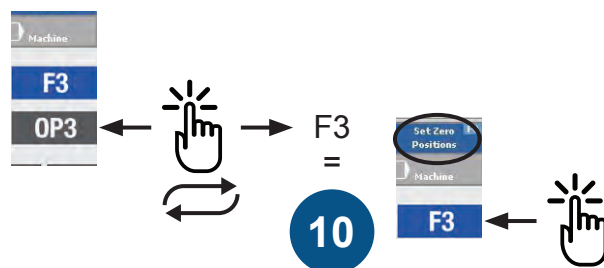
7



8



9



11

11

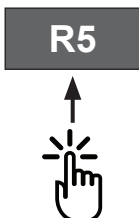
Z ≠ 0

Z = 0

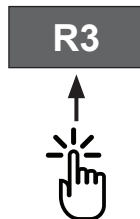
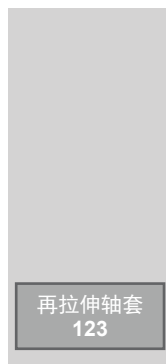
12

F9

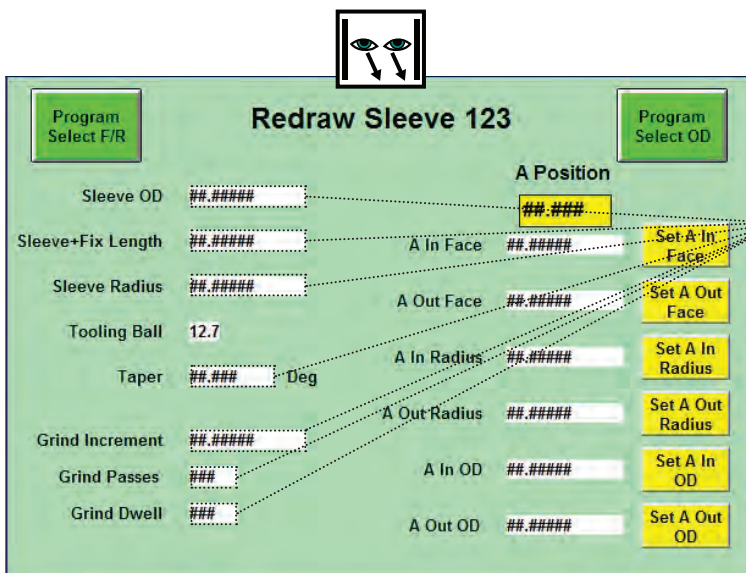
13



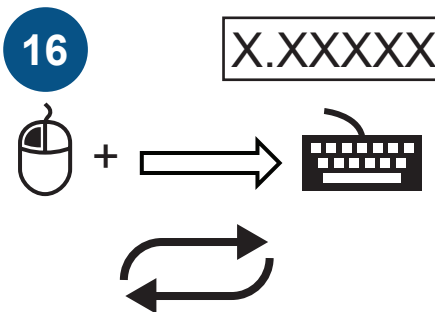
14



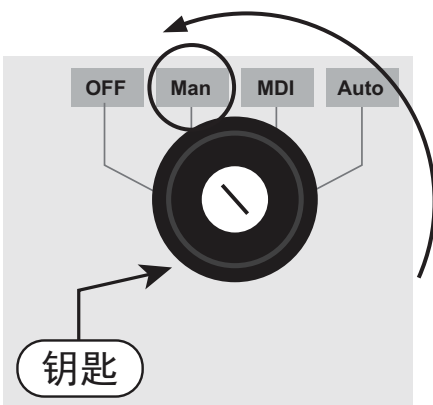
15

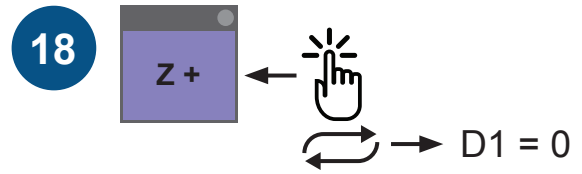
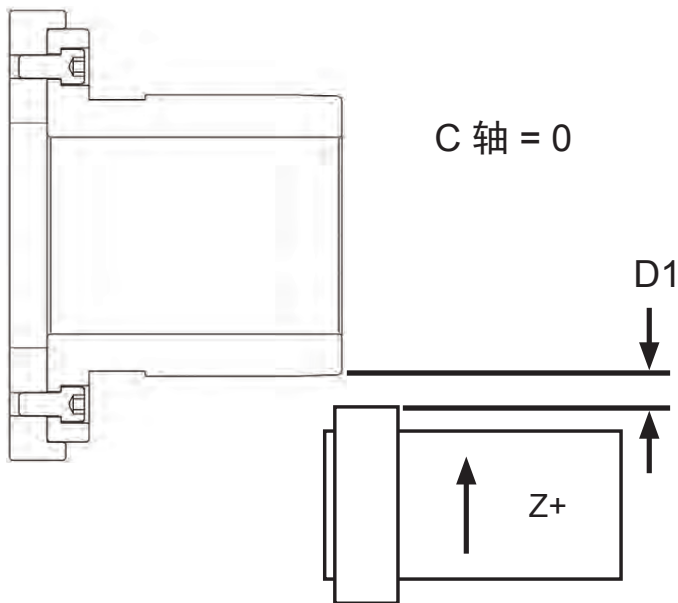


16

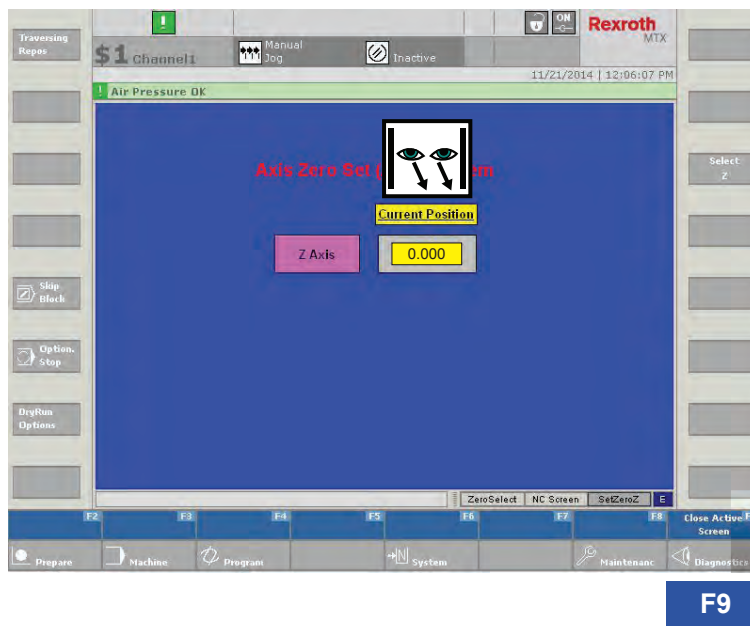
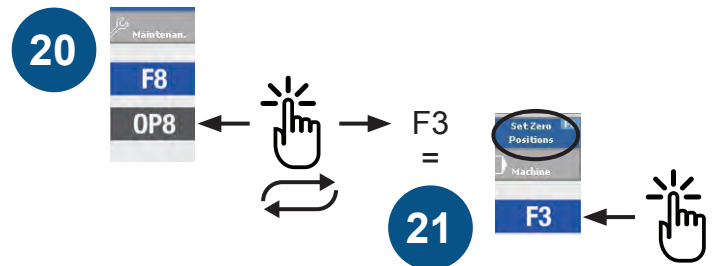
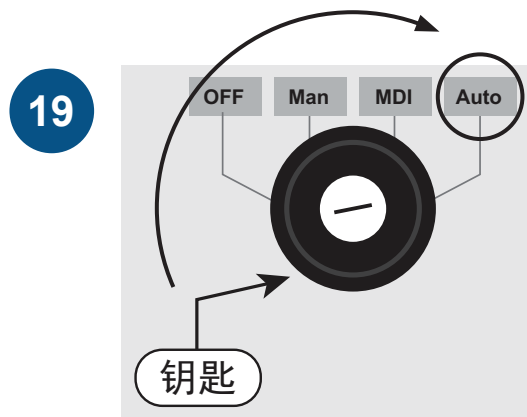


17



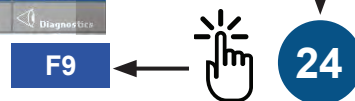


i 触发靠近外径至半径切线的磨轮。

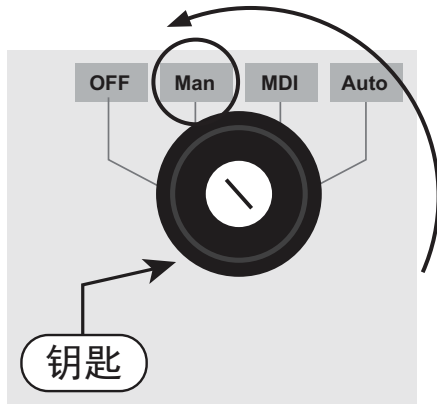


Z ≠ 0

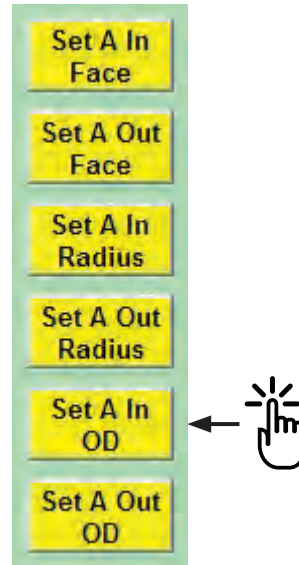
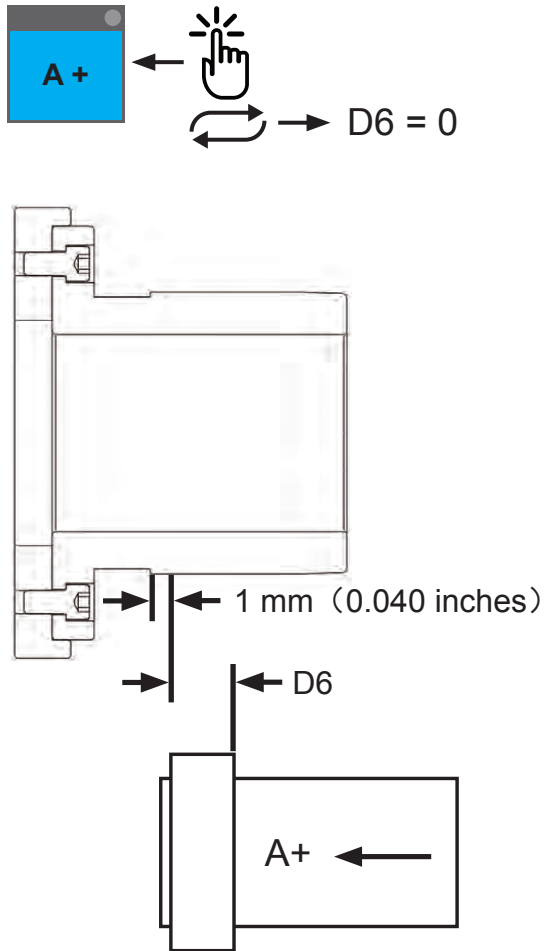
Z = 0



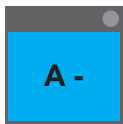
25



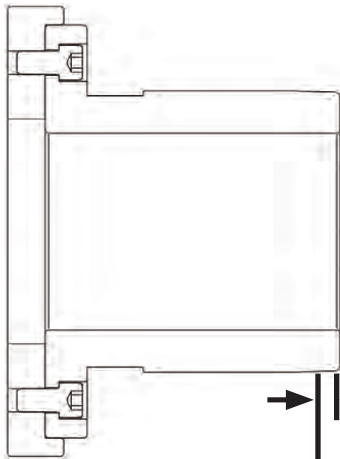
26



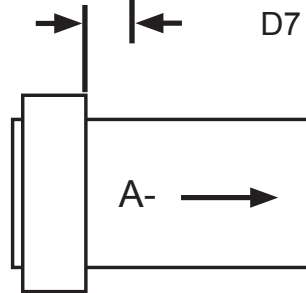
27



$D7 = 0$



1 mm (0.040 inches)



Set A In Face

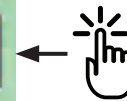
Set A Out Face

Set A In Radius

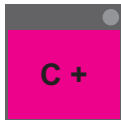
Set A Out Radius

Set A In OD

Set A Out OD

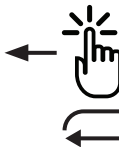


28

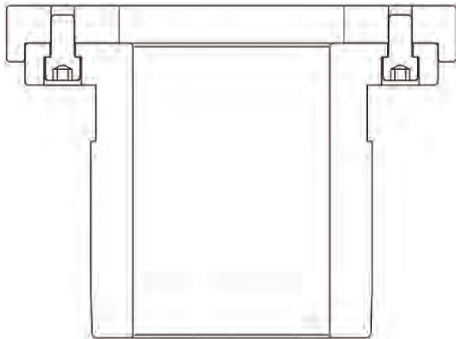


$C = 90^\circ$

29

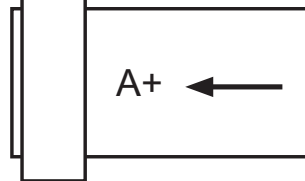


$D2 = 0$

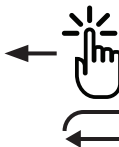
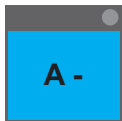


1 mm (0.040 inches)

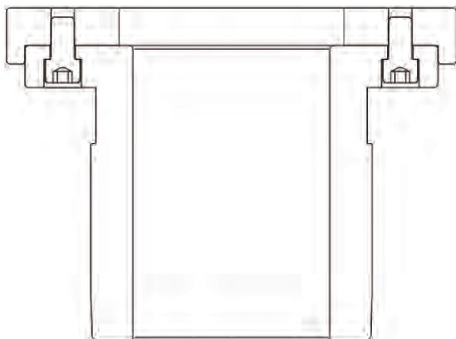
$D2$



30

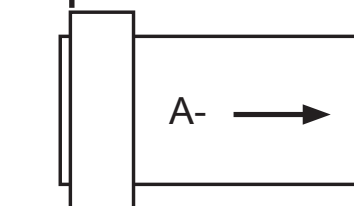


$D3 = 0$



1 mm (0.040 inches)

$D3$

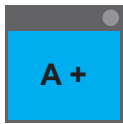


31

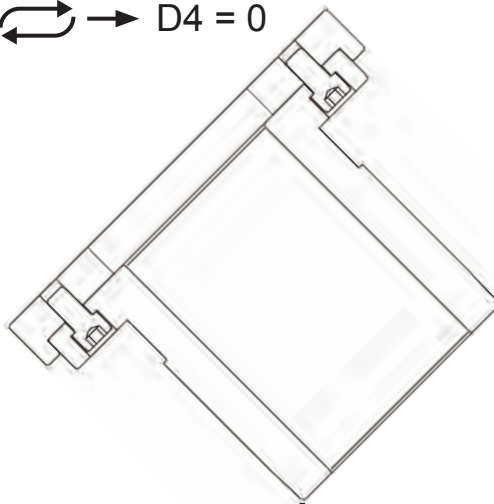


$40^\circ < C < 50^\circ$

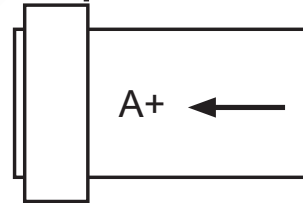
32



$D4 = 0$



$D4$



Set A In Face

Set A Out Face

Set A In Radius

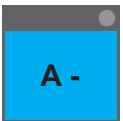
Set A Out Radius

Set A In OD

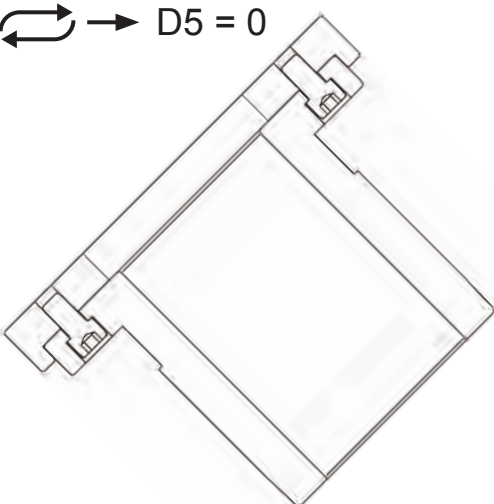
Set A Out OD



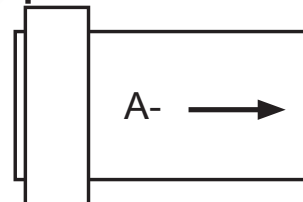
33



$D5 = 0$



$D5$



Set A In Face

Set A Out Face

Set A In Radius

Set A Out Radius

Set A In OD

Set A Out OD



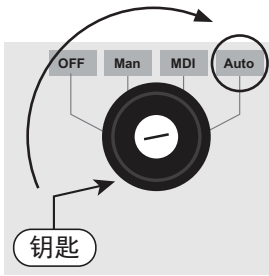
34



$C = 0^\circ$



35



Redraw Sleeve 123

Program Select F/R

Sleeve OD: #####

Sleeve+Fix Length: #####

Sleeve Radius: #####

Tooling Ball: 12.7

Taper: ##### Deg

Grind Increment: #####

Grind Passes: ###

Grind Dwell: ###

A Position: ###.###

A In Face: #####

A Out Face: #####

A In Radius: #####

A Out Radius: #####

A In OD: #####

A Out OD: #####

Set A In Face

Set A Out Face

Set A In Radius

Set A Out Radius

Set A In OD

Set A Out OD

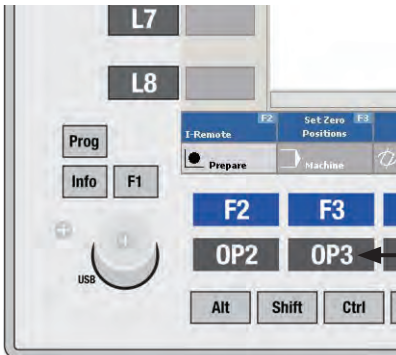
36



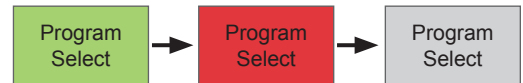
37



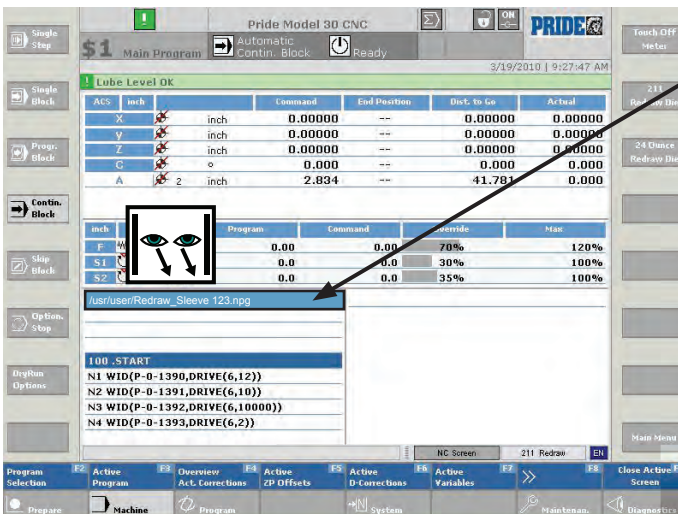
39



38



40



/usr/user/Redraw_Sleeve 123.npg ?

38

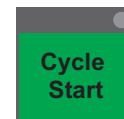


≠

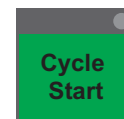
=



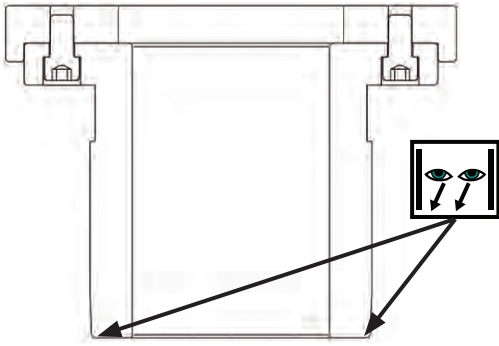
41



42

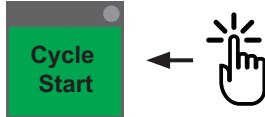


43



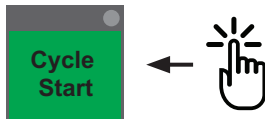
若需要其他打磨，则暂停机器循环，对表面进行检验。

44



开始 A 轴振动，并将磨轮推动至再拉伸套筒表面。

45



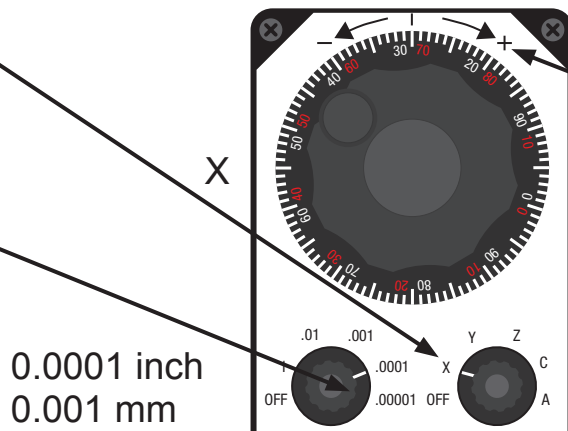
这将启动手轮。



注意！切勿由“Auto”位置移动钥匙。若您由此位置移动钥匙，则程序会重新开始。

46

47

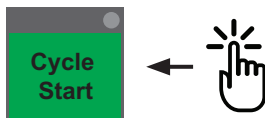


48



以 (+) 方向转动刻度盘，根据需要进行其他打磨操作，从而清理表面。

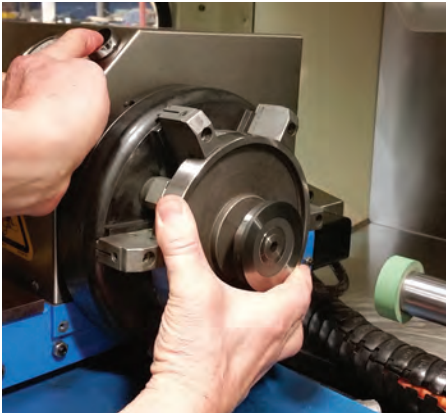
49



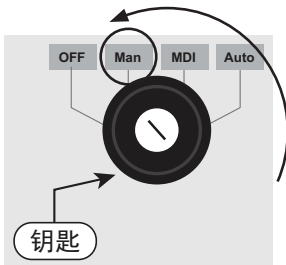
切断手轮电源并继续打磨程序直至完成。

3.8.5 修剪机刀片打磨

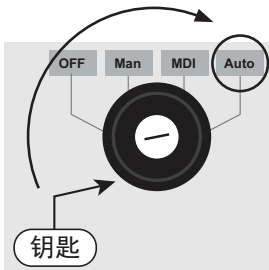
1



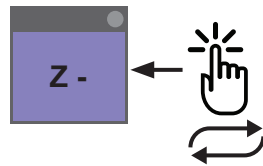
2



4

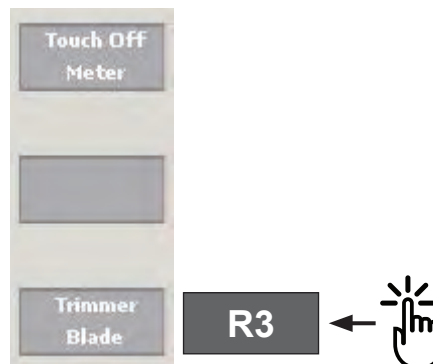


3

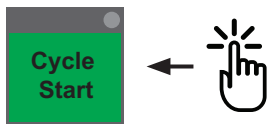


移动 Z 至无修剪机刀片的安全位置处。

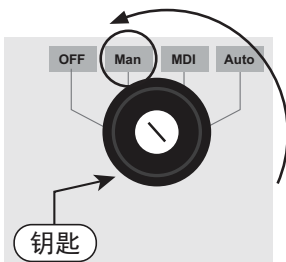
5



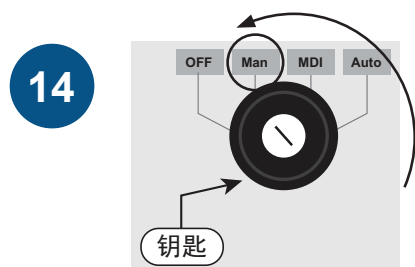
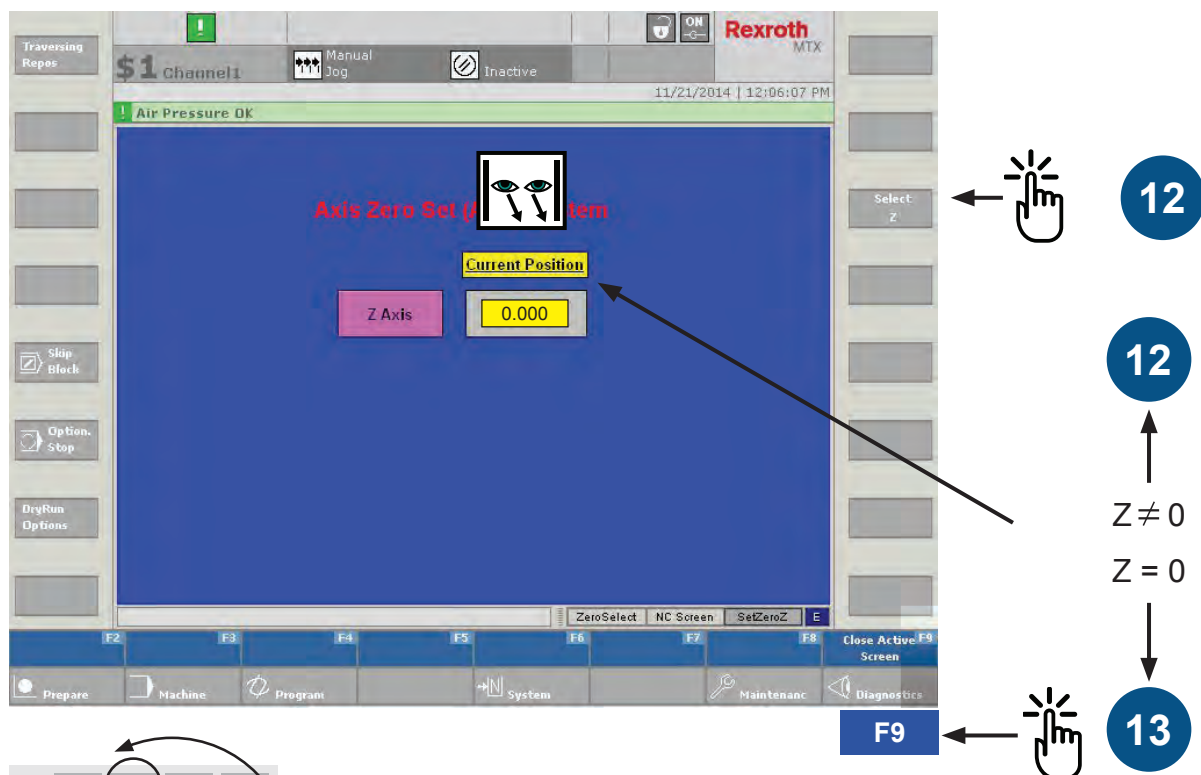
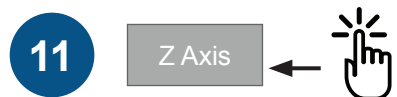
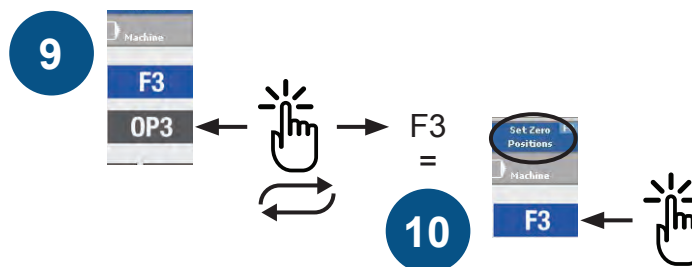
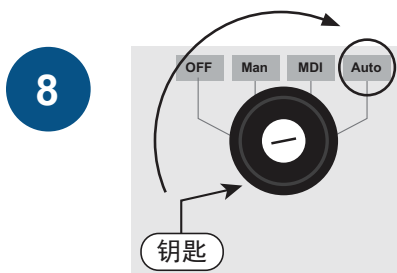
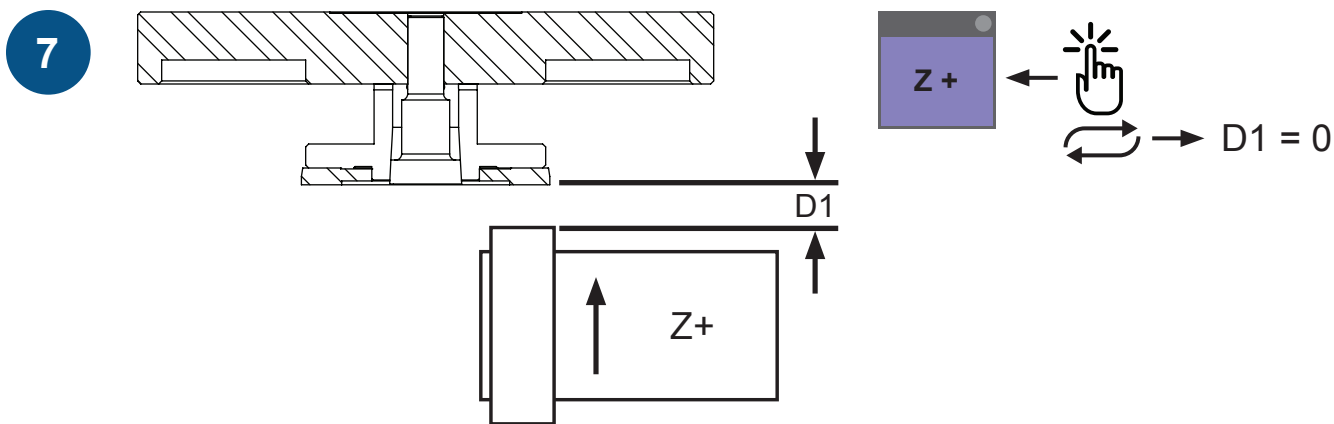
6



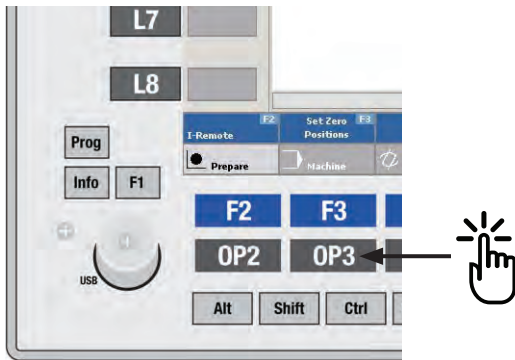
7



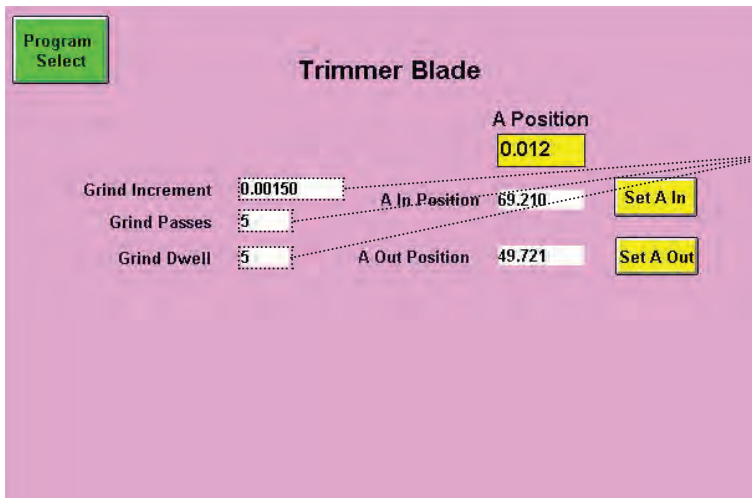
i 移动 C 轴至 90°。



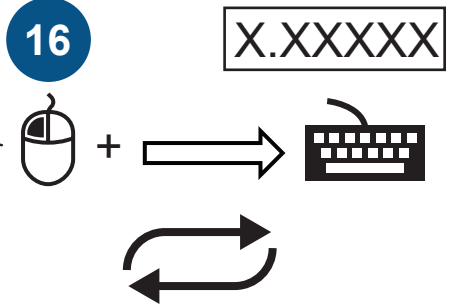
15



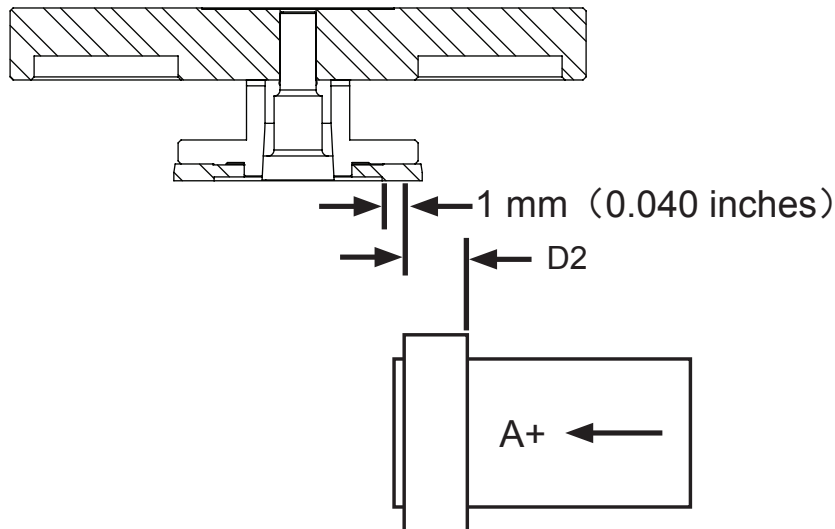
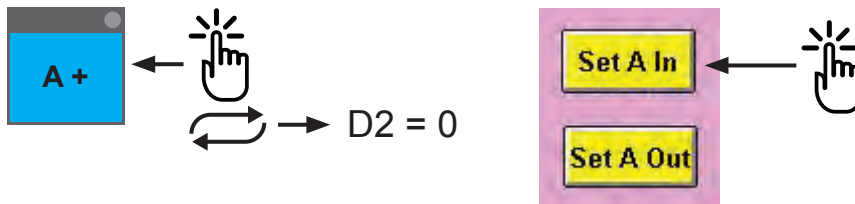
16



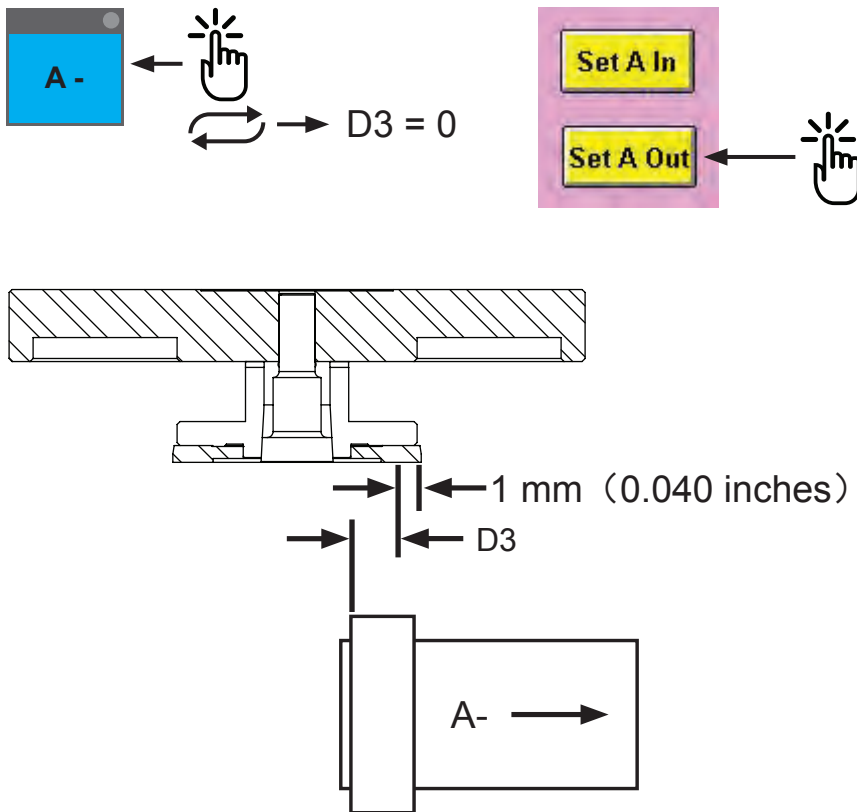
16



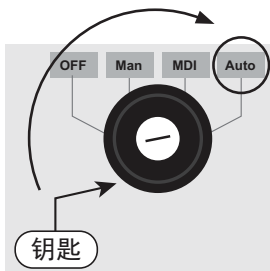
17



18



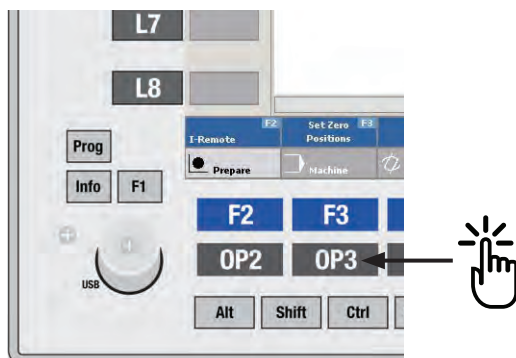
19



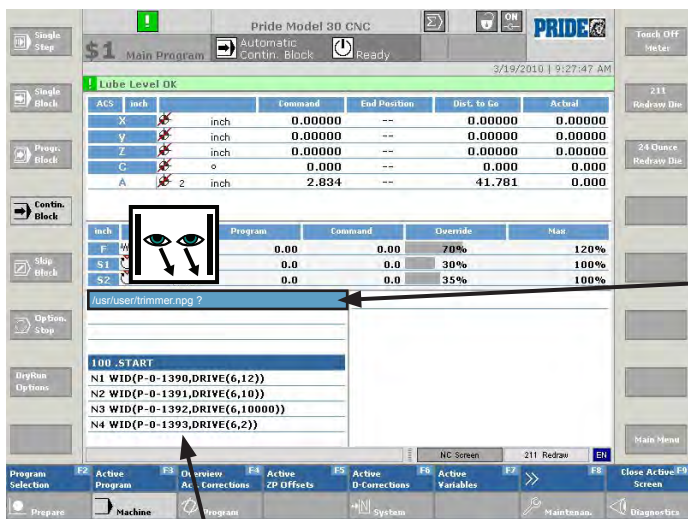
20



21



22



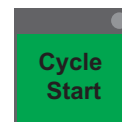
20



/usr/user/trimmer.npg ?

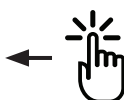
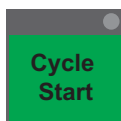


23



观察程序文本区域，立即按“Cycle Start”。

24



这将启动手轮。

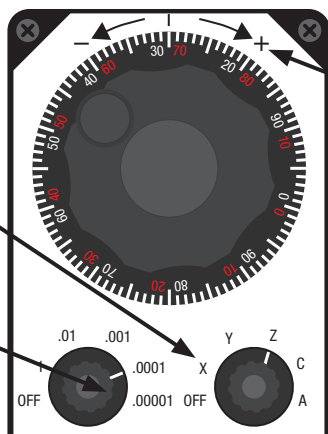


注意！切勿由“Auto”位置移动钥匙。若您由此位置移动钥匙，则程序会重新开始。

25

26

0.0001 inch
(0.001 mm)

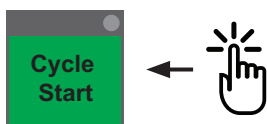


27



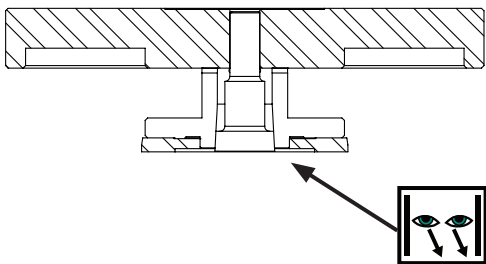
以 (+) 方向转动刻度盘，根据需要进行其他打磨操作，从而清理表面。

28



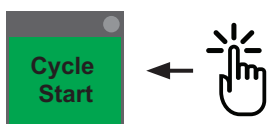
切断手轮电源并检查修剪机刀片表面。

29



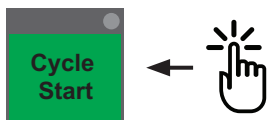
检查修剪机模具表面，确定会否需要其他打磨操作。

30



开始 A 轴振动，并将磨轮推动至修剪机刀片表面。观察程序文本区域，立即按“Cycle Star”。

31



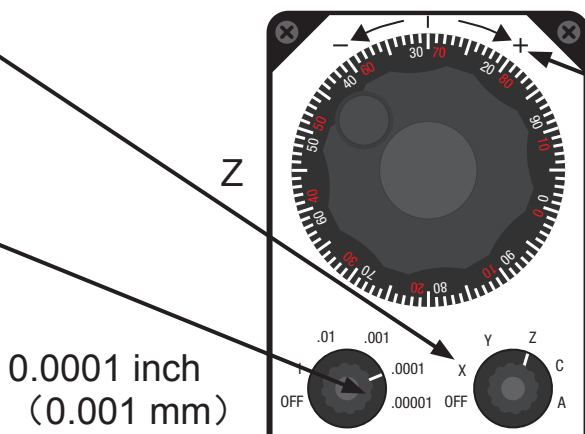
这将启动手轮。



注意！切勿由“Auto”位置移动钥匙。若您由此位置移动钥匙，则程序会重新开始。

32

33

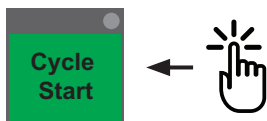


34



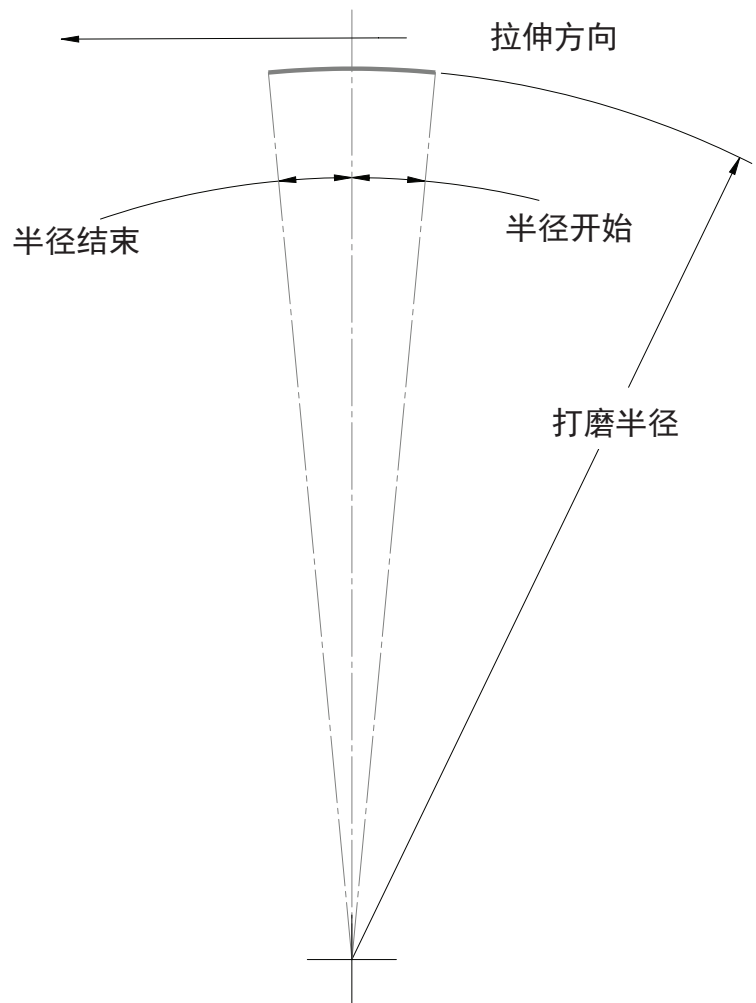
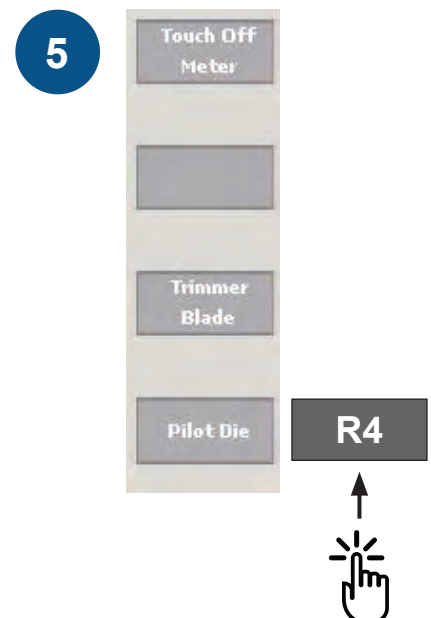
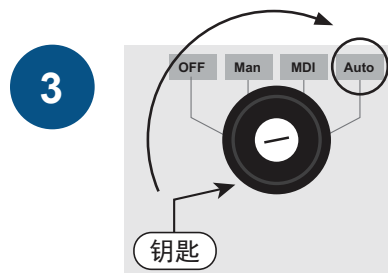
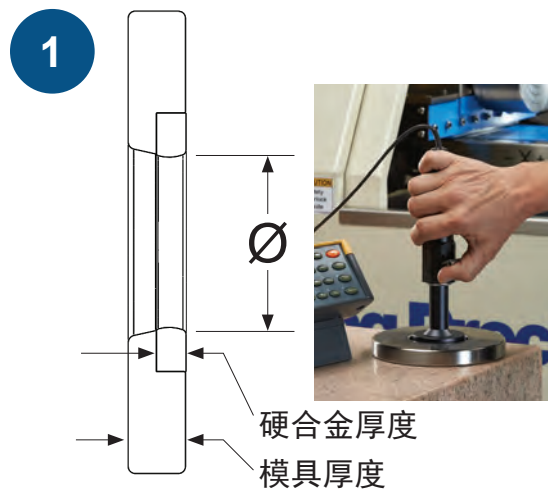
以 (+) 方向转动刻度盘，根据需要进行其他打磨操作，从而清理表面。

35

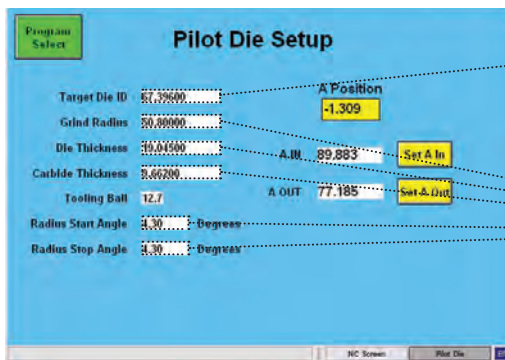


切断手轮电源并结束程序。

3.8.6 样品磨具打磨

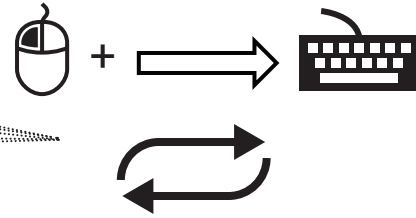


6

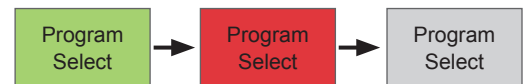
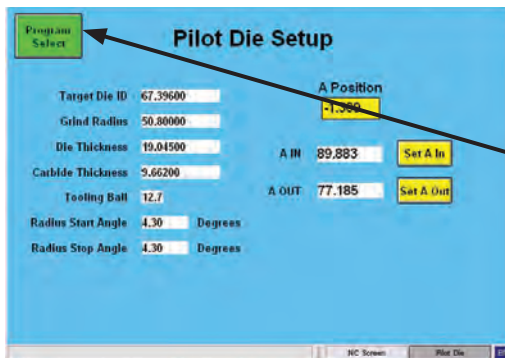


= Ø 实际

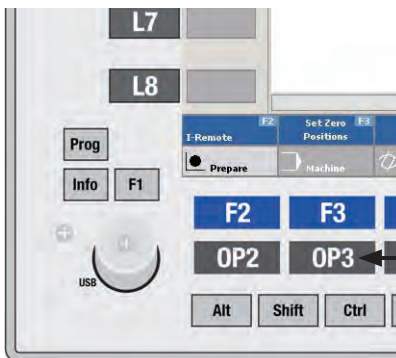
X.XXXXXX



7

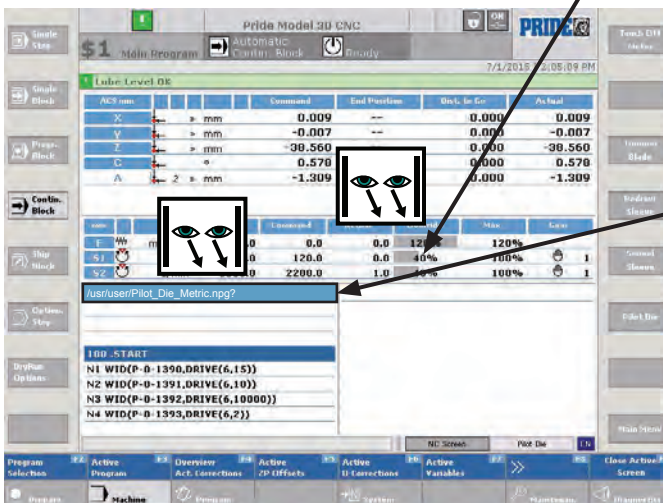


8



Override	
60%	
80%	
80%	

9



7

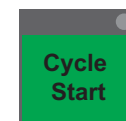


≠

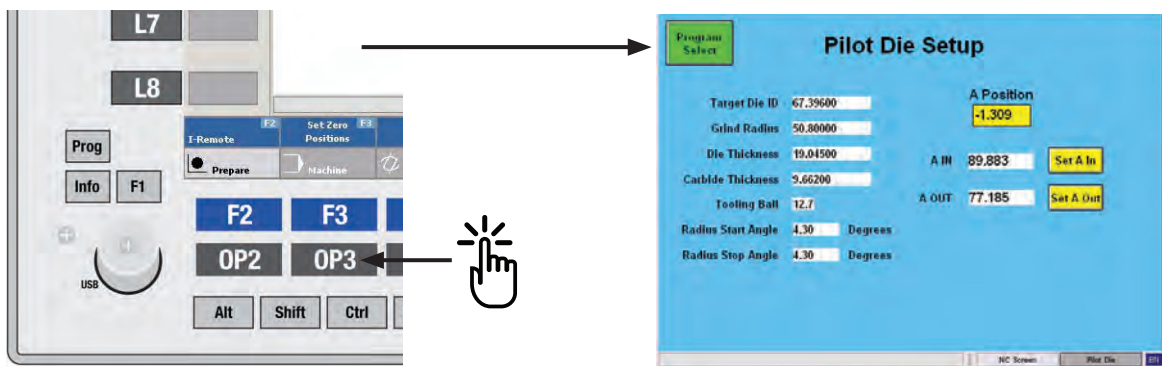
=



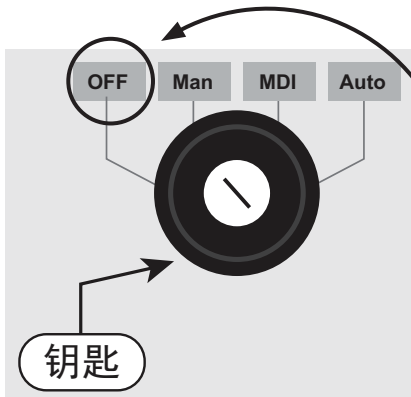
10



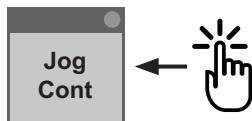
11



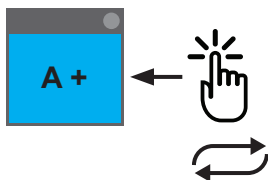
12



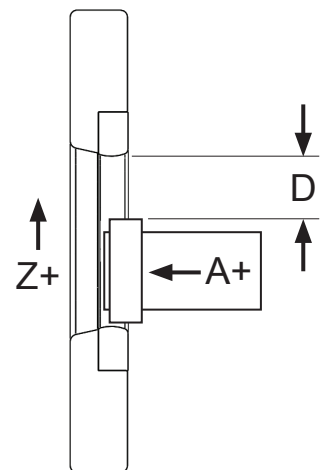
13



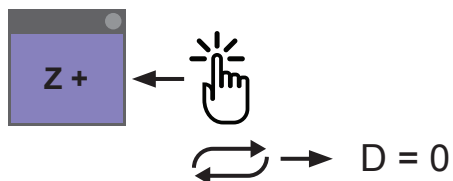
14



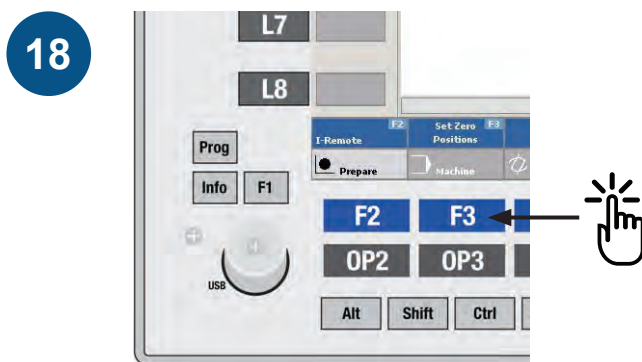
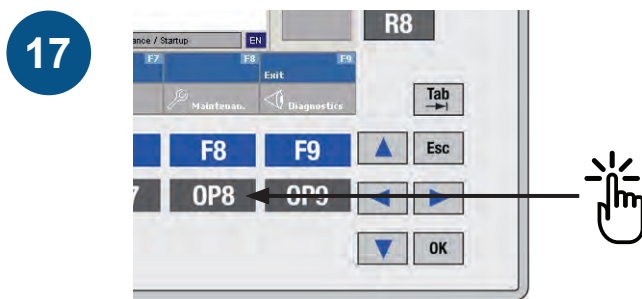
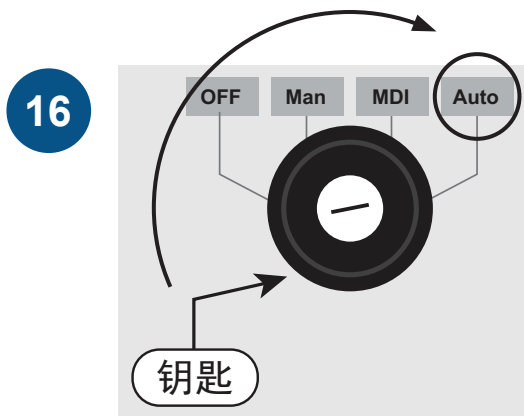
微进给 **A+** 至样品模具硬合金厚度中心上的中央磨轮处。

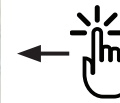
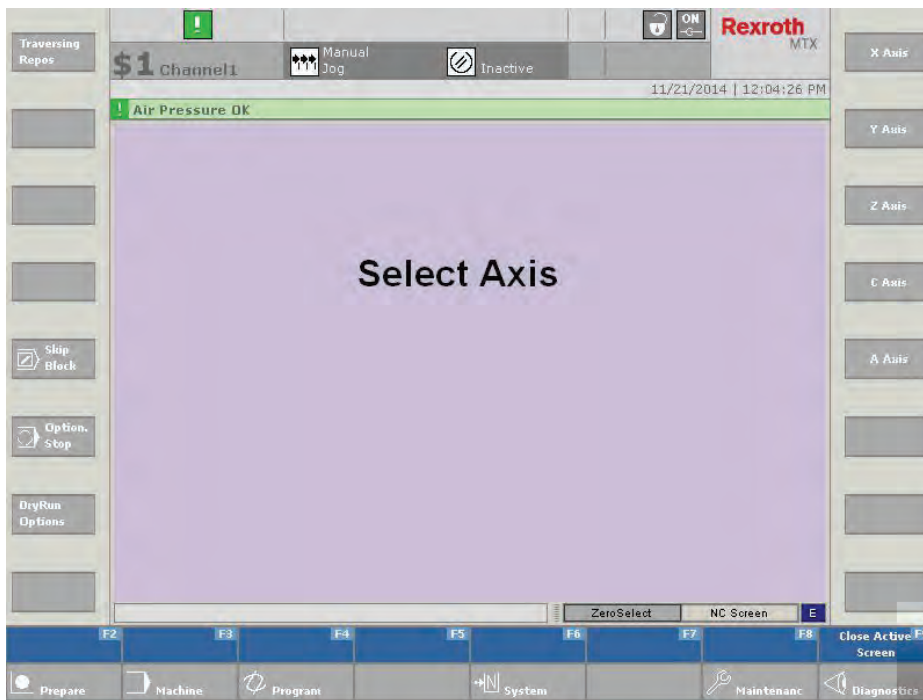


15

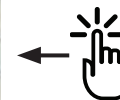
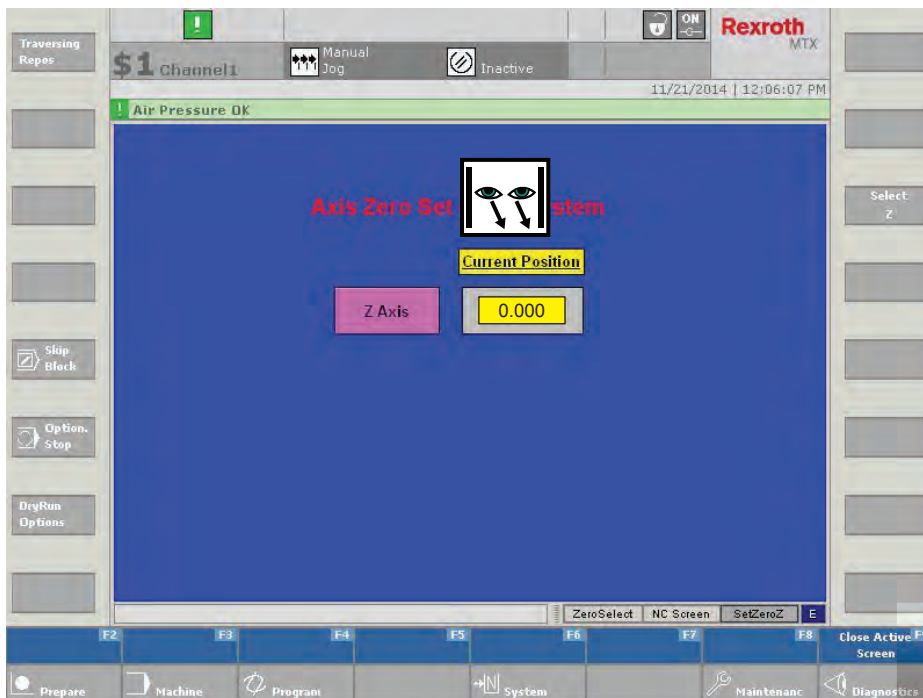


使用 **Z+** 微进给键时手动旋转工件，从而移动磨轮，直至磨轮接触工件并由于接触旋转的工件而开始旋转。磨轮需仅接触工件全程旋转的大约 **25%**。





19



20

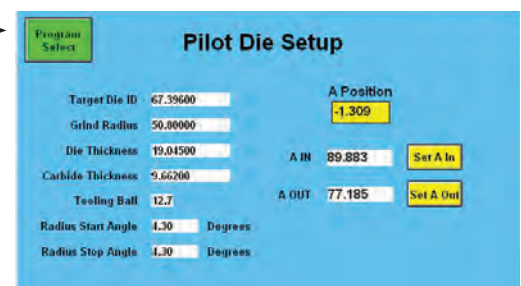
20
Z ≠ 0
Z = 0



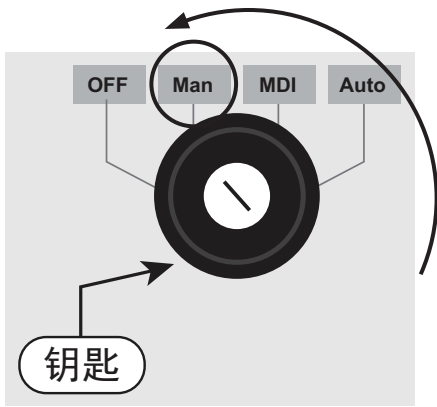
21



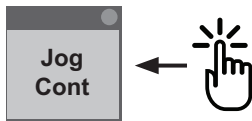
22



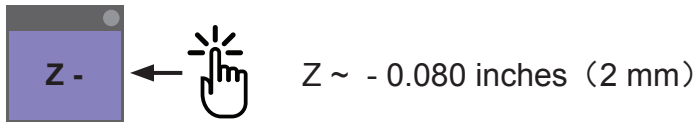
23



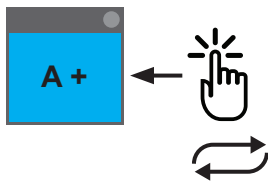
24



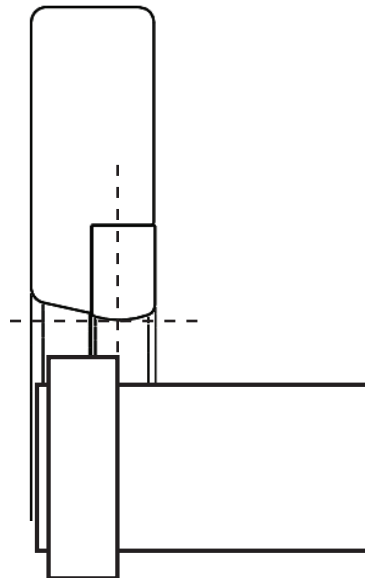
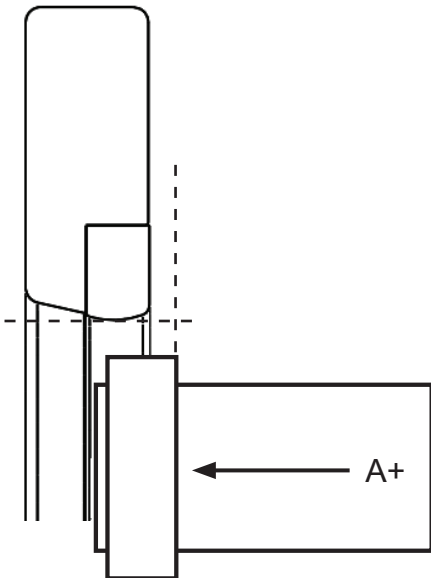
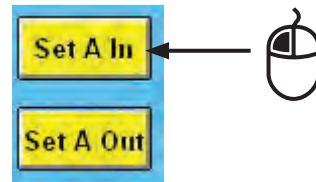
25



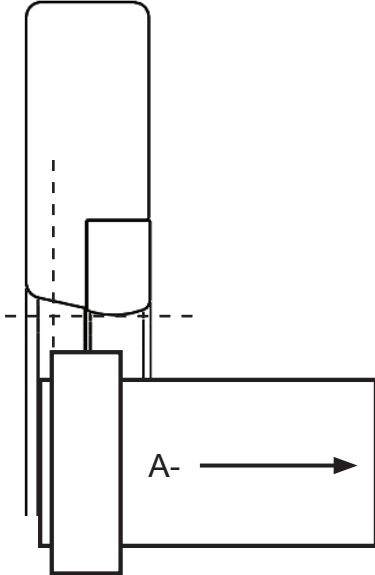
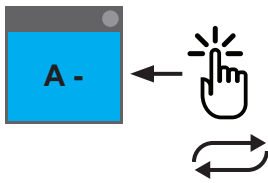
26



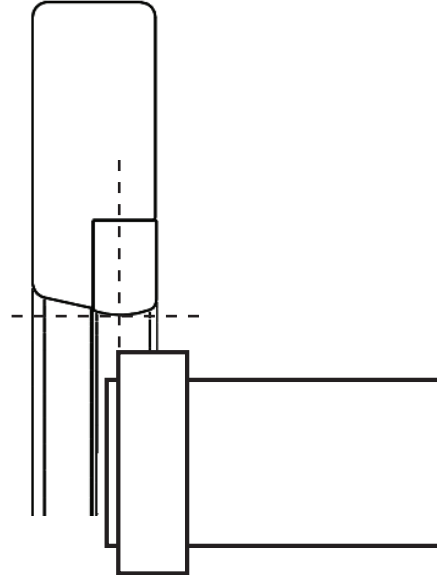
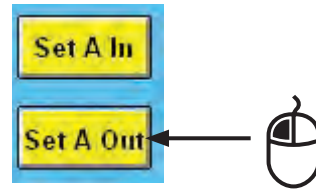
27



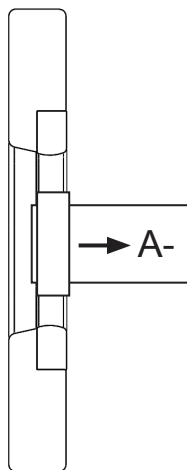
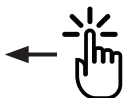
28



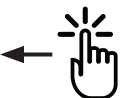
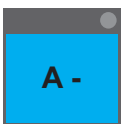
29



30

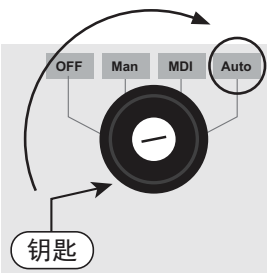


31



微进给 **A-** 直至停止。到达 **A** 轴行走端时，控制器可能会显示错误。

32

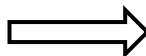


X.XXXXXX

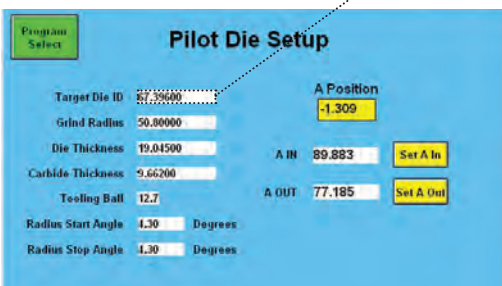
输入目标内径



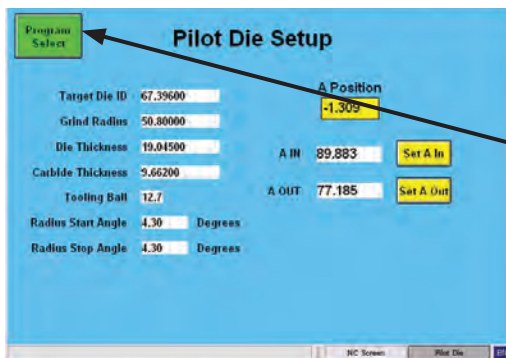
+



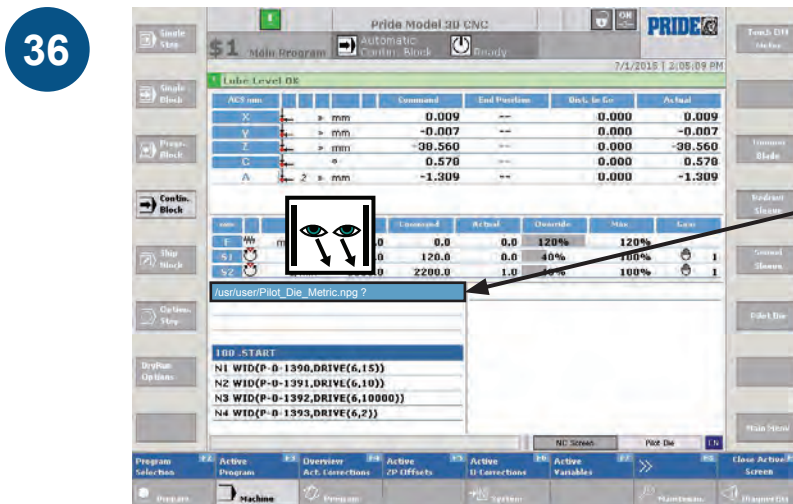
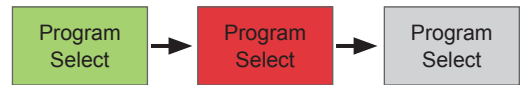
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请注明我们建议取下足量材料，使模具内径增加 **0.0004 - 0.0006 inches (0.010-0.015 mm)**。



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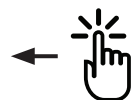
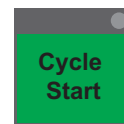
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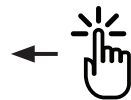
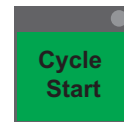
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3.9 故障排除

3.9.1 操作员水平故障排除主题

下述指南提供了帮助排除潜在风险的方法。
操作工可以强调的主要问题：

- 低润滑油
- 低气压
- 通过重启主控制器而强调的错误。
- 门打开造成的安全联锁错误。

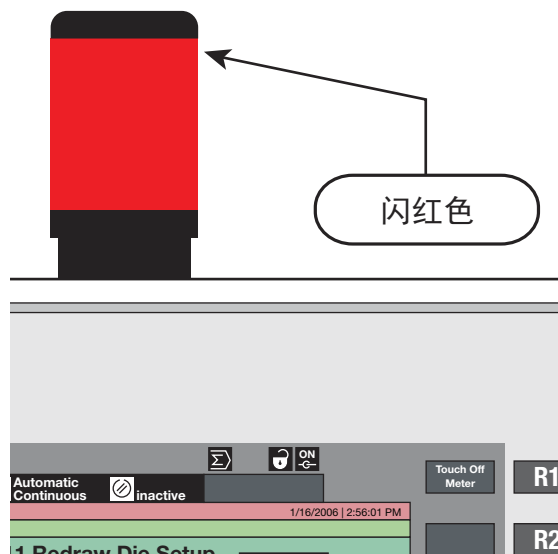
强调要求接触电气箱的错误信息仅允许合格人员执行。

3.9.2 熟练人员水平故障排除主题

要求隔离电源等错误（例如电气和压缩错误）仅允许由接受安全隔离电源的适当流程方面的合格人员执行。参阅维护部分。

3.9.3 清除错误

有时会发生机器碰撞等错误。发生错误时磨床将关闭，操作工也会得到通知。操控台顶部的工作指示灯会闪红色 而不是绿色，控制屏幕上也会出现一条错误信息。屏幕上的每个错误信息会以红色突出显示，如下所示：“Low AP Work Head”。错误共有三类：机器错误，控制器错误和驱动器错误。机器错误信息从屏幕上的信息就能很容易识别。下面所示的错误信息就是一个描述工作头上气压过低的示例。控制器错误和驱动器错误可通过两个诊断手册确定，诊断手册可通过“打开”屏幕上的图标访问。控制器错误可通过“**Rexroth IndraMotion MTX Diagnosis Messages**”确定。驱动器错误可通过“**Rexroth IndraDrive Trouble Shooting Guide**”帮助确定。





一旦出现错误，磨床会关闭，在问题解决前无法重新启动磨床。在这个例子中，直到工作头上的空气供给达到最低要求（70 磅/平方英寸或 4.8 巴）时磨床才会重新启动。当机械碰撞或驱动器超负荷时，磨床将会停止工作，绿色工作指示灯会变为红色。错误可能源于控制器或者某个驱动器。

1. 发生错误时，点击 Diagnostics (OP9) 图标，控制屏幕上会出现错误日志。



2. 点击 Diagnostics (OP9) 图标后，会出现一个错误列表窗口。处理控制屏幕上显示的问题。在这个例子中，应增加工作头上的空气供给。

如果发生驱动器错误，例如由于突然断电引发的错误，诊断屏幕上会显示如下所示的“SERCOS”错误。



这些“SERCOS”错误是由于突然断电引起的，例如按下“紧急停止”所引起的突然断电，或者断路器，或保险丝跳闸。



紧急停止开关



断路器



熔断器

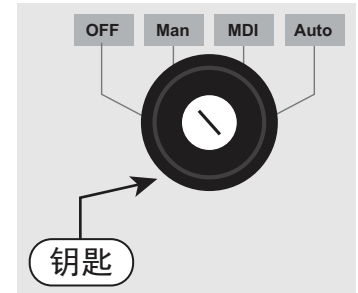
如果需要，在“Rexroth IndraDrive Trouble Shooting Guide”或“Rexroth IndraMotion MTX Diagnosis Messages”手册中查询错误代码（此屏幕上为 F2026）。

3. 左击任一错误，然后左击屏幕底部的“Delete Square” (F4)，或者按下“Clear Error”。如果错误信息不再出现，说明错误解决且磨床可重新启动。如果错误继续存在，必须加以处理。



4. 将钥匙拧至“Man”模式。

5. 按下“Power On”，直到按键上角的小绿灯常亮再松开。如果按键灯常亮，则可以清除诊断屏幕上的错误信息，便可恢复磨床的运行。如果绿灯没有常亮，进行如下操作。



6. 如果“Power On”按钮上的绿灯没有常亮，磨床及其 Windows® 系统的电脑控制器必须重新启动。如同关闭所有 Windows® 系统的电脑一样，通过“Start”菜单关闭 Windows® 控制器。控制器关闭后，用总电源开关关闭磨床电源。总电源开关位于磨床的右侧控制面板门上。打开电源，控制器将会启动。



3.10 电源中断

电源中断会造成机器关机。一旦电源恢复，则需重启主控制器。打磨过程中电源中断最有可能造成工件损坏。检查确保磨轮或其他机器部件无损坏。

若您经历气动轴承气压中断超过 12 小时，则依据第 4.6 部分气动轴承步骤 1-6 进行。

型号 30A

磨床

维护



4. 维护

本章旨在为您提供磨床的维护说明。

4.1 安全性



维护机器时需佩戴护目用具。



警告 - 带电部件产生的致命电击超过 50V!



仅允许经培训的合格维护人员使用主电源开关超驰。若开关超驰，则电源保持开状态。

接触设备前，以及关闭电源电压后等待至少等待 **30** 分钟，进行放电。触碰部件前检查电压是否下降至 **50V** 以下！

4.2 环境

全部液体、滤纸和过滤器需依据本地与国家环境标准进行处理。



依据本地与国家环境保护和处置要求运输并处置冷却液和润滑油。

4.3 日常维护

1. 彻底清洁磨床以便去除所有的打磨和/或金刚石粉末。



近距离观察全部区域，特别是气动轴承，确保安全操作。



切勿使用压缩空气清洁磨床。

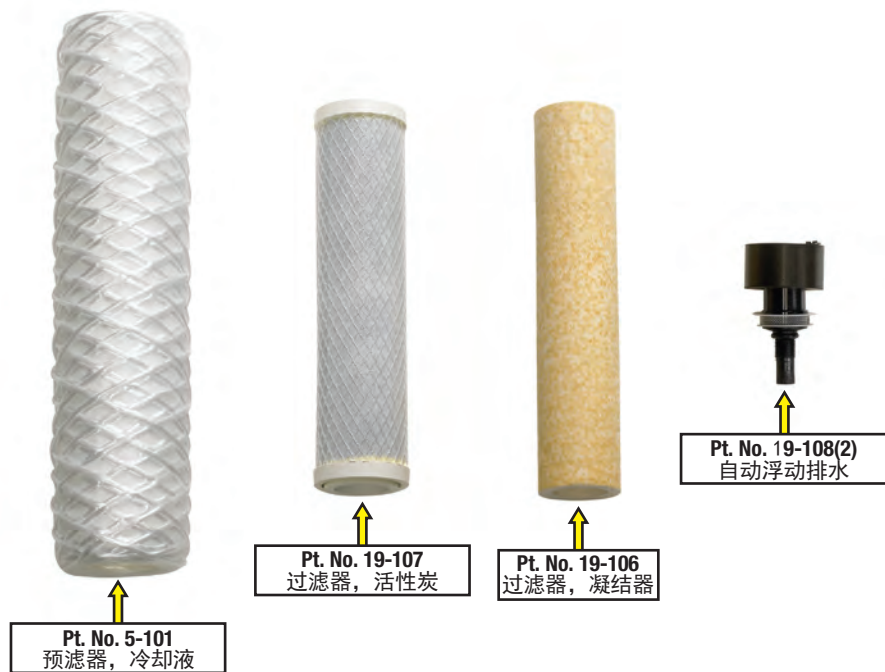
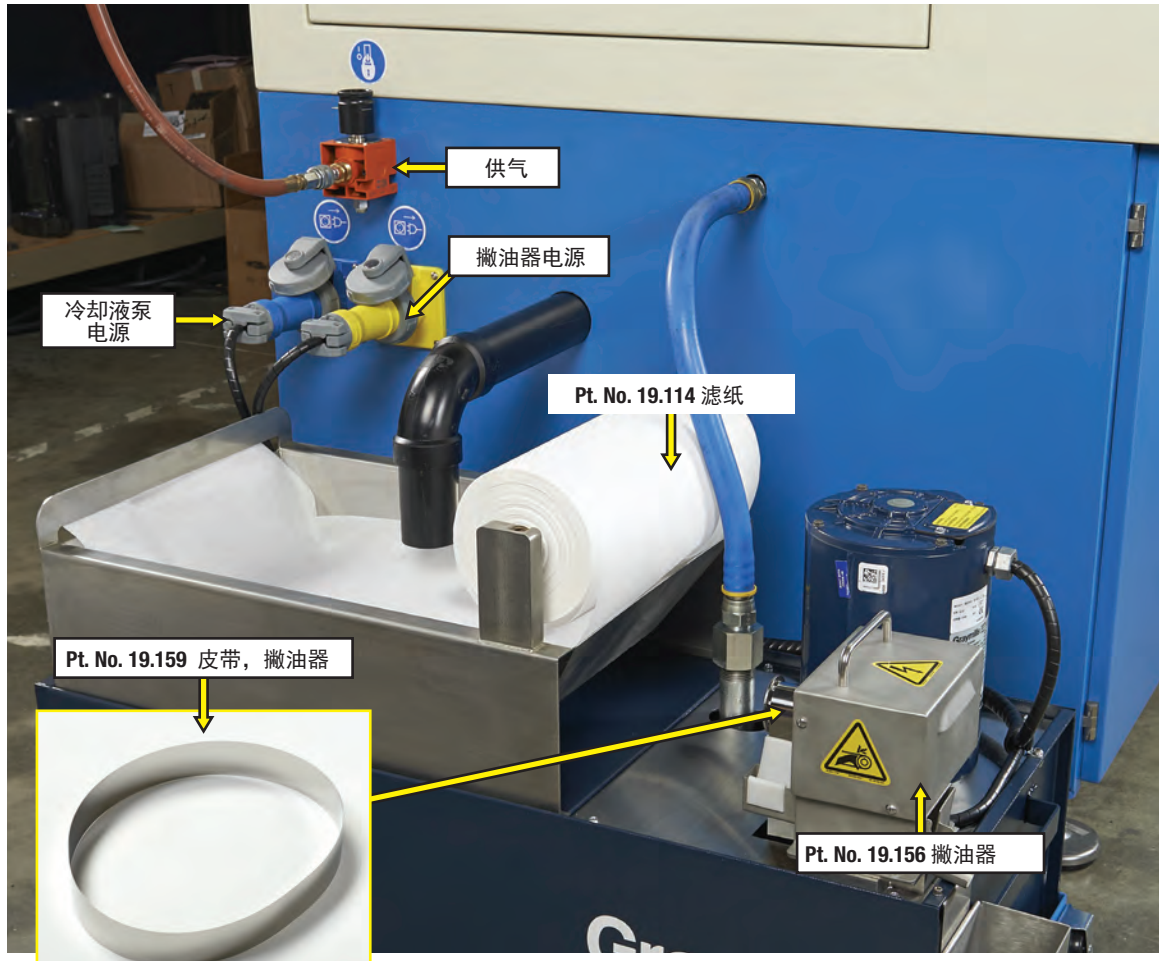
2. 检查直型和球状丝杆润滑罐是否有充足的润滑油。打开机器工作头侧下面的机柜门，您会看到油罐。直型丝杆和球状丝杆的润滑通过一个小泵自动进行，磨轮操作期间定时向滑块中注入润滑油。控制电源开启时计时器就会运行。不供电时，直型润滑系统会增压，润滑油会分配至球状丝杆和轴路径。给往复运动滑块 A 的大部分润滑油经过计量。

若油罐内的油位较低，则机器显示错误。对系统进行编程，允许磨床在检测出低油位后能够运行 30 分钟。这为完成打磨程序提供了充足的时间。油位增加且错误清除后，磨床才会运行。



润滑泵

3. 检查过滤器、撇油器带和冷却液，如有需要予以更换



4. 在整个行走范围内循环各轴（A、X、Y 和 Z），润滑全轴行走。

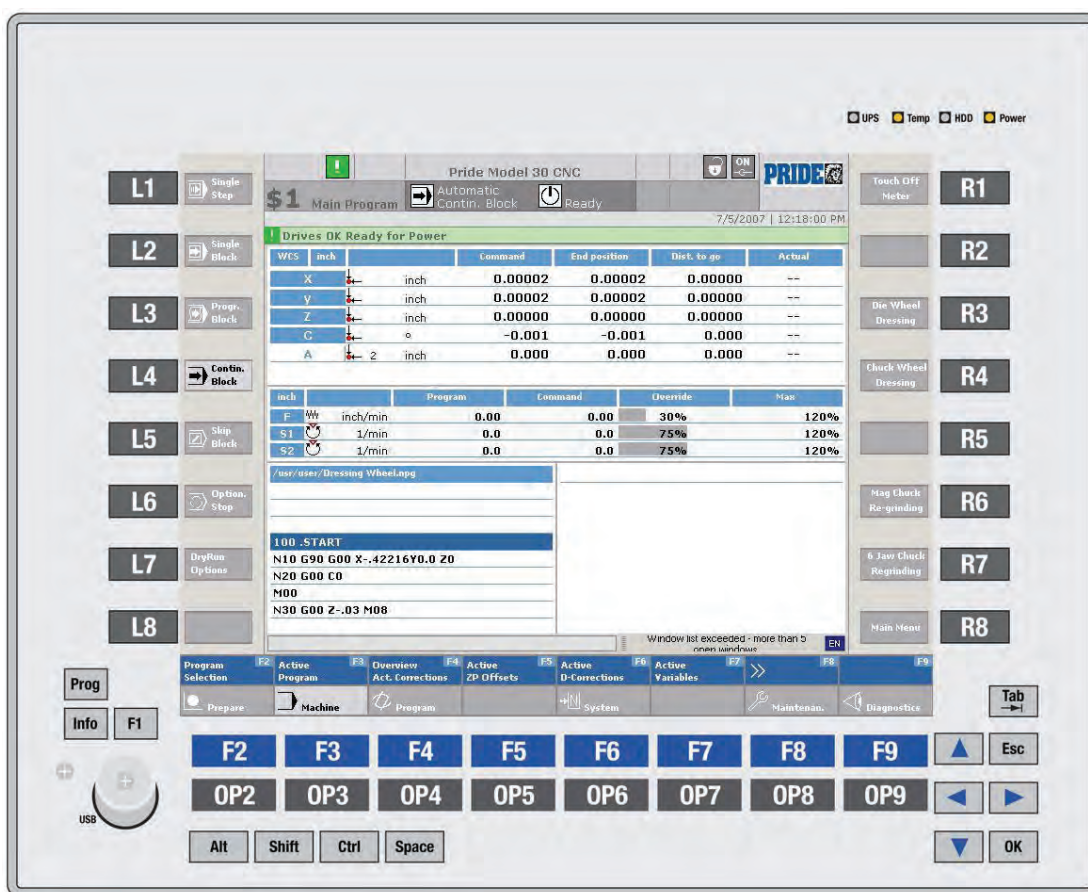
4.4 定期维护

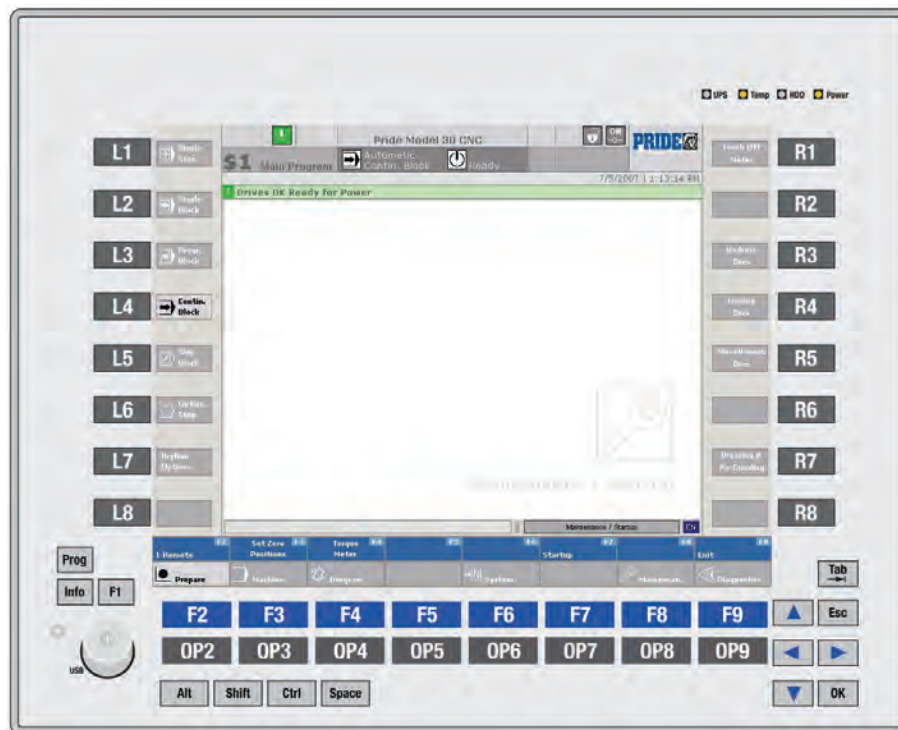
1. 每月检查磨轮头和工作头皮带。



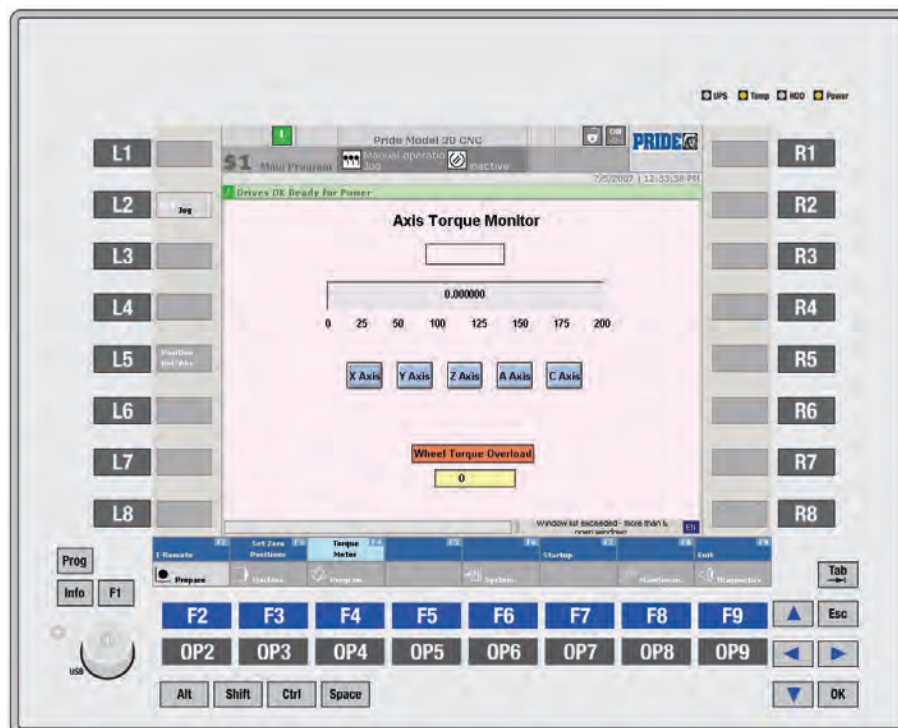
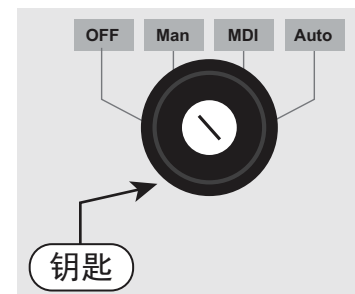
请勿过度拉紧皮带。

2. 在必要时更换空气前置过滤器，或者一年更换一次，取较早者。
3. 在需要时重新打磨磁性吸盘。
4. 按要求上紧夹条，但需小心不可过度上紧。若要设置夹条的张力：
 - a. 选择屏幕右下方的“维护”图标 (OP8)。





- b. 将钥匙置于“Man”模式，因为你将需要在用微进给键上紧夹条的同时移动滑块。
- c. 选择屏幕底部的扭矩监控 (F4) 图标。



您可以选择轴，柱状图会显示其张力。每个滑块的张力会作为每个轴上的驱动机的扭矩显示出来。柱状图上显示 100，说明夹条上的张力要求所选轴上的驱动电机扭矩达到 100%。如果张力小于 75，柱状图则显示为绿色。

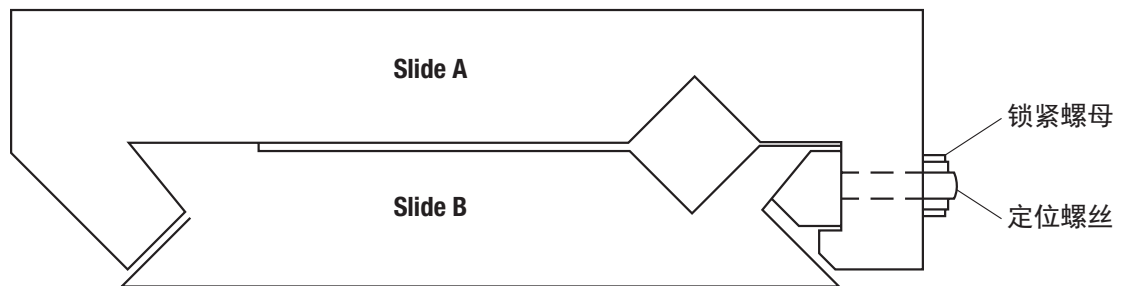
如果张力接近设定驱动机的设定负荷，会显示为黄色。

读数超过 100 说明有过热的危险，也可能烧坏驱动电机。如果夹条过紧，驱动电机就有过热的危险，柱状图就会显示为红色。

- d. 每根轴上的张力应设定使柱状图的显示大约为 75 左右。

滑块 A 属于特殊情况：

- e. 松开防松螺母和固定螺丝。
f. 将滑块 A 向前移动。
g. 仅手动上紧背面的 5 个固定螺丝。请勿上紧后面没有滑块的固定螺丝。

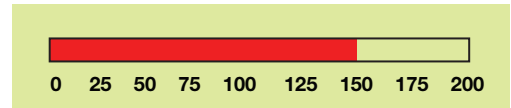
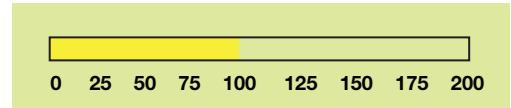
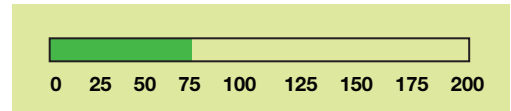


将“Slide A”一直向前移动。首先松开放松螺母并对固定螺丝施加轻轻的压力调节背面的五个固定螺丝。向后移动“Slide A”并☒☒前部五个固定螺☒。

- h. 将滑块 A 向后完全移动并紧固剩余（前）的固定螺丝。设定张力使柱状图显示大约为 75 左右。

A、X、Y 和 Z 更为简单：

- i. 松开防松螺母和固定螺丝
j. 再次上紧固定螺丝至 6 英寸磅或 40 mN. m，但是注意让张力达到柱状图显示大约为 75 左右。
k. 上紧防松螺母。



4.5 卡盘维护

每隔一段时间就需要打磨卡盘以保证平整度和垂直度。没有按要求及时打磨卡盘会导致打磨工件变形，从卡盘上拆下后不是圆形。当打磨工件变形时，再拉伸模端面会不平。首先用来打磨卡盘的打磨轮必须经过修整，否则打磨卡盘会变形。按以下流程来修整打磨卡盘的打磨轮。

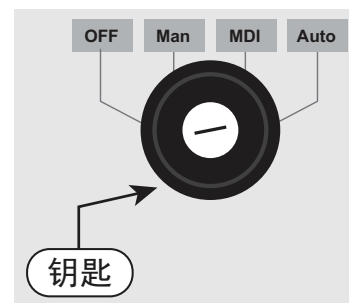


切勿使用手持式磨轮修整工具。

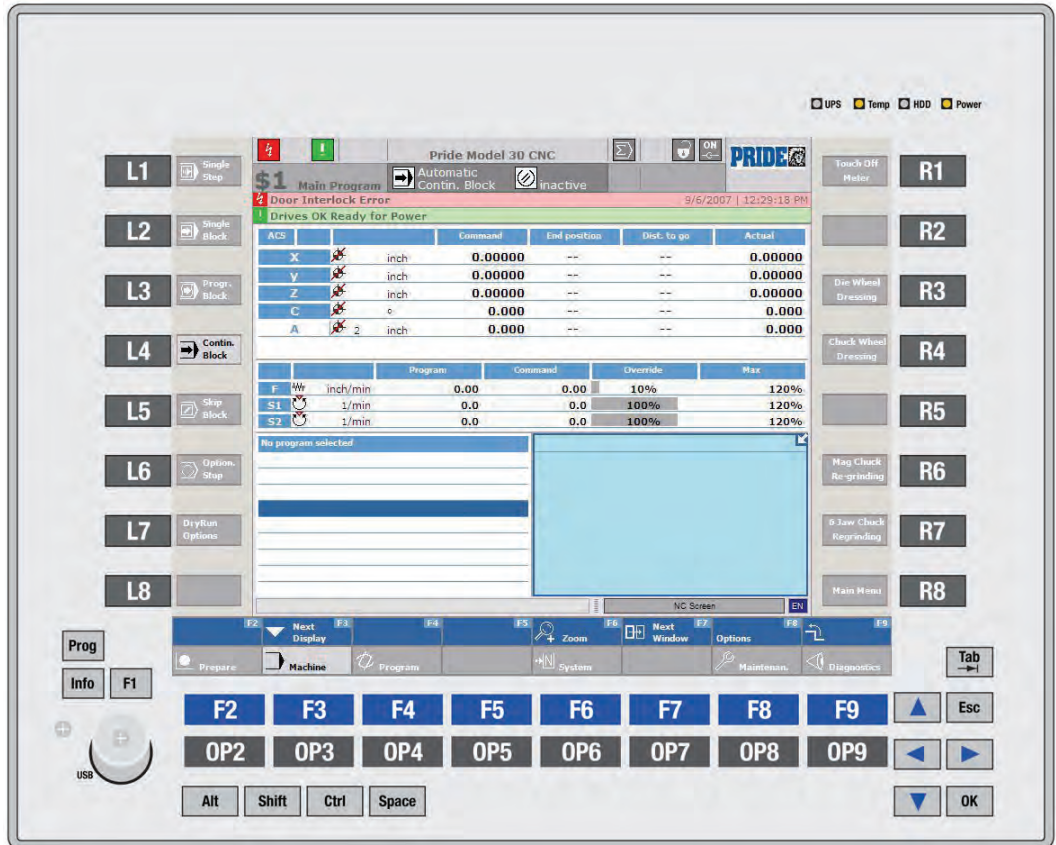
4.5.1 用单点金刚石修整

在打磨卡盘或卡盘爪前，用来打磨卡盘的磨轮必须修整，否则磨盘会变形。按以下流程来修整打磨卡盘的打磨轮。

1. 将钥匙拧至“Auto”位置
2. 选择 R7 Dressing & Regrinding



3. 选择 R4, Chuck Wheel Dressing.



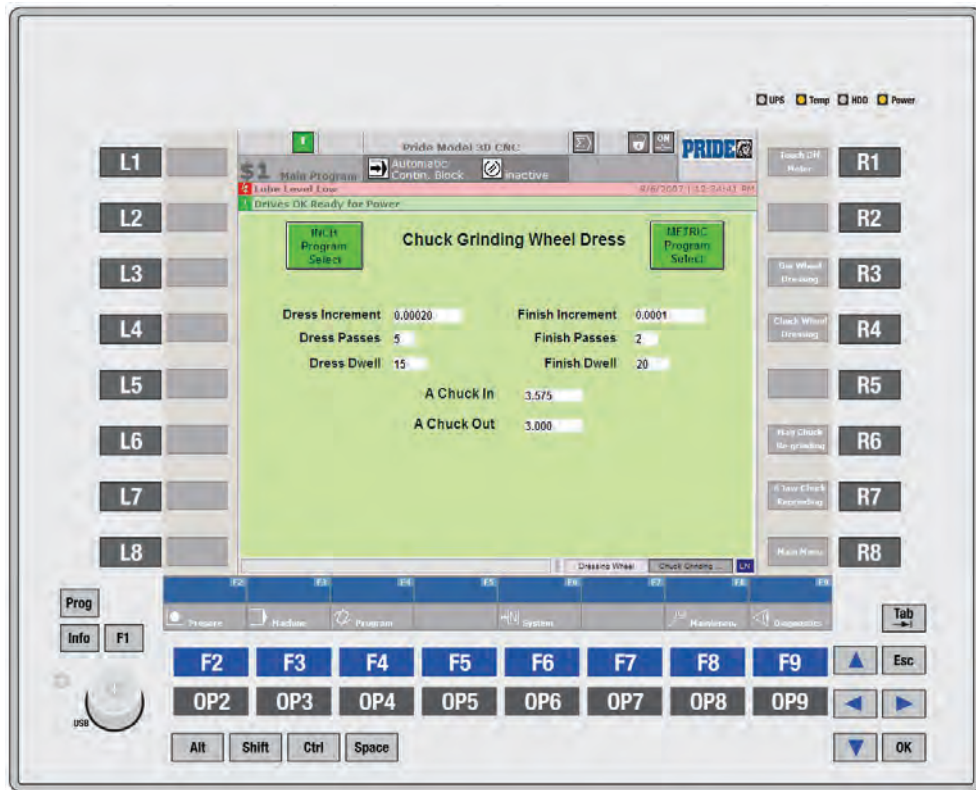
4. 在“卡盘磨轮修整”窗口填入所需的信息。



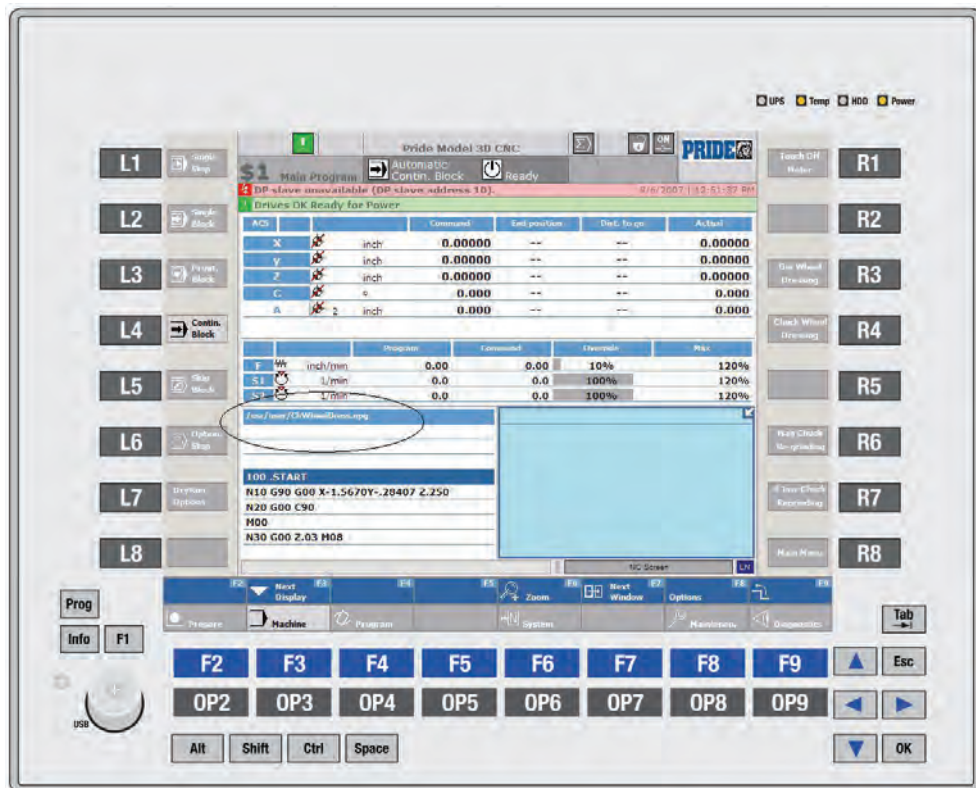
继续步骤 5 前，检查确保“Control Power On”图标处于打开状态。



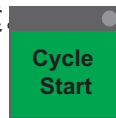
- 将光标移动到“Inch Program Select”或者“Metric Program Select”图标。按下鼠标左键直至绿色图标变灰。



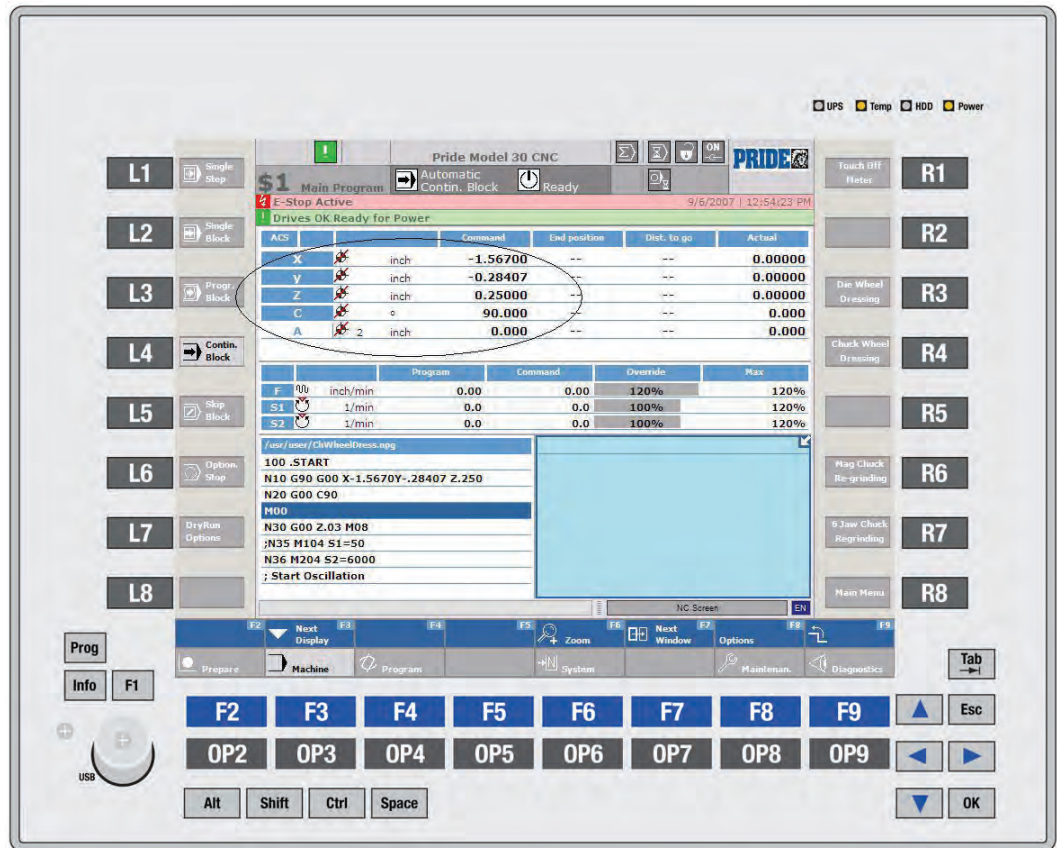
- 选择“Machine”图标 (op3) 并确认选择 “ChWheelDress.ngp” 程序。



7. 按下“Cycle Start”按键

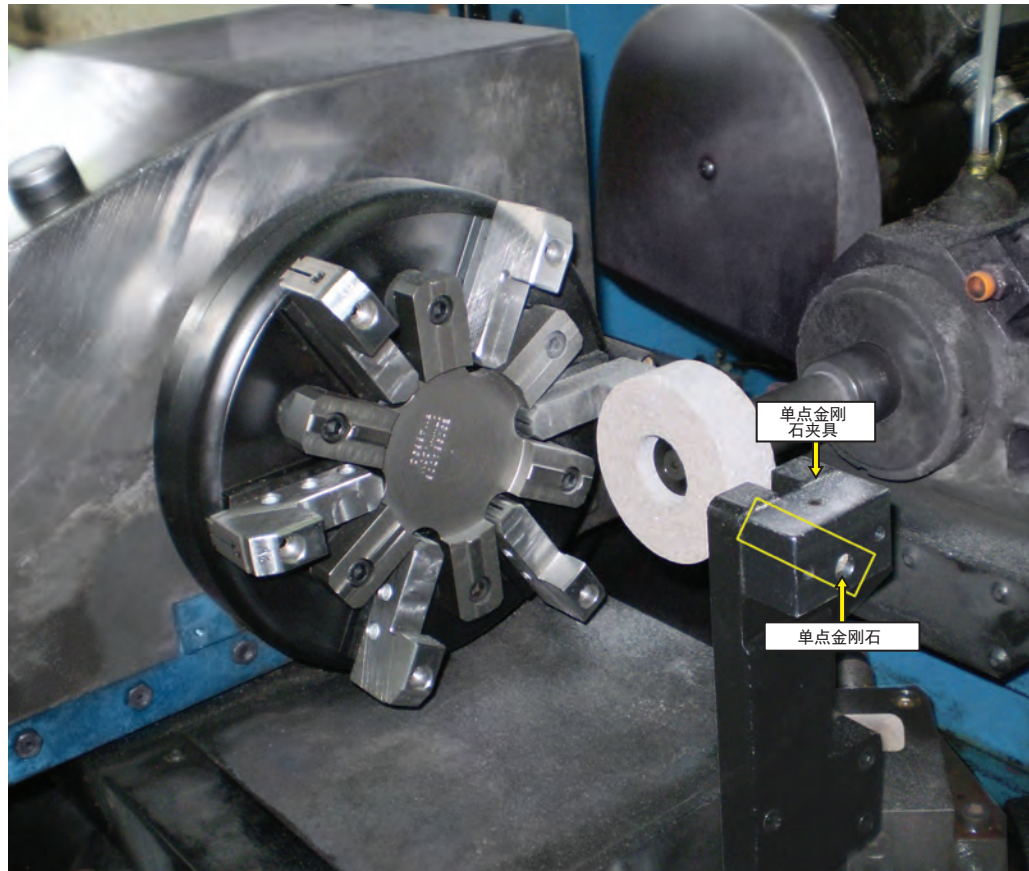


X、Y 和 Z 滑块会移动到位，旋转 C 会转至 90°



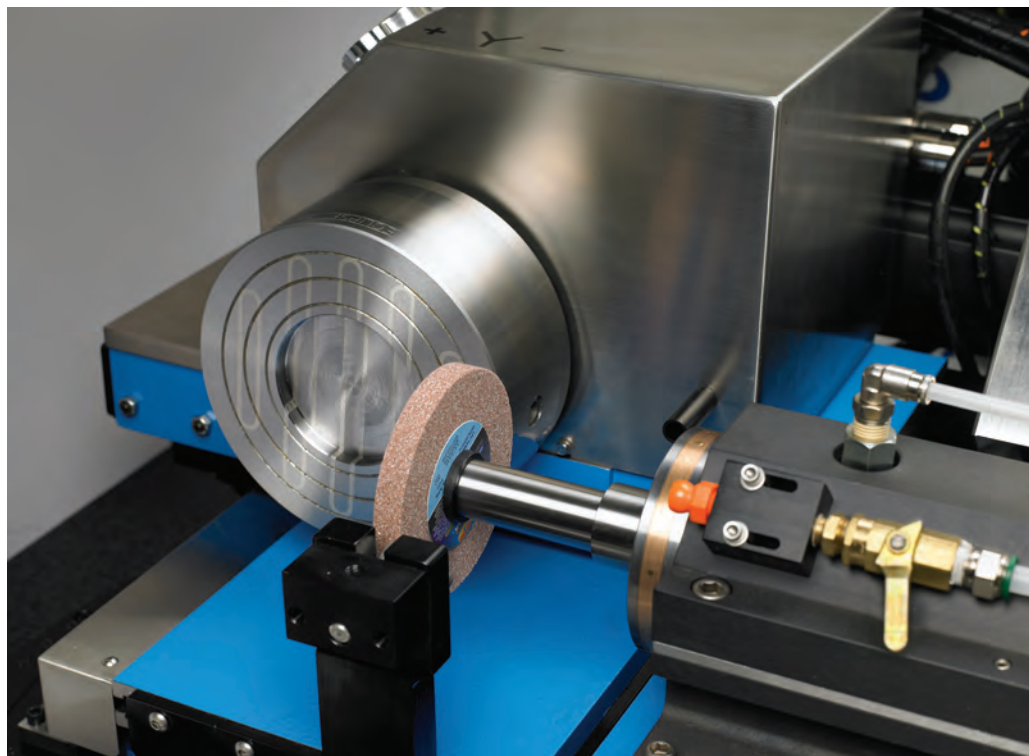
8. 将单点金刚石固定器装在“X”轴滑块正面。用单点金刚石修整打磨轮，方法与打磨磁性吸盘的方法一样，稍后在本章将会介绍。

修整打磨 6 爪卡盘盘爪的磨轮



Set up Single Point Diamond to dress the Grinding Wheel that will grind the Chuck Jaws.

或修整打磨磁性吸盘的磨轮。



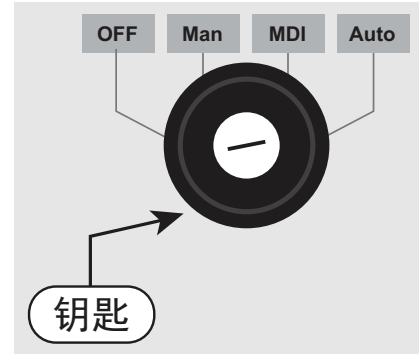
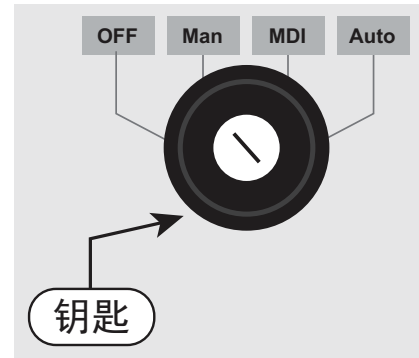
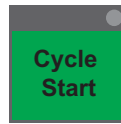
9. 将钥匙锁拧至“手动”（“Man”）

10. 通过微进给 Z 轴与 A 轴，手动接触单点金刚石。手动接触拉伸或修整金刚石磨轮时与此步骤相同。

11. 手动接触后，通过以下操作设置 Z 零位置：

- a. 选择维护 (OP8)
- b. 选择 Z Axis (R3)
- c. 再次选择 Z (R3)，设置 Z 至零。

12. 将钥匙锁开关拧回到“Auto”，点击“Cycle Start”。



4.5.2 备选 A：六爪气动卡盘（6 英寸或 6/7 英寸）

一般的机械卡盘爪易于滑进滑出，但是六爪气动卡盘充气时，通过一个空气膜使六爪从中心向外胀开。当缺少空气压力时，六个爪向中心闭合，紧抓模具。正常工作时，以 80 磅打开或向外张开卡盘。（5.5 巴）的气压打开或外张来更换部件。

当操作工按下按钮更换模具时，便会施加气压并张开六爪。只要操作工释放按钮，卡盘盘爪即关闭。与一般的卡盘爪相比，此机械装置具有更好的同心率。



磨床卡盘爪

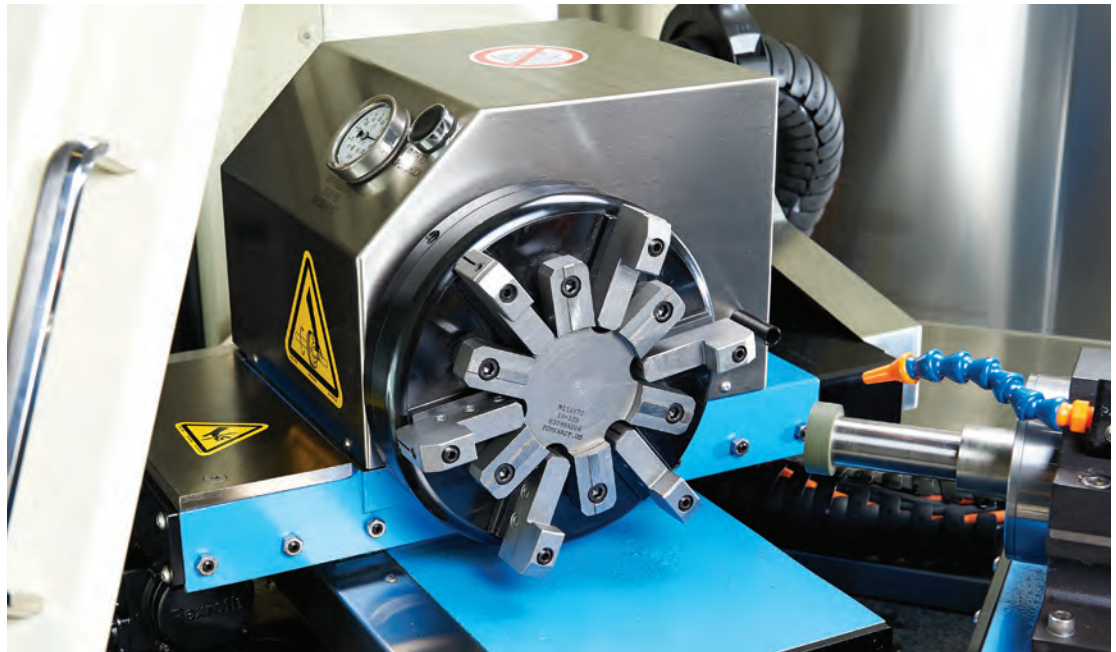


如果没有模具，卡盘不会充气，卡盘爪会以一定角度闭合，而不是如同有模具时那样保持方形。这并非故障，**但是当卡盘爪处于这种状态时请勿打磨**。当需要打磨卡盘爪时，卡盘爪必须保持方形且没有模具。如果卡盘爪在闭合时打磨，在重新投入使用时模具则无法正确就位卡盘爪中。

再打磨卡盘时，卡盘隔气膜气压必须保持在 50 psi (3.5 bar)，这样才能保证没有模具时卡盘爪仍保持方形。为此设有一个独立的气压稳压器。用于再打磨过程中保持盘爪呈方形的气压稳压器由工作头心轴护罩左侧上的一个“Switch, 6-Jaw 磨床 19-128 开关”启动。

如果从卡盘上拆卸模具时遇到问题，查看卡盘气压表（打开卡盘爪需要 80 psi 的压力）上的气压是否达到 80 psi (5.5 bar)。如果卡盘上的模具松脱，释放卡盘上的所有气压，如此便会闭合卡盘，因为打开卡盘需要气压。如果模具仍然松脱，则转动“选择”按钮以打磨卡盘（50 psi），然后按照下列流程再打磨卡盘爪。

当再打磨卡盘时，卡盘爪和星形轮都需再打磨。下列流程首先打磨卡盘爪，而非星形轮。但是顺序先后并无区别。参阅说明书，了解您正常使用的 6 爪卡盘适当型号，6 英寸（备选 A1）或 6/7 英寸梯级爪卡盘（备选 A2）。



6 爪卡盘



6/7 英寸 6 爪卡盘

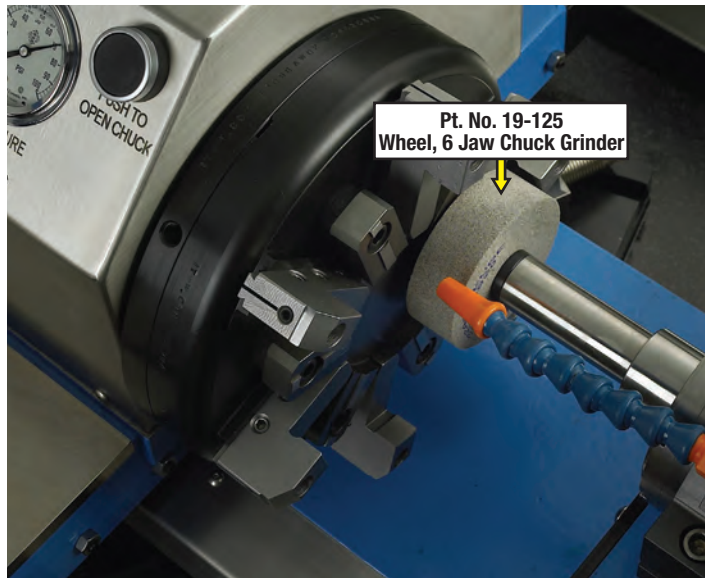
备选 **A1 - 6 英寸 6 爪卡盘**

再打磨卡盘盘爪（Part Number 19-104）

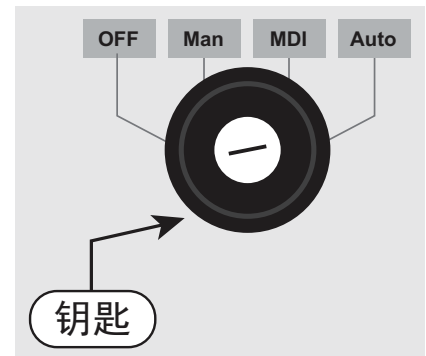
1. 选择下面计量器面板上选择器的“Chuck Grinding”。这样会让盘爪从卡盘底部移动到 90° 的位置。此位置为打磨卡盘爪的正确位置。
2. 逐一调节六个盘爪中每一个的位置，使盘爪和模具之间具有 0.0025” 至 0.005”（0.065 mm 至 0.130 mm）的紧配合。例如，如果要打磨 6 英寸

的模具，将盘爪调节到直径 5.995”。这个过程中，首先要把相对的每一只盘爪向中心移动相等的距离。

3. 用千分表来检测盘爪的同心率。调整每个盘爪使同心率保持在 0.0005” (0.130 mm)。
4. 将每个盘爪表面与模具的接触处涂蓝或以类似材料标记。这样操作工就能知道所有盘爪何打磨完毕的时间。
5. 在磨轮头上安装磨轮 19-125。



6. 将钥匙开关拧至“Auto”模式。屏幕右侧会出现菜单，这也可以通过屏幕旁边的 R 按钮激活。



继续步骤 5 前，检查确保 “Control Power On” 图标处于打开状态。



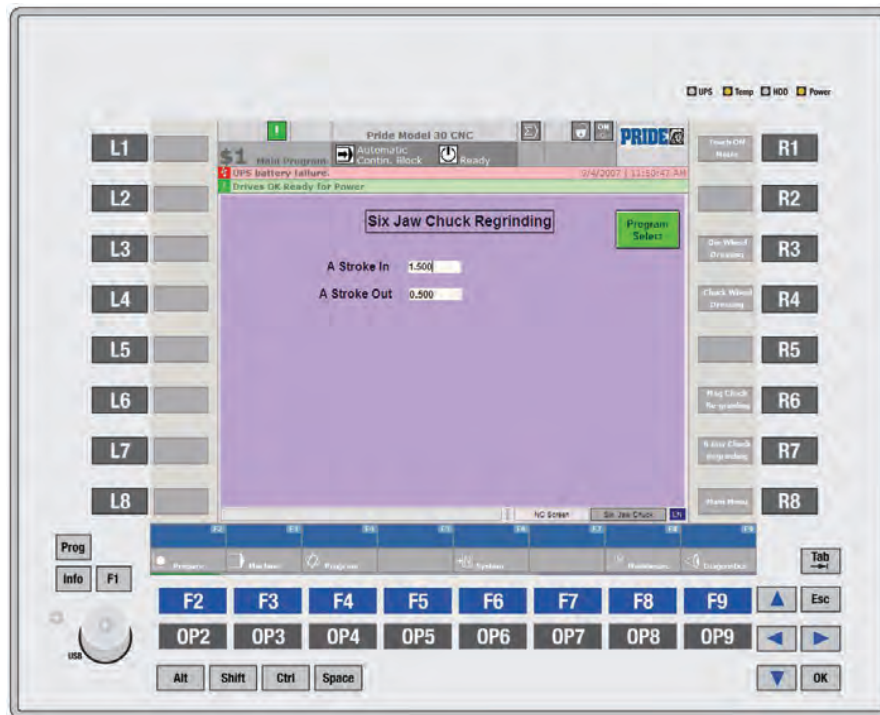
7. 在“Machine”屏幕中选择“Dressing & Re-grinding (R7)”。



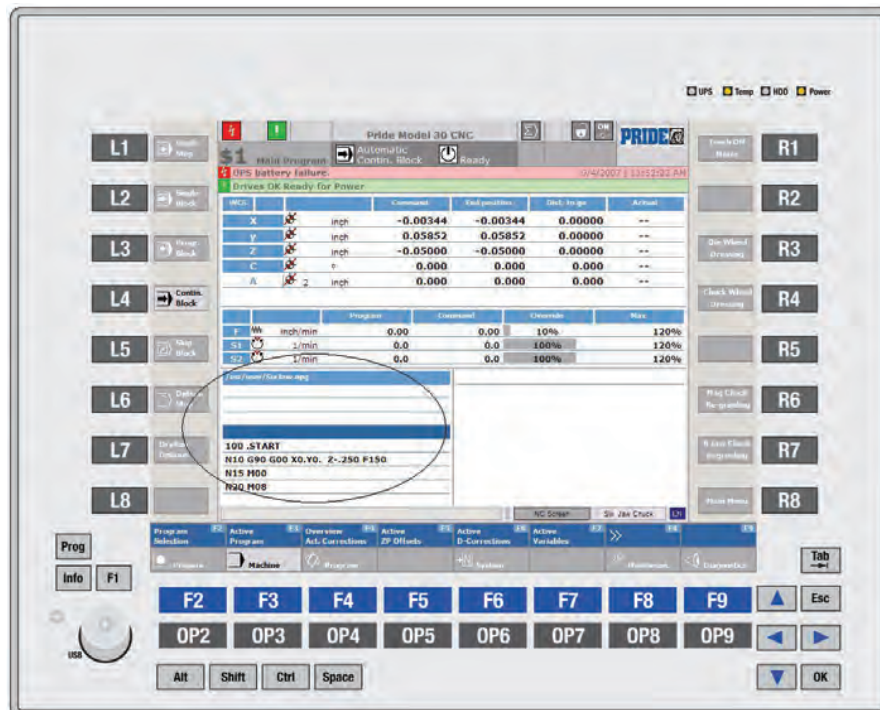
8. 选择“6-Jaw Chuck Re-grinding (R7)”。



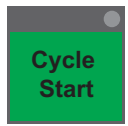
9. 稍后在下列字段中输入“A Chuck In & A Chuck Out”的数值。
10. 选择“Six Jaw Chuck Regrinding”屏幕右上角的绿色“Program Select”图标，左击并按住。绿色图标会变红，而后变灰。当颜色变灰时松开左键。



11. 点击“Machine” (OP3) 以返回机器显示屏并验证左下框中是否有“SixJaw.npg”。

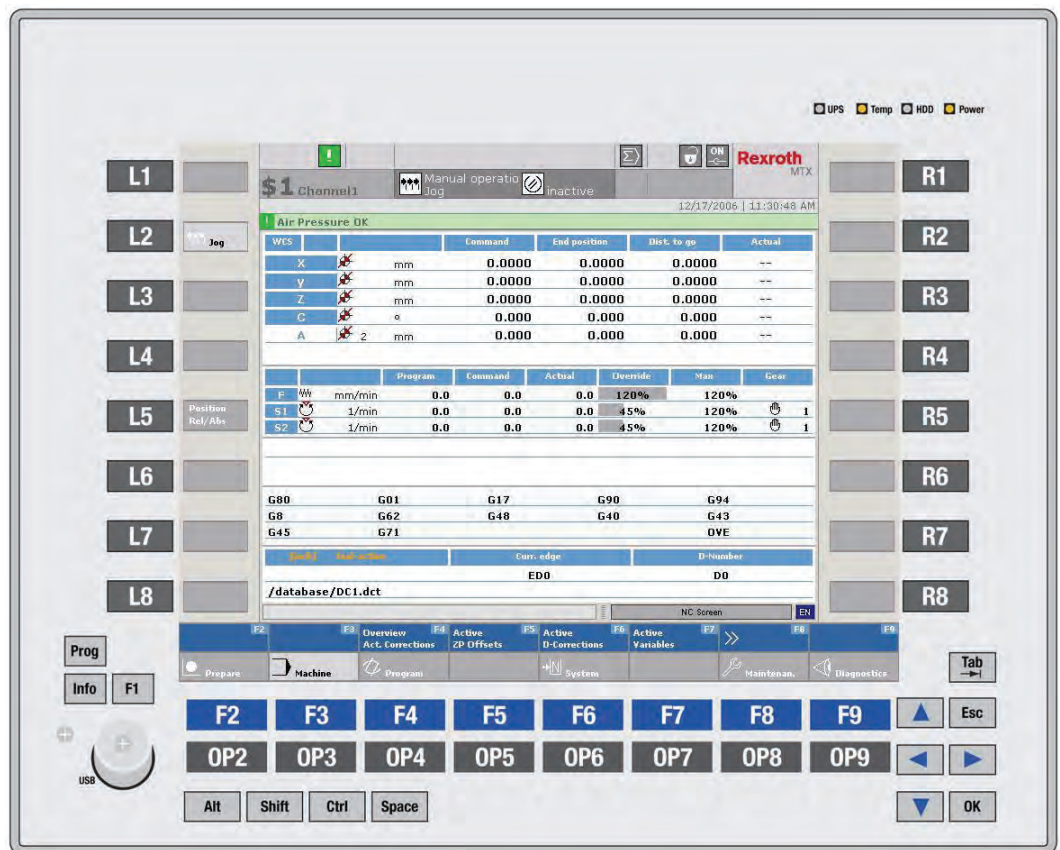
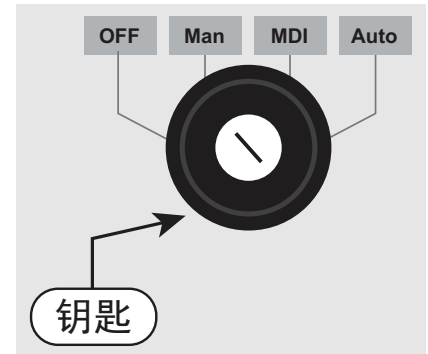


12. 按下“Cycle Start”按钮。这会将 X、Y 轴移动到卡盘再打磨的位置。检查确保 Z 位于卡盘直径内中心处。



13. 将钥匙锁开关拧到“Man”，这样操作工便可确定“A Chuck In and the A Chuck Out”的位置。

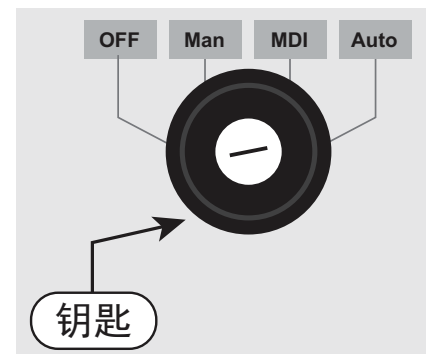
14. 微进给“A In (A+)”至直到磨轮前缘进入盘爪的退切线，同时要避免与“Part Stop” 19-105 碰撞。记录 A 值。这将成为“A Stroke In”位置。



15. 微进给“A Out (A-)”直到磨轮前缘在盘爪外缘大约 0.060 inches (1.5 mm) 的位置。记录 A 值。这将成为“A Stroke Out”位置。

16. 手动接触卡盘爪，如同触摸模具一样。设置 Z 零位置。

17. 将钥匙锁开关返回“Auto”模式。



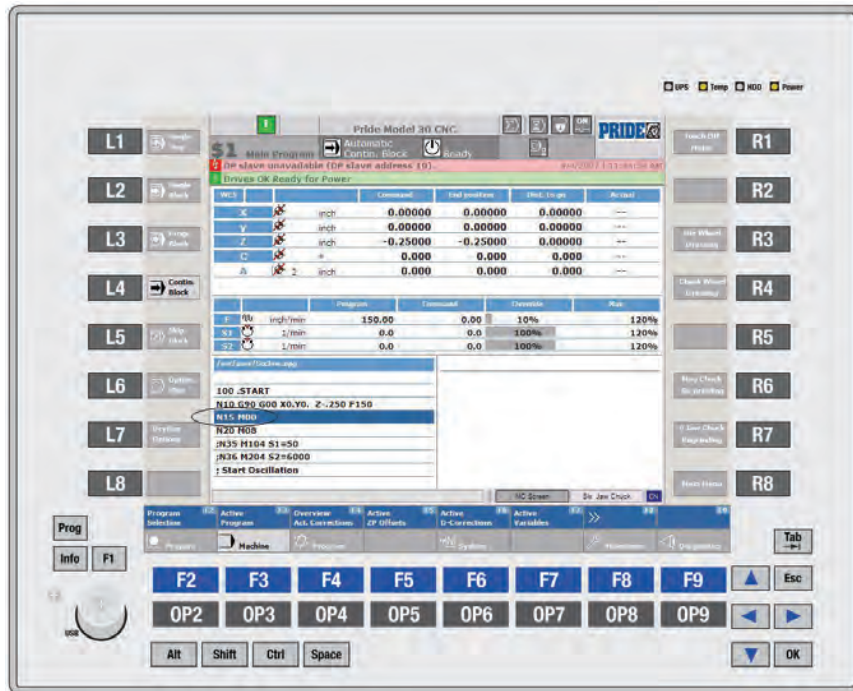
18. 在 “Machine” 屏幕中选择 “Dressing and Re-Grinding (R7)” 。



19. 选择 “Six Jaw Chuck Re-grinding (R7)” 。

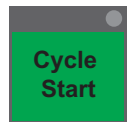


20. 当“六爪卡盘再打磨”屏幕出现时，在相应的“A Chuck In and A Chuck Out”字段中输入第 14 步和第 15 步记录的数值。

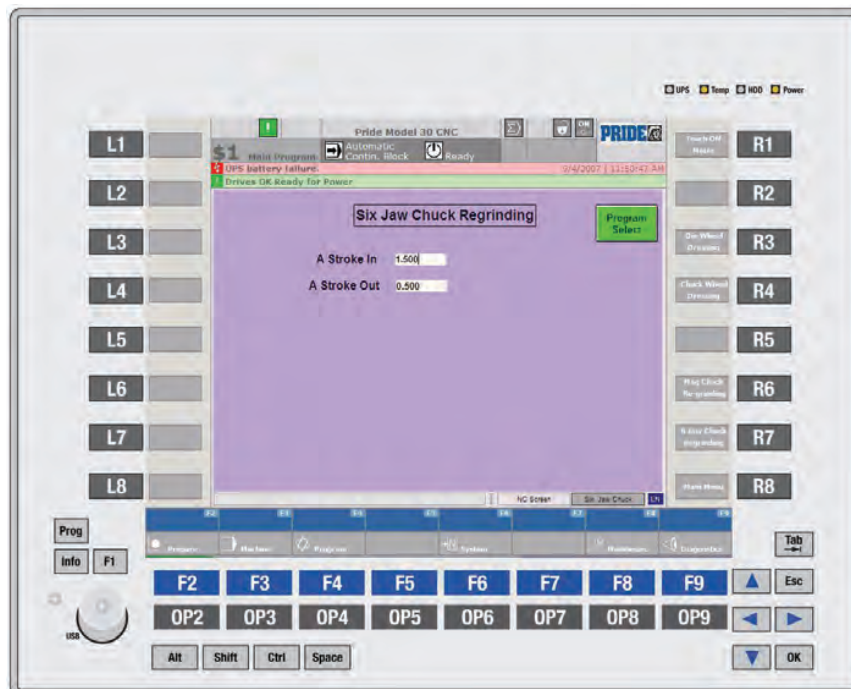


21. 点击“Machine” (OP3) 以返回机器显示屏并验证左下框中是否有“SixJaw.npg”。

22. 按下“Cycle Start” 按键一次。

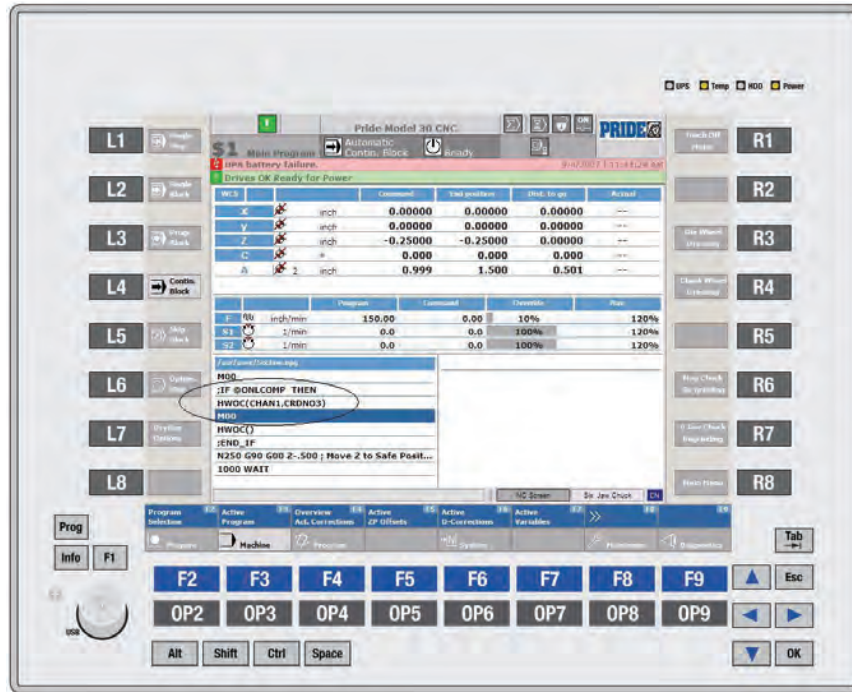
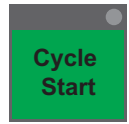


振动循环将会开始，机器会根据程序设定停止（M00）。在开始前请确认 Part Stop 19-105 没有碰撞。



23. 再次按下 “Cycle Start” 。

将会执行 “HWOC(Chan1,CRDN03)” 代码行。
这将启动手轮。



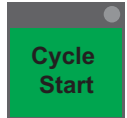
24. 将手轮增量设置为 0.00001，将轴设为 Z。

25. 顺时针转动手轮刻度盘 (+)，Z 轴会移入。1 次点击为 1 个增量。



26. 转动手轮时一次点击一下，让爪上出现火花，继续此过程直到去除了盘爪上所要去掉的材料。

27. 当去除了所需的材料量时，按下“Cycle Start”按钮。Z 轴会缩回到安全位置，A 轴会回归初始位置。

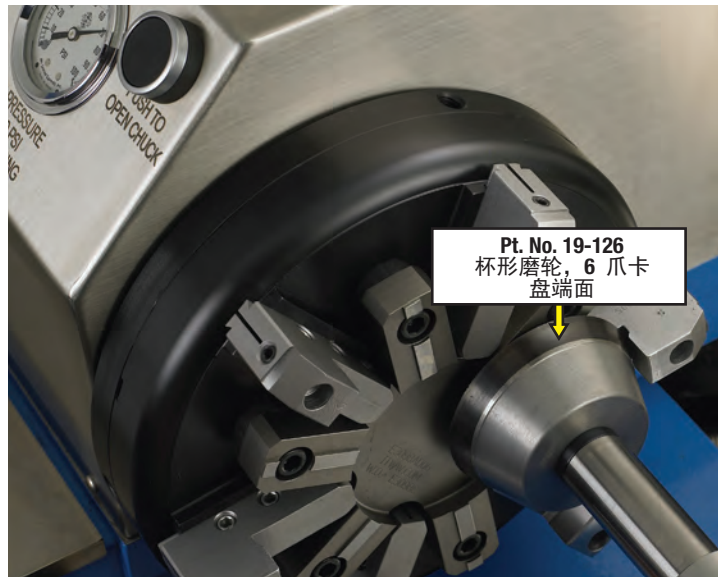


28. 现在可以测量盘爪的内径。测得的内径应为 $6.0000 +$ 或 $- 0.0005$ inches。必要时重复此过程。

29. 卡盘爪与星形轮打磨完成后，将工具球与 X、Y 轴复位。请参阅 Section 3.5 C, X & Y Work Head。

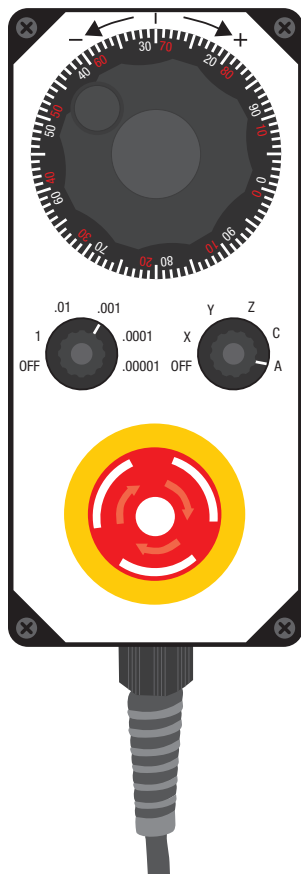
再打磨卡盘星形轮 19-105

1. 安装杯形轮 19-126。
2. 将钥匙开关拧至“Manual”
3. 微进给 C 轴（旋转）至 0° 并将 Shot Pin 9-199 放入钉枪平板 6-111。



4. 将星形轮凸起的部分用蓝色或其他颜色的墨水做标记

5. 使用手轮或操作面板上的微进给键，微进给 A(+), 直到杯形轮离星形轮凸起部分大约 $0.005''$ (0.13mm)。



6. 微进给 Z 轴 (+), 直到杯形轮的边缘进入卡盘爪的退切线。这是为了确保星形轮的整个凸起部分都会经过打磨, 使星形轮剩余部分不会有边缘不平。确保卡盘爪没有接触到杯形轮。
7. 启动磨轮头和工作头电机。
8. 以微小的增量 (0.001) 正向微进给 A (+), 直到杯形轮碰触到星形轮, 出现火花。
9. 以更加微小的增量 (0.0001) 继续正向微进给 A (+), 直到星形轮整个表面的蓝色或其他颜色标记磨掉。
10. 完成后, 将增量调至 0.001, 反向微进给 A (-) 以离开打磨表面: 不要超过 0.005" (0.13mm)。
11. 换到 Z 轴, 反向微进给 Z (-), 直到杯形轮在能不接触任何盘爪的情况下缩回。



12. 换到 A 轴并缩回 (-) 杯形轮并将其返回到初始位置 (0)。
13. 检查星形轮凸起平面的平面度, 根据需要重复以上流程。
14. 盘爪与星形轮打磨完成后复位工具球。请参阅章节 3.5 C, X & Y 工作头定位。

备选 **A2 - 6/7 英寸 6 爪卡盘**

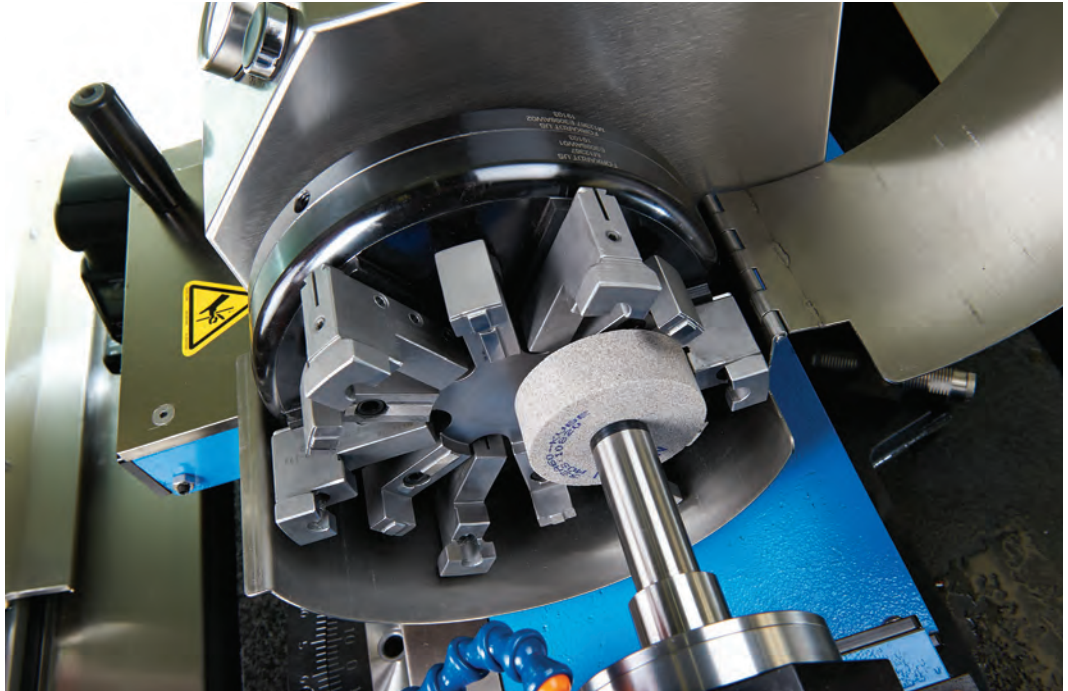
再打磨卡盘盘爪 (Part Number 19-177)

1. 选择下面计量器面板上选择器的 “Chuck Grinding”。这样会让盘爪从卡盘底部移动到 90° 的位置。此位置为打磨卡盘爪的正确位置。

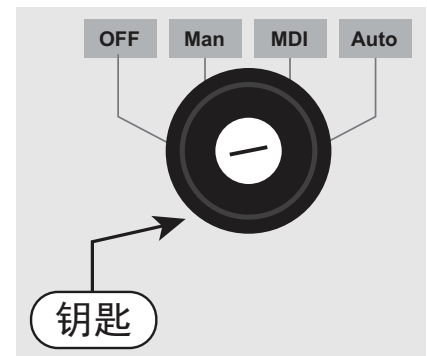


使用装载至 **6 英寸** 盘爪内的 **6 英寸** 拉伸模具, 设置盘爪位置。依据说明书, 打磨 **7 英寸** 盘爪后首先需要打磨 **6 英寸** 盘爪。

2. 逐一调节六个盘爪中每一个的位置，使盘爪和模具之间具有 0.005” (0.130 mm) 的紧配合。例如，如果要打磨 6 英寸的模具，将盘爪调节到直径 5.995”。这个过程中，首先要把相对的每一只盘爪向中心移动相等的距离。
3. 用千分表来检测盘爪的同心率。调整每个盘爪使同心率保持在 0.0005” (0.130 mm)。
4. 将每个盘爪表面与模具的接触处涂蓝或以类似材料标记。这样操作工就能知道所有盘爪何时打磨完毕的时间。
5. 在磨轮头上安装磨轮 19-125。



6. 将钥匙开关拧至“Auto”模式。屏幕右侧会出现菜单，这也可以通过屏幕旁边的 R 按钮激活。



继续步骤 7 前，检查确保“Control Power On”图标处于打开状态。



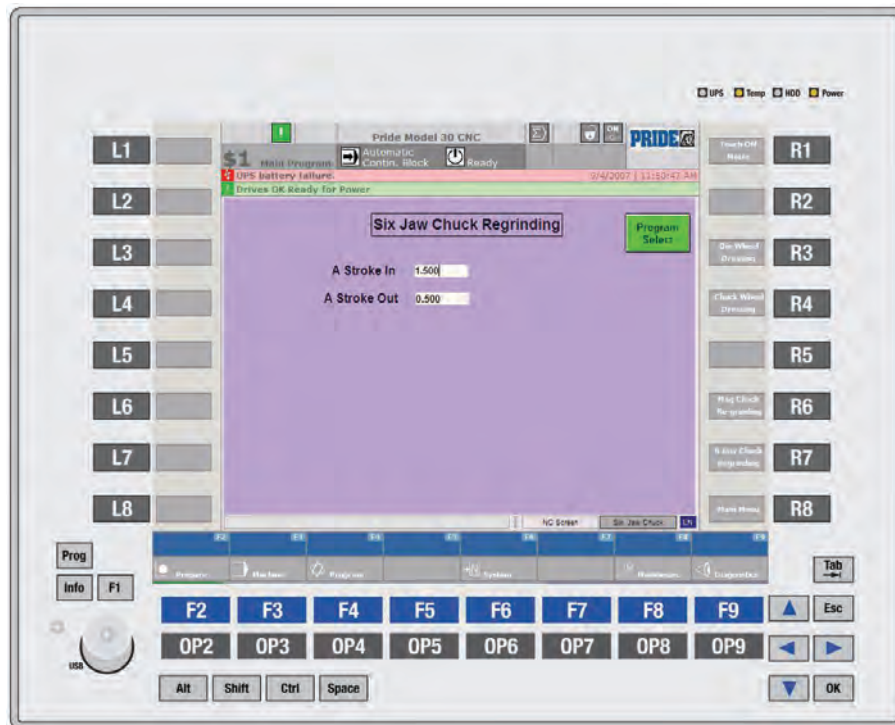
7. 在“Machine”屏幕中选择“Dressing and Re-Grinding (R7)”。



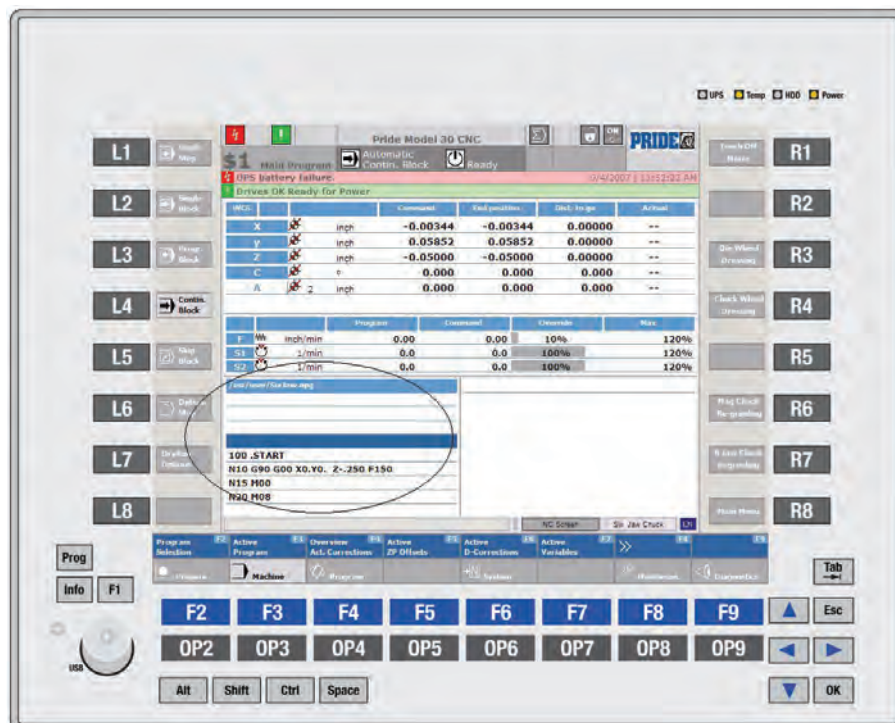
8. 选择“6-Jaw Chuck Re-grinding (R7)”。



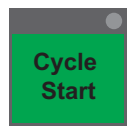
9. 稍后在下列字段中输入“A Chuck In & A Chuck Out”的数值。
10. 选择“Six Jaw Chuck Regrinding”屏幕右上角的绿色“Program Select”图标，左击并按住。绿色图标会变红，而后变灰。当颜色变灰时松开左键。



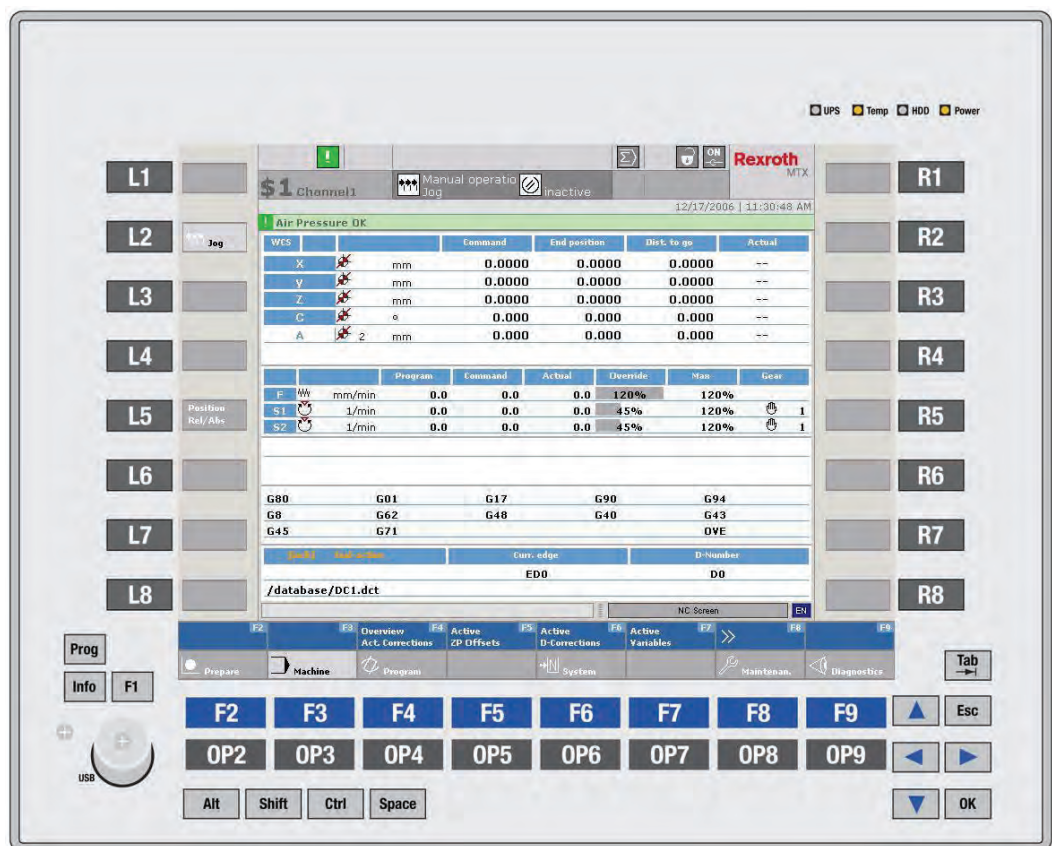
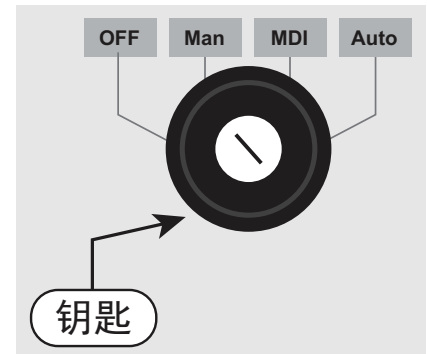
11. 点击“Machine” (OP3) 以返回机器显示屏并验证左下框中是否有“SixJaw.ngp”。



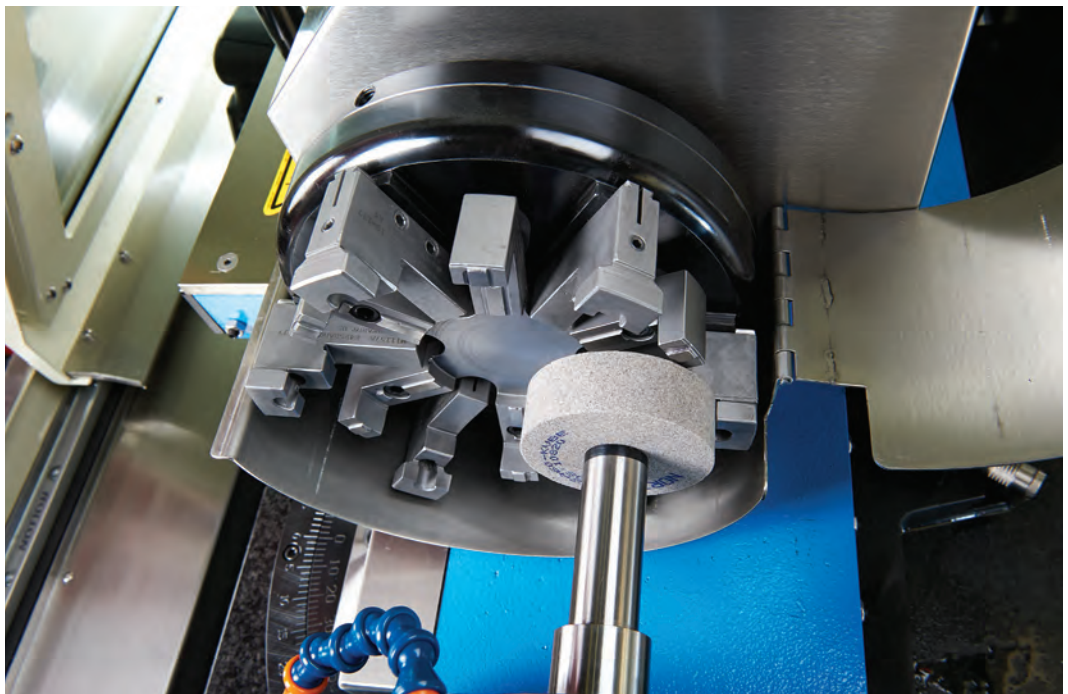
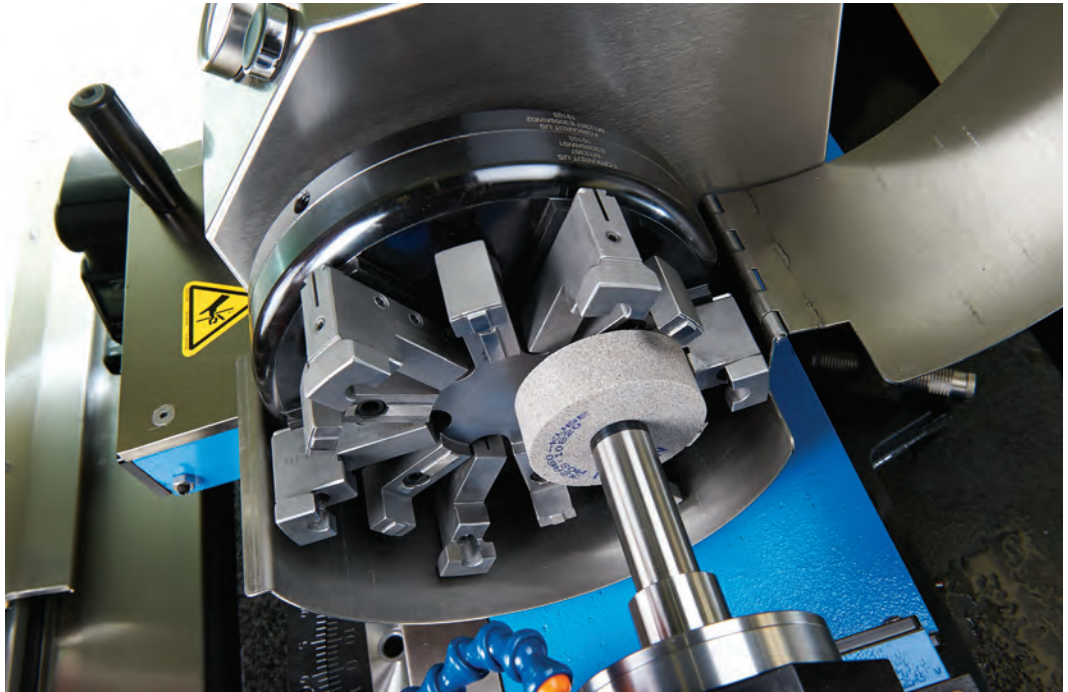
12. 按下 “Cycle Start” 按键。这会将 X、Y 轴移动到卡盘再打磨的位置。检查确保 Z 位于待打磨的专用盘爪套件使用的卡盘内径中心（6 or 7 inch diameter）。



13. 将钥匙锁开关拧到 “Manual Mode”，这样操作工便可确定 “A Chuck In and the A Chuck Out” 的位置。



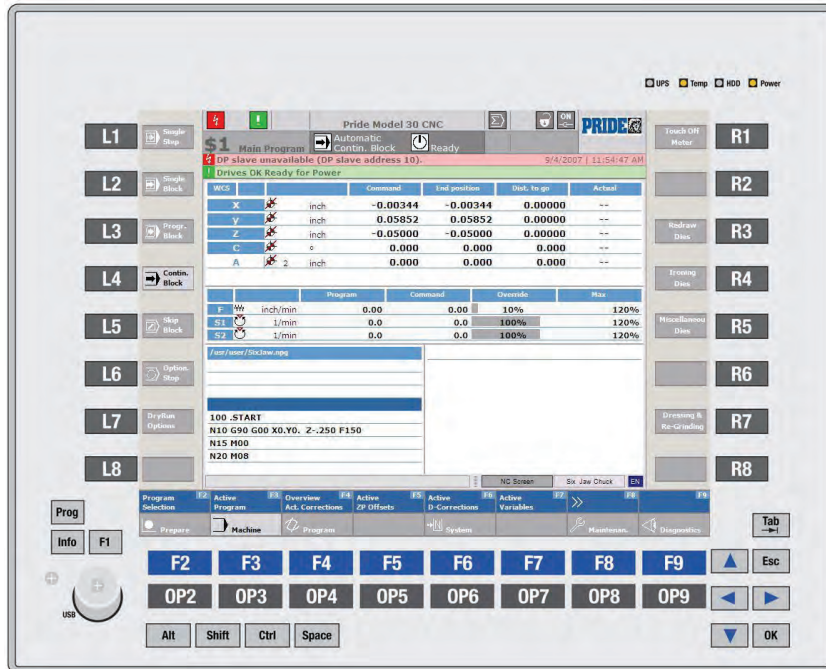
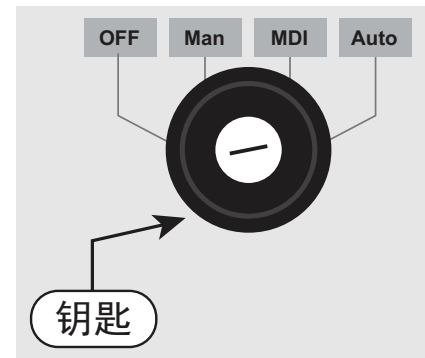
14. 微进给 “A In (A+)” 至直到磨轮前缘进入盘爪的退切线，同时要避免与 Part Stop 19-178 碰撞。记录 A 值。这将成为 “A Stroke In” 位置。



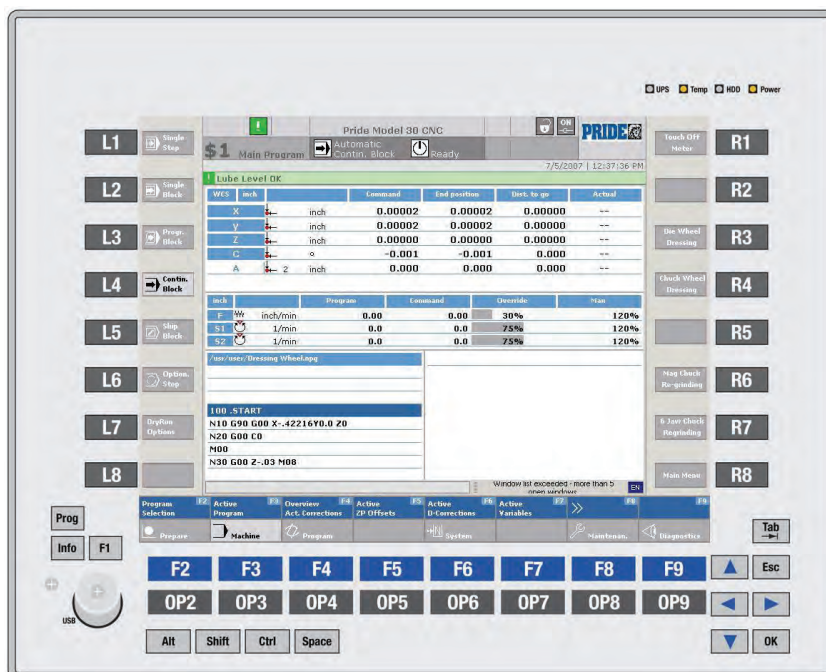
15. 微进给 “A Out (A-)” 直到磨轮前缘在盘爪外缘大约 0.060 inches (1.5 mm) 的位置。记录 A 值。这将成为 “A Stroke Out” 位置。
16. 手动接触卡盘爪，如同触摸模具一样。设置 Z 零位置。

17. 将钥匙锁开关返回“Auto”模式。

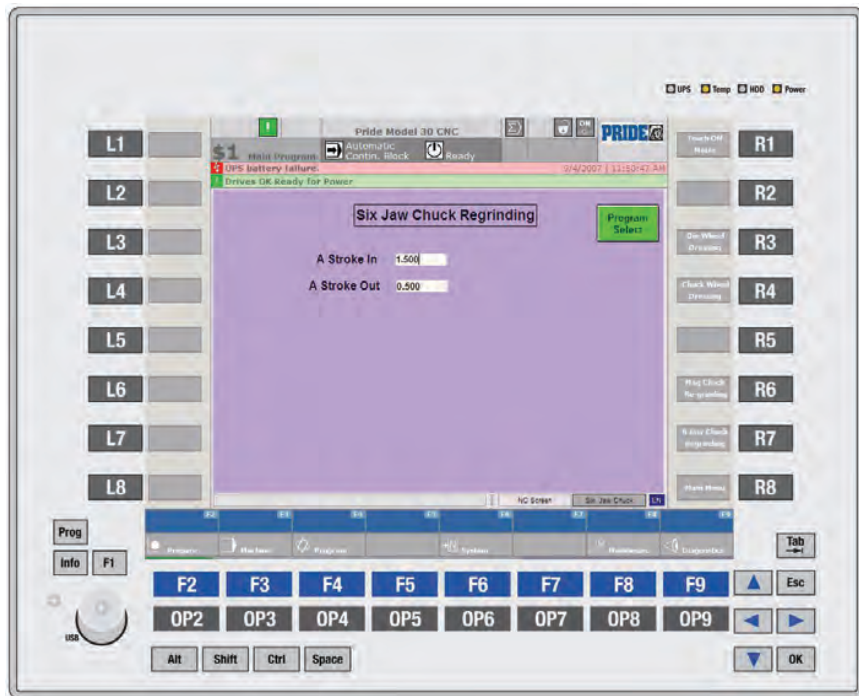
18. 在“Machine”屏幕中选择“Dressing and Re-Grinding (R7)”。



19. 选择“Six Jaw Chuck Re-grinding” (R7)。

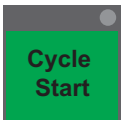


20. 当“六爪卡盘再打磨”屏幕出现时，在相应的“A Chuck In and A Chuck Out”字段中输入第 14 步和第 15 步记录的数值。

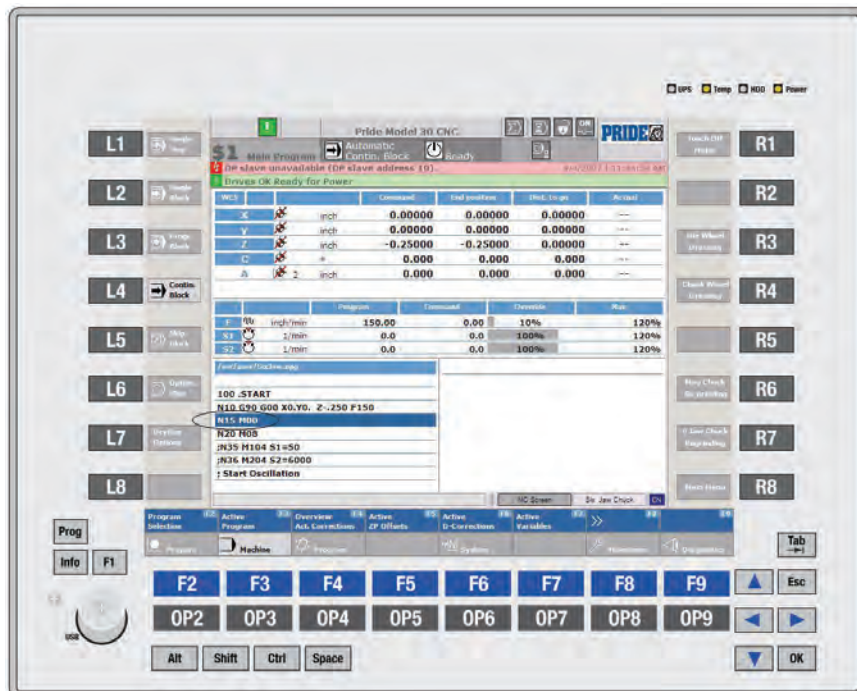


21. 点击“Machine” (OP3) 以返回机器显示屏并验证左下框中是否有“SixJaw.npg”。

22. 按下“Cycle Start” 按键一次

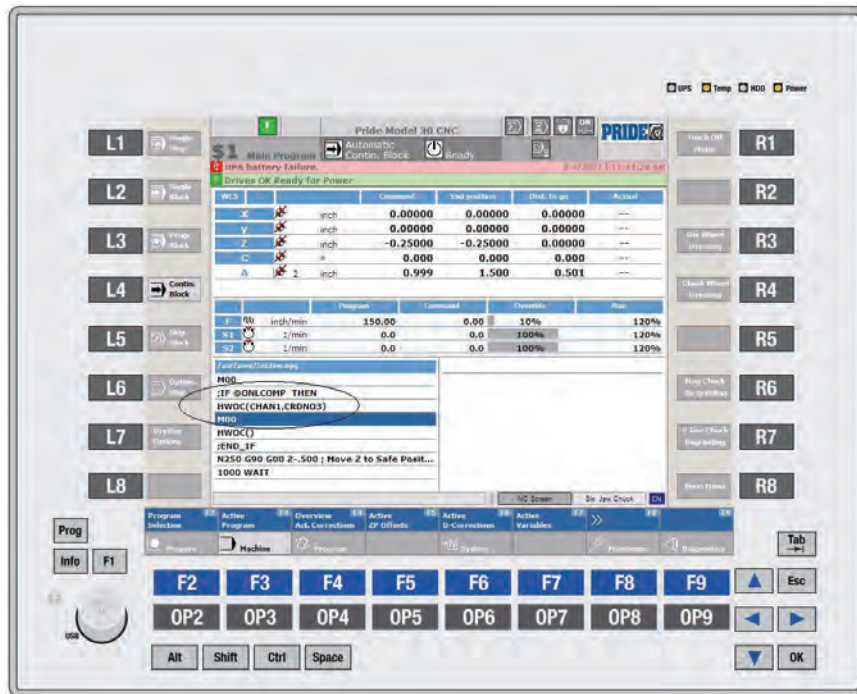
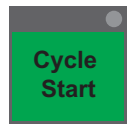


振动循环将会开始，机器会根据程序设定停止（M00）。在开始前请确认与 Part Stop 19-178 没有碰撞。



23. 再次按下 “Cycle Start” 。

将会执行 “HWOC(Chan1,CRDN03)” 代码行。
这将启动手轮。

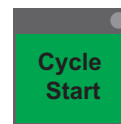


24. 将手轮增量设置为 0.00001，将轴设为 Z。

25. 顺时针转动手轮刻度盘 (+)，Z 轴会移入。1 次点击为 1 个增量。

26. 转动手轮时一次点击一下，让爪上出现火花，继续此过程直到去除了盘爪上所要去掉的材料。

27. 当去除了所需的材料量时，按下 “Cycle Start” 按钮。Z 轴会缩回到安全位置，A 轴会回归初始位置。



28. 现在可以测量盘爪的内径。完成的内径需为 6.0000 (或，若打磨 7 英寸盘爪，则为 7.0000) + 或 - 0.0005 英寸。必要时重复此过程。

29. 重复步骤 4 - 28 打磨 7 inches 盘爪套件。

30. 卡盘爪与星形轮打磨完成后，将工具球与 X、Y 轴复位。请参阅 Section 3.5 C, X & Y Work Head。

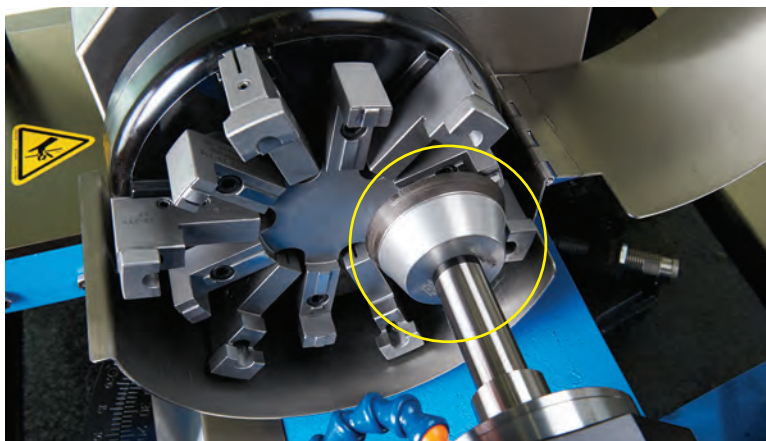


再打磨卡盘星形轮 19-178



依据说明书，打磨 **7 inch** 模具零件后首先需要打磨 **6 inch** 模具零件。

1. 安装 Cupping Wheel 19-126。
2. 将钥匙开关拧至 “Manual”
3. 微进给 C 轴（旋转）至 0° 并将 Shot Pin 9-199 放入钉枪平板 6-111。
4. 将星形轮凸起的部分用蓝色或其他颜色的墨水做标记。
5. 使用手轮或操作面板上的微进给键，微进给 A +，直到杯形轮离星形轮凸起部分大约 $0.005''$ (0.13mm)。
6. 微进给 Z 轴 (+)，直到杯形轮的边缘进入卡盘爪的退切线。这是为了确保星形轮的整个凸起部分都会经过打磨，使星形轮剩余部分不会有边缘不平。确保卡盘爪没有接触到杯形轮。



7. 启动磨轮头和工作头电机。
8. 以微小的增量 (0.001) 正向微进给 A (+), 直到杯形轮碰触到星形轮, 出现火花。
9. 以更加微小的增量 (0.0001) 继续正向微进给 A (+), 直到星形轮整个表面的蓝色或其他颜色标记磨掉。
10. 完成后, 将增量调至 0.001, 反向微进给 A (-) 以离开打磨表面: 不要超过 0.005" (0.13mm)。
11. 换到 Z 轴, 反向微进给 Z (-), 直到杯形轮在能不接触任何盘爪的情况下缩回。
12. 换到 A 轴并缩回 (-) 杯形轮并将其返回到初始位置 (0)。
13. 检查星形轮凸起平面的平面度, 根据需要重复以上流程。
14. 重复步骤 4 - 13 打磨 7 inch 模具零件。
15. 盘爪与星形轮打磨完成后复位工具球。请参阅章节 3.5 C, X & Y 工作头定位。

4.5.3 备选 B: 磁性吸盘

为了保证工件具有精准的圆度, 有时需要再打磨磁性吸盘。在需要的情况下未能如此操作将会导致打磨工件从卡盘上拆下时变形, 并在正常情况下被检查出来。有时候也会出现圆度偏差。当打磨工件变形时, 再拉伸模端面会不平。按如下流程再打磨卡盘。

1. 将“旋转”轴移动到零度。用转接头在套筒头上安装千分表。通过套筒摆动来使用千分表确定卡盘的端面。卡盘应当设定在零位, 能让模具直线部分沿拉伸方向略微移动。



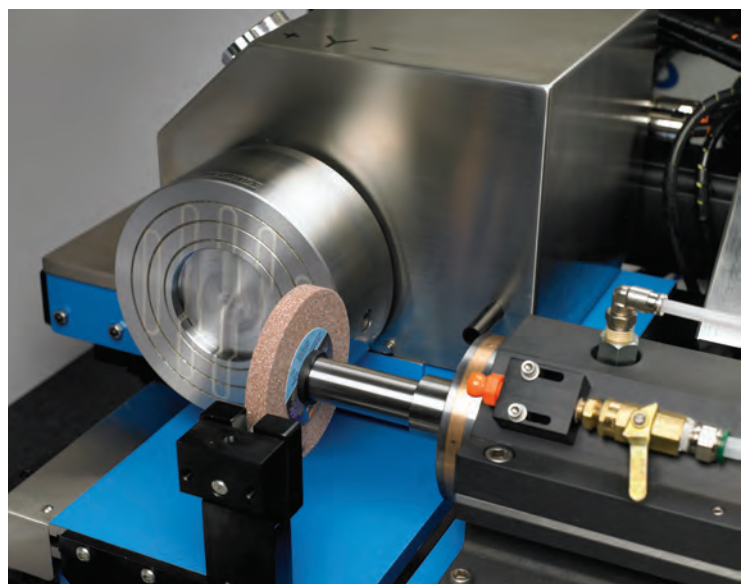
2. 将“旋转”轴移动到 90 度，安装试棒。向前移动磨轮头滑块，显示测试棒读数。如果试棒读数是零，可以开始打磨。如果存在偏差，则必须通过打磨或给剩余按钮加垫片来调节卡盘。

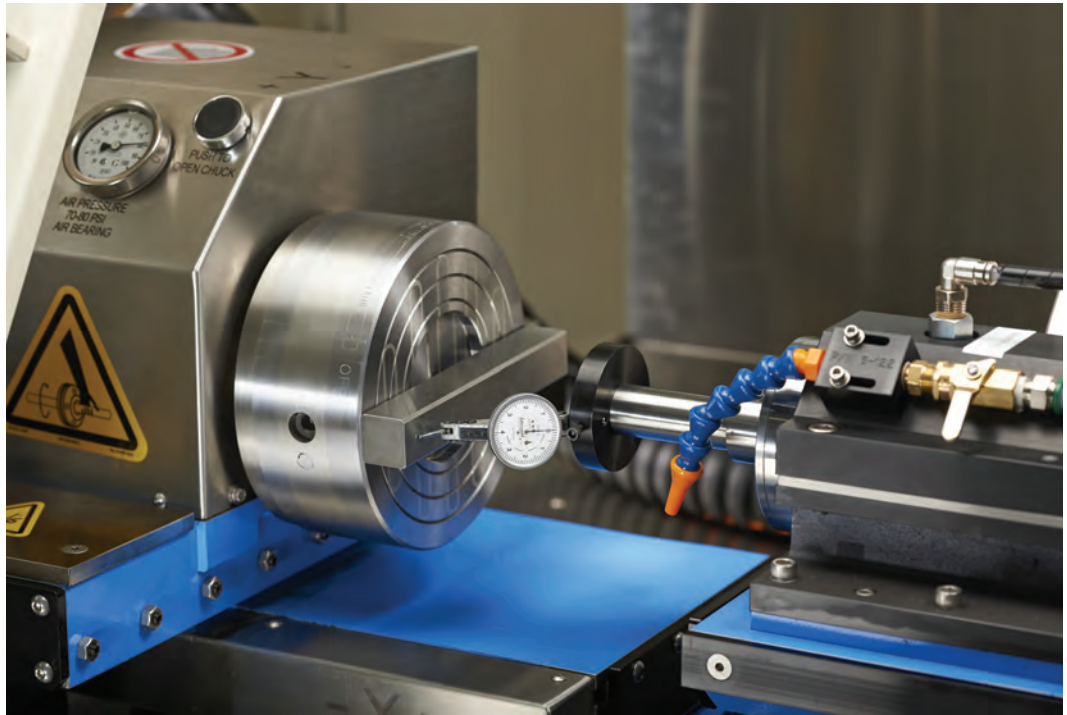


方形固定块

3. 安装转接头和 4 英寸磨轮。拆除测试棒，给卡盘加电。
4. 将单点金刚石固定器装在“X”轴滑块正面。将“Z”轴向金刚石方向移动，以此来修整磨轮。以 50% 的速度运行磨轮头心轴。单点金刚石固定装置可以留在原位以备之后修整。
5. 磨轮修整后，移动“Z”轴直到磨轮接触到磁性吸盘。**设置零点并后退“Z”轴。**

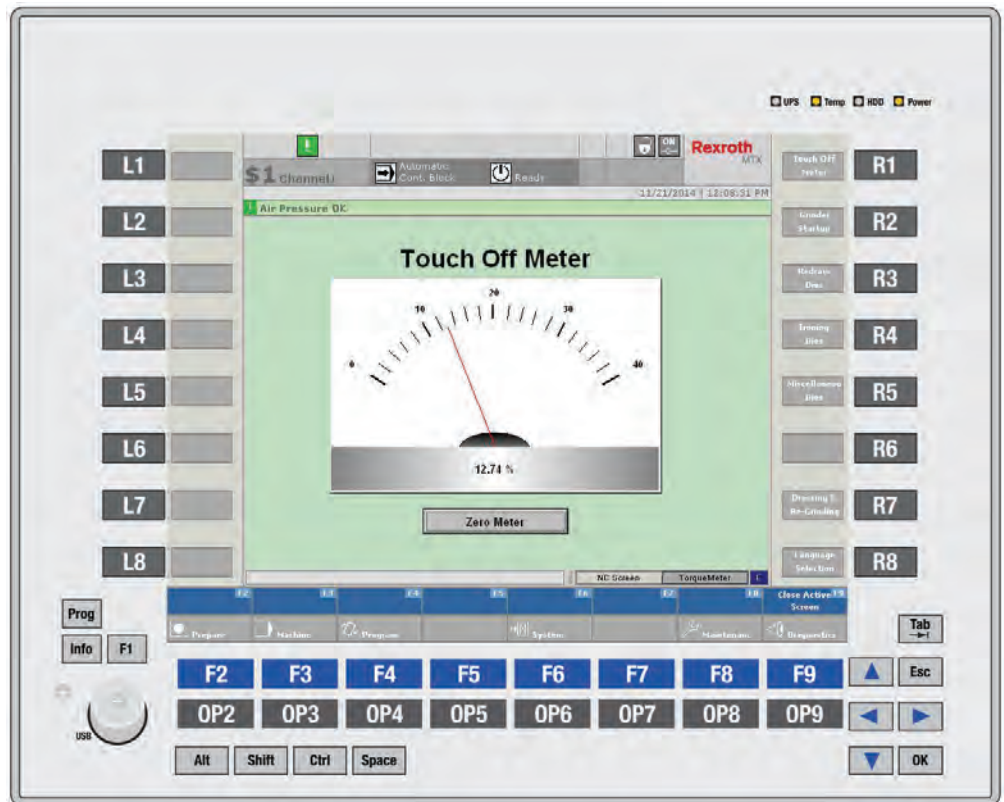
设置滑块 A 使磨轮在行程两端都不与磨盘接触。以 50rpm 速度运行磁性吸盘并以 0.0001 英寸的增量移动。卡盘应满程加电。磨轮上不要超过 50%。打磨时使用冷却液。





方形固定块

6. 将“Z”轴移回零位。“Z”轴移入后，观察心轴“Touch Off Meter”表上增加的扭矩读数。



正确流程下，“Z”轴每移动 .0001 inches (2.5 microns)，心轴可以伸展或后退一次。进给完成后，让磨轮头额外通过两次，需有火花。检查卡盘是否整洁。如果磨轮在打磨过程中负荷上升，必须在金刚石上重新修整。

7. 打磨卡盘后，复位工具球。请参阅章节 3.5 C, X & Y 工作头。

4.6 气动轴承



切勿尝试现场维修气动轴承心轴。

本章旨在提供当由于严重的污染和意外超负荷引起损伤而需要更换轴承的说明。对于轻微污染，通常在空气供给处滴入几滴酒精便可使其恢复正常工作。按如下方法操作：

1. 关闭气压。
2. 从柜隔壁接合处取下空气管路。
3. 向空气管路处加入酒精。
4. 装回空气管道。
5. 将气压加到 80 psi (6 bar)
6. 手动旋转轴承（如果不能自由旋转请勿用力）。

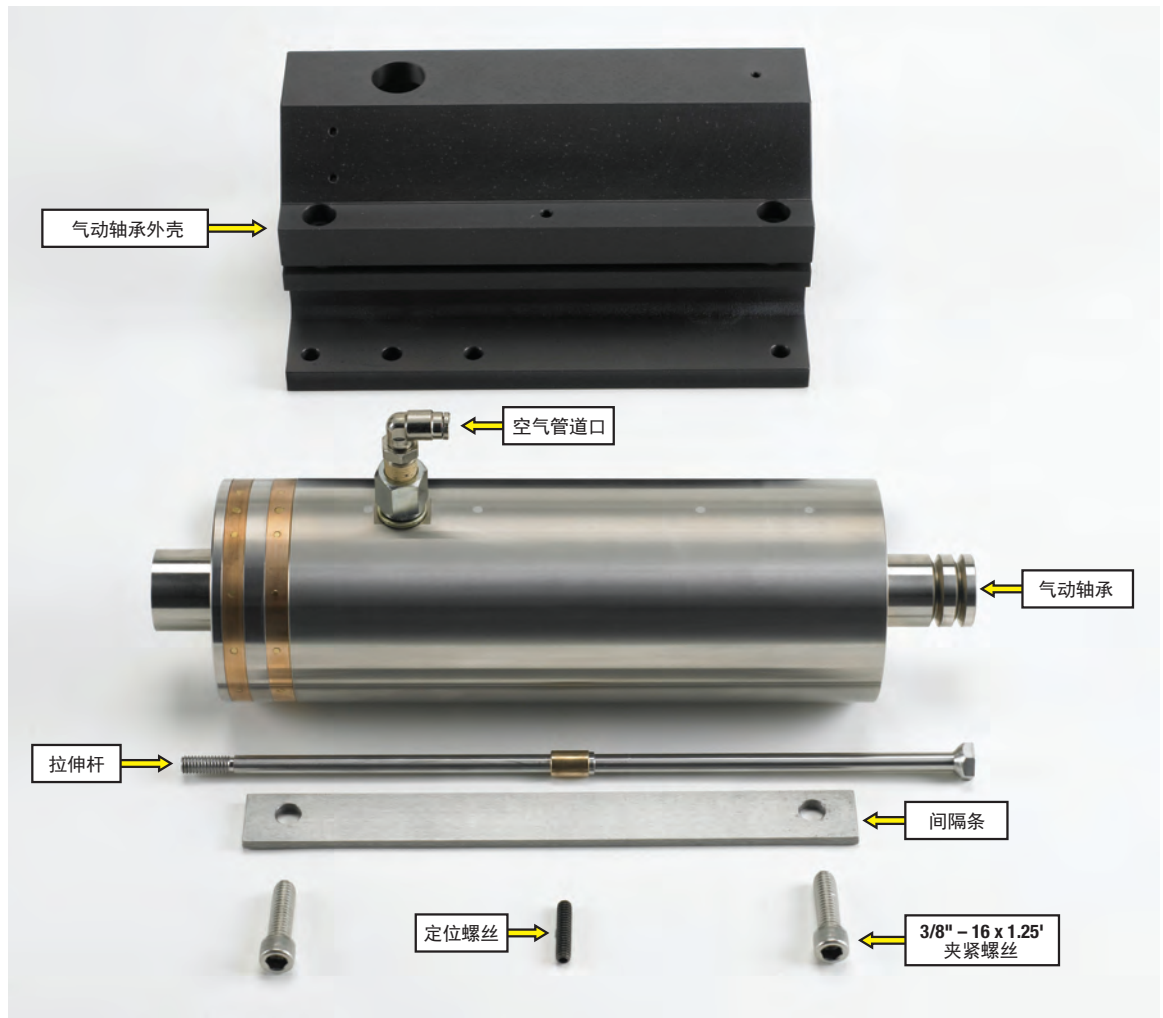
拆卸气动轴承的流程如下：

7. 拆掉驱动皮带和套筒（需要将滑轮从工作头轴承上拆下）。
8. 拆卸空气管道。
9. 拆卸空气管道气口。
10. 松开 2 个紧固螺栓（中央固定螺丝可作为减少轴承组件张力的释压器。再重新组装时不要忘记拧回固定螺丝）。
11. 从外壳中取出轴承。

按以下步骤更换气动轴承：

12. 将轴承放入外壳。
13. 将气口放置在外壳开口的中央。
14. 用酒精冲刷空气管道。
15. 更换空气过滤器。

16. 安装空气管道并施加气压。
17. 在开始前请确认其能够自由转动（让轴承有 ½ 小时的自净）。
18. 上紧两个紧固螺栓至 120-150 inch pounds 扭矩。（确认间隔条就位且中央固定螺丝已拧回）。
19. 装回驱动皮带。
20. 装回套筒（套筒应在 0.0002 T.I.R. 范围内运行）。损坏的气动轴承在几天内就会由我们的服务工程师修理完毕。。



磨轮头气动轴承

4.7 磨床轴较平

注：较平前所需的卡盘盘爪（6 爪卡盘）已打磨。

工作头（Y 轴）

1. 将工具球固定装置安装至卡盘
2. 将钥匙拧至“OFF”位置
3. 微进给 C 至 0°。钉枪 C 轴旋转底座处于 0°。
4. 将千分表底座安装在具有工具球面附近（操作工侧）千分表的磨床旋转底座上。
5. 移动 Y 轴 + 和 -，指示工具球面近端和远端。
6. 若千分表在 ± 0.0003 inch (0.007 mm) 范围内移动，则对轴进行较平操作。跳过磨轮头较平。否则，继续步骤 7-10。
7. 旋松工作头气动轴外壳螺栓并取下前合销。将后销作为枢轴。
8. 微进给 Y 轴 + 和 -，同时推入至外壳内直至较平。
9. 紧固螺栓并更换前合销。
10. 检验较平是否在 ± 0.0003 inch (0.007 mm) 内。否则，重复步骤 7-10。若较平，则继续磨轮头较平。

磨轮头（A 轴）

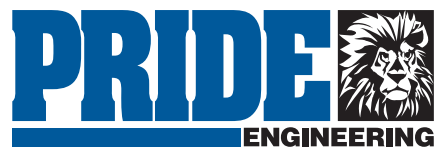
1. 将千分表安装在磨轮头心轴上。
2. 旋转千分表直至指向后方并保持在此位置处。
3. 将钥匙拧至“OFF”位置（该钥匙位置保持心轴并防止旋转）。
4. 由 C 轴旋转底座取下钉枪并将 C 轴微进给至 90°。
5. 微进给 A & Z 轴，直至千分表处于工具球近面上。
6. 微进给 A + 和 -，指示工具球面的仅侧和远侧。若较平在 ± 0.0003 inch (0.007 mm) 内，则跳至步骤 10。
7. 旋松 Z 底座的安装螺栓（Part 6-135）。紧固用于枢轴点的左前螺栓。
8. 微进给 A 轴 + 和 -，同时推入铸件内，直至较平处于 ± 0.0003 inch (0.007 mm) 内。
9. 检验较平时拧紧螺栓。

10. 微进给 A 至安全位置。
11. 微进给 C 至 0°。
12. 钉枪 C 轴旋转底座处于 0°。
13. 将钥匙拧至 “Manual” 位置。
14. 微进给 X 和 Y，因而使工具求处于 C 轴旋转轴点中心旁。
15. 微进给 Z，因而使心轴中心线处于 C 轴旋转轴点中心旁。
16. 微进给 A 直至千分表接触工具球面。绕工具球面拉动千分表。
若较平在 ± 0.0003 inch (0.007 mm) 内，则跳至步骤 20。
17. 旋松磨轮头气动轴外壳螺栓并取下前合销。
保留后销。
18. 拉动工具球面，同时推入至外壳内直至较平处于 ± 0.0003 inch (0.007 mm) 内。
19. 紧固螺栓，同时检查较平，更换前合销。
20. 微进给 A 轴至安全位置。
21. 由 C 轴旋转底座取下钉枪。

型号 30A

磨床

部件识别



5. 部件识别

本手册中图片含部件识别号。本部分包含其他零件识别信息，包括耗材和建议使用的零部件。

5.1 附件

参阅第 2.2 部分了解附件表。

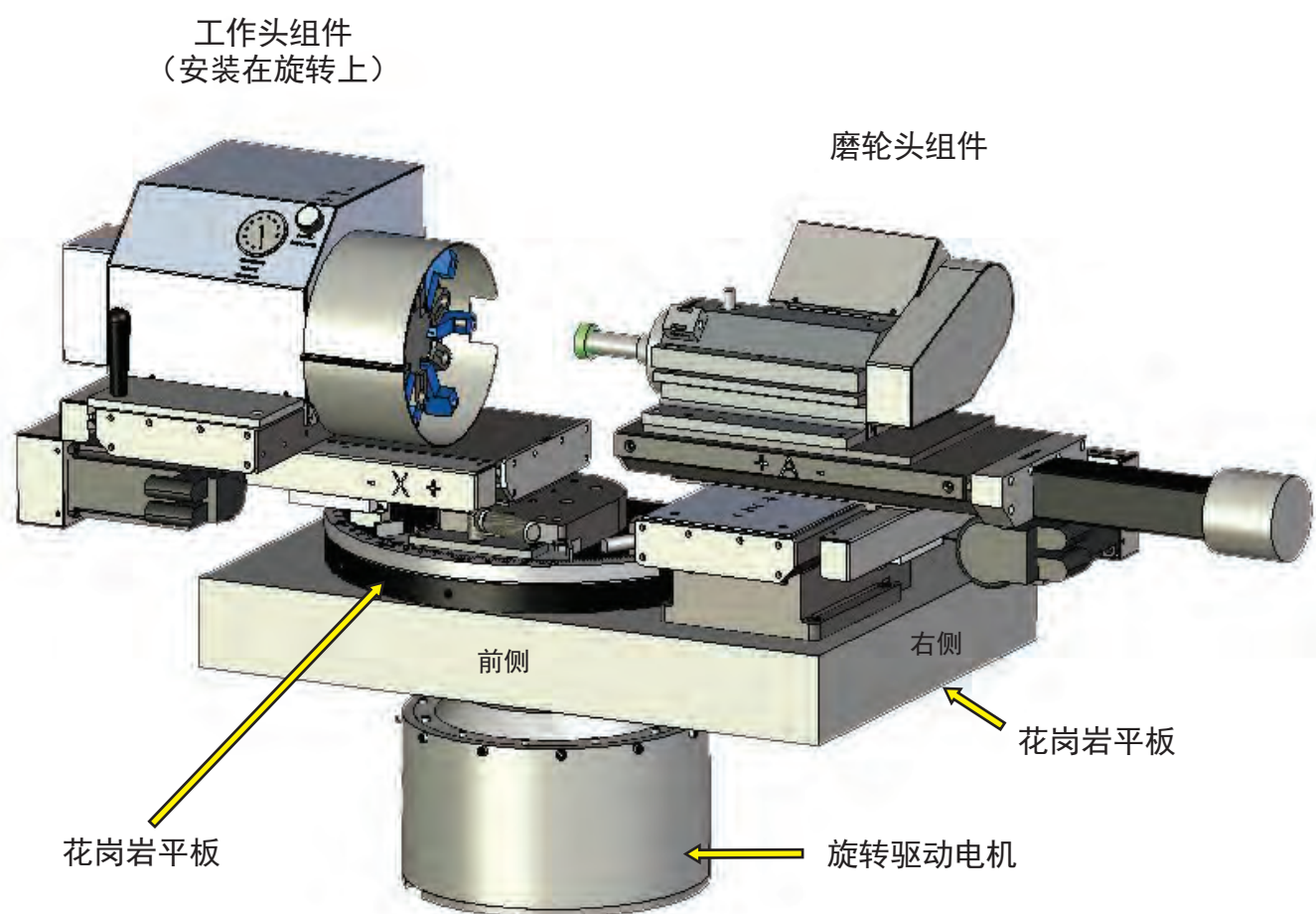
5.2 耗材

冷却液，5 加仑。	9-124	(混合 30 份水： 1 份冷却液)
金刚石修整器	9-149	
金刚石磨轮	9-201	
过滤器，卷式	19-114	
金刚石磨轮，1,000 周长	9-178	
金刚石磨轮，800 周长	9-143	
磨轮，6 爪卡盘打磨	19-125	
磨轮，6 爪卡盘端面	19-126	
金刚石磨轮	19-110	

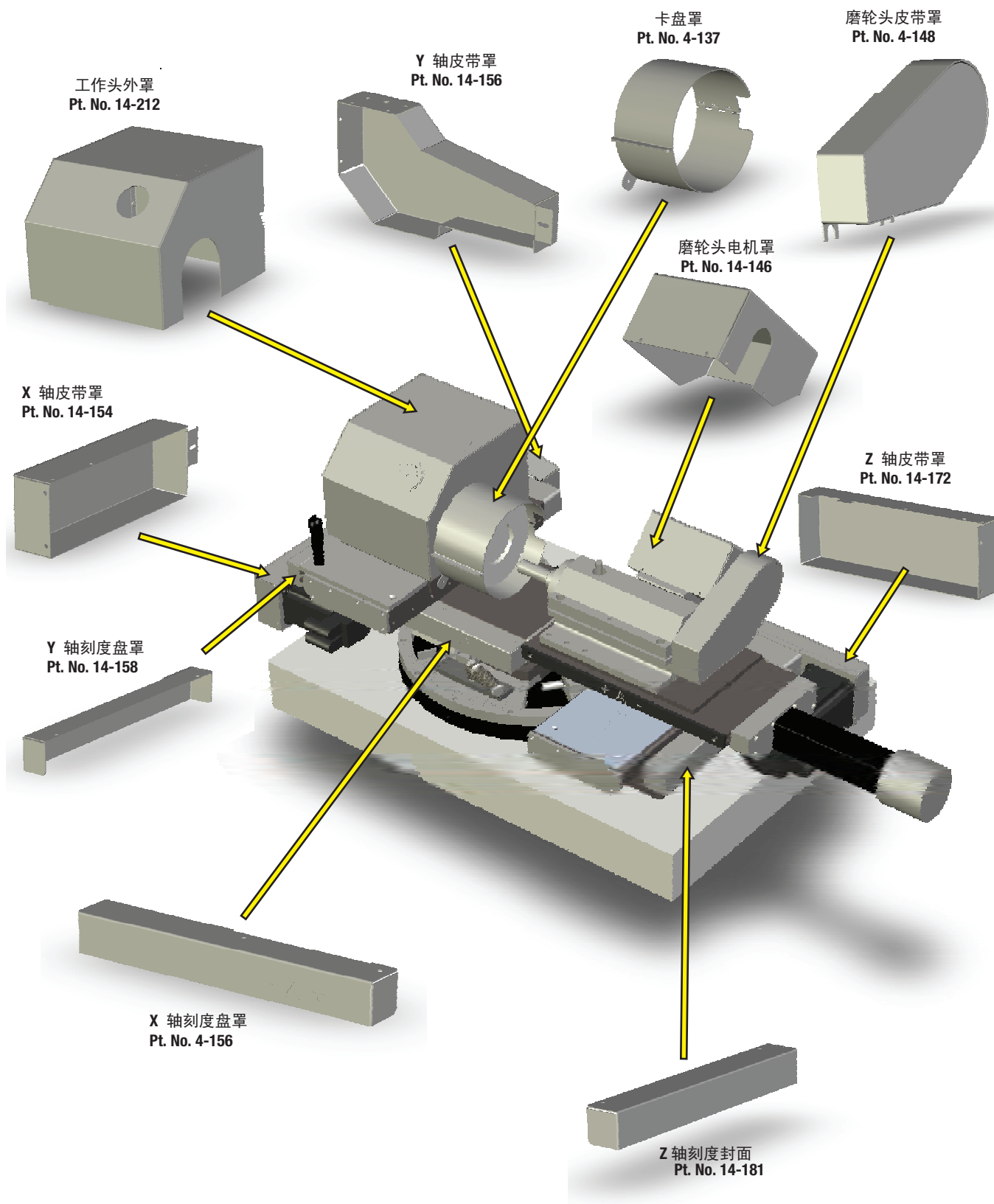
5.3 推荐使用备件

冷却液前置过滤器，（10 微米）	5-101
滑轮，工作头气动轴承	6-100
传送皮带，磨轮头心轴	9-128
润滑油计量阀 (AA)（每种 6 个）	12-103
A 轴润滑油计量阀	12-104
滑轮，Y 轴驱动电机	16-107
链轮，30 齿滚珠丝杆滑轮 X、Y 和 Z	16-108
驱动皮带，X、Y 和 Z 滑块驱动机（每种 3 个）	16-124
滑轮，工作头心轴电机	16-139
滑轮，X 轴驱动电机	16-140
驱动皮带，工作头心轴	16-143
滑轮，磨轮头气动轴承	16-151
空气过滤器（第 3 润滑油凝结器）	19-106
空气过滤器（第 2 油气）	19-107
浮阀（每种 2 个）	19-108
过滤卷 (10 μ m)（每卷 50 码）	19-114
空气过滤机（第 1 水分离机）	19-118

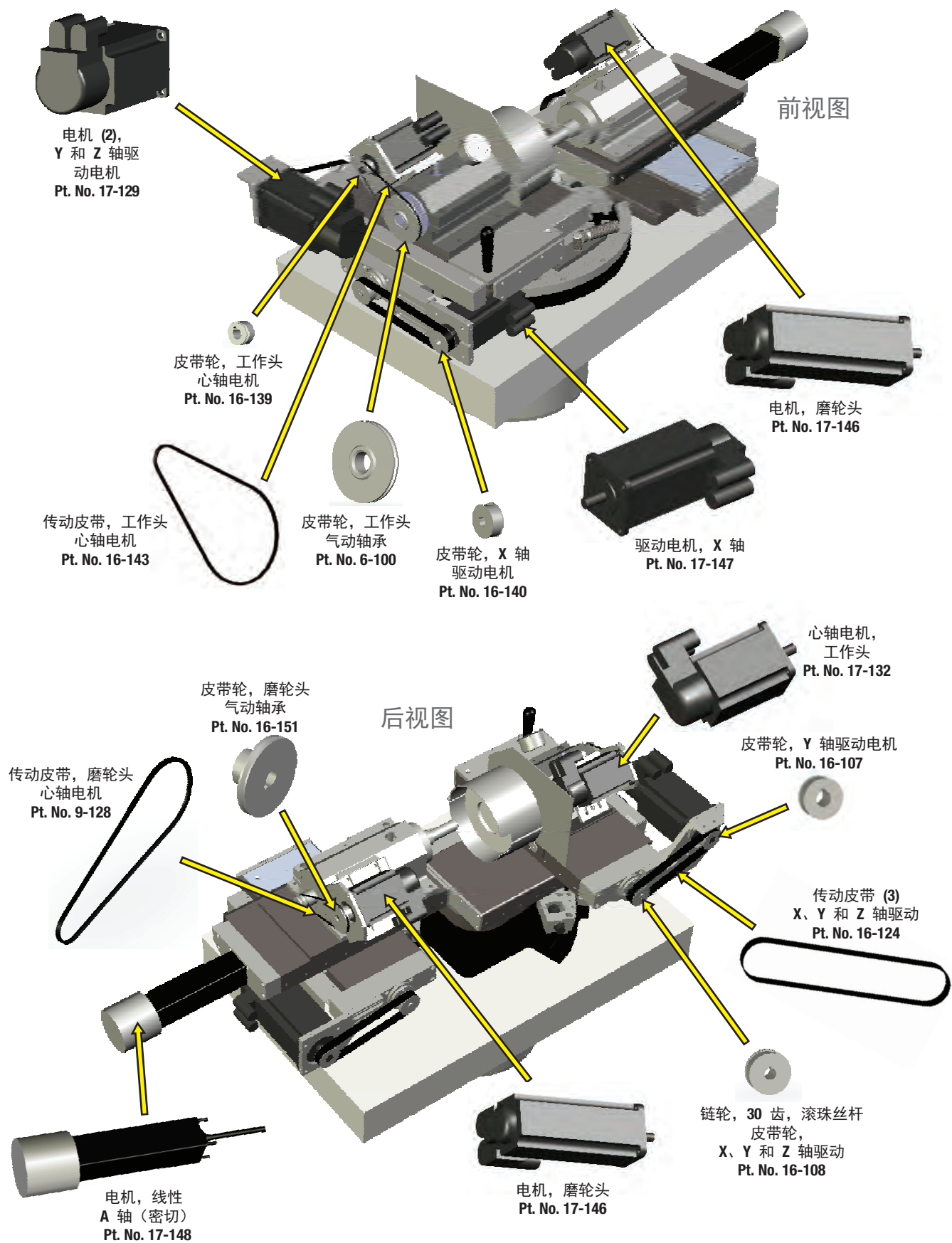
5.4 机械零部件



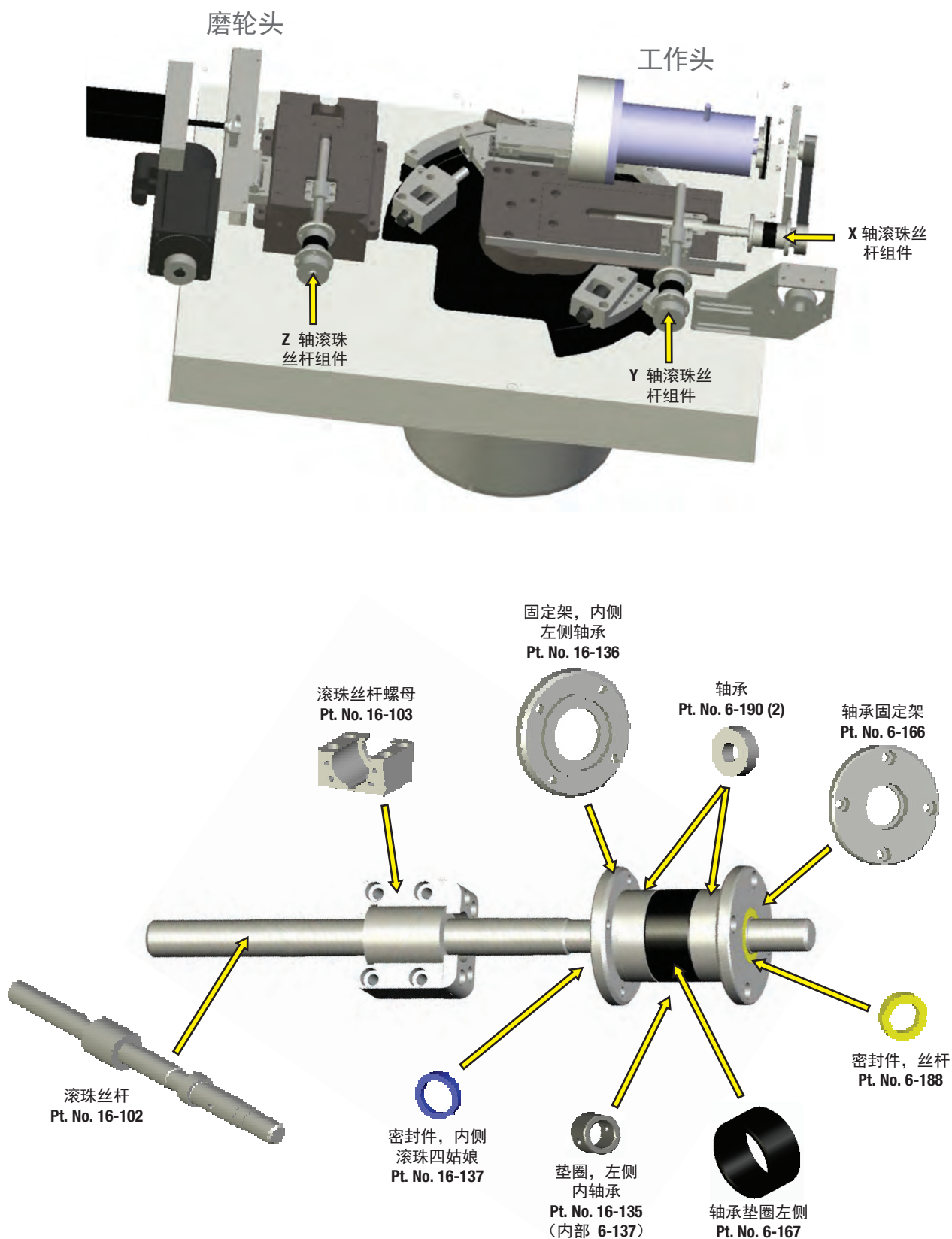
磨床防护罩



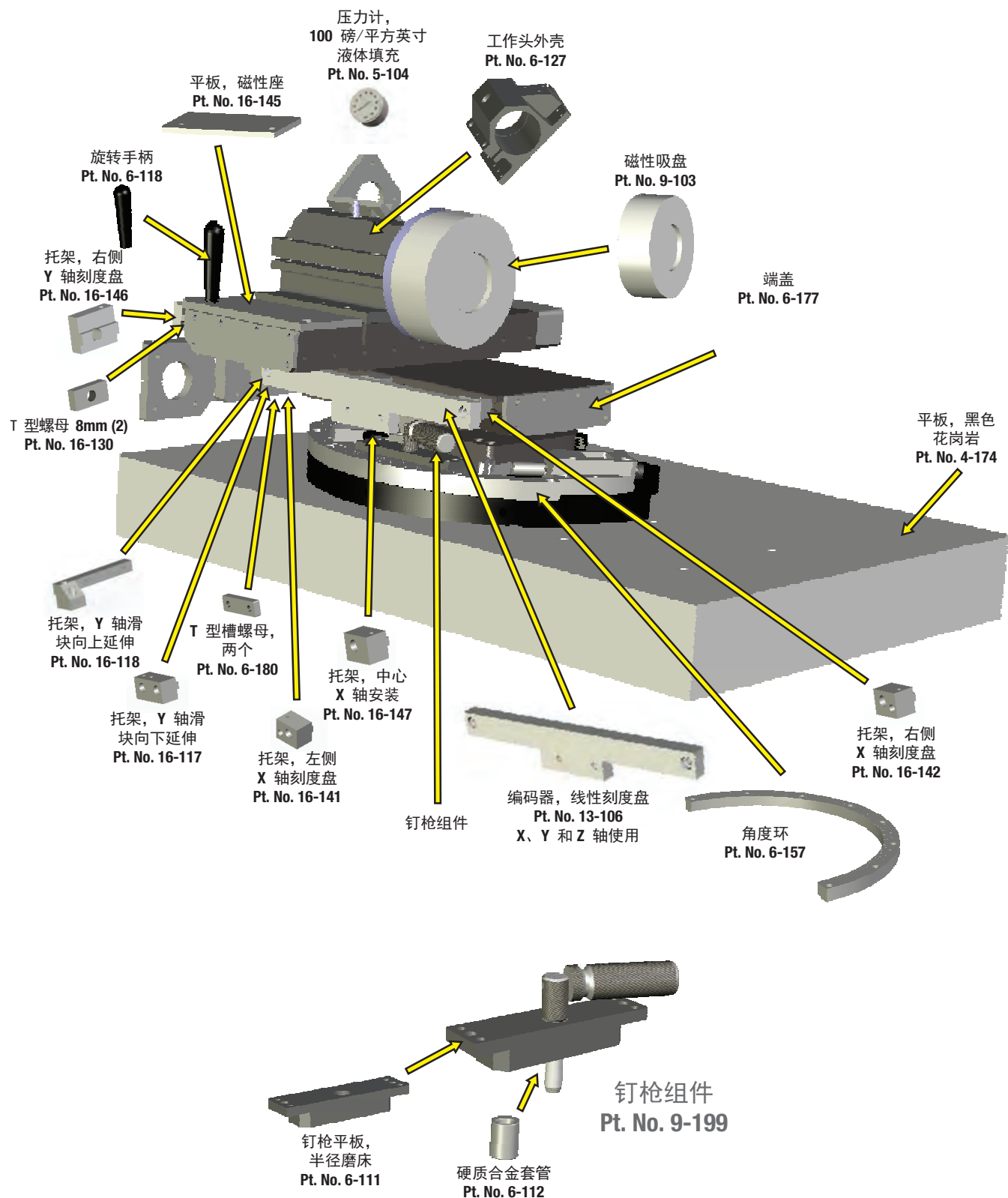
电机、皮带与皮带轮



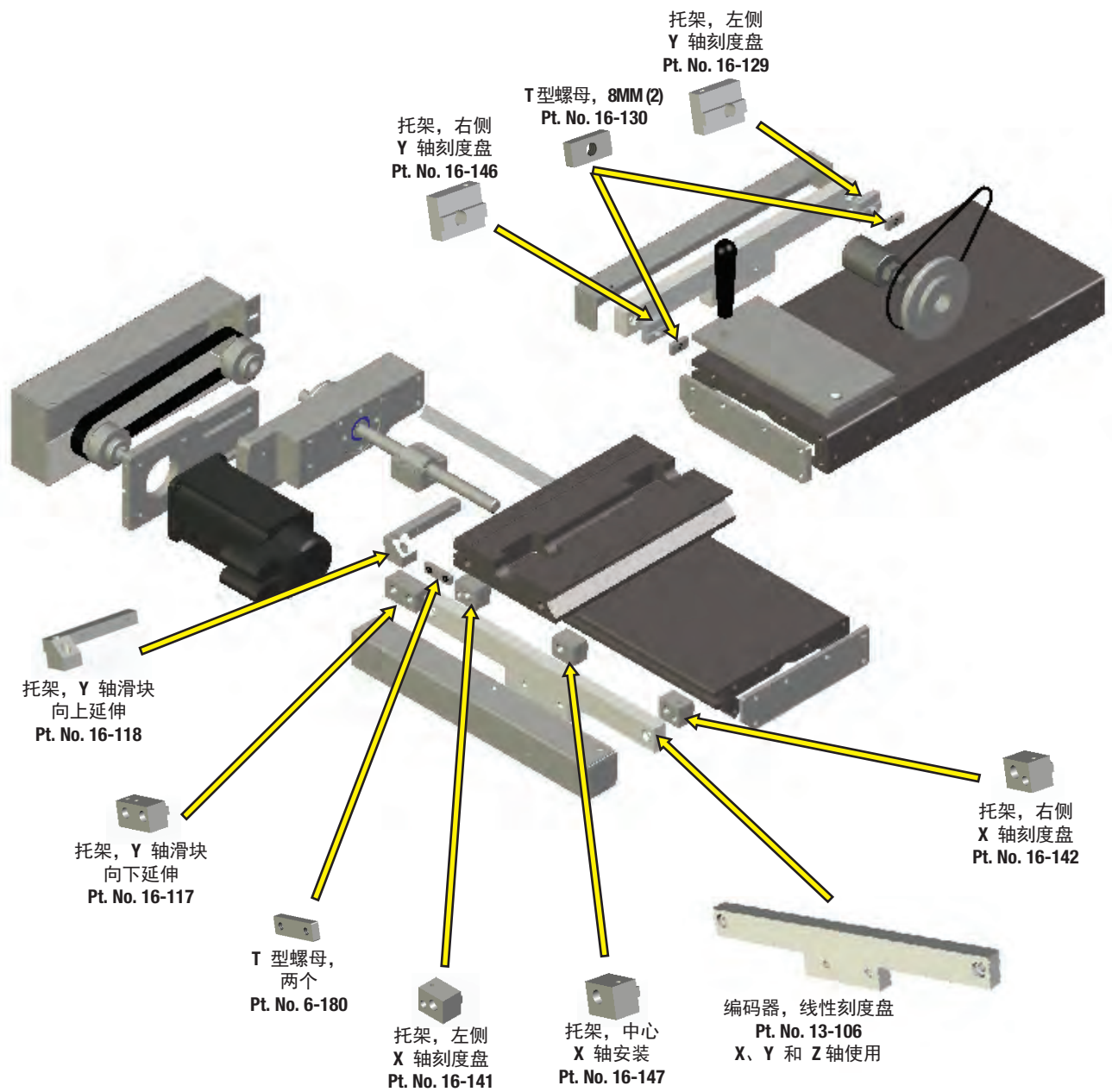
丝杆组件



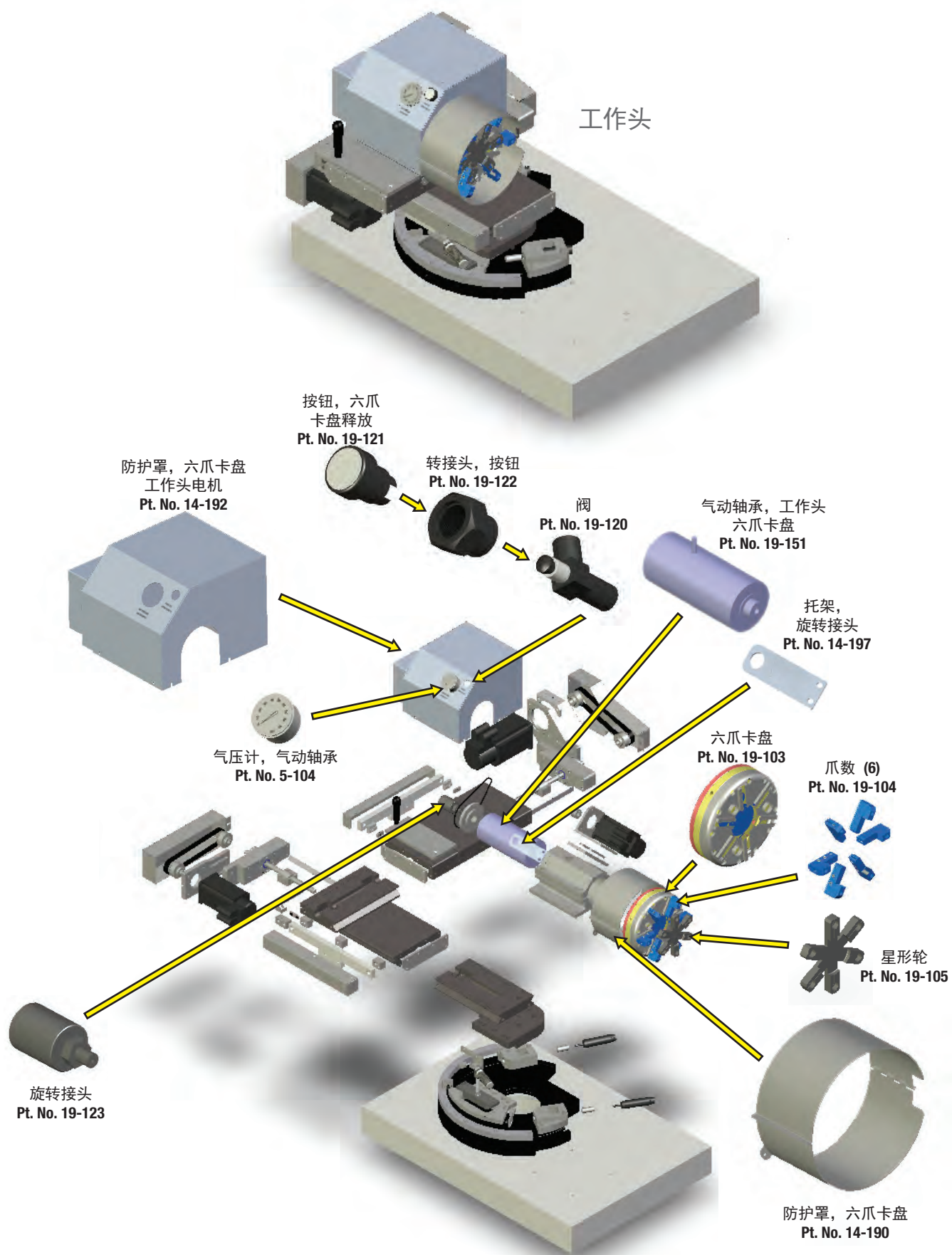
工作头 (前视图)



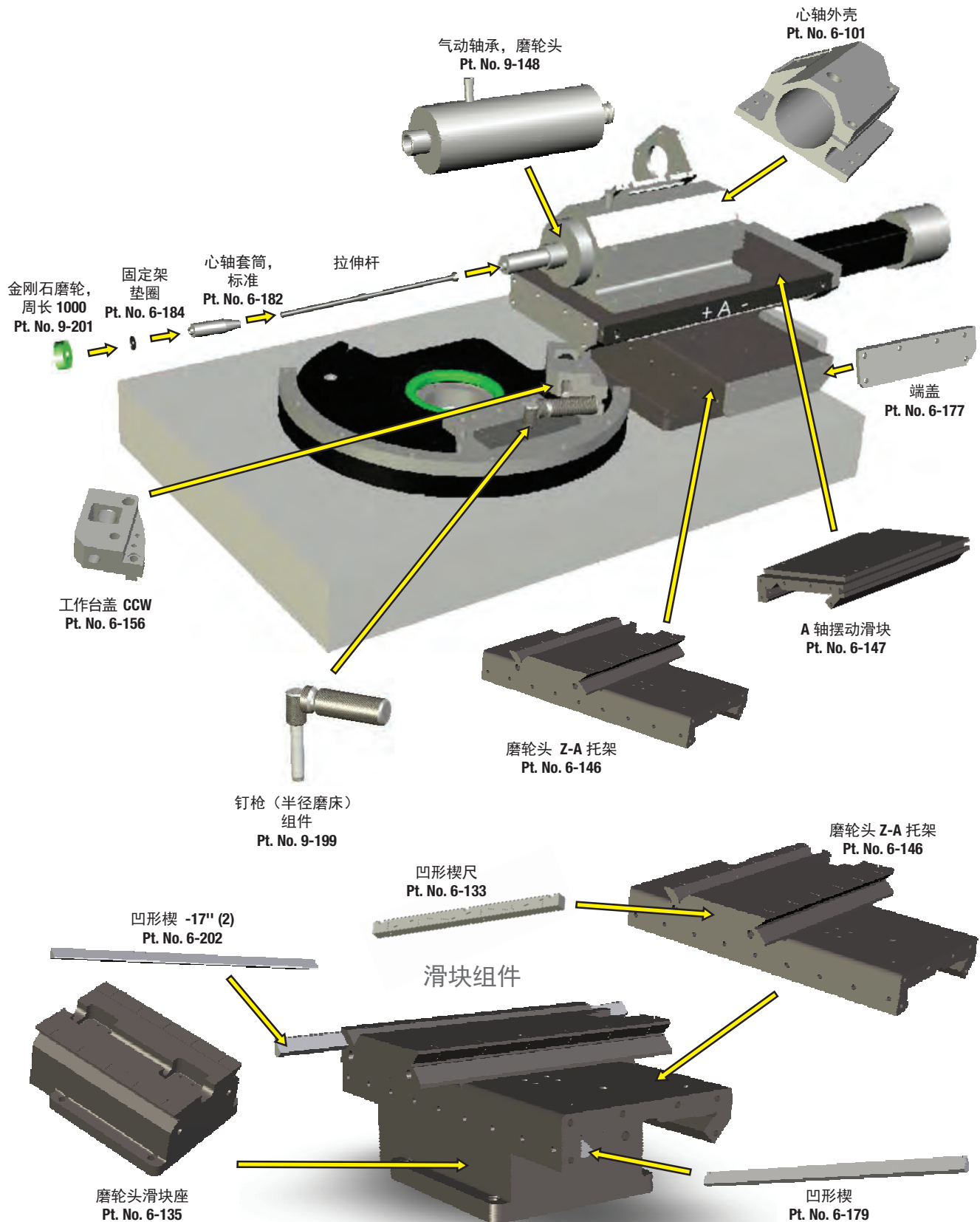
工作头 (前视图详图)



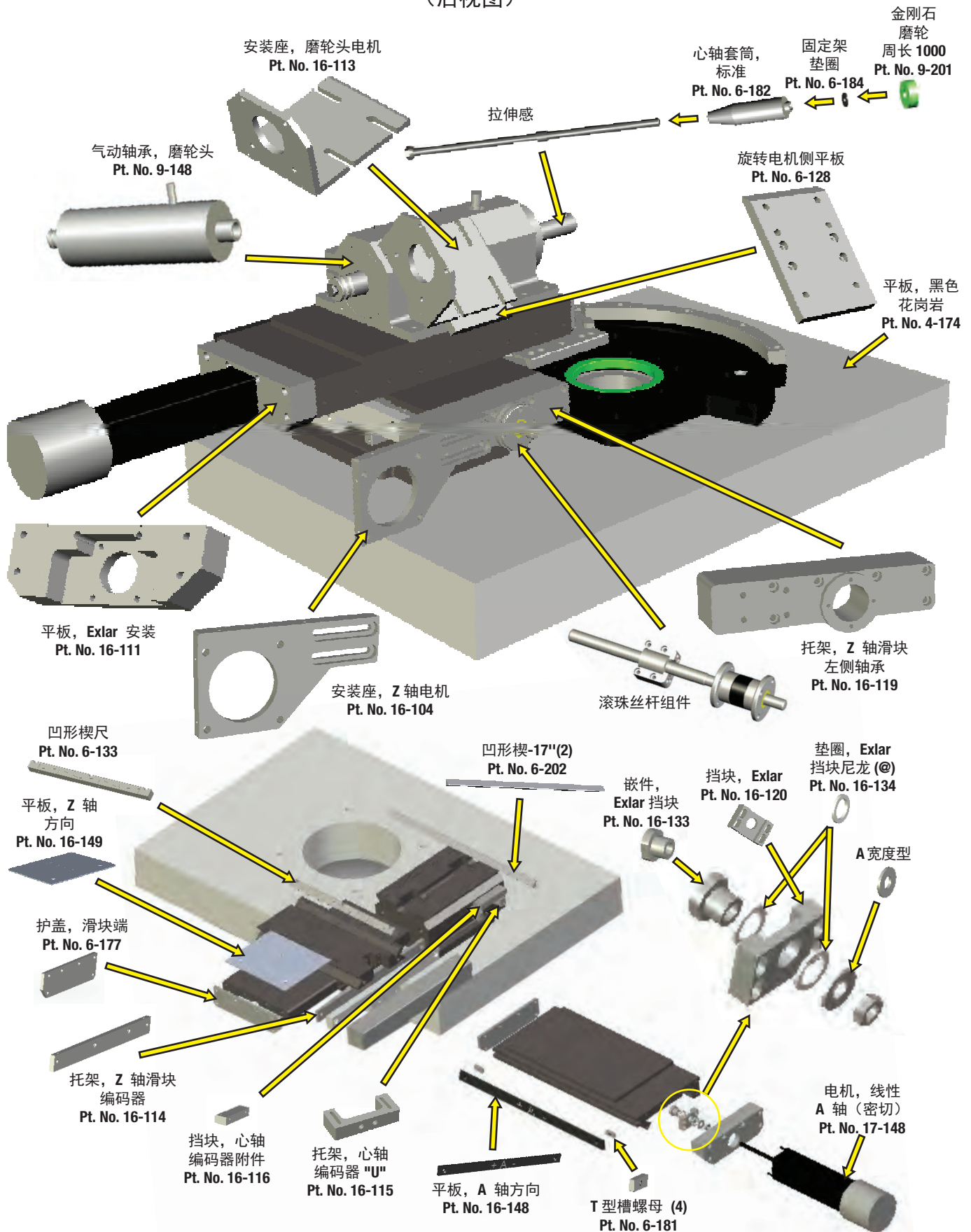
工作头，六爪卡盘选件



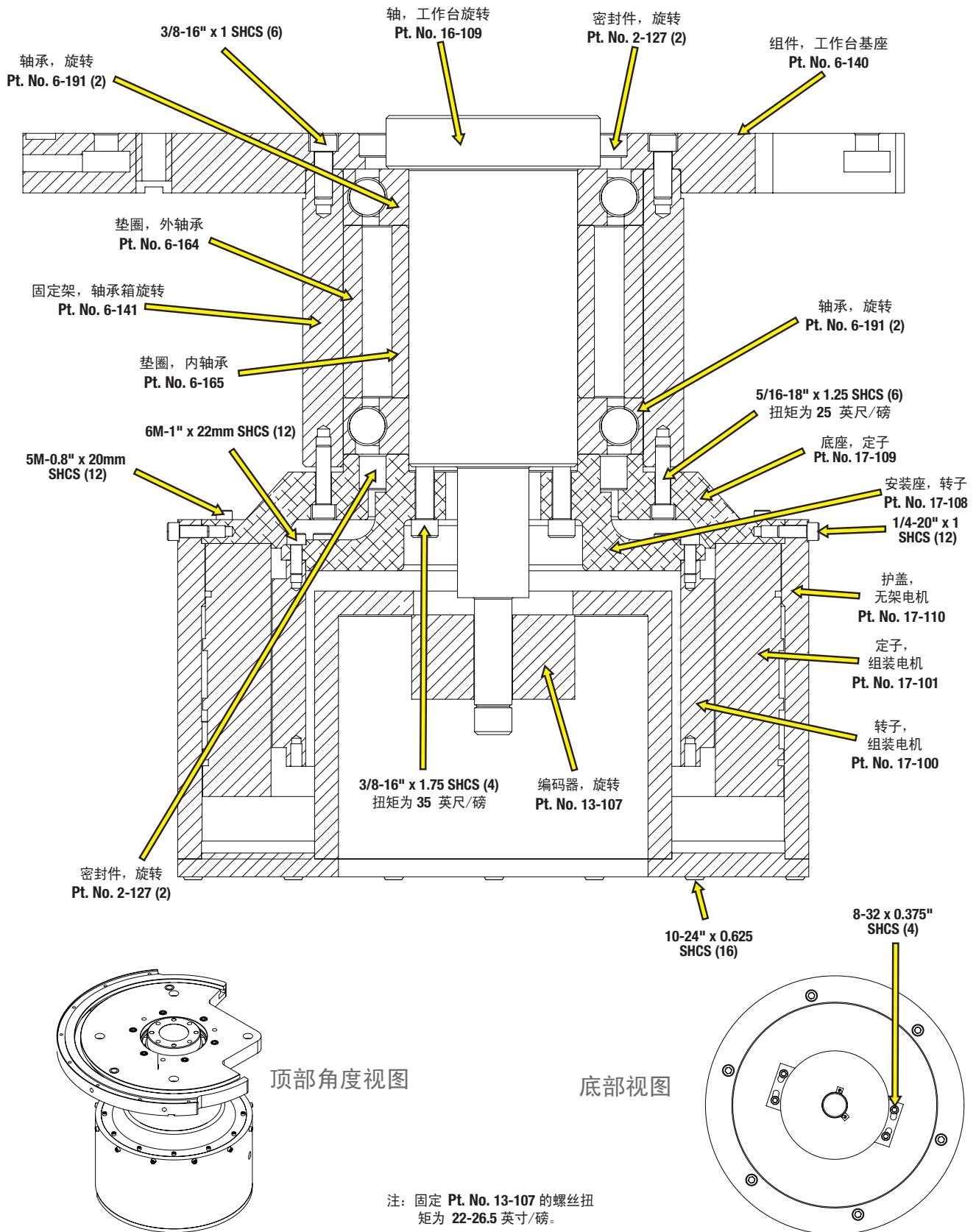
磨轮头 (前视图)



磨轮头 (后视图)



旋转组件



旋转组件

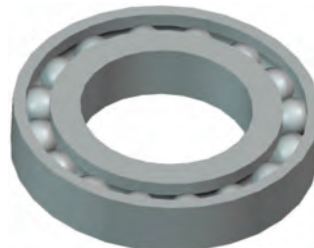
轴，工作台旋转
Pt. No. 16-109



轴承垫圈
Pt. No. 6-164



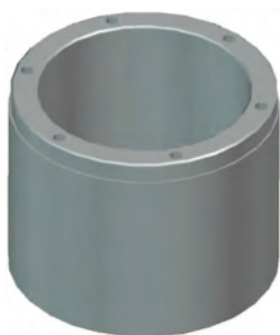
轴承，旋转
Pt. No. 6-191



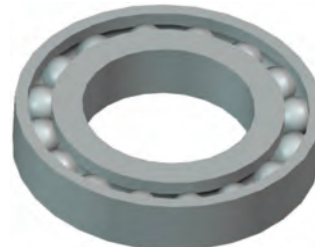
轴承垫圈
Pt. No. 4-167



固定架
轴承箱旋转
Pt. No. 6-141



轴承，旋转
Pt. No. 6-191



数字直接驱动
无架旋转电机



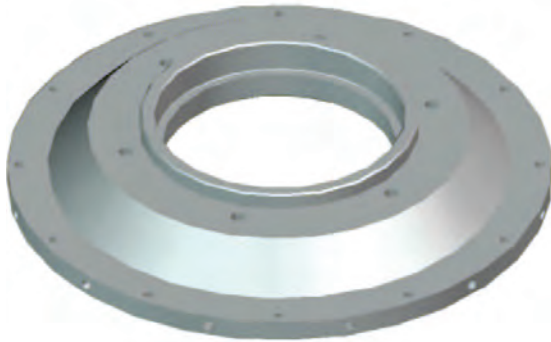
基座组件，工作台
Pt. No. 6-140



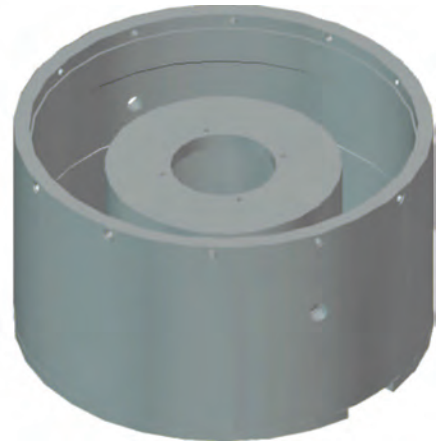
无架旋转电机



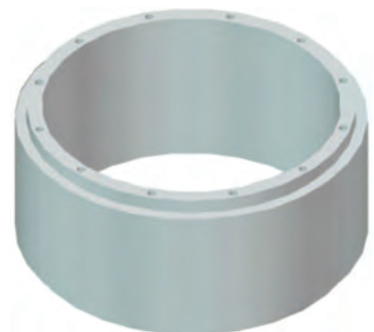
护盖, 无架电机
Pt. No. 17-110



安装座, 定子
Pt. No. 17-109



安装座, 转子
Pt. No. 17-108

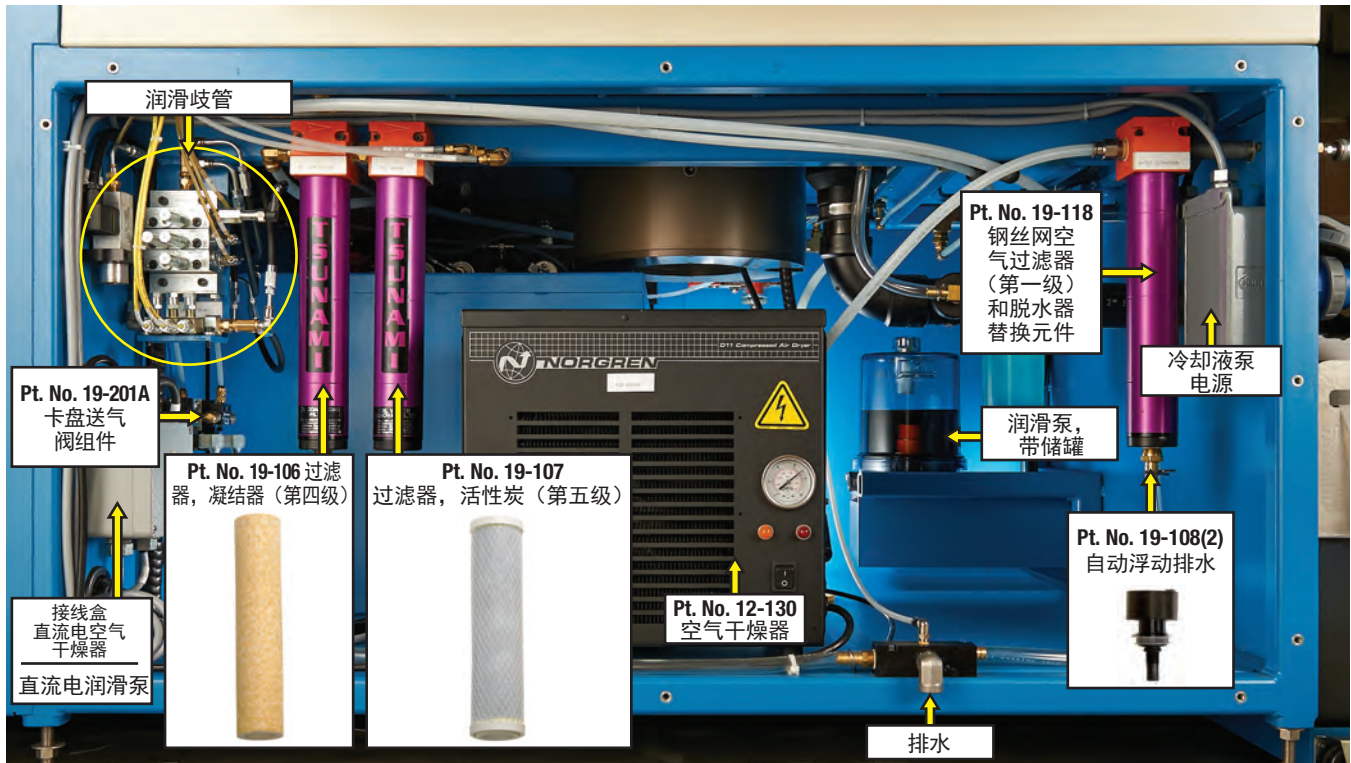


转子
Pt. No. 17-100



定子
Pt. No. 17-101

机柜 - 后部



空气净化与过滤系统

该多阶过滤系统确保气动轴承持久耐用。系统清除油、油雾、水和蒸汽至 .001 PPM (.01 micron)。为保持气动轴承性能, 过滤的空气供应必须保持一天 24 小时。

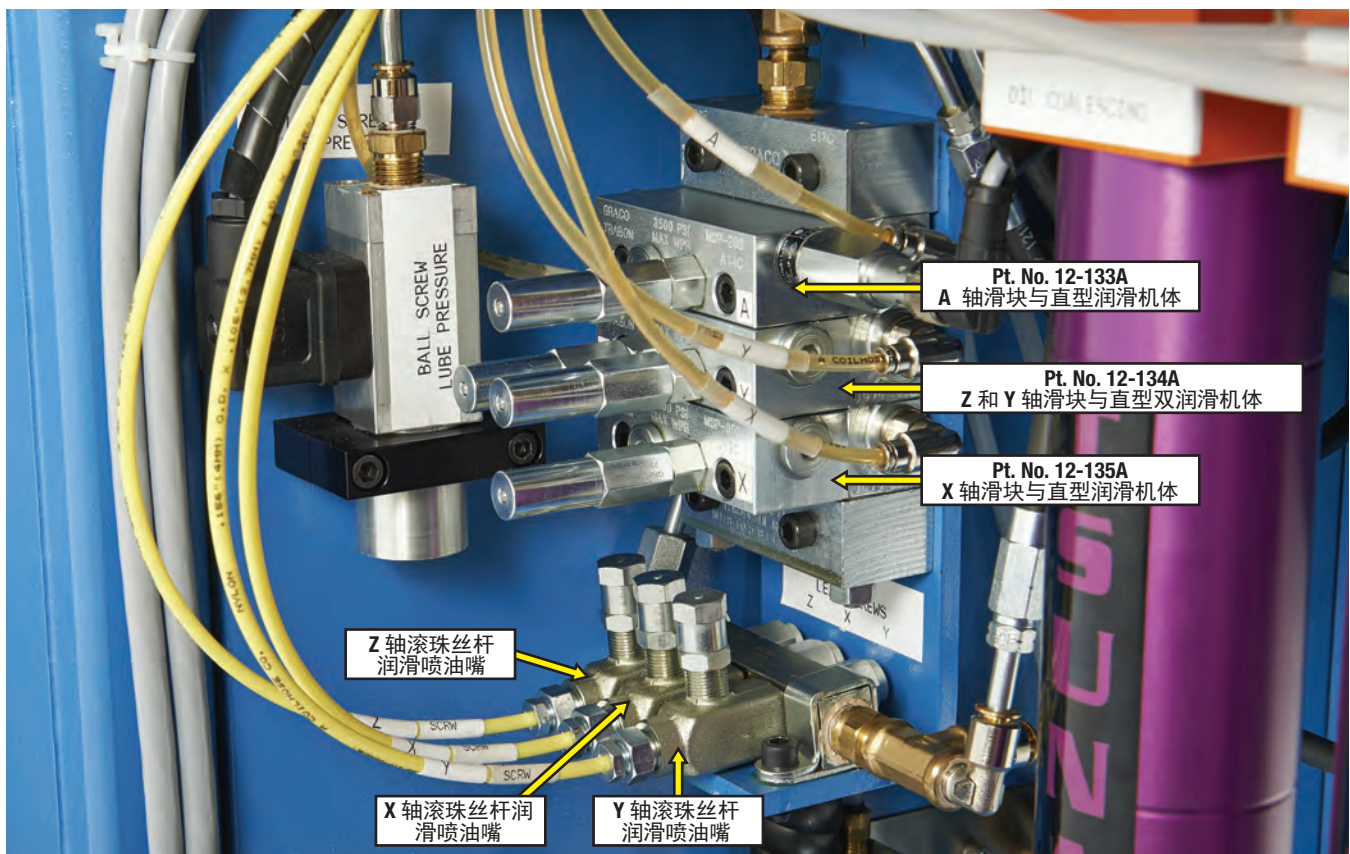
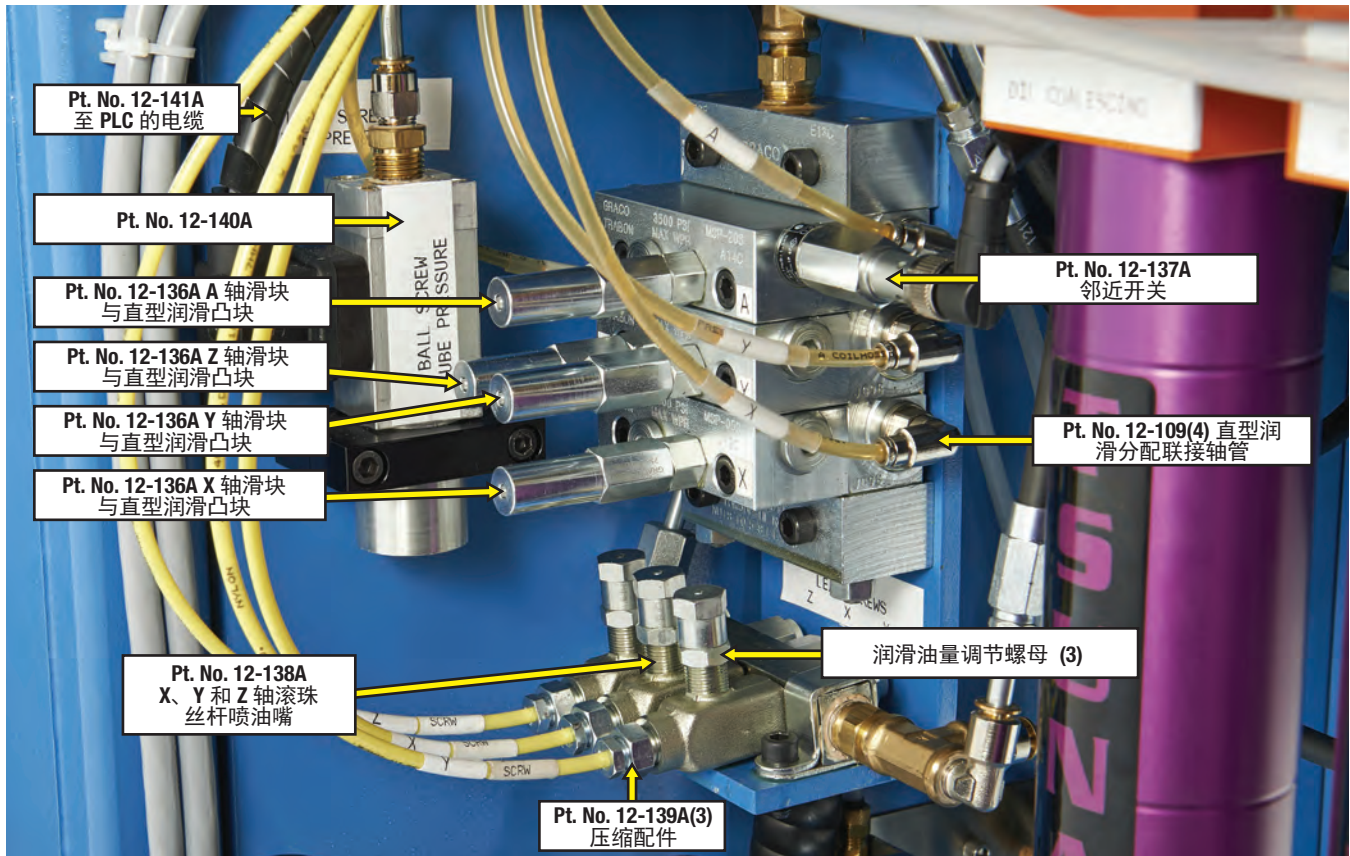
每四 (4) 个月更换 19-106 Filter, Coalescer

每四 (4) 个月更换 19-107 Filter, Activated Carbon

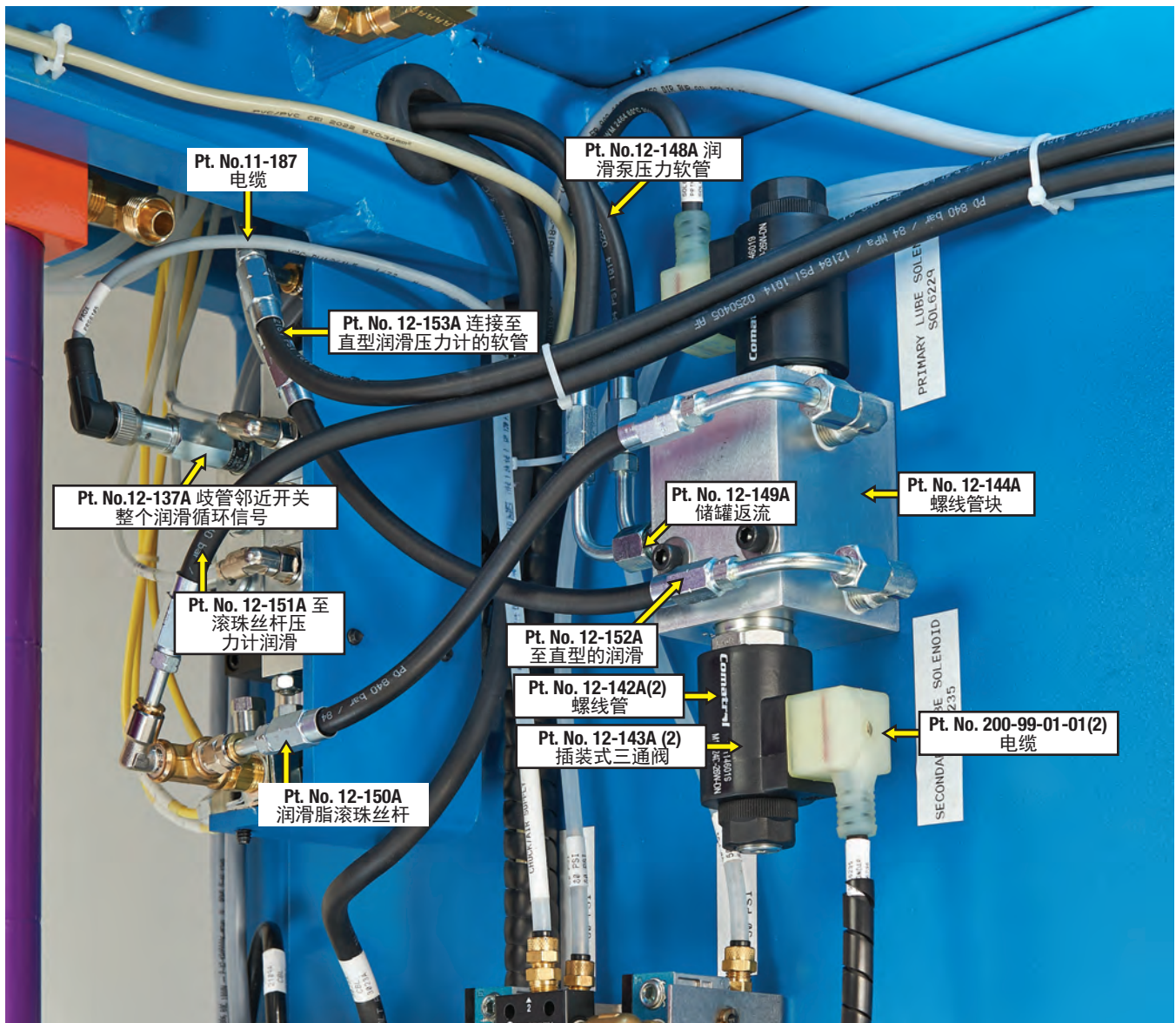
根据需要更换 19-108 Float Valves

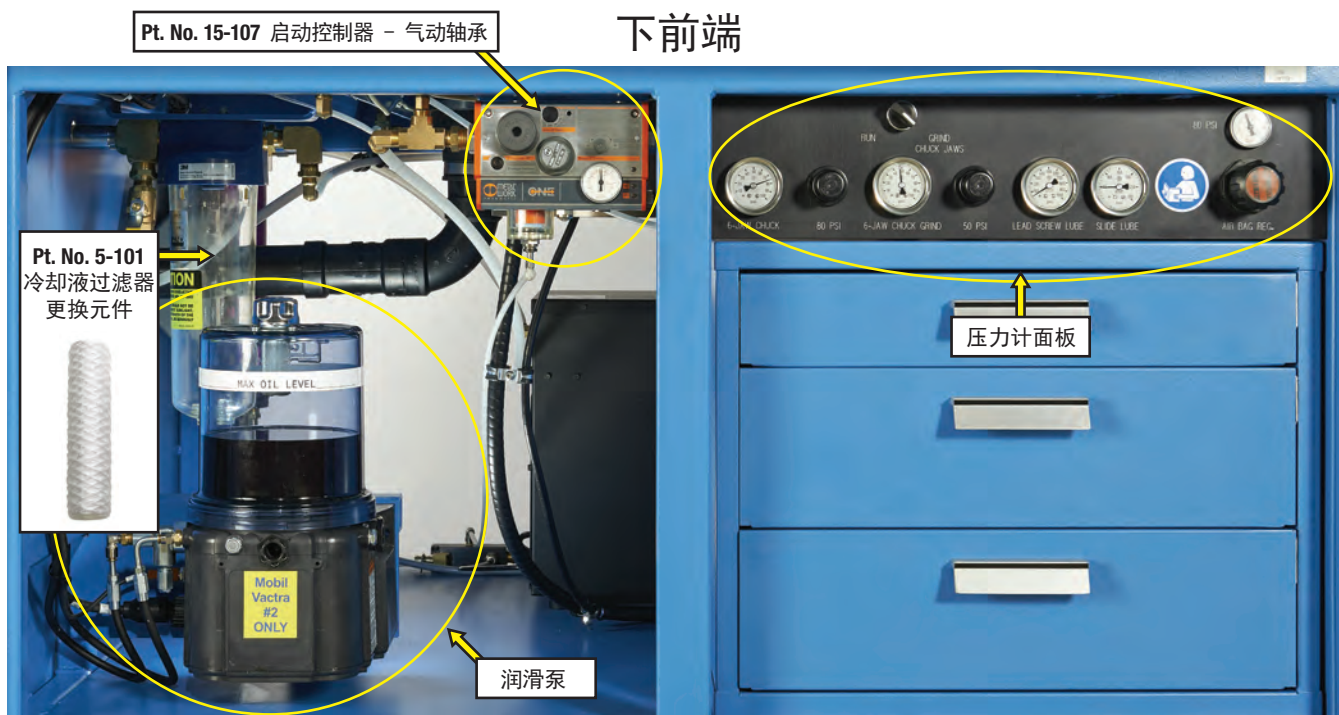
需拆卸并清洁 19-118 Steel Mesh, 但不需要更换

润滑歧管

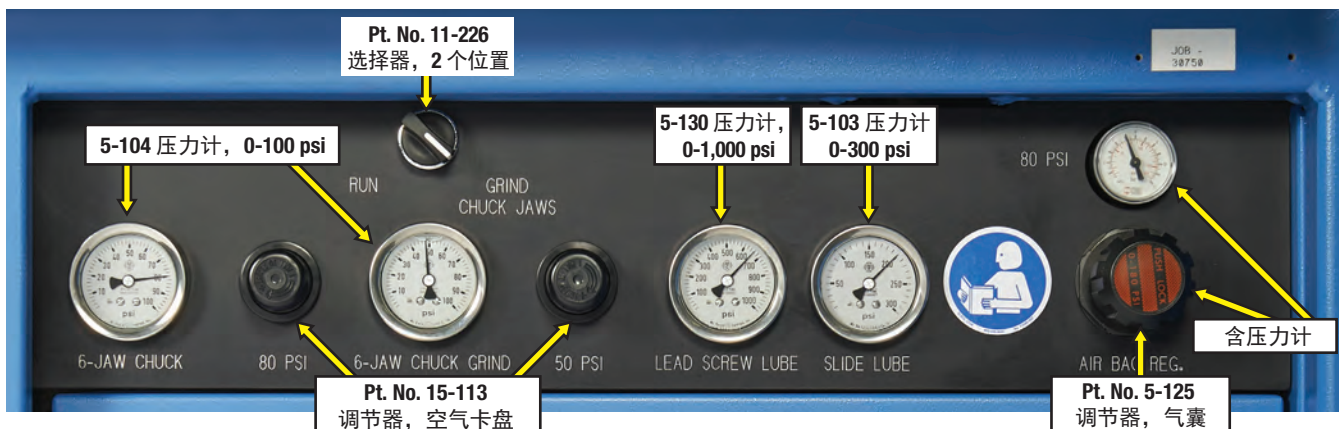


润滑分配系统，带螺线管





压力计面板



Pt. No. 15-107 空气控制器-气囊

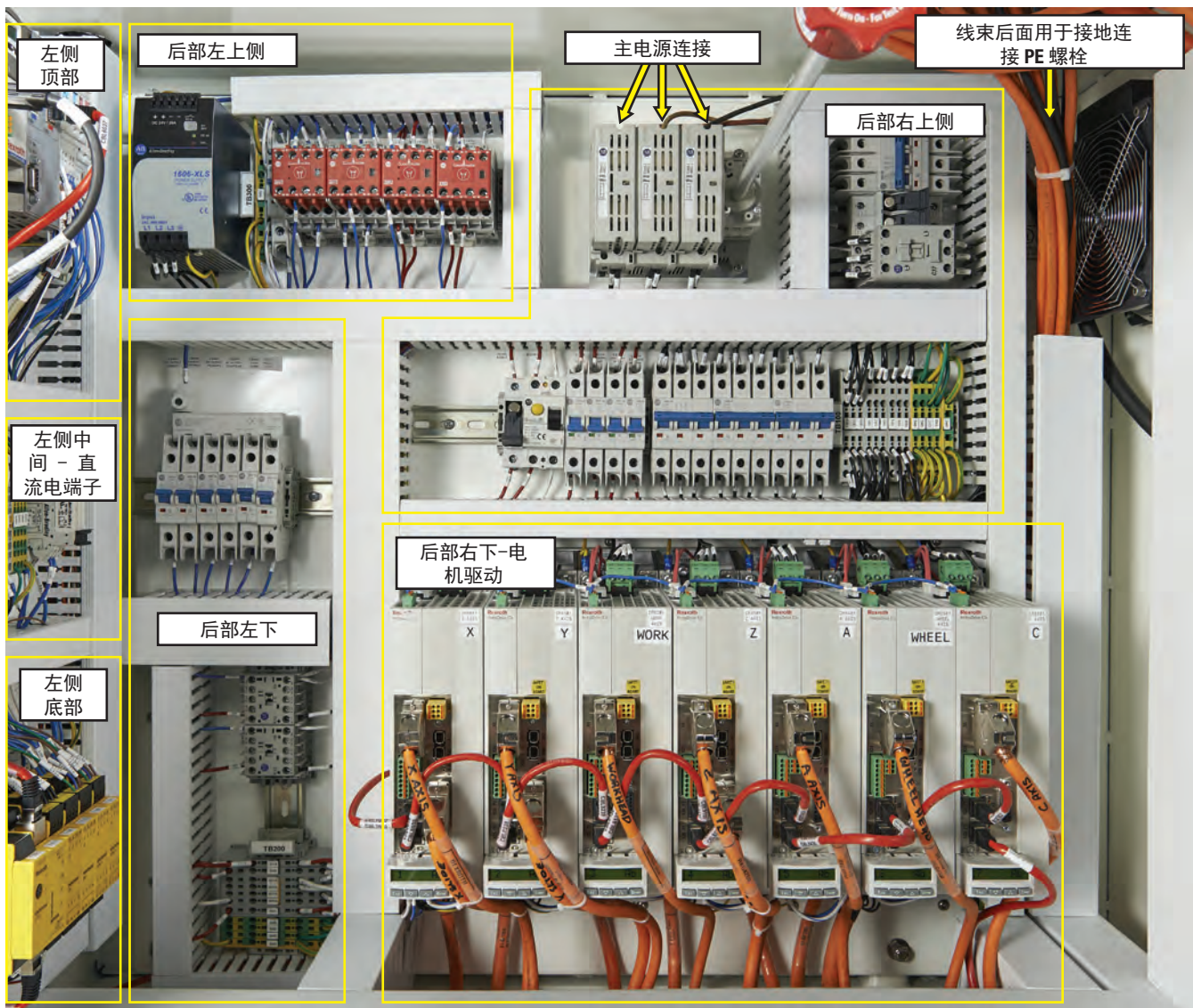


润滑泵

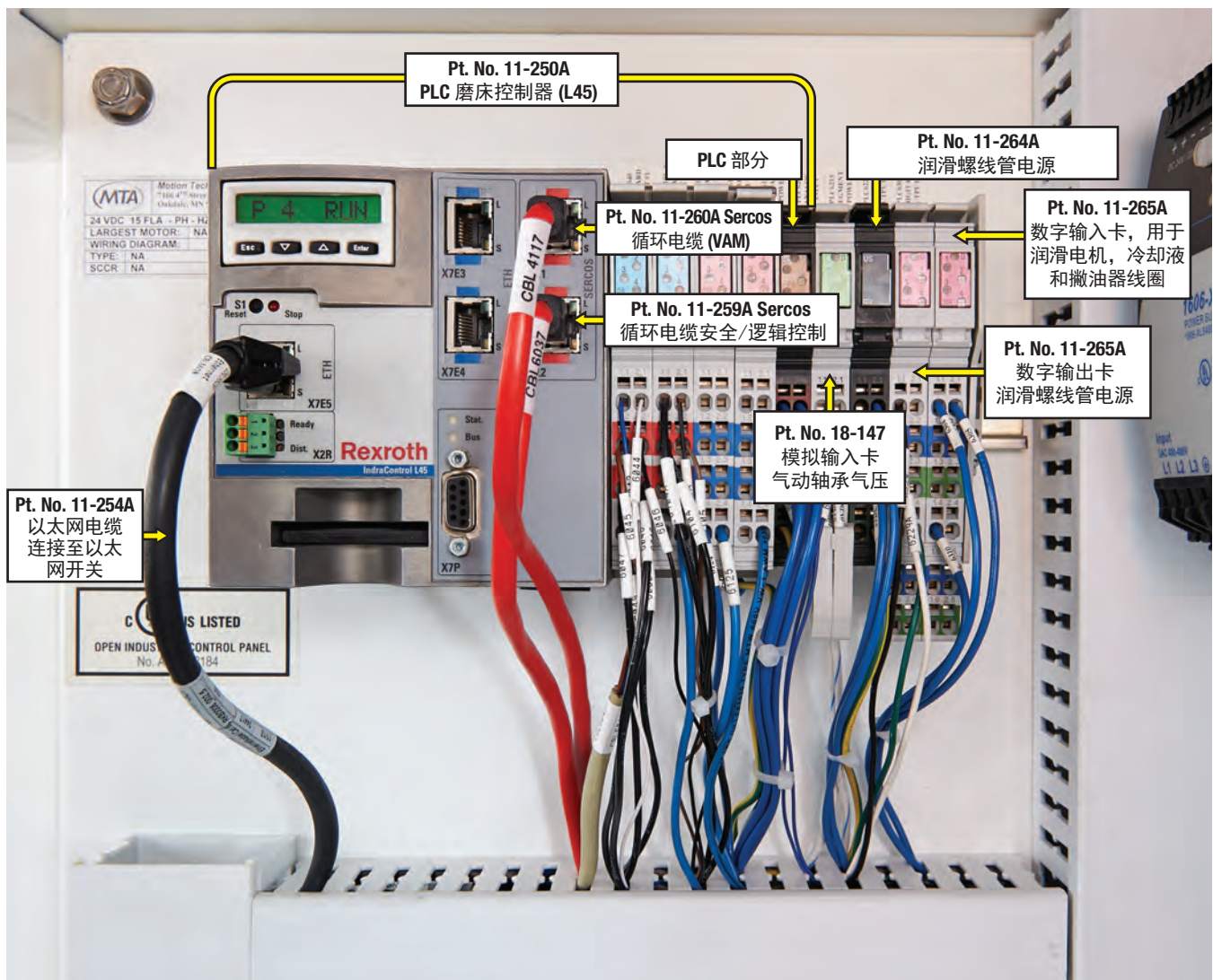


5.5 电子元件

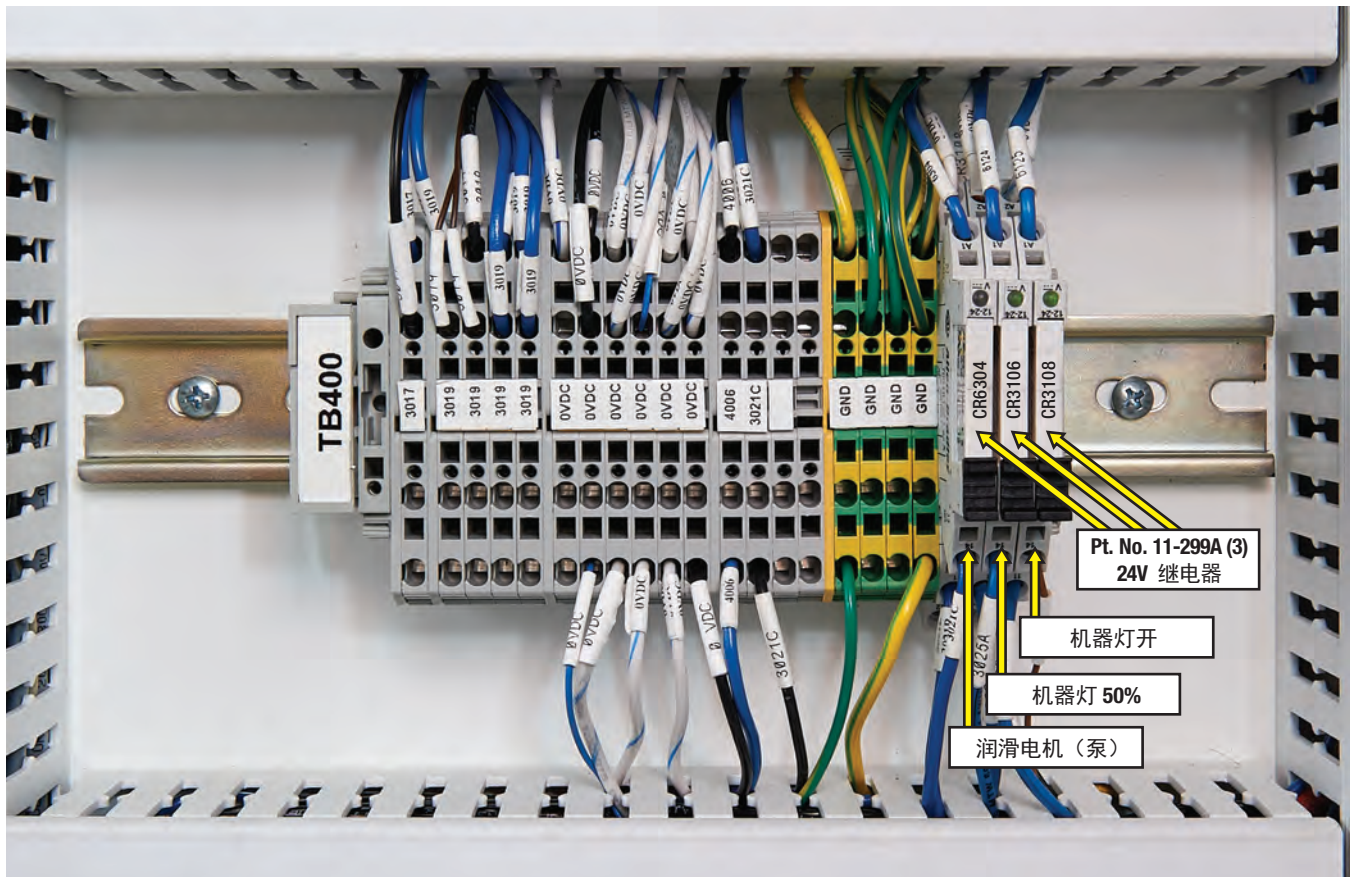
控制柜



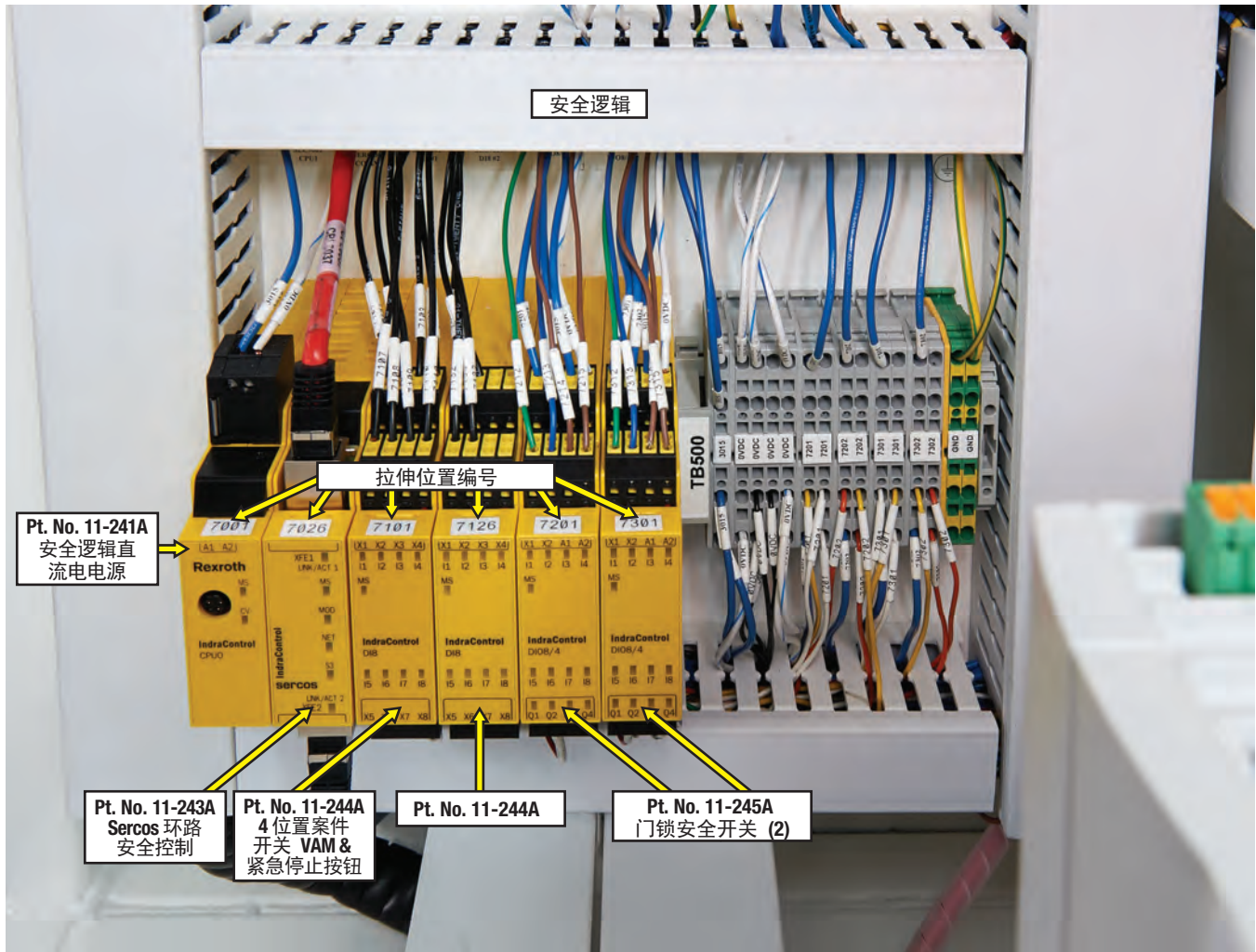
控制柜 - 左侧顶部



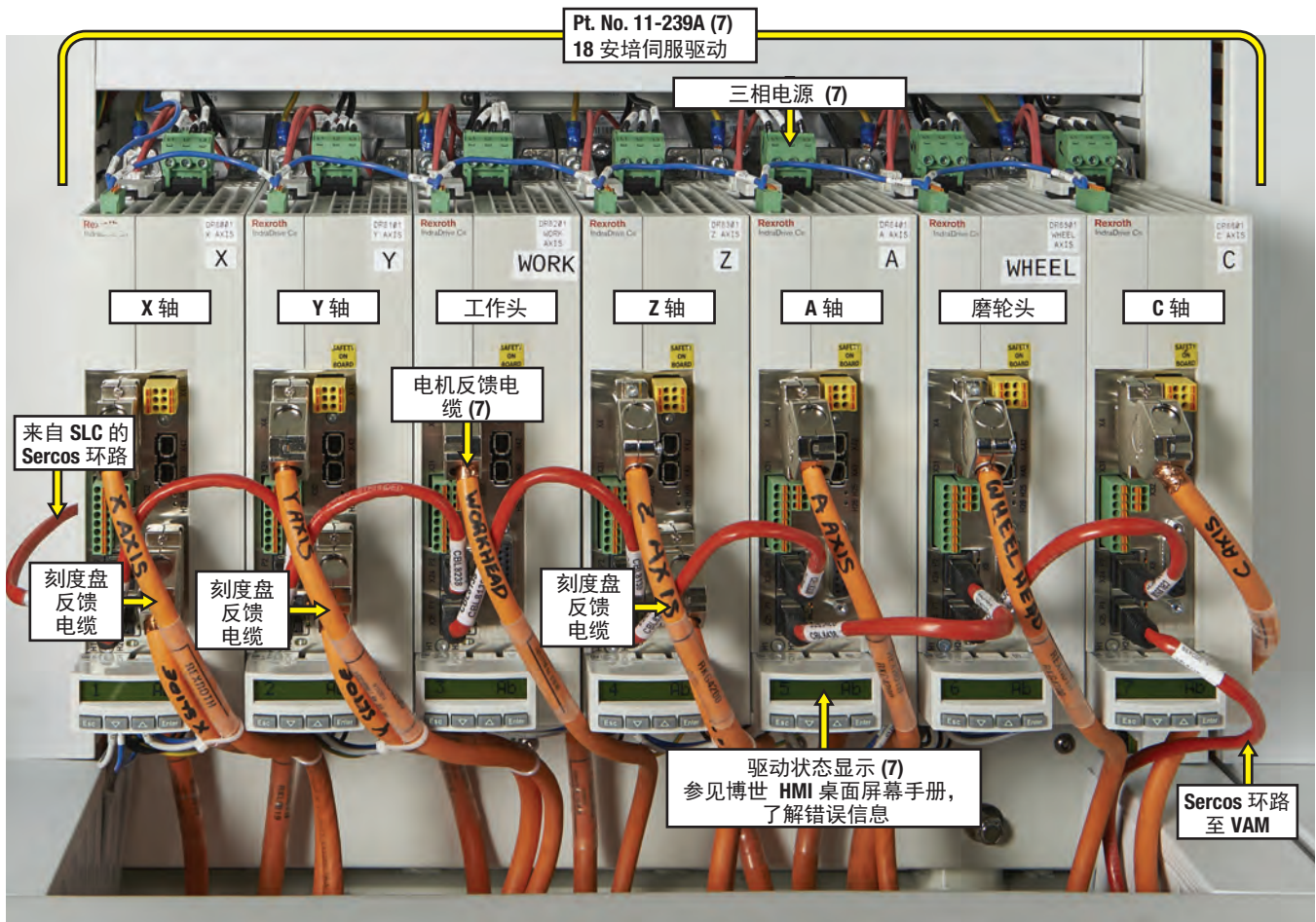
控制柜-左侧中间-直流电端子



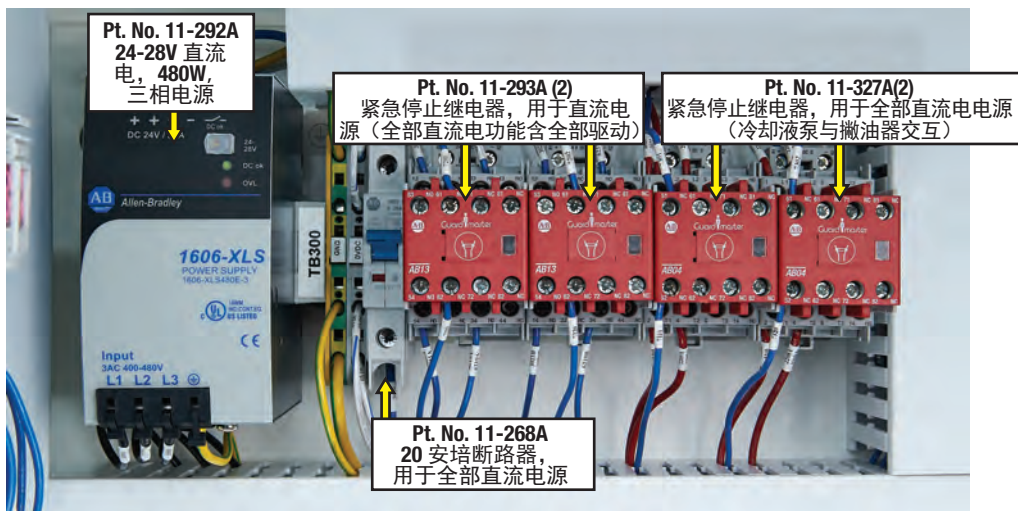
控制柜 - 左侧底部



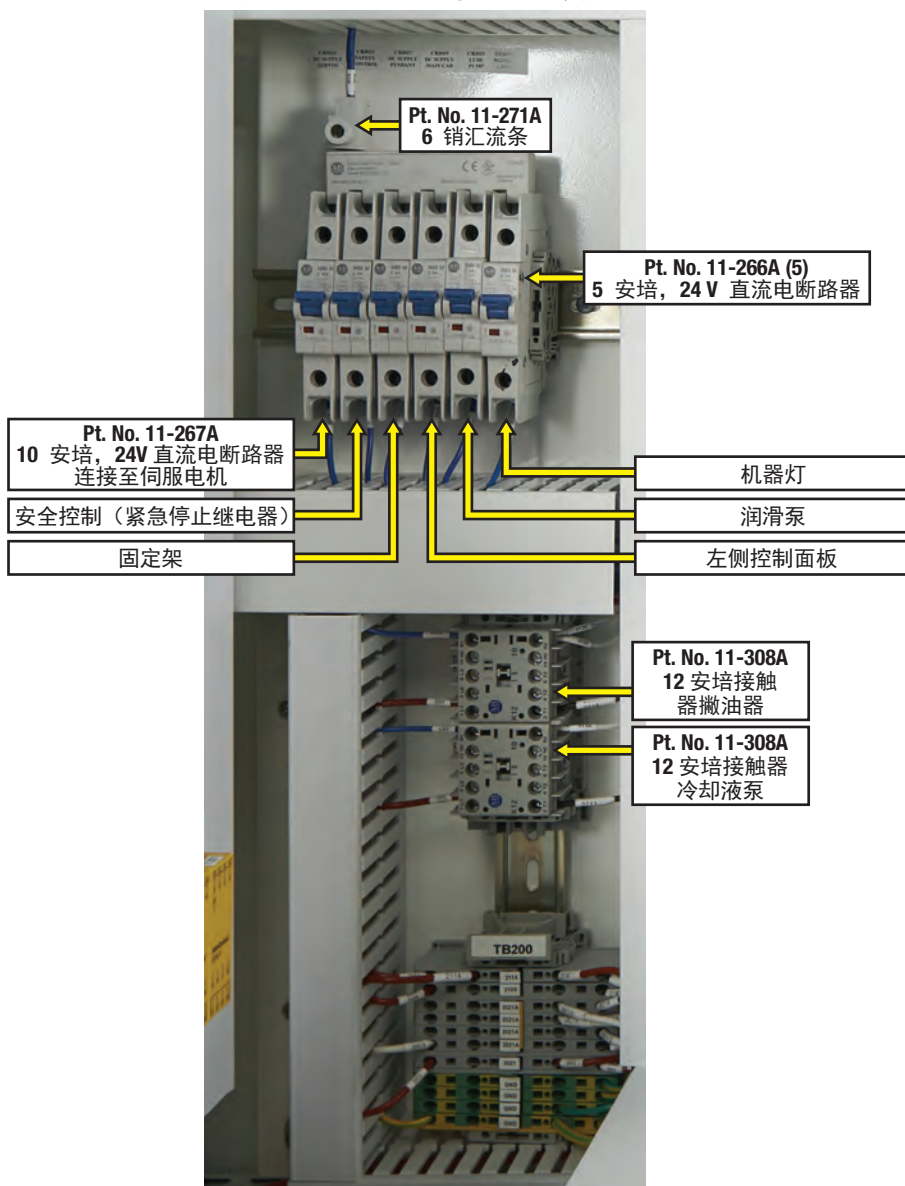
控制柜-后部右下方-电机驱动



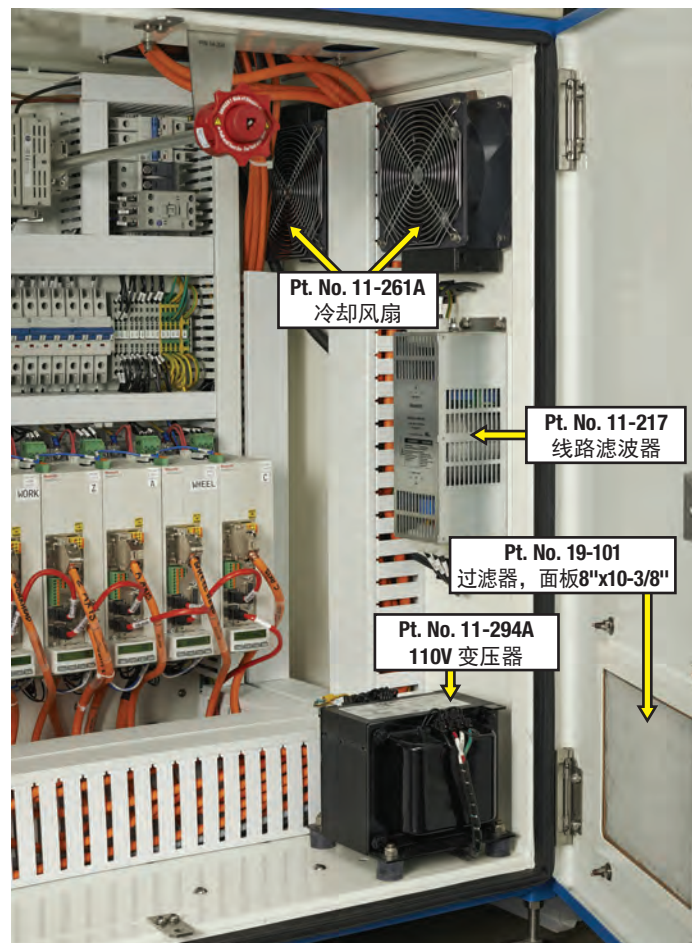
控制柜 - 后部左上



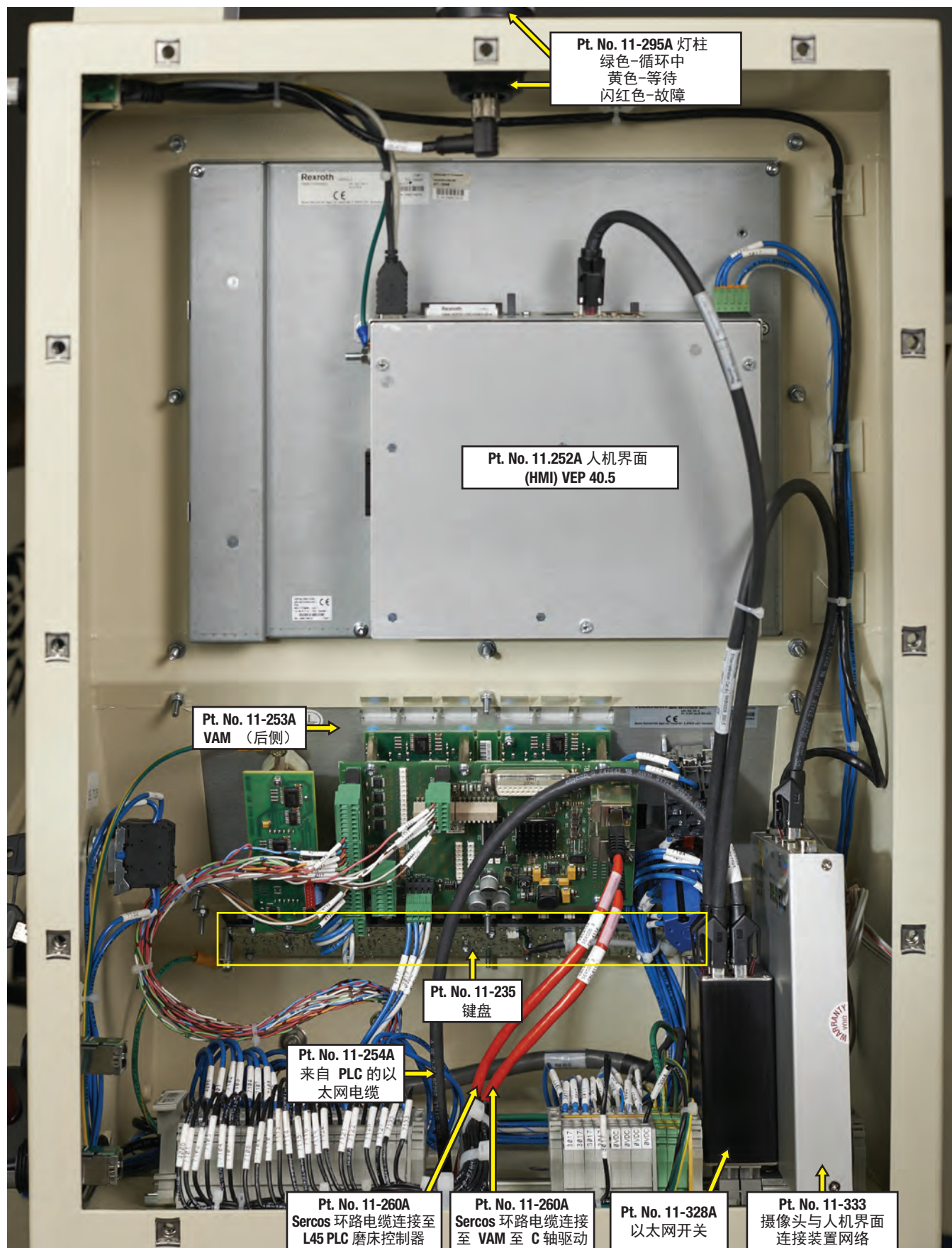
控制柜-后部左下方



控制柜-右侧



基座部件



固定架侧标签



手轮

Hand Wheel
Pt. No. 11-184



5.6 布线图

01

9401 73rd Avenue North
Suite 200
Minneapolis, MN 55428
USA

Serial No.		Mfg. Date	
Volts	480	Phase	3
F.L.A.	55.2	Freq.	50/60
MAX. DISC. AMPS			60
LARGEST LOAD AMPS			7.3
SCCR			5 kA
Model			MODEL 30A
Type			AIR BEARING PRECISION GRINDER
DRAWING #			100-30A-SCH

PRIDE ENGINEERING

9401 73RD AVENUE NORTH
SUITE 200
MINNEAPOLIS, MN 55428
(763) 427-6290

DRAWN BY:

CHECKED BY:

DATE:

REVISION:

SHEET:

OF:

MACHINE

DESCRIPTION

PROJECT REF:

COVER PAGE

MODEL 30A-CNC

AIR BEARING PRECISION GRINDER

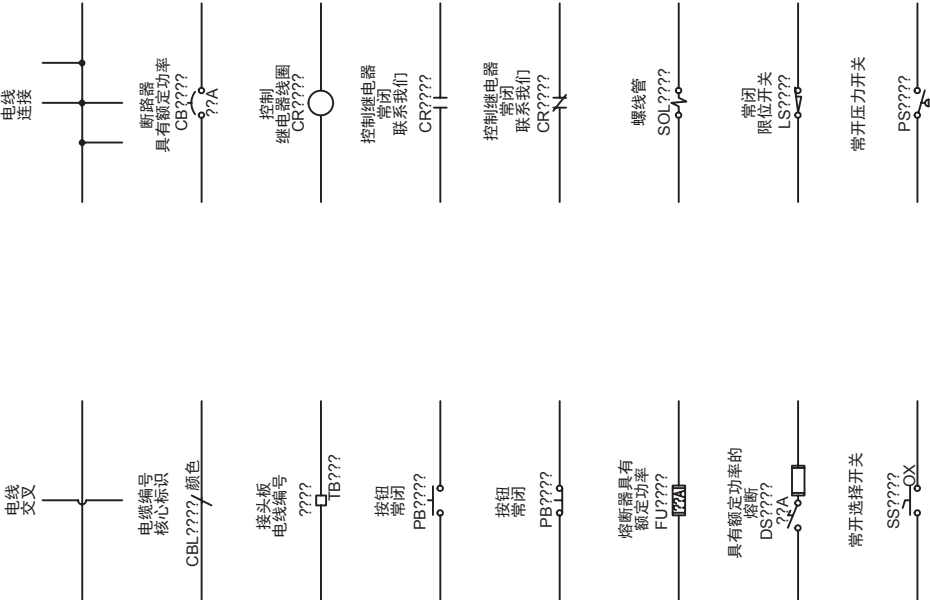
100-30A-SCH

100-30A-SCH

图纸#	描述
1	标题页
2-9	原理图描述
10	配电 480V 交流电
20	配电 120V 交流电
30	配电 24V 直流电
40	机器控制
55	通信/联网
60	PLC 输入/输出
70	安全电路
80	伺服控制
100-101	主面板
102	副面板
103-104	HMI 布局
105	接线盒 TB700
106	面板尺寸
107	接头板布局

- 位置
- (ME)
- (MP1)
- (SP1)
- (PEN)
- (JB1)
- (F)
- 描述
- 主关闭
- 主附件内板
- 主附件内副板
- 面板/操作工界面
- 接线盒 TB700
- 现场

图例描述
编号代码
XX???? = 部件类型
???X?? = 表单
????XX = 列



PRIDE ENGINEERING		MACHINE MODEL 30A CNC	
140173RDVAE NORTH		DESCRIPTION	
MINING		PROJECT REF: 100.30A.SCH	
DRAWN BY: SJP		DESCRIPTION: SCHEMATIC	
CHECKED BY: SJP		SHEET DESCRIPTIONS	
DATE: 11/09/14		FILENAME: SCHW.DWG	
REVISION: A		DWG NO: 06	
SHEET: 2 OF 43			

电线参考	颜色
BLK	黑色
WHT	白色
BLU	蓝色
RED	RED
GRN	绿色
ORG	橙色
BRN	棕色
YLW	黄色

电线参考	颜色
RED_GRY	红线带灰条
GRY_RED	灰线带红条
WHT_BRN	白线带棕条
BRN_WHT	棕线带白条
WHT_GRY	白线带灰条
GRY_WHT	灰线带白条
RED_BLU	红线带蓝条
BLU_RED	蓝线带红条
RED_ORG	红线带橙条
ORG_RED	橙线带红条
RED_GRN	红线带绿条
GRN_RED	绿线带红条
BRN_RED	棕线带红条
RED_BRN	红线带棕条
WHT_GRN	白线带绿条
GRN_WHT	绿线带白条
WHT_BLU	白线带蓝条
BLU_WHT	蓝线带白条
WHT_ORG	白线带橙条
ORG_WHT	橙线带白条

PRIDE ENGINEERING				MACHINE MODEL 30A CNC	
8401 73RD AVE NORTH				DESCRIPTION	
MINNETONKA, MN 55345				PROJECT REF: 105-30A-SCH	
DRAWN BY: SCP				DESCRIPTION	
DATE: 11/06/14				SCALE: N/A	
CHECKED BY: SCP				REVISION: A	
				SHEET: 3 OF 43	
				FILENAME: SC07.DWG	DWG NO: 07

FUSE REPLACEMENT CHART

ITEM	TAGS	VOLTAGE	AMPERAGE	DESCRIPTION / AMP RATINGS	SC I/R	TYPE
1	FU1001	600	60	60AMP JTD SERIES FUSE JTD60ID	20kA	J
2	FU1014	600	7.5	7.5 AMP CLASS CC KLDR SERIES KLDR075	200kA	CC
3	FU2012	600	15	15 AMP CLASS CC KLDR SERIES KLDR015	200kA	CC

American Wire Gauge (AWG)	Diameter (Inches)	Cross Sectional Area (mm ²)	Ampacity (75°C Copper)
6	0.162	13.29	65
8	0.1285	8.36	50
10	0.1019	5.26	30
12	0.0808	3.31	20
14	0.0641	2.08	15
16	0.0508	1.31	10
18	0.0403	0.82	7
20	0.032	0.52	5
22	0.0254	0.33	3

PRIDE ENGINEERING				MACHINE	MODEL 30A CNC
				DESCRIPTION	ART BURNING
					MANUFACTURED BY PRINDER
					PROJECT REF: 10030A-SCH
DRAWN BY: SUP	DATE: 11/05/14	SCALE: N/A	DESCRIPTION	PROJECT REF: 10030A-SCH	
CHECKED BY: SCP	REVISION: A	SHEET: 4 OF 43	FILENAME: SC08.DWG	CROSS REFERENCE	
				DWG NO:	08

CABLE NUMBER	CABLE TYPE	PART NUMBER
CB12109	14G3C	11-329A
CB12109A	FACTORY CABLE	
CB12114	14G3C	11-329A
CB12116	14G3C	11-329A
CB12118	18G3C	11-330A
CB12118A	18G3C	11-330A
CB12211	14G3C	11-329A
CB12211A	14G3C	11-329A
CB12215	14G3C	11-329A
CB12215A	14G3C	11-329A
CB13017	18G25C	11-331A
CB13023	18G3C	11-330A
CB13023A	FACTORY CABLE	
CB13142	18G3C	11-330A
CB13142A	FACTORY CABLE	
CB14114	SERCOS	11-260A
CB14117	SERCOS	11-260A
CB14132	M12 MOLDED	11-298A
CB14219	FACTORY CABLE	
CB15516	ETHERNET	11-346A
CB15518	ETHERNET	11-348A
CB15520	ETHERNET	11-254A
CB15522	ETHERNET	11-346A
CB15608	ETHERNET	11-349A
CB15608A	ETHERNET	11-348A
CB15616	ETHERNET	11-346A
CB16037	SERCOS	11-259A
CB16043	FACTORY CABLE	
CB16044	FACTORY CABLE	12-145A
CB16047	18G3C	11-330A
CB16048	18G3C	11-330A
CB16104	FACTORY CABLE	12-141A
CB16105	FACTORY CABLE	11-187
CB16118	FACTORY CABLE	11-345A
CB16119	FACTORY CABLE	11-345A
CB16206	FACTORY CABLE	11-187

CABLE NUMBER	CABLE TYPE	PART NUMBER
CB16207	FACTORY CABLE	11-187
CB16229	FACTORY CABLE	200-99-01-01
CB16235	FACTORY CABLE	200-99-01-01
CB17032	SERCOS	11-263A
CB17201	18G8C	11-332A
CB17215	18G8C	11-332A
CB17301	18G8C	11-332A
CB17315	18G8C	11-332A
CB18006	ENDAT FEEDBACK	17-155A
CB18007	FEEDBACK Cs	17-143
CB18009	ENDAT FEEDBACK	13-113
CB18017	POWER Cs	17-156A
CB18038	SERCOS	11-255A
CB18106	ENDAT FEEDBACK	17-155A
CB18107	FEEDBACK Cs	17-131
CB18109	ENDAT FEEDBACK	13-113
CB18117	POWER Cs	17-154A
CB18138	SERCOS	11-255A
CB18207	FEEDBACK Cs	17-141
CB18217	POWER Cs	17-157A
CB18238	SERCOS	11-255A
CB18306	ENDAT FEEDBACK	17-155A
CB18307	FEEDBACK Cs	17-139
CB18309	ENDAT FEEDBACK	13-114
CB18317	POWER Cs	17-153A
CB18338	SERCOS	11-255A
CB18407	FEEDBACK Cs	17-139
CB18417	POWER Cs	17-153A
CB18438	SERCOS	11-255A
CB18507	FEEDBACK Cs	17-139
CB18517	POWER Cs	17-153A
CB18538	SERCOS	11-255A
CB18607	ENDAT FEEDBACK	17-158A
CB18614	FACTORY CABLE	
CB18617	FACTORY CABLE	

PRIDE ENGINEERING

MACHINE DESCRIPTION
 3401 73RD AVE NORTH
 MINNETONKA, MN 55345
 763.427.6230

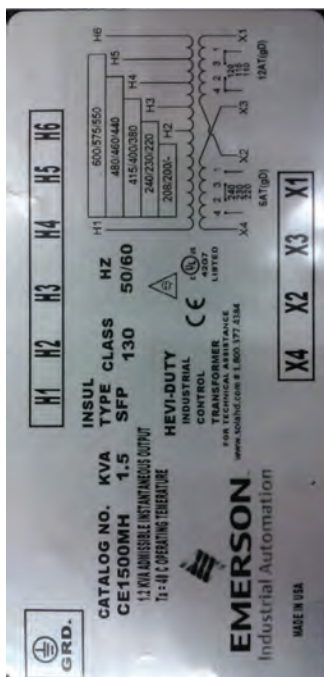
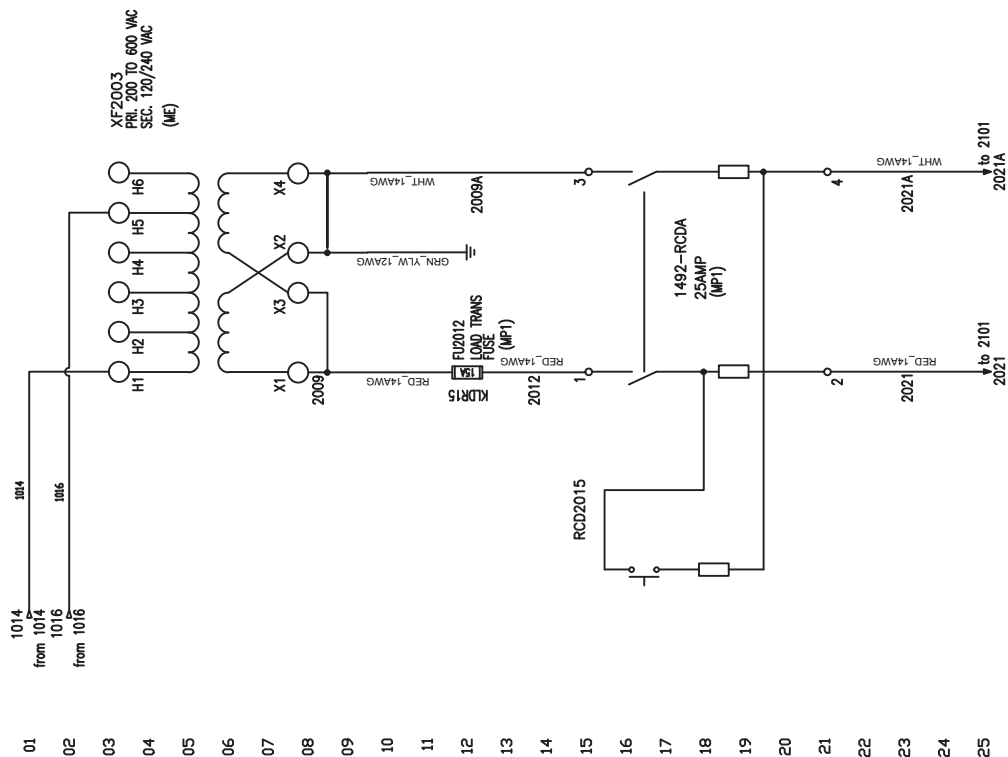
PROJECT REF: 10330A-SCH
 PROJECT REF: 10330A-SCH
 PROJECT REF: 10330A-SCH

DRAWN BY: SJP
 CHECKED BY: SJP

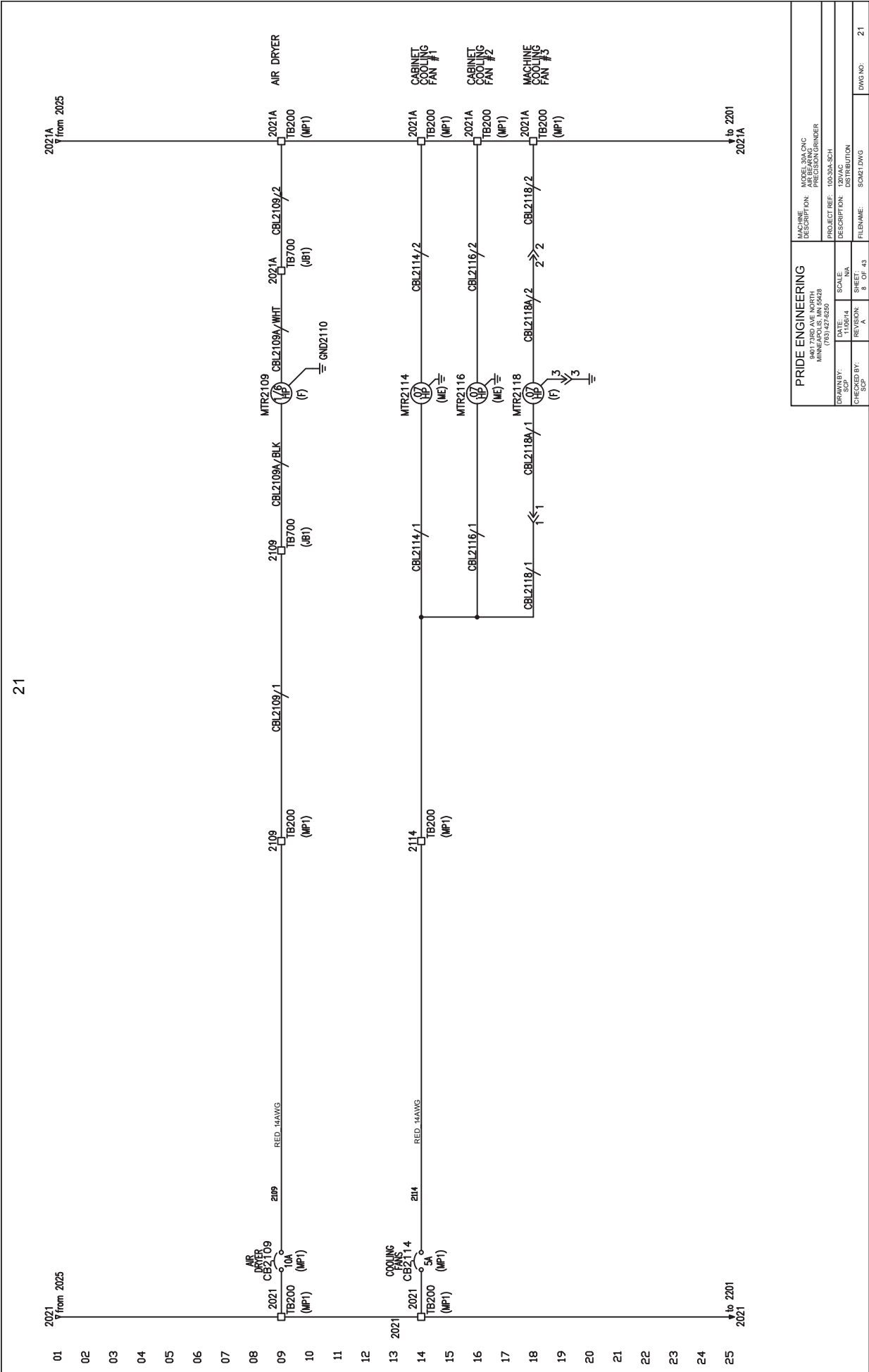
DATE: 11/05/14
 REVISION: A

SCALE: N/A
 SHEET: 5 OF 43

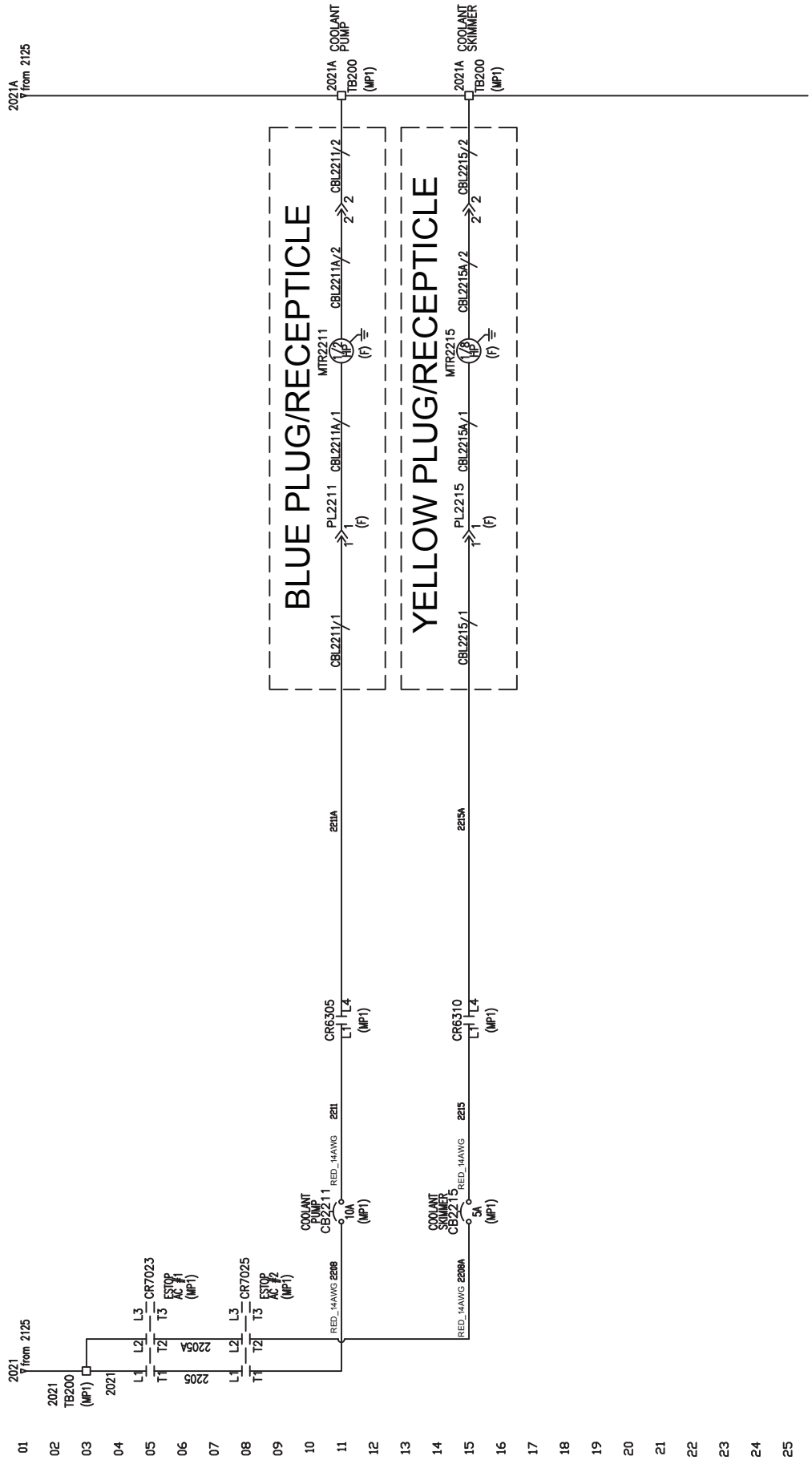
FILENAME: SCMS.DWG
 DWG NO: 9



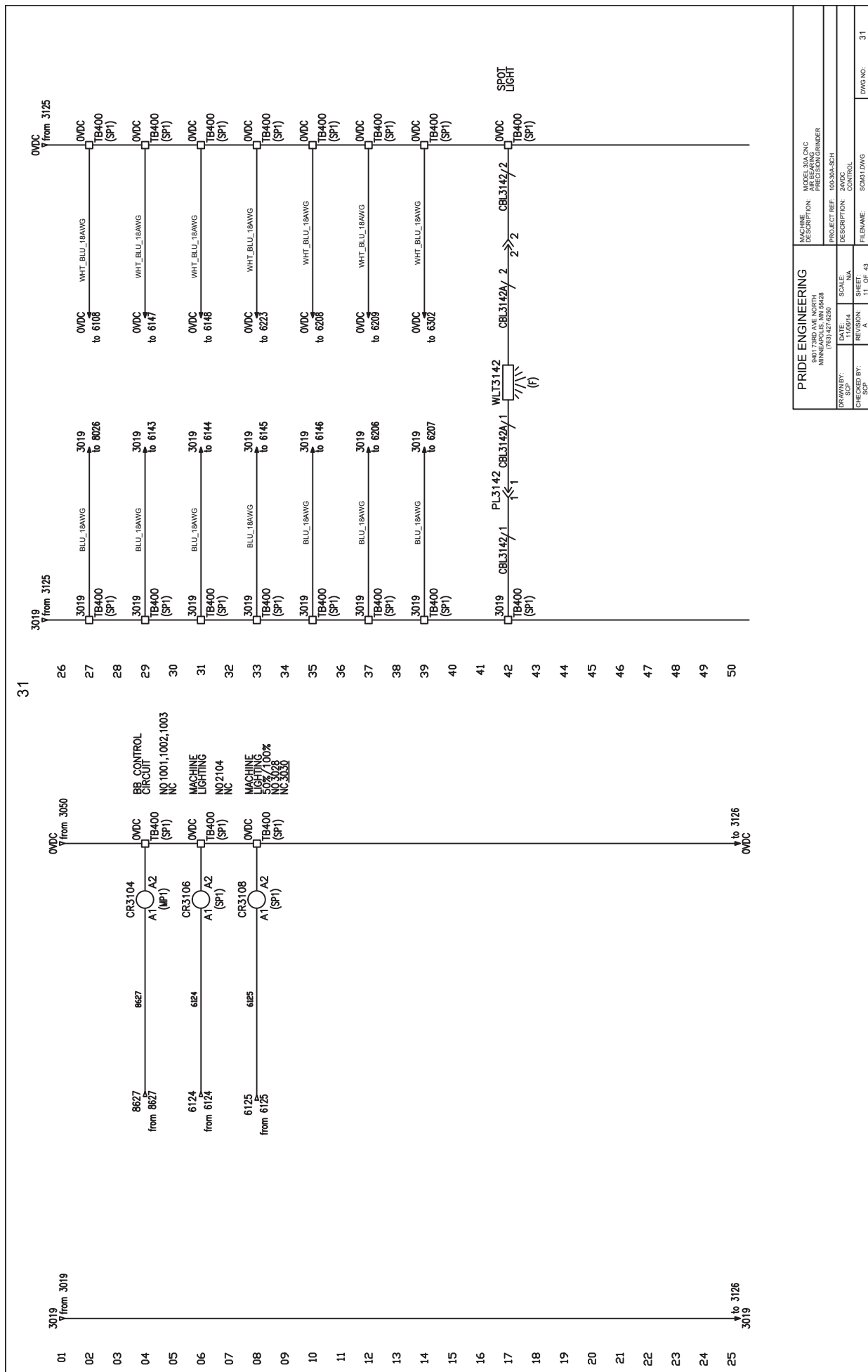
PRIDE ENGINEERING		MACHINE NO. 04C DESCRIPTION: AIR BENDING PRECISION GRINDER	
3401 78RD AVE NORTH MINNEAPOLIS, MN 55428 (763) 427-6550		PROJECT REF: 103/04-SC/H	DWG NO: 20
DRAWN BY: SGP	DATE: 11/28/14	SCALE: 12X/4	DISTRIBUTION
CHECKED BY: SGP	REVISION: 1	FILE NAME: SC020.DWG	

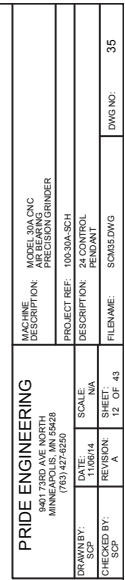


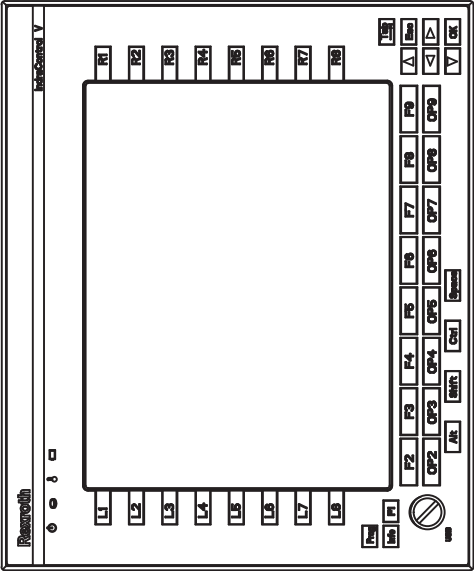
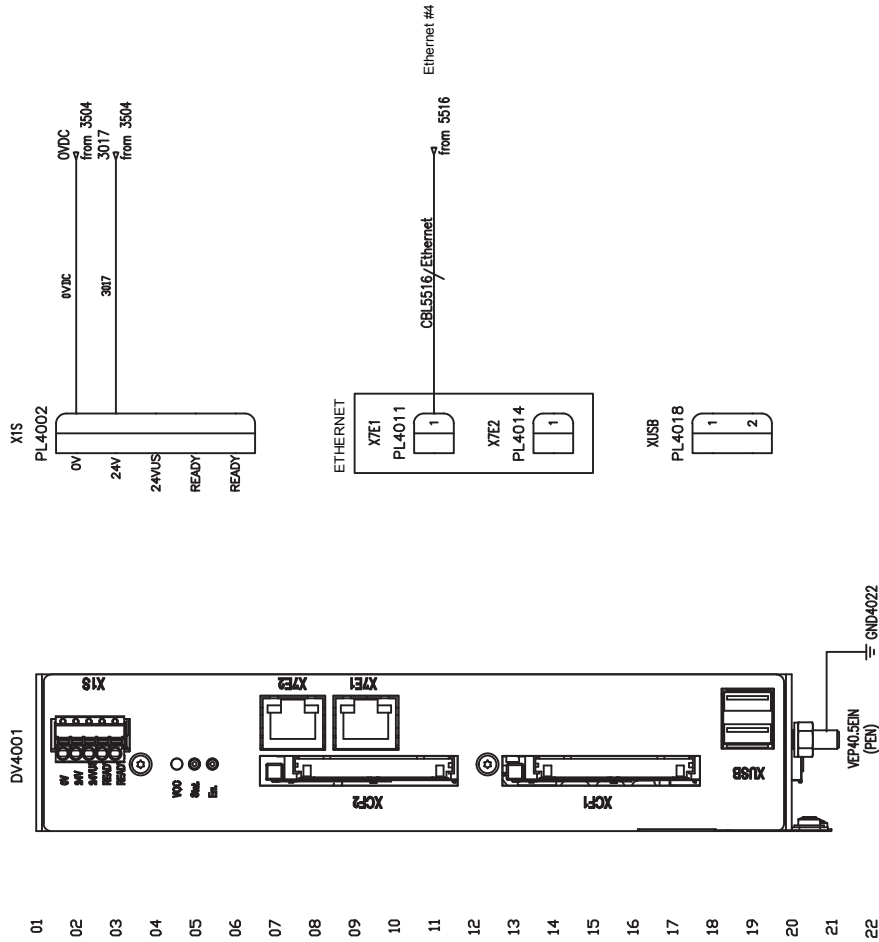
PRIDE ENGINEERING		MACHINE MODEL 30A CMC	
8401 73RD AVE NORTH		AIR DRYING	
MINNETONKA, MN 55345		ELECTRICAL ENGINEER	
DRAWN BY: SUP		PROJECT REF: 10330A-SCH	
DATE: 11/05/14		DESCRIPTION: AIR DRYING DISTRIBUTION	
CHECKED BY: SCP		SCALE: NA	
		SHEET: 8 OF 43	
		FILENAME: SCH21.DWG	
		DWG NO: 21	



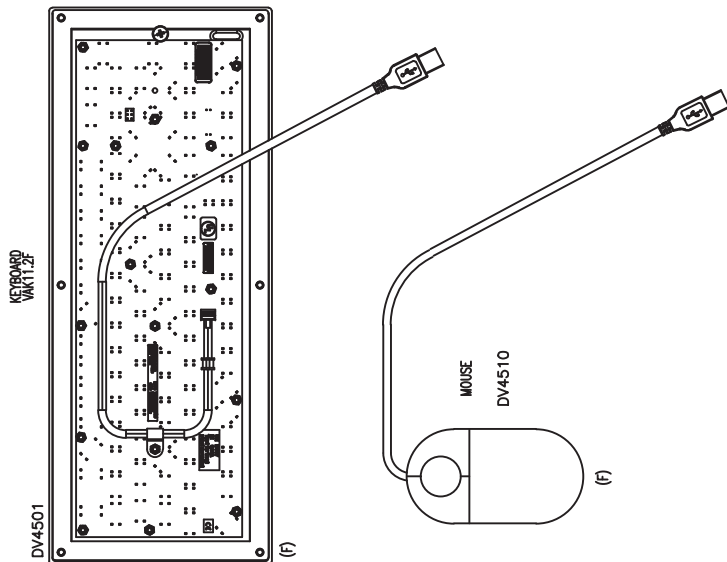
PRIDE ENGINEERING		MACHINE MODEL 30A CNC	
8401 73RD AVE NORTH		AIR BEARING	
MINNETONKA, MN 55345		AIR BEARING	
DATE: 11/05/14		PROJECT REF: 10330A-SCH	
REVISION: A		DESCRIPTION: DISTRIBUTION	
DRAWN BY: SCP		FILENAME: SCH22.DWG	
CHECKED BY: SCP		SHEET: 9 OF 43	
		DWG NO: 22	



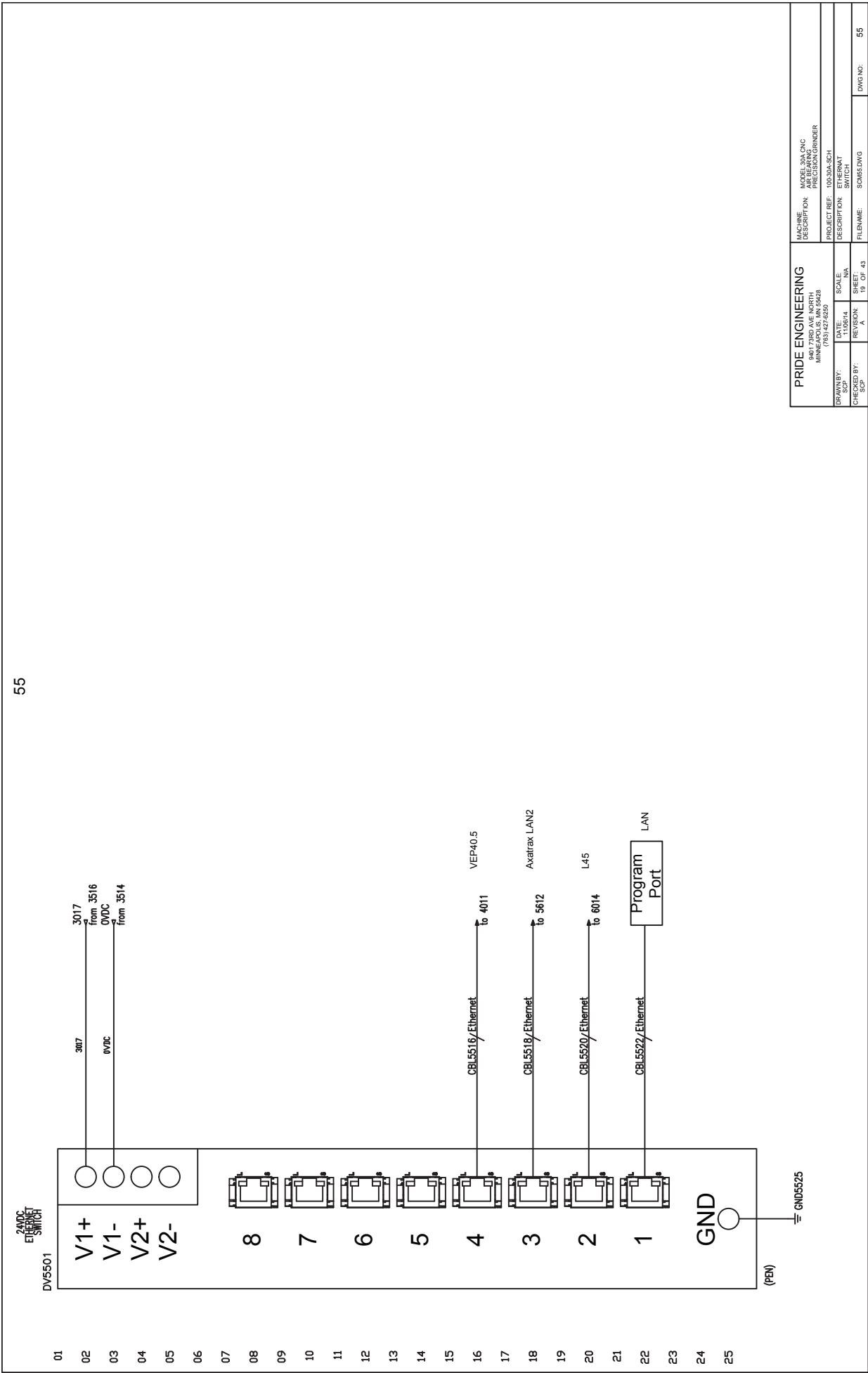




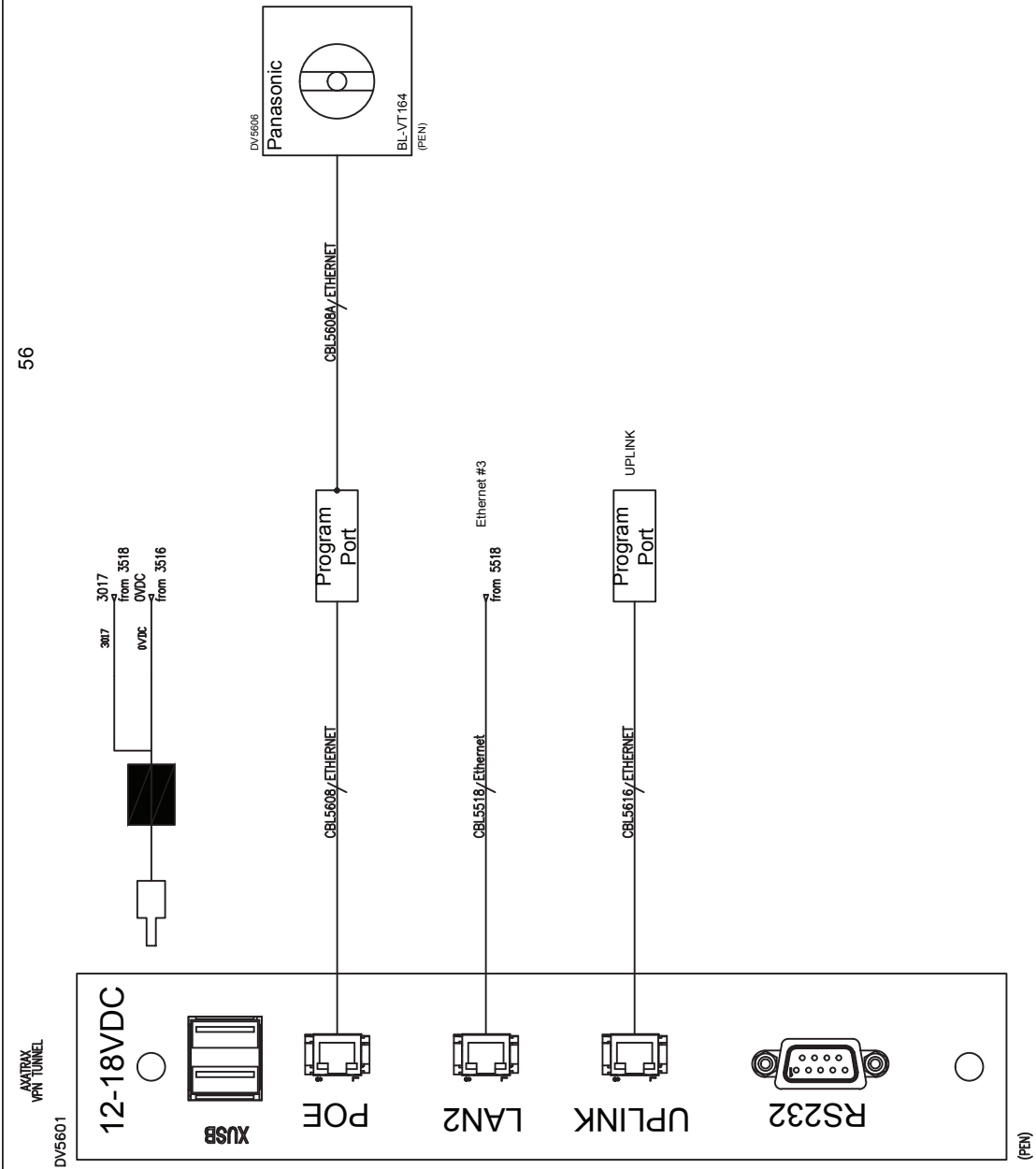
PRIDE ENGINEERING				MACHINE MODEL 30A CNC			
9401 73RD AVE NORTH				AIR BEARING			
MINNETONKA, MN 55345				PRIDE ENGINEERING			
DATE: 11/05/14				PROJECT REF: 100-30A-SCH			
REVISION: A				DESCRIPTION: INTERFACE			
DRAWN BY: SCP				SHEET: 13 OF 43			
CHECKED BY: SCP				FILENAME: SCAM.DWG			
				DWG NO: 40			



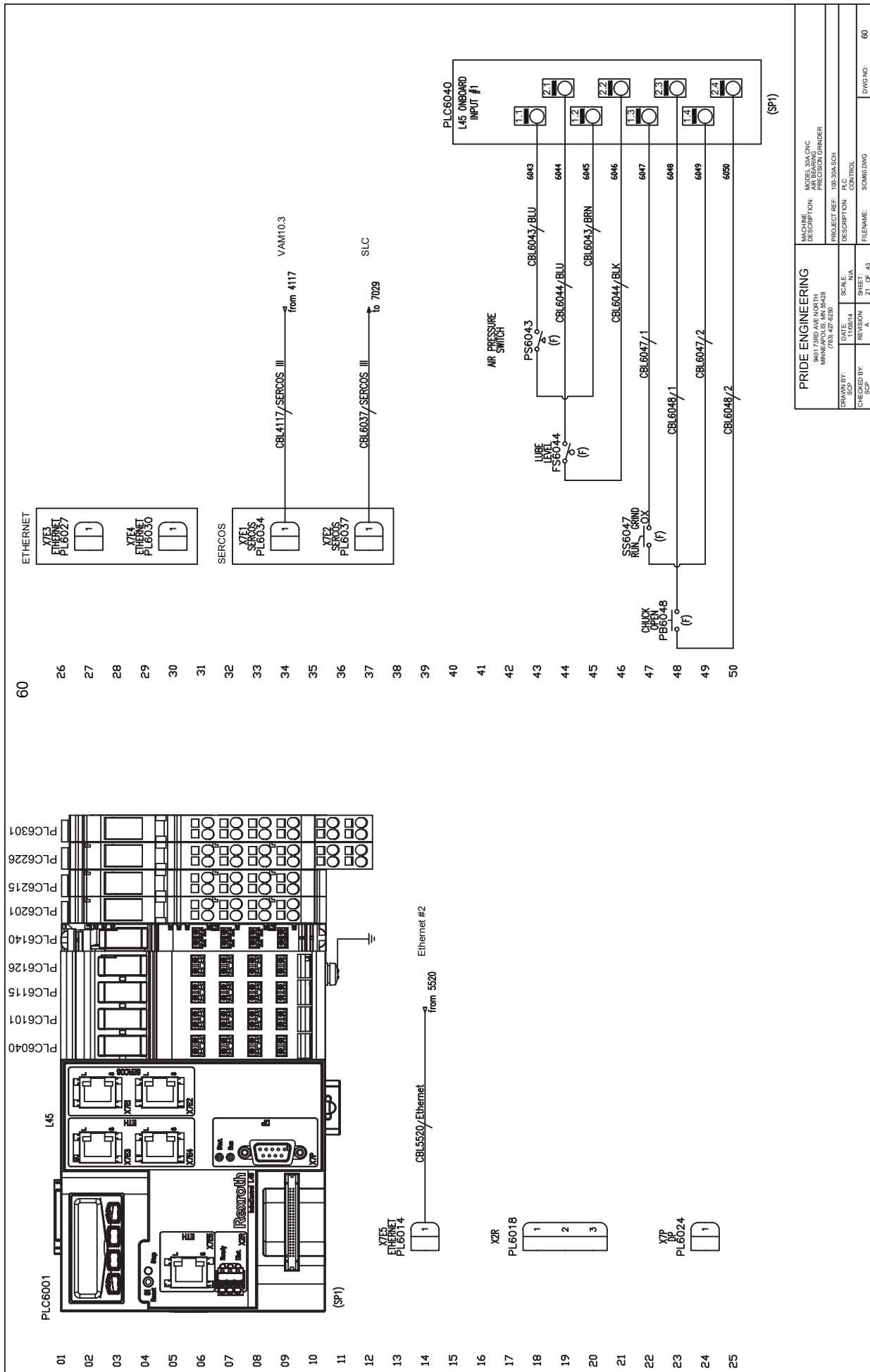
PRIDE ENGINEERING		MACHINE DESCRIPTION		MODEL 30A CNC AIR BEARING PRECISION GRINDER	
901 73RD AVE NORTH MINNEAPOLIS, MN 55428 (612) 477-6260		PROJECT REF:		100-30A-3CH	
DRAWN BY: SCP		DATE: 05/04/14		SCALE: 1:1	
CHECKED BY: SCP		REVISION: A		SHEET 18 OF 43	
				FILENAME: SOMA21WG	
				DWG NO: 45	

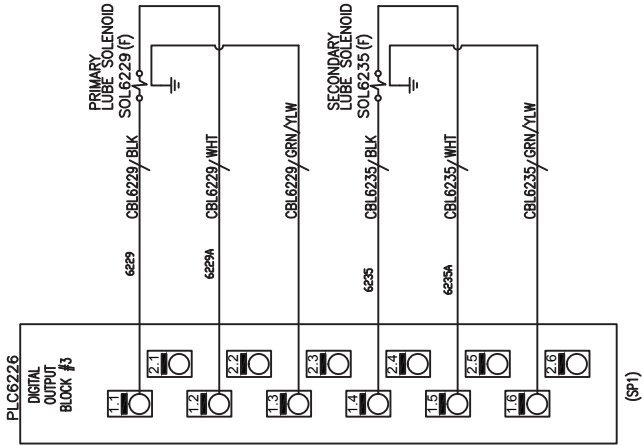
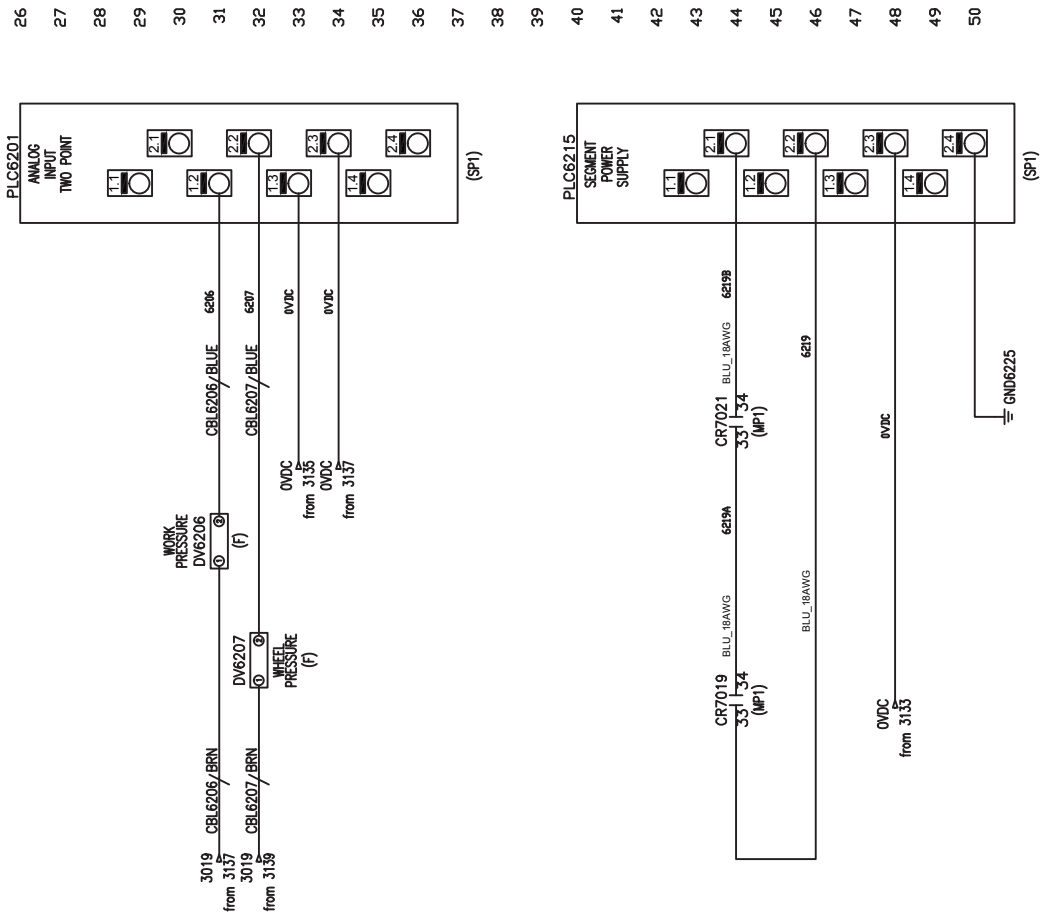


PRIDE ENGINEERING				MACHINE MODEL 30A CNC			
9401 73RD AVE NORTH				AIR BEARING			
MINNETONKA, MN 55345				PRIDE ENGINEERING			
DRAWN BY: SJP				PROJECT REF: 10338A-SCH			
CHECKED BY: SJP				DESCRIPTION: SWITCH			
DATE: 11/05/14				FILENAME: S0455.DWG			
REVISION: A				SHEET: 43			
SCALE: NA				DWG NO: 55			



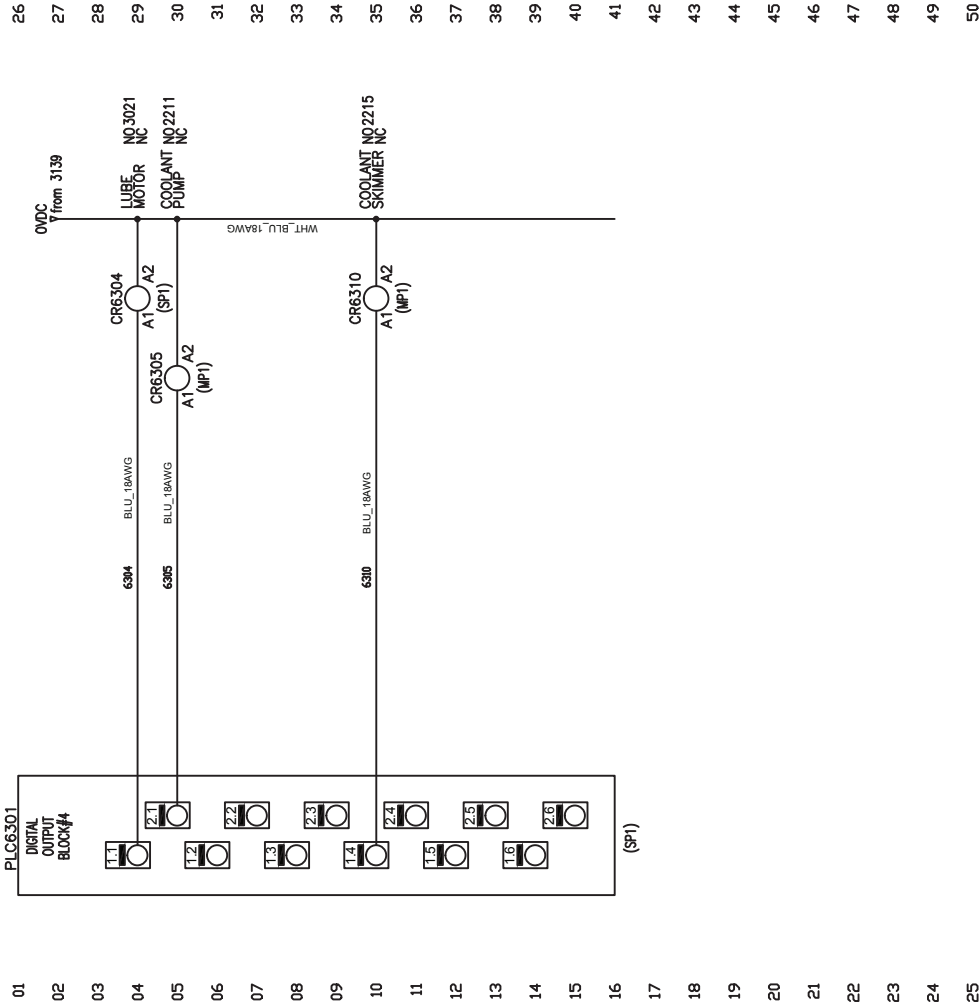
PRIDE ENGINEERING				MACHINE DESCRIPTION		MODEL 30A CNC	
9017 73RD AVE NORTH							
MINNETONKA, MN 55345							



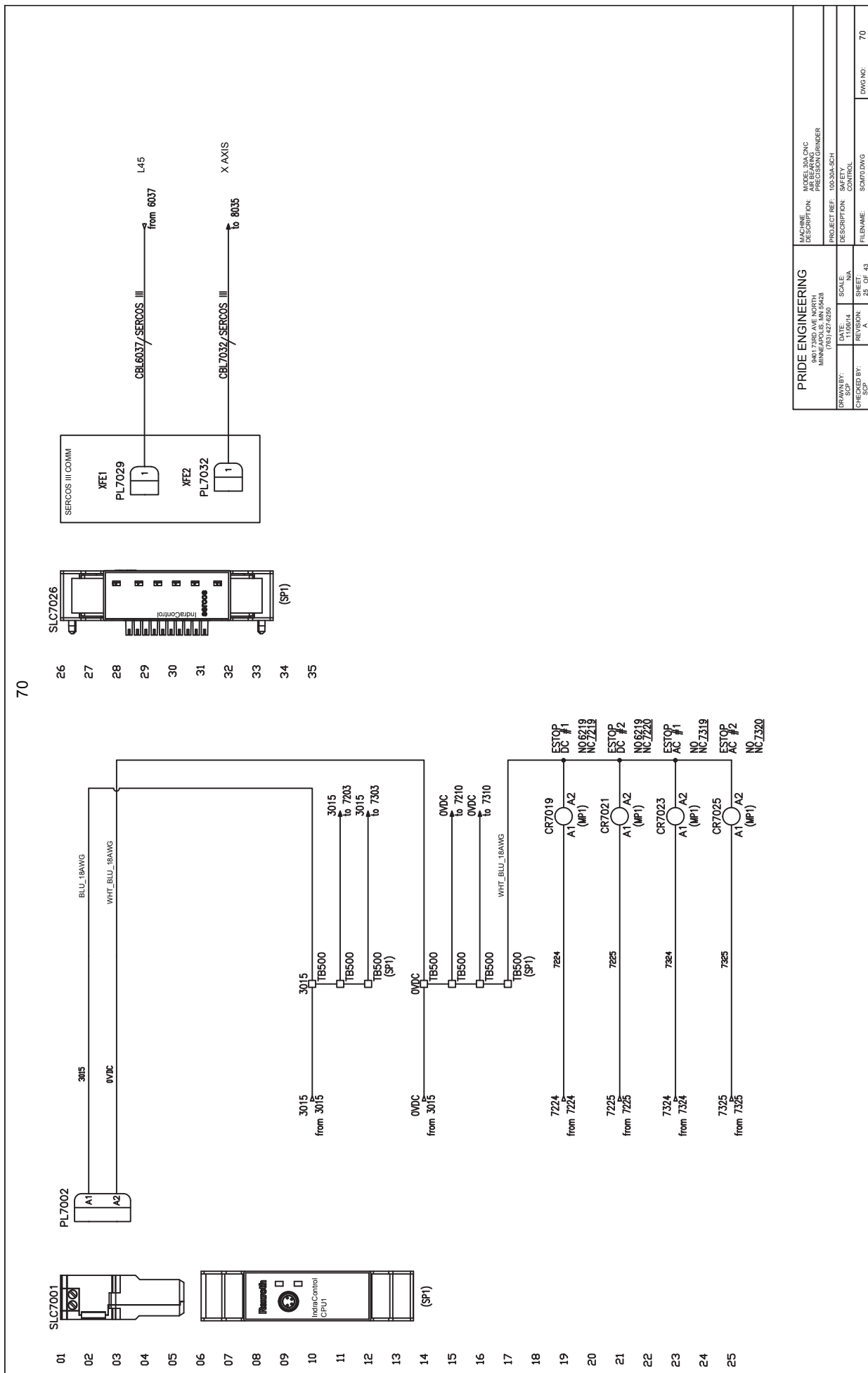


PRIDE ENGINEERING		MACHINE DESCRIPTION		MODEL 30A CNC	
				AIR BEARING	
				MANUFACTURED BY PRINDER	
				PROJECT REF: 10338A-SCH	
				CONTROL	
DRAWN BY: SUP	DATE: 11/05/14	SCALE: NA	SHEET: 23	OF: 43	DWG NO: 62
CHECKED BY: SCP	REVISION: A	FILENAME: SCMG2.DWG			

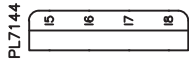
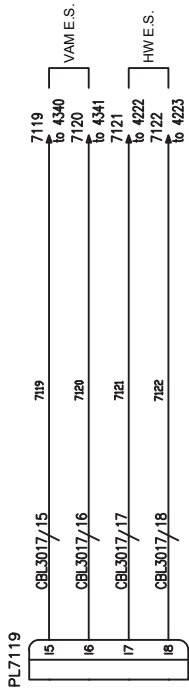
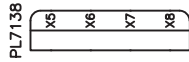
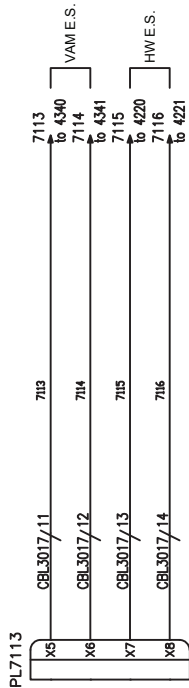
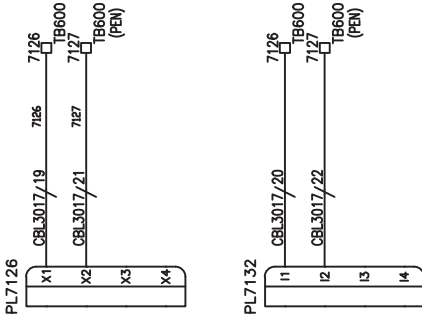
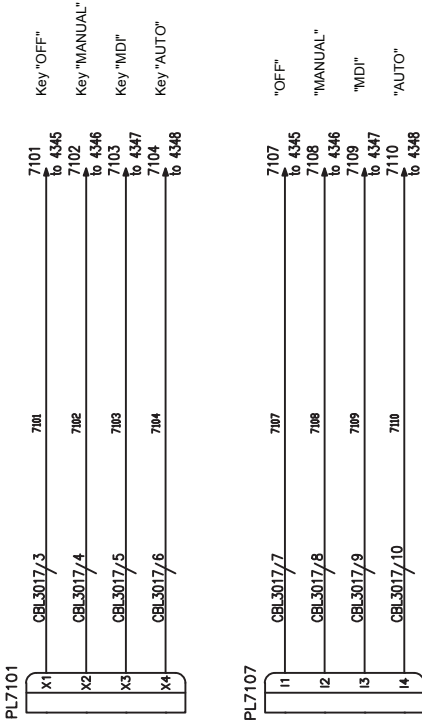
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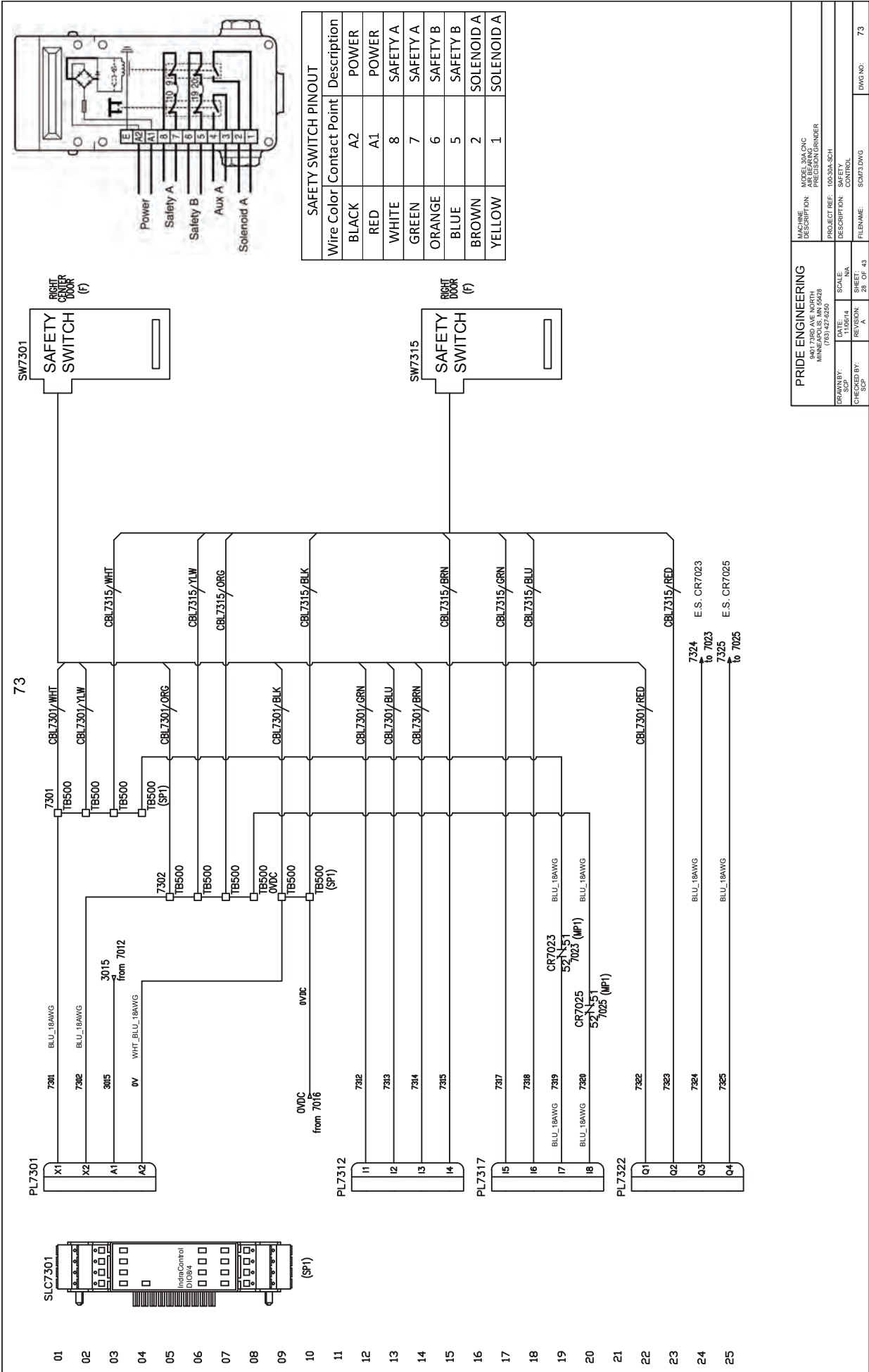
PRIDE ENGINEERING				MACHINE DESCRIPTION: MODEL 30A CNC AIR BEARING AIR BRASS GRINDER	
9401 73RD AVE NORTH MINNETONKA, MN 55342				PROJECT REF: 100-30A-SCH	
DRAWN BY: SJP				DATE: 11/05/14	SCALE: N/A
CHECKED BY: SJP				REVISION: A	SHEET: 24 OF 43
				FILENAME: SCAMS.DWG	DWG NO: 63



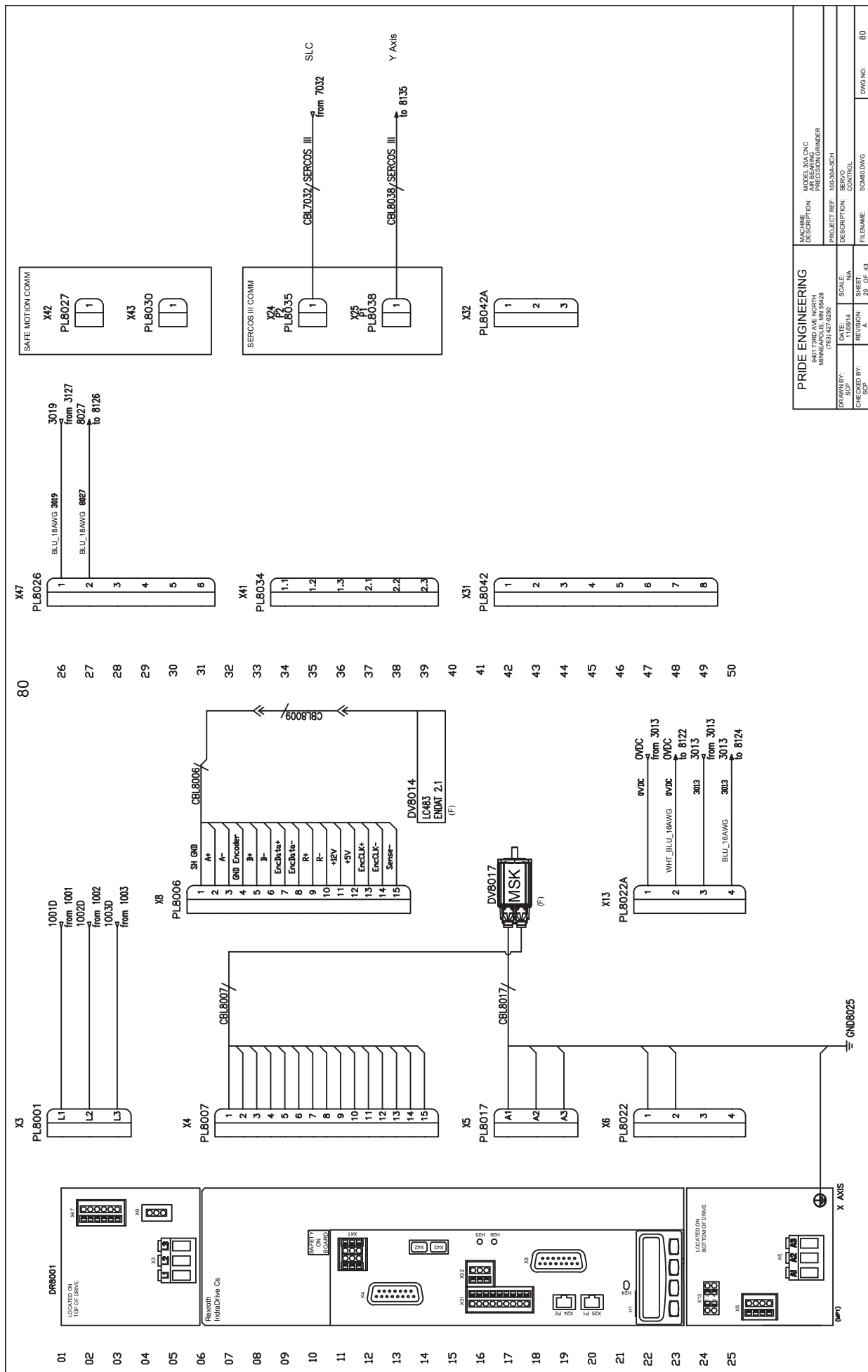
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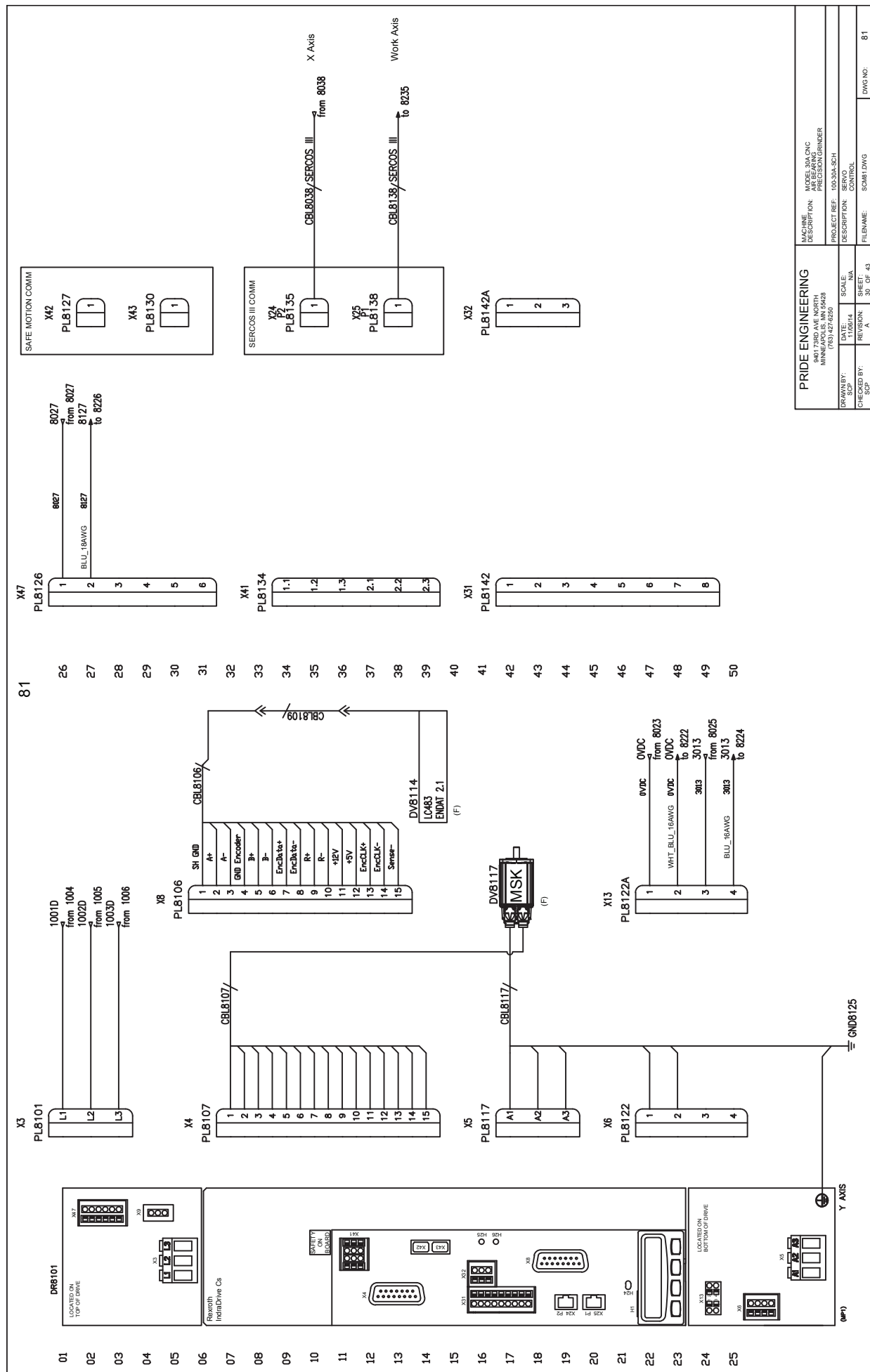


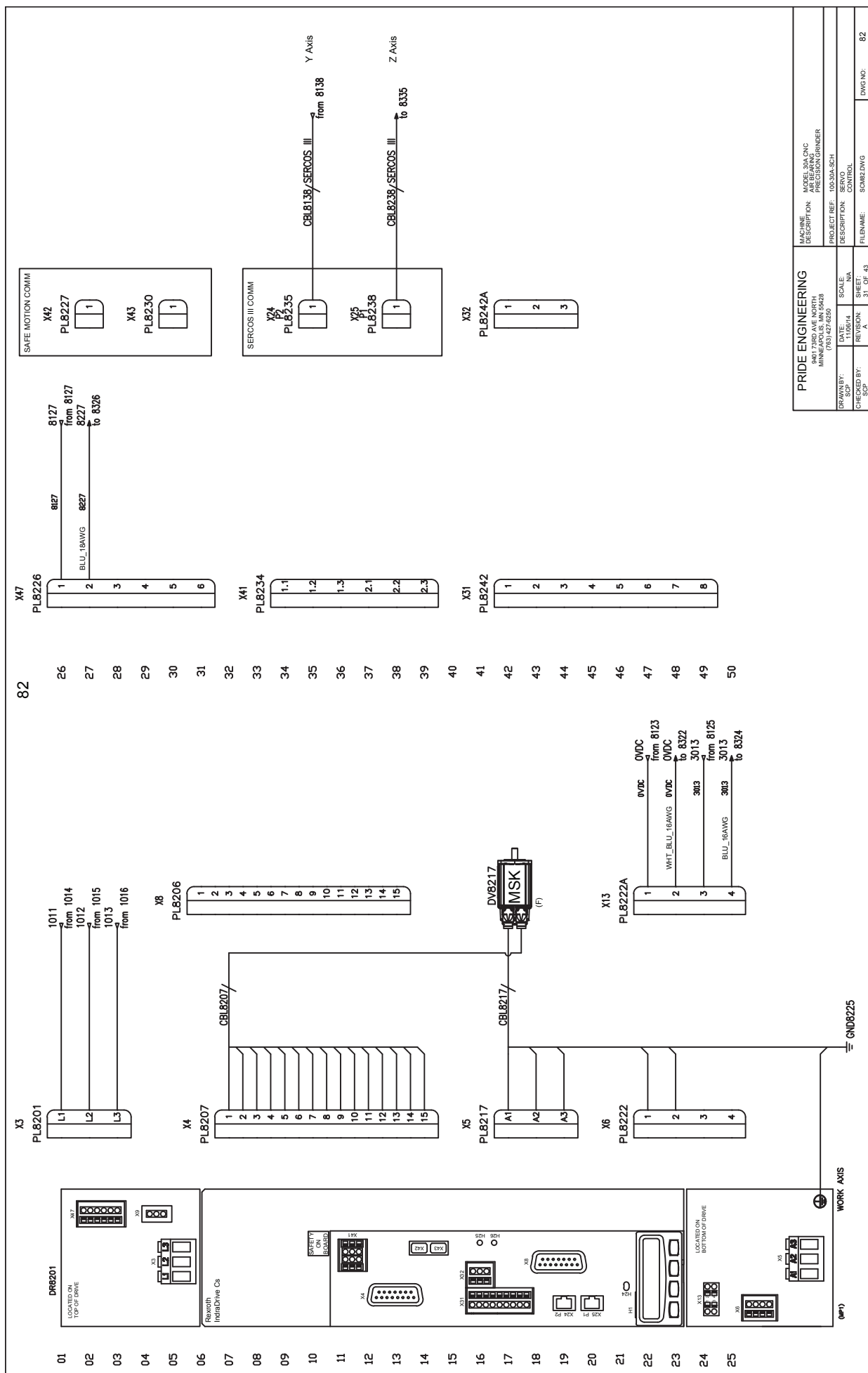
PRIDE ENGINEERING				MACHINE MODEL 30A CNC			
				DESCRIPTION: AIR BEARING			
				MANUFACTURER: PRIDE ENGINEER			
				PROJECT REF: 103-30A-SCH			
				DESCRIPTION: SPINDLE CONTROL			
				FILENAME: SCH71.DWG			
DRAWN BY: SCP	DATE: 11/05/14	SCALE: NA	SHEET: 26	OF: 43			
CHECKED BY: SCP	REVISION: A	SHEET: 26	OF: 43				DWG NO: 71

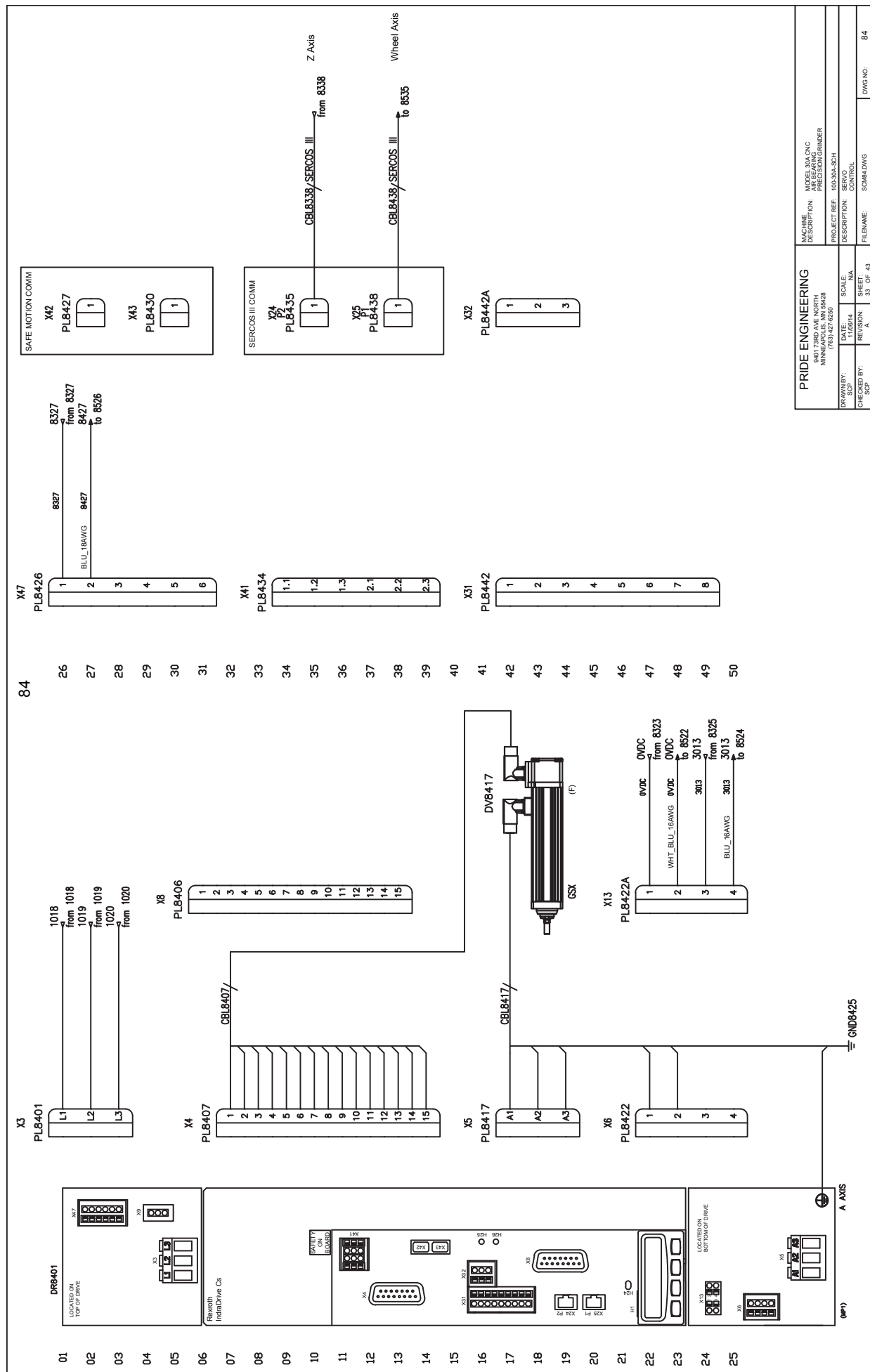


PRIDE ENGINEERING		MACHINE MODEL 30A CNC	
18401 73RD AVE NORTH		DESCRIPTION: AIR BEARING	
MINNETONKA, MN 55345		DRAWN BY: J. B. BENDER	
DATE: 11/05/14		PROJECT REF: 100-30A-SCH	
SCALE: N/A		DESCRIPTION: SAFETY CONTROL	
REVISION: A		FILENAME: SCW73.DWG	
SHEET: 28		DWG NO: 73	

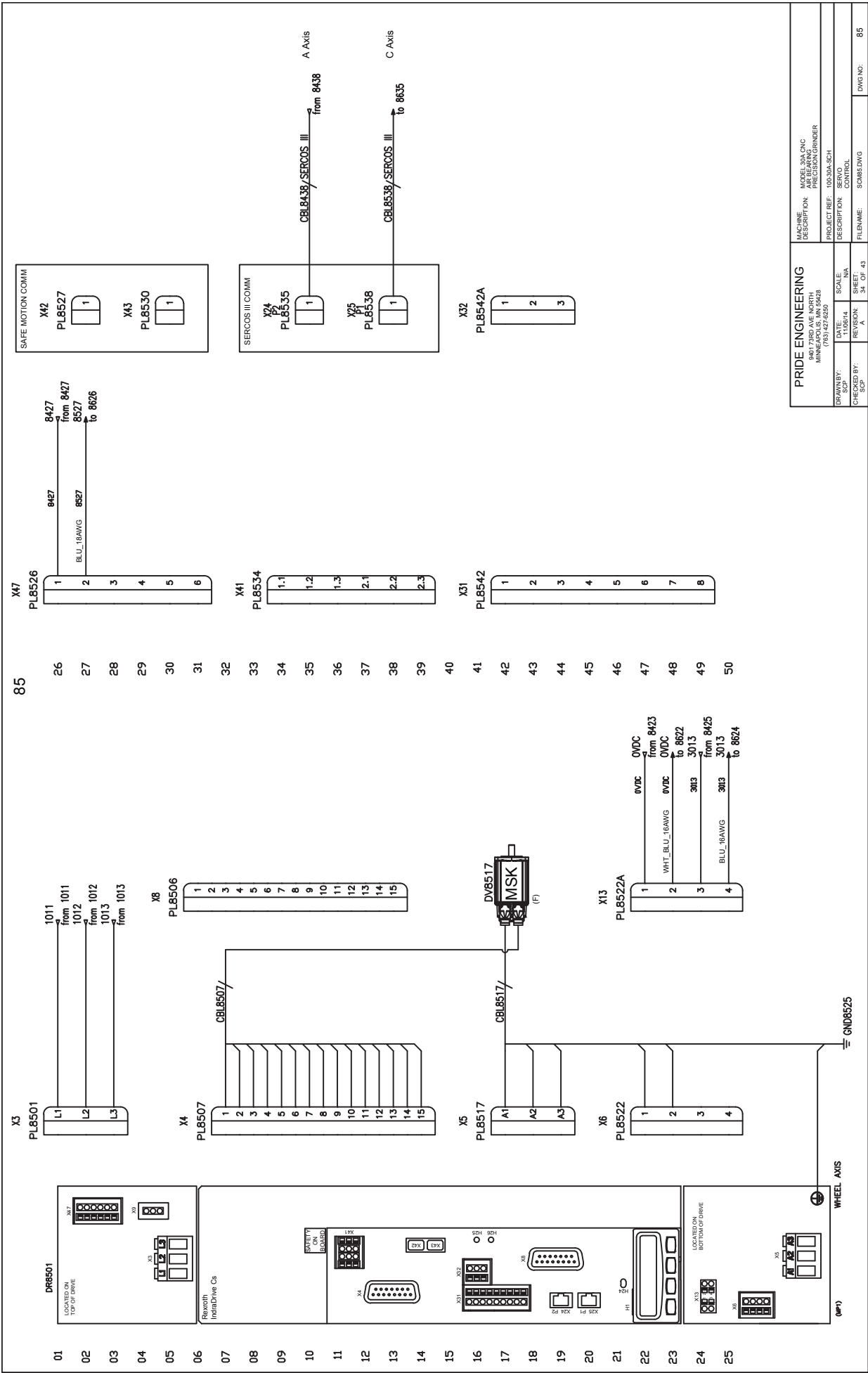




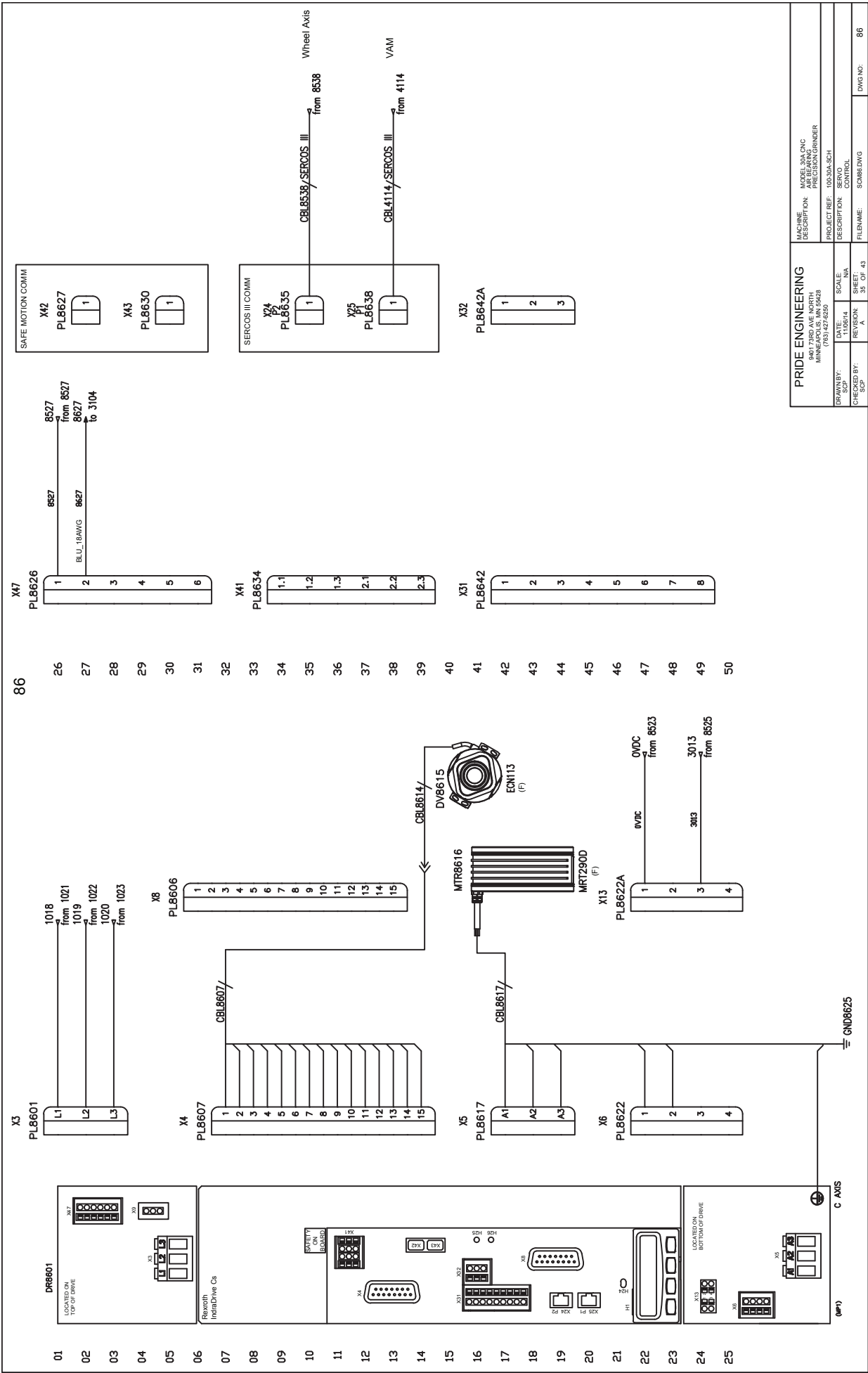




PRIDE ENGINEERING		MACHINE DESCRIPTION: MODEL 30A CNC AIR BEARING PRECISION GRINDER		DWG NO: 84	
9401 73RD AVE NORTH MINNEAPOLIS, MN 55428 (763) 427 0260		PROJECT REF: 103-30A-SCH		FILENAME: SC08A.DWG	
DRAWN BY: SJP		DATE: 11/06/14		SCALE: N/A	
CHECKED BY: SJP		REVISION: 1		SHEET OF: 43	



PRIDE ENGINEERING		MACHINE MODEL 30A CNC	
DRAWN BY: SJP		DESCRIPTION: AIR BEARING	
CHECKED BY: SJP		PROJECT REF: 10330A-SCH	
DATE: 11/05/14		DESCRIPTION: MOTOR CONTROL	
REVISION: A		FILENAME: SCAMS.DWG	
SHEET 34		DWG NO: 85	



PRIDE ENGINEERING		MACHINE DESCRIPTION: MODEL 30A CNC AIR BEARING MILL	
DRAWN BY: SUP		PROJECT REF: 10330A-SCH	
CHECKED BY: SCP		DESCRIPTION: MOTOR CONTROL	
DATE: 11/05/14		FILENAME: SC86SDWG	
REVISION: A		SHEET: 43	
		DWG NO: 86	

PRIDE ENGINEERING 9401 73RD AVE NORTH MINNEAPOLIS, MN 55428 (612) 427-6551		MACHINE DESCRIPTION: MODEL 30A CMC AIR BEARING PRECISION GRINDER	
DRAWN BY: SCB	SCALE: 1/16"=1"	SHEET NO.: NA	PROJECT REF.: 30A-PANEL
CHECKED BY: SCB	REVISION: A	FILE NAME: SCANTOLING	DWG NO.: 100

ITEM#	DRAWING CODE	PART NUMBER	DESCRIPTION	QTY
1	PSW-3006	11-292A	24-28VDC 480W, 3 PHASE POWER SUPPLY	1
2	CB3010	11-288A	CIRCUIT BREAKER, 1-POLE, C-CURVE, 20AMP	1
3	TB300	11-317A	GROUP MARKER	1
		11-286A	4 PLACE TERMINAL BLOCK	1
		11-279A	4 PLACE TERMINAL BLOCK END	1
		11-288A	4 PLACE TERMINAL BLOCK GROUND	1
		11-280A	4 PLACE TERMINAL BLOCK GROUND END	1
		11-316A	END RETAINER	3
4	CR7019	11-293A	SAFETY CONTROL RELAY, 8-POLE, 24VDC	1
5	CR7021	11-293A	SAFETY CONTROL RELAY, 8-POLE, 24VDC	1
6	CR7023	11-327A	SAFETY CONTACTOR, 23AMP, 24VDC	1
7	CR7025	11-327A	SAFETY CONTACTOR, 23AMP, 24VDC	1
8	DS1001	11-300A	DISCONNECT, MAIN, 60AMP, KIT	1
		11-301A	60 AMP FUSE, JTD, INDICATING	3
9	CB1006	11-289A	CIRCUIT BREAKER, 3-POLE, C-CURVE, 6AMP	1
		11-281A	END RETAINER	2
10	FU1014	11-283A	FUSE HOLDER, 2-POLE, CLASS CC, 30AMP	1
		11-297A	KLDR SERIES, CLASS CC, 7.5AMP FUSE	2
11	CR3104	11-326A	CONTRACTOR, 37A, 24VDC	1
12	BUSSBAR	11-271A	6 PINS, 6 CIRCUIT BREAKERS, 1-PHASE, BUSSBAR	1
		11-272A	PROTECTIVE SHROUD FOR UNUSED PINS	1
		11-273A	TERMINAL POWER FEED 35MM ²	1
13	CR3013	11-267A	CIRCUIT BREAKER, 1-POLE, C-CURVE, 10AMP	1
14	CR3015	11-266A	CIRCUIT BREAKER, 1-POLE, C-CURVE, 5AMP	1
15	CB3017	11-266A	CIRCUIT BREAKER, 1-POLE, C-CURVE, 5AMP	1
16	CB3019	11-266A	CIRCUIT BREAKER, 1-POLE, C-CURVE, 5AMP	1
17	CB3021	11-266A	CIRCUIT BREAKER, 1-POLE, C-CURVE, 5AMP	1
18	CB3025	11-266A	CIRCUIT BREAKER, 1-POLE, C-CURVE, 5AMP	1
19	FU2012	11-282A	FUSE HOLDER, 1-POLE, CLASS CC, 30AMP	1
		11-296A	KLDR SERIES, CLASS CC, 15AMP FUSE	1
20	RCD2015	11-291A	RESIDUAL CURRENT CB, 2-POLE, 25AMP	1
21	CB2109	11-314A	CIRCUIT BREAKER, 1-POLE, D-CURVE, 10AMP	1
22	CB2114	11-313A	CIRCUIT BREAKER, 1-POLE, D-CURVE, 5AMP	1
23	CB2211	11-314A	CIRCUIT BREAKER, 1-POLE, D-CURVE, 10AMP	1
24	CB2215	11-313A	CIRCUIT BREAKER, 1-POLE, D-CURVE, 5AMP	1
25	CB1001	11-270A	CIRCUIT BREAKER, 3-POLE, D-CURVE, 10AMP	1
26	CB1011	11-270A	CIRCUIT BREAKER, 3-POLE, D-CURVE, 10AMP	1
27	CB1018	11-270A	CIRCUIT BREAKER, 3-POLE, D-CURVE, 10AMP	1

ITEM#	DRAWING CODE	PART NUMBER	DESCRIPTION	QTY
28	TB100	11-317A	GROUP MARKER	1
		11-286A	4 PLACE TERMINAL BLOCK	9
		11-279A	4 PLACE TERMINAL BLOCK END	3
		11-288A	4 PLACE TERMINAL BLOCK GROUND	4
		11-280A	4 PLACE TERMINAL BLOCK GROUND END	1
		11-315A	TERMINAL BLOCK GROUND, 6MM	1
		11-316A	TERMINAL BLOCK GROUND END, 6MM	1
		11-281A	END RETAINER	3
29	CR8310	11-308A	MINI CONTACTOR, 12AMP, 24VDC	1
30	CR8305	11-308A	MINI CONTACTOR, 12AMP, 24VDC	1
31	TB200	11-317A	GROUP MARKER	1
		11-286A	4 PLACE TERMINAL BLOCK	7
		11-279A	4 PLACE TERMINAL BLOCK END	3
		11-288A	4 PLACE TERMINAL BLOCK GROUND	4
		11-280A	4 PLACE TERMINAL BLOCK GROUND END	1
		11-322A	4-POLE CENTER JUMPER	1
		11-281A	END RETAINER	4
32	DR8001	11-239A-X	18AMP SERVO DRIVE, SAFE MOTION, DUAL ENCODER	1
		11-240A	MACHINE TOOL FIRMWARE, v18, CLOSED LOOP	1
33	DR8101	11-239A-Y	18AMP SERVO DRIVE, SAFE MOTION, DUAL ENCODER	1
		11-240A	MACHINE TOOL FIRMWARE, v18, CLOSED LOOP	1
34	DR8201	11-239A-O	18AMP SERVO DRIVE, SAFE MOTION, DUAL ENCODER	1
		11-240A	MACHINE TOOL FIRMWARE, v18, CLOSED LOOP	1
35	DR8301	11-239A-Z	18AMP SERVO DRIVE, SAFE MOTION, DUAL ENCODER	1
		11-240A	MACHINE TOOL FIRMWARE, v18, CLOSED LOOP	1
36	DR8401	11-239A-A	18AMP SERVO DRIVE, SAFE MOTION, DUAL ENCODER	1
		11-240A	MACHINE TOOL FIRMWARE, v18, CLOSED LOOP	1
37	DR8501	11-239A-H	18AMP SERVO DRIVE, SAFE MOTION, DUAL ENCODER	1
		11-240A	MACHINE TOOL FIRMWARE, v18, CLOSED LOOP	1
38	DR8601	11-239A-C	18AMP SERVO DRIVE, SAFE MOTION, DUAL ENCODER	1
		11-240A	MACHINE TOOL FIRMWARE, v18, CLOSED LOOP	1

PRIDE ENGINEERING

1801 73RD AVE NORTH
MINNETONKA, MN 55345
(763) 427-6200

MACHINE
DESCRIPTION
MODEL 30A CNC
AIR BEARING
MACHINE TOOL
ENCODER

PROJECT REF: 18338A-SCH

DESCRIPTION: 11324A-BOM

DRAWN BY:
SJP

CHECKED BY:
SJP

DATE:
11/05/14

REVISION:
A

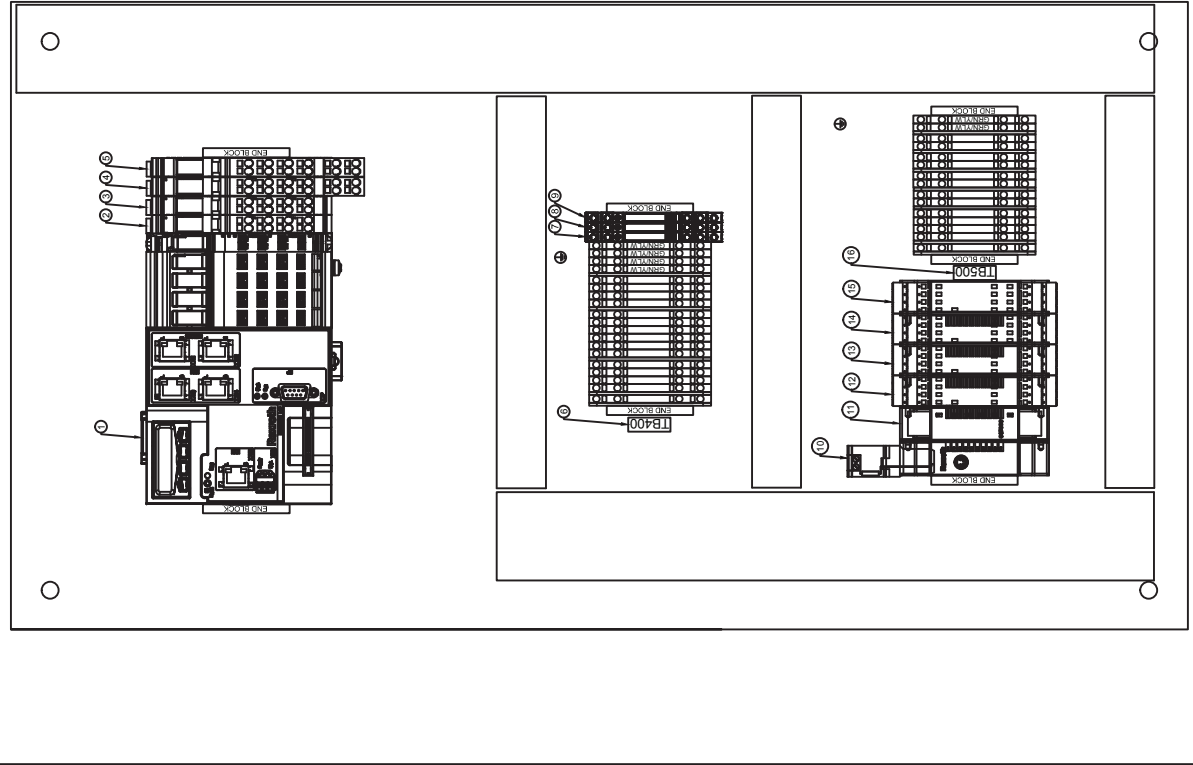
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SHEET:
31 OF 43

FILENAME:
SOM101.DWG

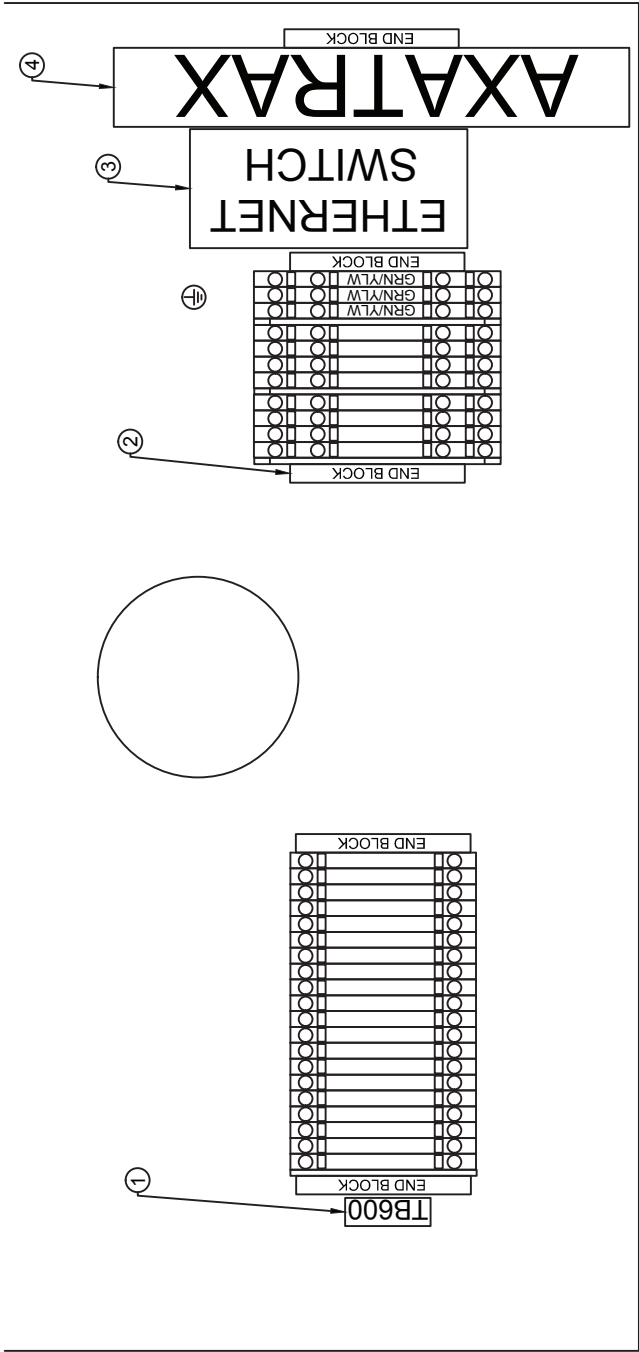
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101

102



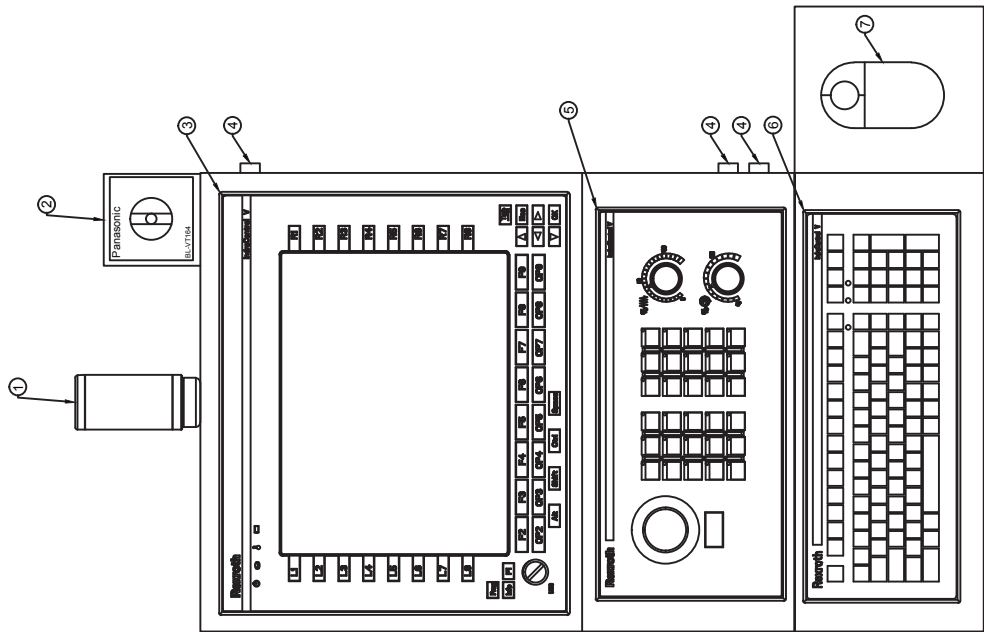
ITEM#	DRAWING CODE	PART NUMBER	DESCRIPTION	QTY
1	PLC6001	11-250A	CML45.1 PLC CONTROLLER	1
		11-251A	PLC FIRMWARE	1
		18-105	PLC CONNECTOR SET	1
		11-281A	END RETAINER	2
2	PLC6201	18-147	2 POINT ANALOG INPUT CARD	1
3	PLC6215	11-264A	SEGMENTED POWER CONNECTOR	1
4	PLC6226	11-265A	24VDC DIGITAL OUTPUT CARD	1
5	PLC6301	11-265A	24VDC DIGITAL OUTPUT CARD	1
6	TB400	11-317A	GROUP MARKER	1
		11-285A	4 PLACE TERMINAL BLOCK	15
		11-277A	4 PLACE TERMINAL BLOCK END	4
		11-287A	4 PLACE TERMINAL BLOCK GROUND	4
		11-278A	4 PLACE TERMINAL BLOCK GROUND END	1
		11-275A	4 POLE CENTER JUMPER	1
		11-323A	6 POLE CENTER JUMPER	1
		11-281A	END RETAINER	2
7	CR6304	11-299A	24VDC RELAY	1
8	CR3106	11-299A	24VDC RELAY	1
9	CR3108	11-299A	24VDC RELAY	1
10	SLC7001	11-241A	SLC-3-CPU000300	1
		11-242A	SLC-3-MPL000301	1
11	SLC7026	11-243A	SLC-3-GS3500300	1
12	SLC7101	11-244A	SLC-3-XTD180302	1
13	SLC7126	11-244A	SLC-3-XTD180302	1
14	SLC7201	11-245A	SLC-3-XTD180302	1
15	SLC7301	11-245A	SLC-3-XTD180302	1
16	TB500	11-317A	GROUP MARKER	1
		11-285A	4 PLACE TERMINAL BLOCK	13
		11-277A	4 PLACE TERMINAL BLOCK END	6
		11-287A	4 PLACE TERMINAL BLOCK GROUND	2
		11-278A	4 PLACE TERMINAL BLOCK GROUND END	1
		11-274A	2 POLE CENTER JUMPER	4
		11-275A	4 POLE CENTER JUMPER	1
		11-281A	END RETAINER	2

PRIDE ENGINEERING			MACHINE DESCRIPTION		MODEL 30A CMC	
1801 73RD AVE NORTH MINNETONKA, MN 55345			1801 73RD AVE NORTH MINNETONKA, MN 55345		1801 73RD AVE NORTH MINNETONKA, MN 55345	
DRAWN BY: SCP			DATE: 11/05/14		SCALE: NA	
CHECKED BY: SCP			REVISION: A		SHEET 38 OF 43	
PROJECT REF: 10338A-SCH			DESCRIPTION: 11325A VIBOM		FILENAME: SCH1032.DWG	
DWG NO: 102						



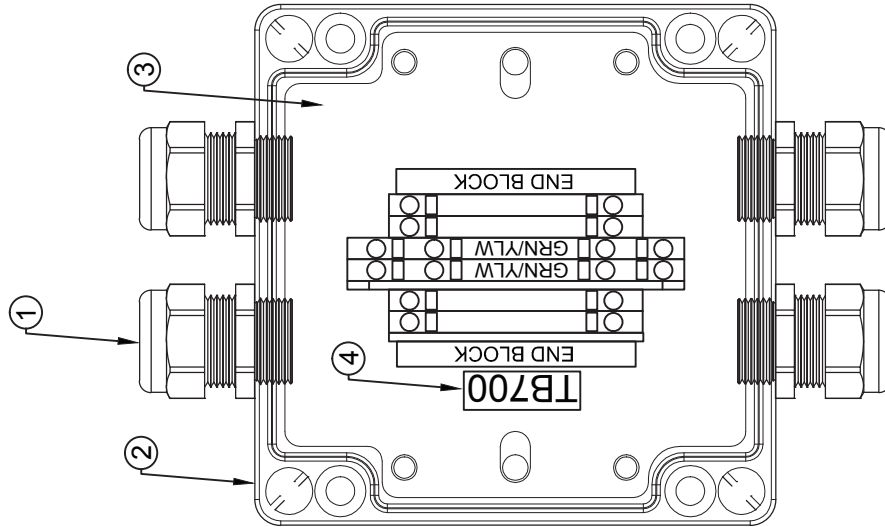
ITEM#	DRAWING CODE	PART NUMBER	DESCRIPTION	QTY
1	TB600	11-317A	GROUP MARKER	1
		11-284A	2 PLACE TERMINAL BLOCK	20
		11-276A	2 PLACE TERMINAL BLOCK END	1
		11-281A	END RETAINER	2
2		11-285A	4 PLACE TERMINAL BLOCK	8
		11-277A	4 PLACE TERMINAL BLOCK END	2
		11-287A	4 PLACE TERMINAL BLOCK GROUND	3
		11-278A	4 PLACE TERMINAL BLOCK GROUND END	1
		11-275A	4 POLE CENTER JUMPER	2
		11-281A	END RETAINER	2
3	OV5501	11-328A	8 PORT, ETHERNET SWITCH	1
		11-281A	END RETAINER	1
4	DV5601	11-333A	VPN TUNNEL APPLIANCE	1
		11-334A	NETWORK IP CAMERA	1

PRIDE ENGINEERING		MACHINE MODEL 30A CNC	
1801 73RD AVE NORTH		DESCRIPTION	
MINNETONKA, MN 55345		PROJECT REF: 10330A-SCH	
DRAWN BY: SCZ		DESCRIPTION: LAYOUT W/COM	
DATE: 11/05/14		FILENAME: SCH103.DWG	
REVISION: A		SHEET 38 OF 43	
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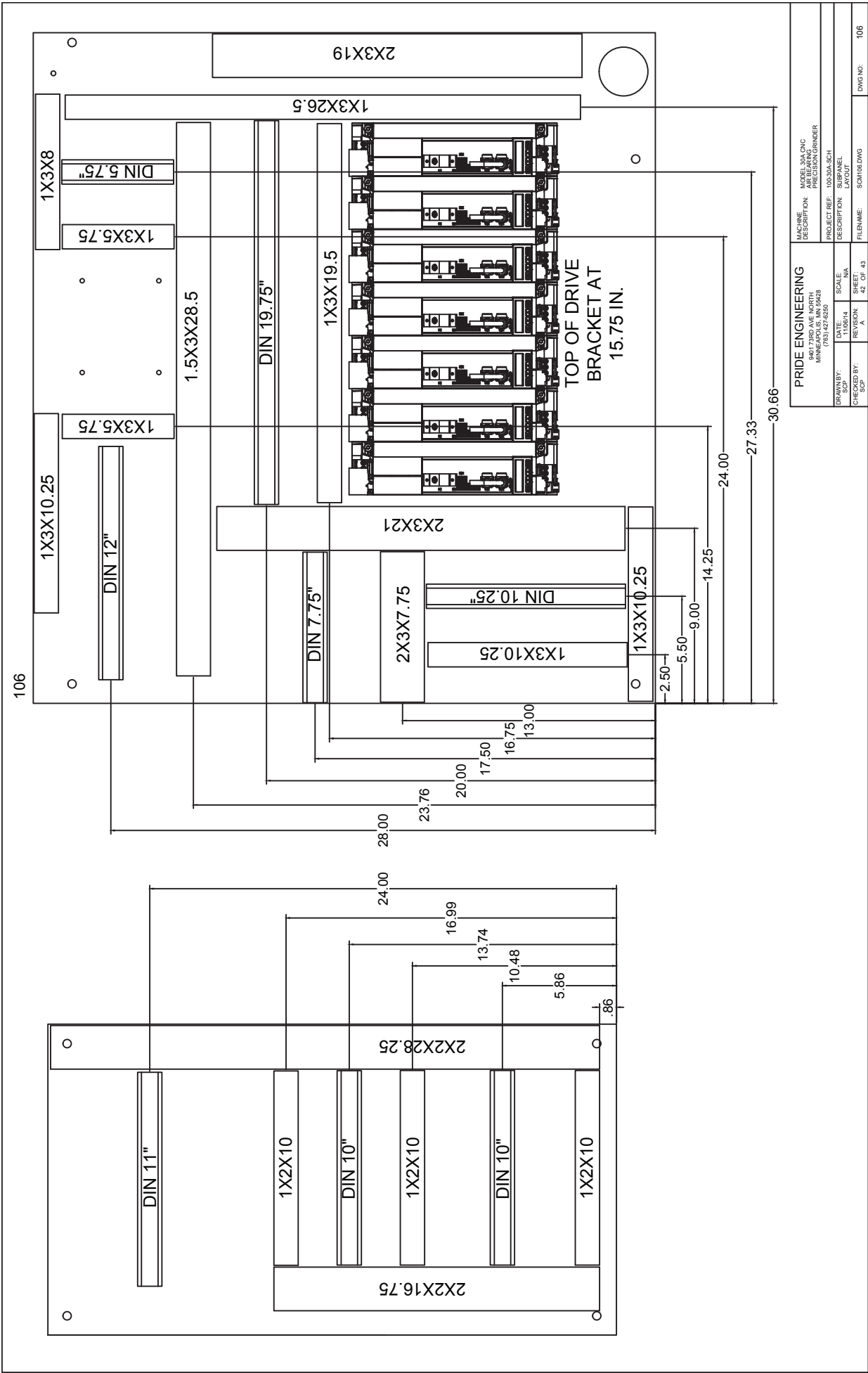
ITEM#	DRAWING CODE	PART NUMBER	DESCRIPTION	QTY
1	LT4132	11-295A	COLUMN LIGHT	1
2	DV5606	11-298A	4-PIN QUICK DISCONNECT CABLE	1
3	DV5606	11-324A	AXATRAX CABLE	1
4	DV4001	11-252A	VEP40.5 HMI INTERFACE	1
5	DV4101	11-188	ETHERNET RECEPTACLE	3
6	DV4501	11-253A	VAM10.3 CONTROL PANEL	1
7	DV4510	11-235	VAK11.2 KEYBOARD	1
		11-207	TRACKBALL MOUSE	1

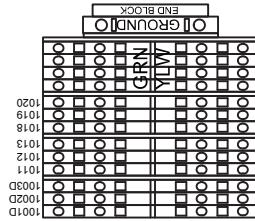
PRIDE ENGINEERING				MACHINE	MODEL 30A CNC
				DESCRIPTION	ART BURNING
					MANUFACTURED BY PRIDE ENGINEER
				PROJECT REF:	100-30A-SCH
DRAWN BY:	DATE:	SCALE:	SHEET:	DESCRIPTION	
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CHECKED BY:	REVISION:	SHEET:	OF:		
SCP	A	43			104



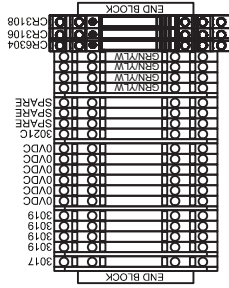
ITEM#	DRAWING CODE	PART NUMBER	DESCRIPTION	QTY
1			CABLE GLAND, 1/2 NPT	4
2		11-309A	JUNCTION BOX, ALUMINUM, 4.8X4.8	1
3		11-310A	INNER PANEL	1
4	TB700	11-317A	GROUP MARKER	1
		11-284A	2 PLACE TERMINAL BLOCK	4
		11-276A	2 PLACE TERMINAL BLOCK END	2
		11-287A	4 PLACE TERMINAL BLOCK GROUND	2
		11-278A	4 PLACE TERMINAL BLOCK GROUND END	1
		11-281A	END RETAINER	2

PRIDE ENGINEERING		MACHINE	MODEL 30A CNC
1801 73RD AVE NORTH		DESCRIPTION	AIR BEARING
MINNETONKA, MN 55345		MANUFACTURER	PRIDE ENGINEER
DRAWN BY: SCP	DATE: 11/05/14	SCALE: NA	PROJECT REF: 10338A-SCH
CHECKED BY: SCP	REVISION: A	SHEET: 41 OF 43	DESCRIPTION: JUNCTION BOX LAYOUT W/BOA
FILENAME: SCH1038.DWG			DWG NO: 105



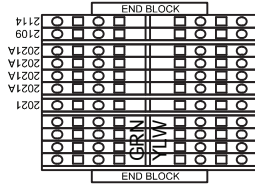


TB100

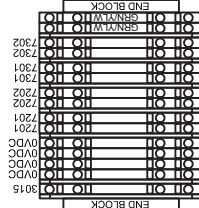


TB400

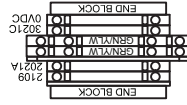
Note:
Interconnect all ground blocks



TB200



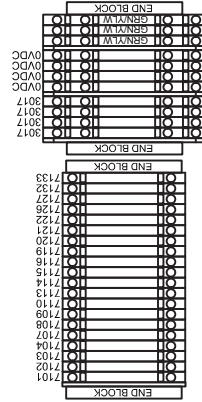
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TB700



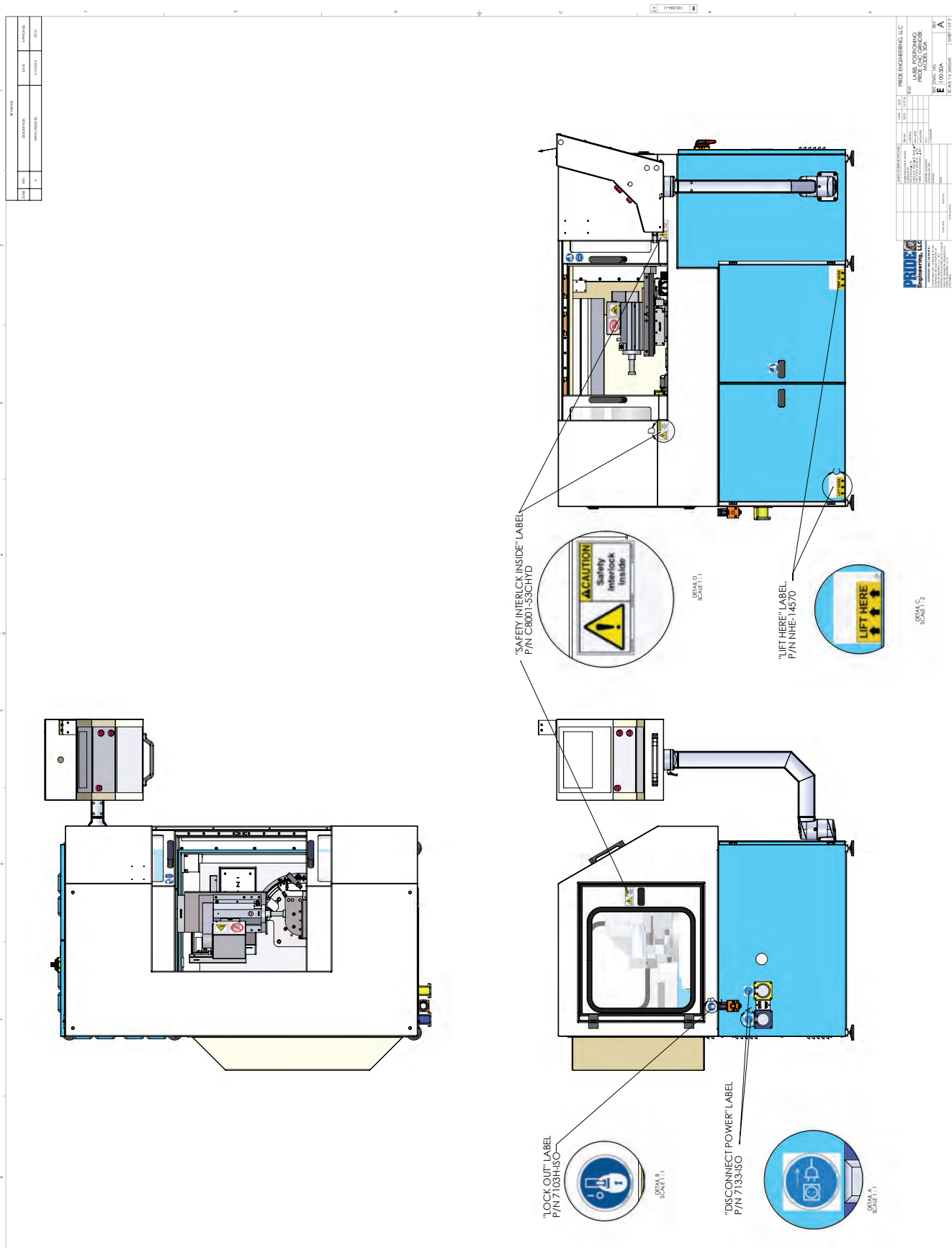
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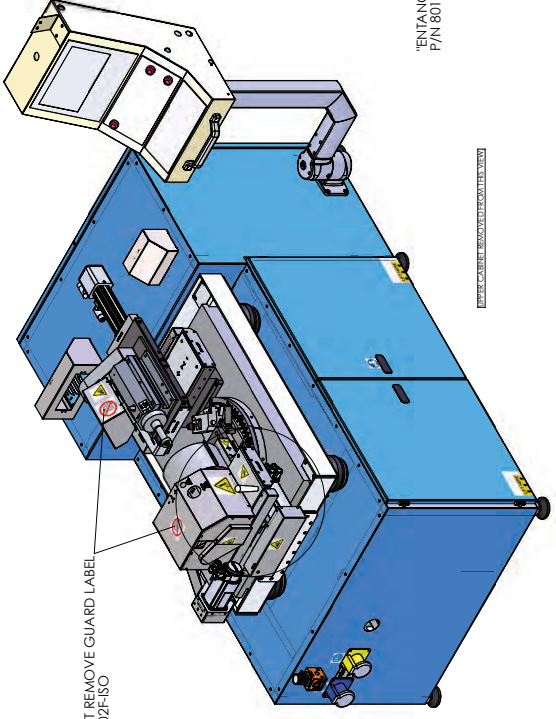
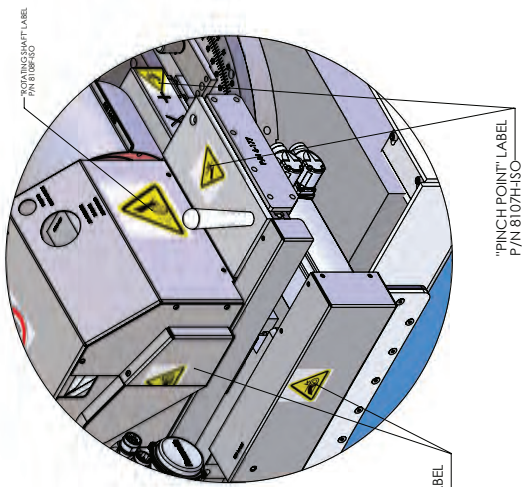
TB600

PRIDE ENGINEERING		MACHINE DESCRIPTION		MODEL 30A CNC	
8401 73RD AVE NORTH		MINNEAPOLIS, MN 55428		AIR BEARING	
DRAWN BY: SCP		DATE: 11/05/14		PROJECT REF: 10338A-SCH	
CHECKED BY: SCP		REVISION: A		DESCRIPTION: END BLOCK DESCRIPTIONS	
SHEET 43		OF 43		FILENAME: SCH107.DWG	
				DWG NO: 107	

5.7 安全元件

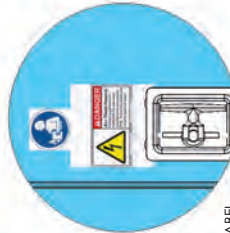
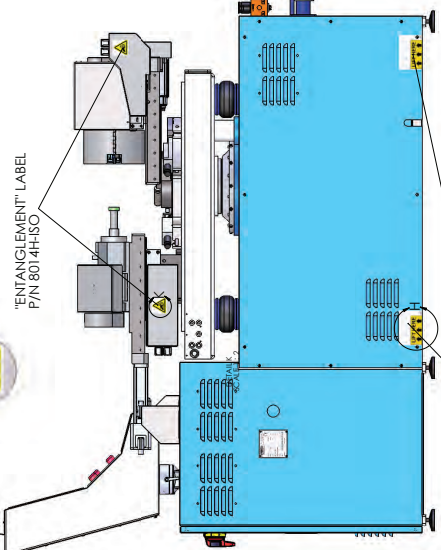


REV	DATE	DESCRIPTION	BY	APPROVED
1	11/11/11	INITIAL DESIGN	1	1



"ENTANGLEMENT" LABEL
P/N 8014H-ISO

"ENTANGLEMENT" LABEL
P/N 8014H-ISO



"LOCK OUT" LABEL
P/N 7103H-ISO

"LOCK OUT" LABEL
P/N 7103H-ISO

"READ MANUAL" LABEL
P/N 7104H-ISO

"ELECTRICAL SHOCK" LABEL
P/N 8002H-ISO

"READ MANUAL" LABEL
P/N 7104H-ISO

"ARC FLASH" LABEL
P/N C8002-42DR1D

"ARC FLASH" LABEL
P/N C8002-42DR1D

PRIDE ENGINEERING, LLC	
1000 S. 1000 E. SUITE 100	
TAMPA, FL 33606	
TEL: 813.241.1111	
FAX: 813.241.1112	
WWW.PRIDEENGINEERING.COM	
REV: 1.0	
DATE: 11/11/11	
DRAWN BY: 1	
CHECKED BY: 1	
APPROVED BY: 1	
SCALE: 1:1	
SHEET 1 OF 1	

Product Name: MOBIL VACTRA OIL NO. 2
Revision Date: 17Oct2008
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MATERIAL SAFETY DATA SHEET

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: MOBIL VACTRA OIL NO. 2
Product Description: Base Oil and Additives
Product Code: 600494-00, 970716
Intended Use: Lubricant

COMPANY IDENTIFICATION

Supplier: EXXON MOBIL CORPORATION
3225 GALLOWES RD.
FAIRFAX, VA. 22037 USA
24 Hour Health Emergency 609-737-4411
Transportation Emergency Phone 800-424-9300
ExxonMobil Transportation No. 281-834-3296
Product Technical Information 800-662-4525, 800-947-9147
MSDS Internet Address <http://www.exxon.com>, <http://www.mobil.com>

SECTION 2 COMPOSITION / INFORMATION ON INGREDIENTS

No Reportable Hazardous Substance(s) or Complex Substance(s).

SECTION 3 HAZARDS IDENTIFICATION

This material is not considered to be hazardous according to regulatory guidelines (see (M)SDS Section 15).

POTENTIAL HEALTH EFFECTS

Low order of toxicity. Excessive exposure may result in eye, skin, or respiratory irritation. High-pressure injection under skin may cause serious damage.

NFPA Hazard ID:	Health: 0	Flammability: 1	Reactivity: 0
HMIS Hazard ID:	Health: 0	Flammability: 1	Reactivity: 0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 4 FIRST AID MEASURES

INHALATION

Remove from further exposure. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use

Product Name: MOBIL VACTRA OIL NO. 2

Revision Date: 17Oct2008

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mouth-to-mouth resuscitation.

SKIN CONTACT

Wash contact areas with soap and water. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

First aid is normally not required. Seek medical attention if discomfort occurs.

SECTION 5	FIRE FIGHTING MEASURES
------------------	-------------------------------

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO₂) to extinguish flames.

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Hazardous Combustion Products: Smoke, Fume, Aldehydes, Sulfur oxides, Incomplete combustion products, Oxides of carbon

FLAMMABILITY PROPERTIES

Flash Point [Method]: >205C (401F) [ASTM D-92]

Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0

Autoignition Temperature: N/D

SECTION 6	ACCIDENTAL RELEASE MEASURES
------------------	------------------------------------

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. US regulations require reporting releases of this material to the environment which exceed the applicable reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

SPILL MANAGEMENT

Product Name: MOBIL VACTRA OIL NO. 2

Revision Date: 17Oct2008

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Land Spill: Stop leak if you can do it without risk. Recover by pumping or with suitable absorbent.

Water Spill: Stop leak if you can do it without risk. Confine the spill immediately with booms. Warn other shipping. Remove from the surface by skimming or with suitable absorbents. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7

HANDLING AND STORAGE

HANDLING

Prevent small spills and leakage to avoid slip hazard.

Static Accumulator: This material is a static accumulator.

STORAGE

Do not store in open or unlabelled containers. Keep away from incompatible materials.

SECTION 8

EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure limits/standards for materials that can be formed when handling this product: When mists / aerosols can occur, the following are recommended: 5 mg/m³ - ACGIH TLV, 10 mg/m³ - ACGIH STEL, 5 mg/m³ - OSHA PEL.

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

No special requirements under ordinary conditions of use and with adequate ventilation.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator

Product Name: MOBIL VACTRA OIL NO. 2

Revision Date: 17Oct2008

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selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

No special requirements under ordinary conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

No protection is ordinarily required under normal conditions of use.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

No skin protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid skin contact.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

See Sections 6, 7, 12, 13.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

Typical physical and chemical properties are given below. Consult the Supplier in Section 1 for additional data.

GENERAL INFORMATION

Physical State: Liquid

Color: Brown

Odor: Characteristic

Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 C): 0.883

Flash Point [Method]: >205C (401F) [ASTM D-92]

Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0

Autoignition Temperature: N/D

Boiling Point / Range: N/D

Vapor Density (Air = 1): > 2 at 101 kPa

Vapor Pressure: < 0.013 kPa (0.1 mm Hg) at 20 C

Evaporation Rate (n-butyl acetate = 1): N/D

pH: N/A

Product Name: MOBIL VACTRA OIL NO. 2

Revision Date: 17Oct2008

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Log Pow (n-Octanol/Water Partition Coefficient): > 3.5

Solubility in Water: Negligible

Viscosity: 68 cSt (68 mm²/sec) at 40 C | 8.6 cSt (8.6 mm²/sec) at 100C

Oxidizing Properties: See Sections 3, 15, 16.

OTHER INFORMATION

Freezing Point: N/D

Melting Point: N/A

Pour Point: -6°C (21°F)

DMSO Extract (mineral oil only), IP-346: < 3 %wt

SECTION 10

STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat. High energy sources of ignition.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11

TOXICOLOGICAL INFORMATION

ACUTE TOXICITY

<u>Route of Exposure</u>	<u>Conclusion / Remarks</u>
Inhalation	
Toxicity (Rat): LC50 > 5000 mg/m ³	Minimally Toxic. Based on test data for structurally similar materials.
Irritation: No end point data.	Negligible hazard at ambient/normal handling temperatures. Based on assessment of the components.
Ingestion	
Toxicity (Rat): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Skin	
Toxicity (Rabbit): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Irritation (Rabbit): Data available.	Negligible irritation to skin at ambient temperatures. Based on test data for structurally similar materials.
Eye	
Irritation (Rabbit): Data available.	May cause mild, short-lasting discomfort to eyes. Based on test data for structurally similar materials.

CHRONIC/OTHER EFFECTS

Contains:

Base oil severely refined: Not carcinogenic in animal studies. Representative material passes IP-346, Modified Ames test, and/or other screening tests. Dermal and inhalation studies showed minimal effects; lung non-specific infiltration of immune cells, oil deposition and minimal granuloma formation. Not sensitizing in test animals.

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Additional information is available by request.

The following ingredients are cited on the lists below: None.

	--REGULATORY LISTS SEARCHED--	
1 = NTP CARC	3 = IARC 1	5 = IARC 2B
2 = NTP SUS	4 = IARC 2A	6 = OSHA CARC

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.

MOBILITY

Base oil component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Base oil component -- Expected to be inherently biodegradable

BIOACCUMULATION POTENTIAL

Base oil component -- Has the potential to bioaccumulate, however metabolism or physical properties may reduce the bioconcentration or limit bioavailability.

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrosivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be

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completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14	TRANSPORT INFORMATION
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LAND (DOT) : Not Regulated for Land Transport

LAND (TDG) : Not Regulated for Land Transport

SEA (IMDG) : Not Regulated for Sea Transport according to IMDG-Code

AIR (IATA) : Not Regulated for Air Transport

SECTION 15	REGULATORY INFORMATION
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OSHA HAZARD COMMUNICATION STANDARD: When used for its intended purposes, this material is not classified as hazardous in accordance with OSHA 29 CFR 1910.1200.

NATIONAL CHEMICAL INVENTORY LISTING: AICS, IECSC, DSL, EINECS, ENCS, KECI, PICCS, TSCA

EPCRA: This material contains no extremely hazardous substances.

SARA (311/312) REPORTABLE HAZARD CATEGORIES: None.

SARA (313) TOXIC RELEASE INVENTORY: This material contains no chemicals subject to the supplier notification requirements of the SARA 313 Toxic Release Program.

The Following Ingredients are Cited on the Lists Below: None.

--REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive

SECTION 16	OTHER INFORMATION
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N/D = Not determined, N/A = Not applicable

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:

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No revision information is available.

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Internal Use Only

MHC: 0B, 0B, 0, 0, 0, 0

PPEC: A

DGN: 2007221XUS (1014962)

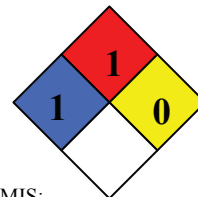
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MATERIAL SAFETY DATA SHEET

1. Identification of the material and supplier

Product name CLC COOLANT 2224 EP
Product use Metalworking coolant
Supplier CLC Lubricants
0N902 Old Kirk Road
PO Box 764
Geneva, IL 60134
630-232-7900

Emergency
Phone : 1-800-535-5053
Infotrac



HMIS:
HEALTH=1
FIRE=1
REACTIVITY=0
SPECIAL= NONE

2. Hazards identification

OSHA HAZARDOUS COMPONENTS (29 CFR 1910.1200)

This product is not formulated to contain ingredients that have exposure limits exceeding those established by US agencies *See Section 8 for exposure limits.

Keep out of reach of children.

Eyes: May cause eye burns

Skin: May cause severe irritation

Ingestion: Harmful, damaging to mucous membranes

Inhalation: Vapors and/or aerosols which may be formed at elevated temperatures may be irritating to eyes and respiratory tract.

Not a sensitizer.

3. Composition/ information on ingredients

Ingredient	CAS#	%
Alkanolamines	May be one of the following:	<30
	102-71-6	
	124-68-5	
	27646-80-6	
	929-06-6	
	141-43-5	
	78-96-6	
	110-97-4	

Non-hazardous ingredients are treated confidentially.

4. First-aid measures

Eyes	If symptoms develop, immediately move individual away from exposure and into fresh air. Flush eyes gently with water for at least 15 minutes while holding eyelids apart; seek immediate medical attention.
Skin	Remove contaminated clothing. Flush exposed area with large amounts of water. If skin is damaged, seek immediate medical attention. If skin is not damaged but symptoms persist, seek medical attention. Launder clothing before reuse.
Ingestion	Seek medical attention. If individual is drowsy or unconscious, do not give anything by mouth; place individual on the left side with the head down. Contact physician, medical facility, or poison control center for advice about whether to induce vomiting. Do not leave individual unattended.
Inhalation	If symptoms develop, move individual away from exposure and into fresh air. If symptoms persist, seek medical attention.

5. Fire-fighting measures

Flash point	Will not flash
Extinguishing media	Carbon dioxide, dry chemical
Protection of fire-fighters	Fire-fighters should wear self-contained positive pressure breathing apparatus (SCBA) and full turnout gear.

6. Accidental release measures		
Methods and materials for containment and cleanup	Dike to contain spill, cover with inert absorbent material, sweep up and place in a suitable container. Flush area well with water. Keep spills and cleaning run-off out of municipal sewers and bodies of water	
7. Handling and storage		
HANDLING: Keep containers closed. Avoid contact with eyes, skin or clothing. Wash hands after handling.		
Empty container may retain product residue which may exhibit hazards of product.		
8. Exposure controls/personal protection		
Alkanolamines	TLV- 5 mg/M3 OSHA/ACGIH	
Personal protective equipment		
Respiratory system	None required; however, use of adequate ventilation is good industrial practice.	
Hands	Wear suitable gloves	
Skin and body	Avoid contact with skin clothing. Wear suitable protective clothing.	
Eyes	Safety glasses with side shields.	
9. Physical and chemical properties		
Physical state	Liquid	
Color	Clear blue	
Boiling point	<212°F	
Freezing point	>32°F	
pH (concentrated)	9-11	
Solubility in water	Complete	
Density	8.74 lbs/gal	
10. Stability and reactivity		
Stability	Stable under normal conditions	
Incompatibility with various substances/hazardous reactions	Avoid acids, acetone, aldehydes, aluminum, copper, halogenated hydrocarbons, ketones, strong alkalis, strong oxidizing agents, metals, organic anhydrides, organic halides.	
Hazardous polymerization	Will not occur	
Decomposition products	Oxides of Carbon, sulfur, and nitrogen	
11. Toxicological information		
For Alkanolamines:		
Oral LD50, Rat: 2000-4000 mg/kg		
Dermal LD50, Rabbit: >2000 mg/kg		
Not a sensitizer		
Not a carcinogen		
Not mutagenic		
12. Ecological information		
For Alkanolamines:		
Bacterial Toxicity EC50= 132 ppm		
Acute Fish Toxicity, Bluegill Sunfish, 96 h LC50= 190 mg/l		
Acute Fish Toxicity, Plaice, 96 h LC 50= 180 mg/l		
Acute Toxicity, Daphnia magna, 48 h LC50= 193 mg/l		
Acute Toxicity, Brown Shrimp, 96 h LC50= 179 mg/l		
Bacterial Toxicity, Pseudomonas putida, EC10= 50 mg/l		
LC50, Pimephales promelas, static, 96 h: 580 mg/l		
EC50, alga Scenedesmus sp., 72 h: 270 mg/l		

13. Disposal information

Materials contaminated must be disposed to a permitted hazardous waste management facility in accordance with the Clean Air and Clean Water Acts, Resources Conservation and Recovery Act, and all relevant laws or regulations regarding disposal. If it can be determined that spilled material and absorbent do not meet hazardous waste criteria, disposal may not be regulated.

14. Transport information

Not classified as hazardous for transport (DOT, TDG, IMO/IMDG, IATA/ICAO)

15. Regulatory information

SARA TITLE III SECTION 313: Not applicable

SARA 311/312: Acute Health Hazard

The chemical ingredients in this product are on the 8(b) TSCA Inventory Lists (40 CFR 710) or exempt.

16. Other information

All reasonably practicable steps have been taken to ensure this data sheet and the health, safety and environmental information contained in it is accurate as of the date specified below. No warranty or representation, express or implied is made as to the accuracy or completeness of the data and information in this data sheet. The data and advice given apply when the product is sold for the stated application or applications. You should not use the product other than for the stated application or applications without seeking advice from us.

It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. CLC Lubricants shall not be responsible for any damage or injury resulting from use, other than the stated product use of the material, from any failure to adhere to recommendations, or from any hazards inherent in the nature of the material. Purchasers of the product for supply to a third party for use at work, have a duty to take all necessary steps to ensure that any person handling or using the product is provided with the information in this sheet. Employers have a duty to tell employees and others who may be affected of any hazards described in this sheet and of any precautions that should be taken.
