
Poka Yoke

**Avoid
Poka**

**Inadvertent Errors
Yoke**

**Poka
Yoke**

**避免
无意的错误**

Poka Yoke Is a Common Method for Improving Process Robustness

- It seeks ways to take over repetitive tasks or actions that depend on vigilance or memory
- It frees workers' time to pursue other activities
- It is **not acceptable** to produce even a small number of defects or defective products.
- The objective is **zero defects**.
- Examples of Types of Poka Yoke
 - **Source Inspections** - An additional locator pin in a tool to prevent misalignment of the workpiece
 - **100% Inspection** - An inexpensive sensing device such as a limit switch
 - **Immediate Action to Stop an operation when a Defect is Detected** - An interlock circuit that automatically shuts down the machine
 - **Design Changes** - Eliminating unused holes in a circuit board to avoid errors in inserting a plug

Poka Yoke是改进流程鲁棒性的常规工具

- 它靠警觉或记忆寻找接管重复工作或行动的方法。
- 它给使工人有更多时间开展其它的行动。
- 即使是少量的缺陷或含缺陷的产品也不能接受。
- 目标是零缺陷。
- Poka Yoke类型的举例
 - 根原检查 - 工具上附加的刻度针，防止校对错误
 - 100% 检查 - 一个便宜的传感器，如限制开关
 - 当发现缺陷时立即停止流程操作- 连锁电路自动关闭机器
 - 设计的变化 - 去除电路板上多余的接孔，以避免插入插头时犯错误

Inadvertent Errors 无意的错误

Forgetfulness 遗漏

Errors from Misunderstanding 误解的错误

Errors in Identification 鉴定错误

Errors from “Lack of Experience” 缺乏经验上的错误

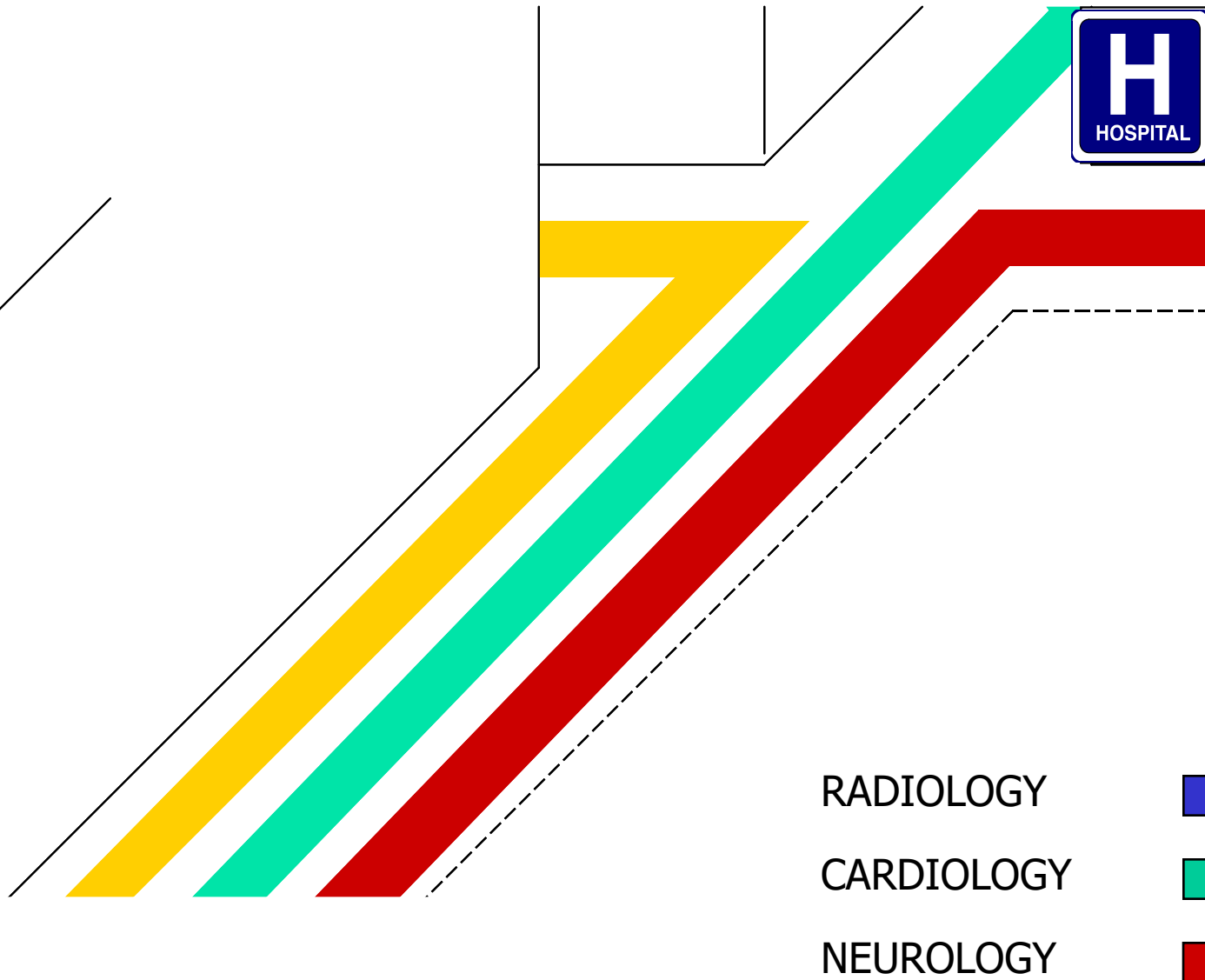
Errors Because of Speed 速率造成的错误

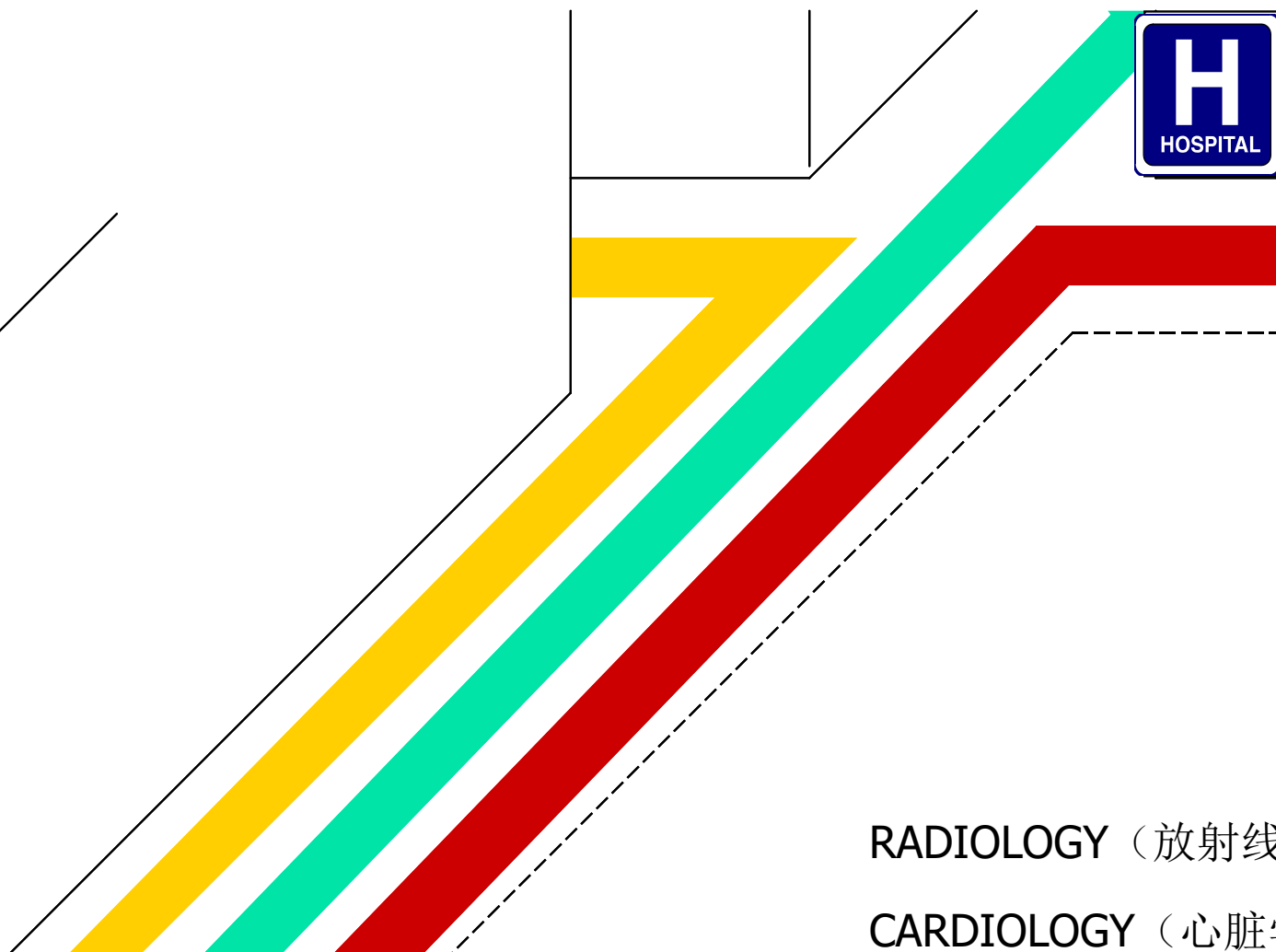
Errors due to “Lack of standards” 缺乏标准造成的错误

Surprise Errors 意外的错误

Willful Errors 故意的错误

Poka Yoke for Patients





- Working together, develop a list of examples of mistake proofing that we experience every day.
- Be prepared to present your ideas
 - Examples:
 - Automatic Seatbelts
 - Auto-Shut-Off Irons
 - Automatic Sinks in Public Facilities

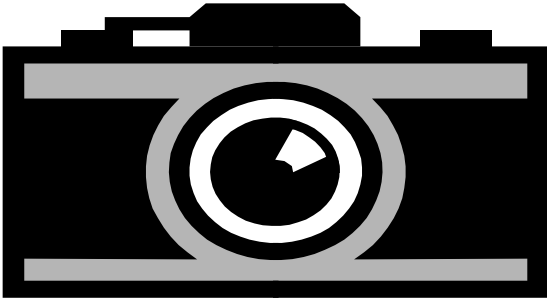
- 我们一起制作，列出每天生活中体验到的防止错误例子
- 准备发表你的意见
 - 举例：
 - 自动座椅带
 - 自动开关的熨斗
 - 公共建筑的自动饮用喷泉

<i>Technique</i>	<i>Prediction / Prevention</i>	<i>Detection</i>
Control	<i>Errors are impossible.</i>	<i>Defective items can not move on to the next step.</i>
Shutdown	<i>When a mistake is about to be made.</i>	<i>When a mistake or defect has been made.</i>
Warning	<i>That something is about to go wrong.</i>	<i>Immediately when something does go wrong.</i>

**Poka Yoke is a KISS process
Simpler is Better!!!**

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**Poka Yoke 是个 KISS 流程
简单就是最好!!!**

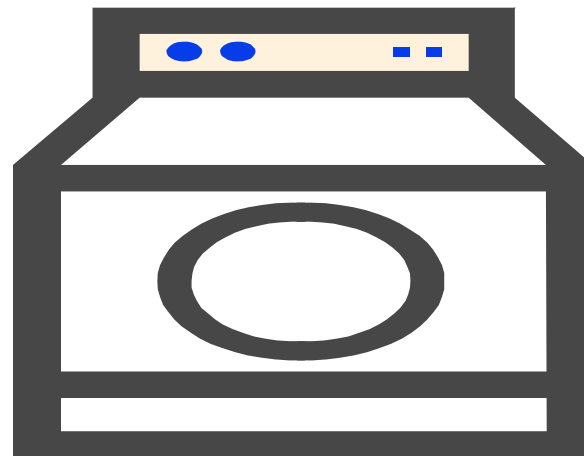


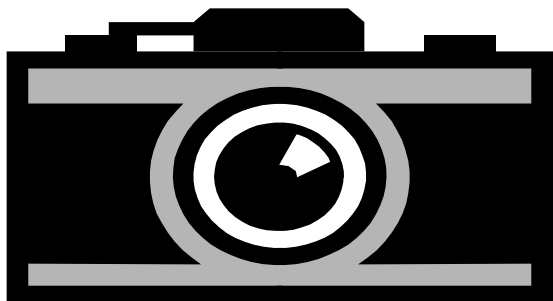
PREDICTION/PREVENTION

Some cameras will not function when there is not enough light to take a picture.

DETECTION

Some laundry dryers have a device that shuts them down when overheating is detected.



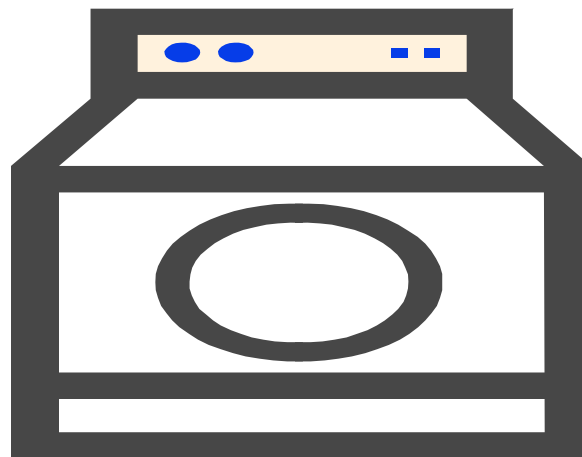


预报/预防

有些照相机若光线不够就不能拍照。

侦测

一些干衣机当侦测到温度过高时，会自动关闭。



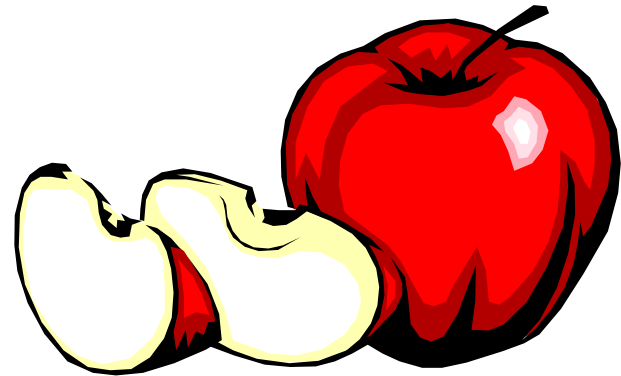


PREDICTION/PREVENTION

When gas stations still offered leaded gasoline in addition to unleaded gasoline, the nozzle on the unleaded pump and the hole for the gas tank were smaller than that for leaded gasoline.

DETECTION

A fruit orchard that takes great pride in its oversized apples, assures only the biggest apples get to customers by passing all apples through a sizer. Those that do not make it are sent to the discount outlet.



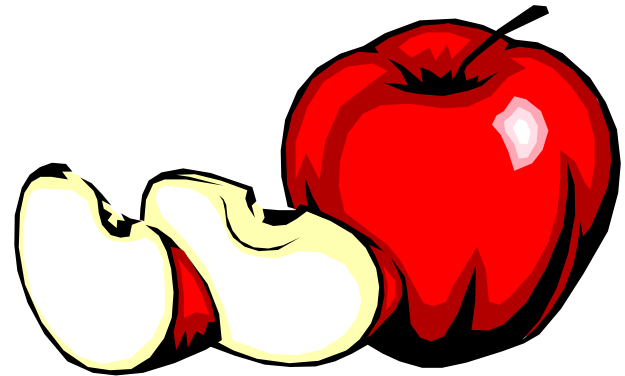


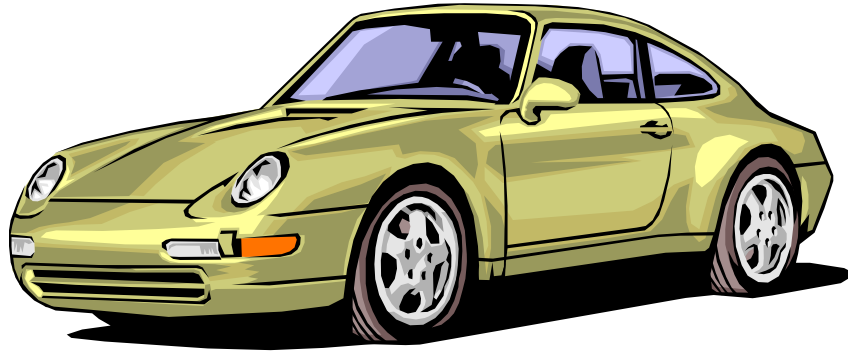
预报/预防

当加油站还提供无铅及含铅两种汽油时，无铅汽油泵的管口和油箱上的接口都比含铅汽油的小。

侦测

一果园以其特大的苹果为荣，并承诺只有通过检测口的大苹果才会卖给消费者。没有通过的就在折让市场出售。



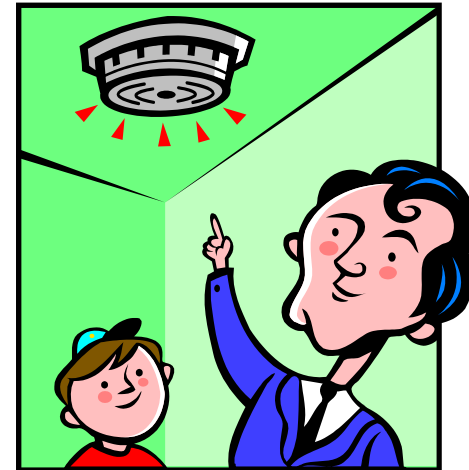


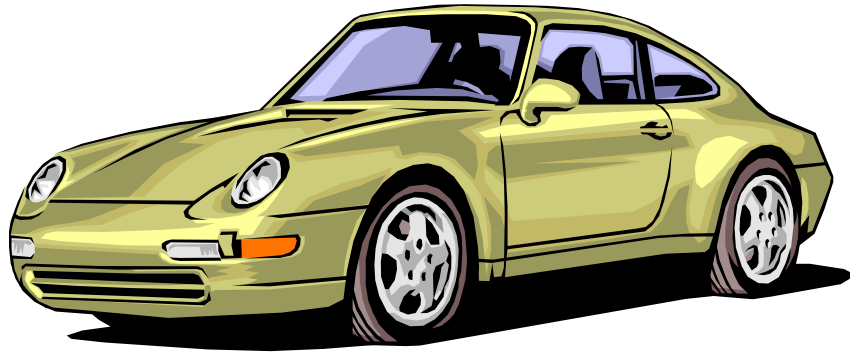
PREDICTION/PREVENTION

Many cars have warning systems to alert the driver that not all seat belts have been fastened.

DETECTION

Smoke detectors provide a warning that smoke has been detected and that there is a possible fire.





预报/预防

许多车辆都有预警系统提醒司机，有些座椅安全带未系牢。

侦测

当发现有烟雾时，烟雾探测器会发出信号警报可能的火灾。



Guide Pins of different sizes 不同大小的定位针

Error Detection Devices with Alarms 有闹铃的缺陷侦测装置

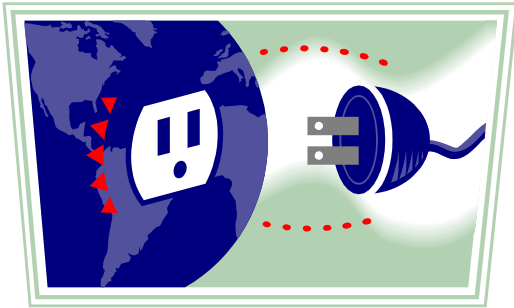
Limit Switches 限制开关

Counters 计算器

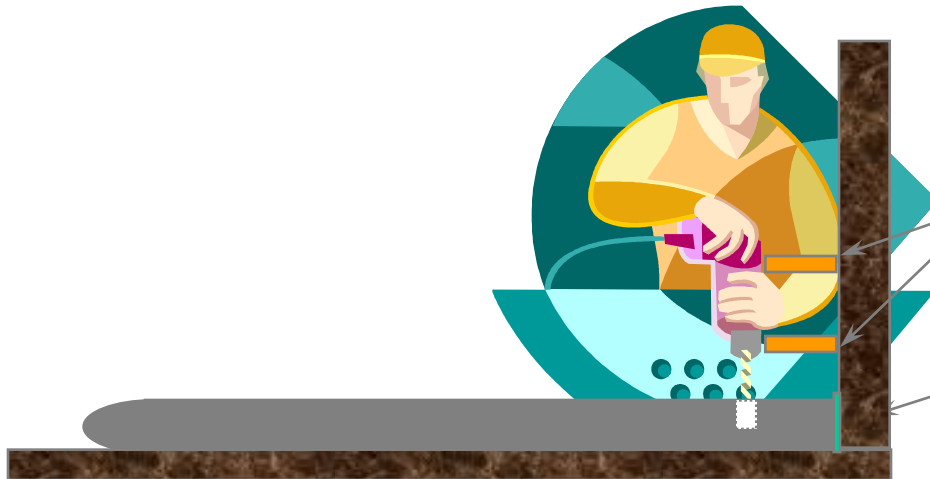
Checklists 检查名单

- Contact methods
 - Contact with the part highlights errors
- Fixed-value methods
 - Errors are detected through counting
- Motion-step methods
 - Errors are detected by motion or lack of it

- 接触方法
 - 当接触有缺陷部件时亮起错误警示
- 定值方法
 - 通过点算发现错误
- 移动步骤方法
 - 通过移动或缺乏移动而发现错误

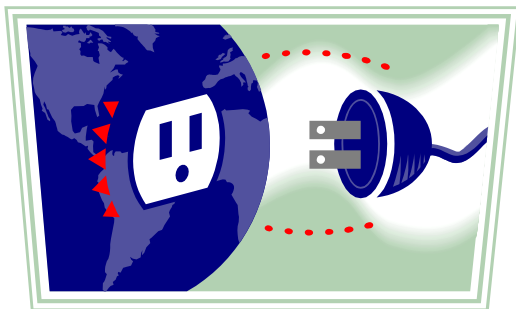


Electrical outlets have been redesigned to assure proper polarity. It is impossible to put a plug in the outlet incorrectly.

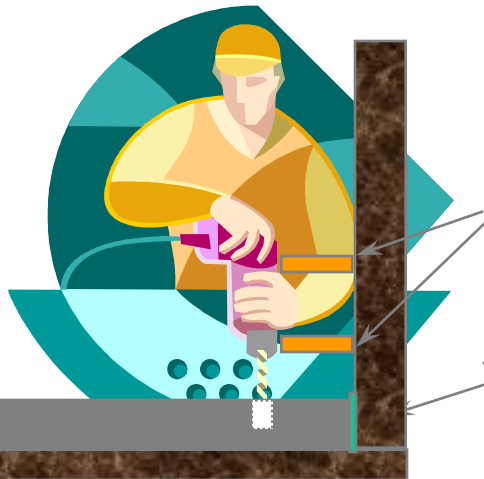


Guides line up the drill to assure the drilled hole is 90°.

A magnetic contact assures that the shaft is correctly inserted and seated before drilling.



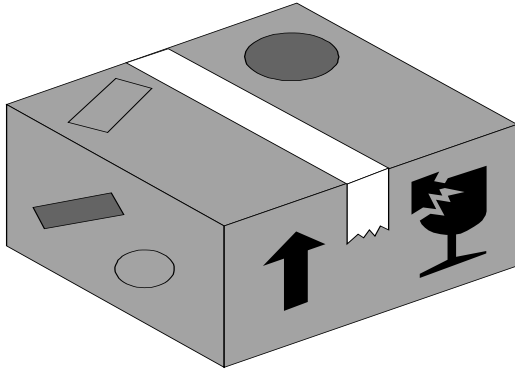
电源插座经重新设计保证了正确的极性。从而，不存在插头错插的可能性。



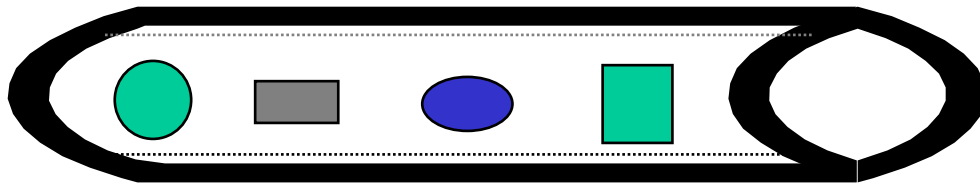
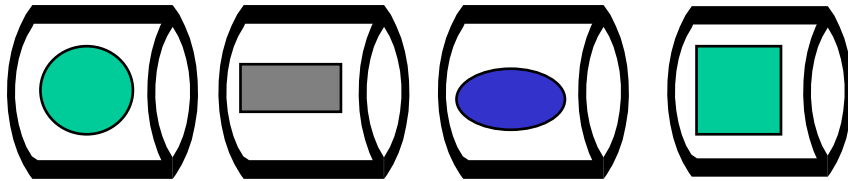
定位针及钻孔机成垂直状，从而保证钻孔是 90° 。

磁性接触装置确保在钻孔前，钻轴已正确插入及固定。

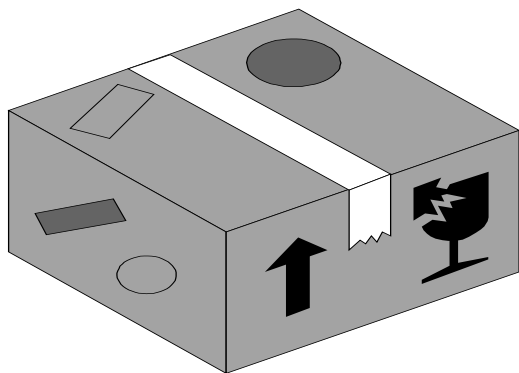
Fixed Value Methods



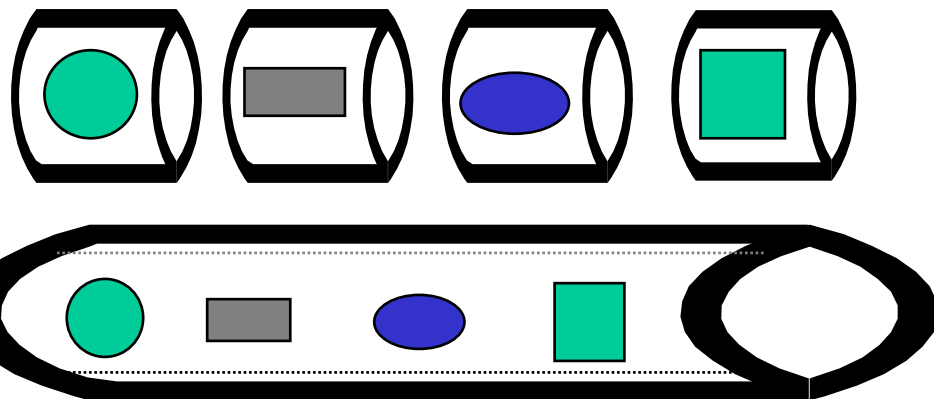
Four different hazardous material warning labels had to be applied before shipping the product. Boxes without the labels would be returned which would result in delayed shipments.



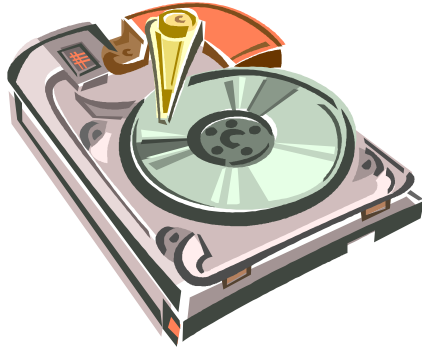
The labels were on four separate rolls. When all four labels were put onto one roll, it was easy for the worker to know when a label had been missed.



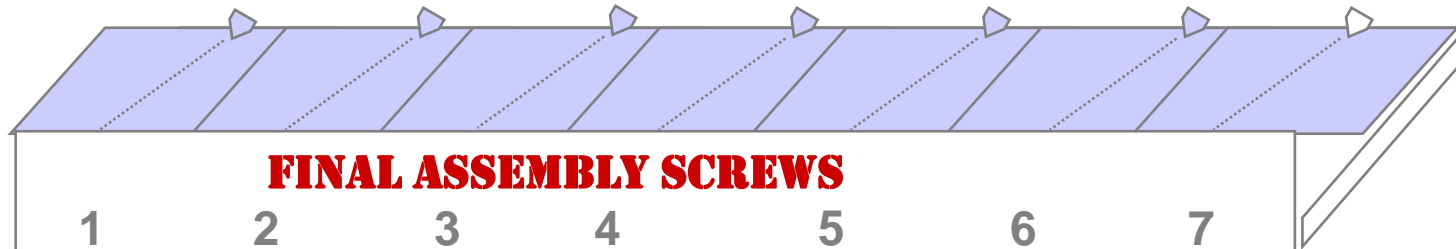
在运送危险物品前，必需贴上了四种不同的危险物料标签。没有标签的盒子将被退回而造成延迟运送的后果。



标签在四个分散的卷轴上。当四个标签同时在一个卷轴上时，工人很容易发现遗漏了一个标签。



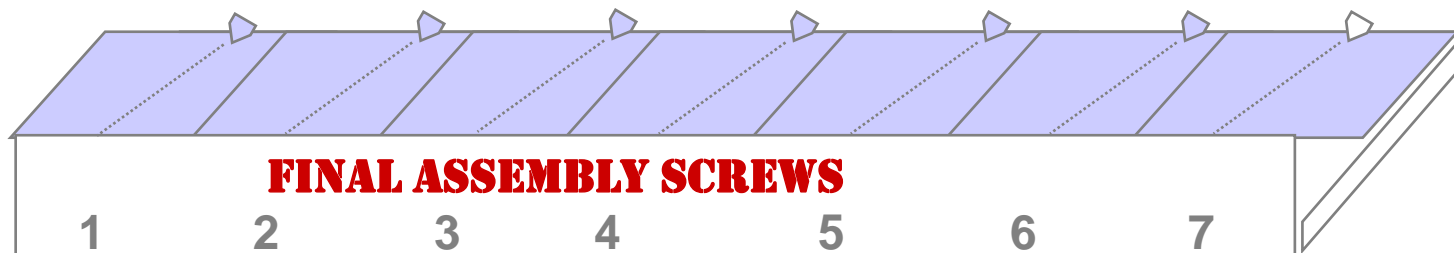
Seven screws in various sizes were inserted in the final assembly of a CD ROM drive. Often a screw would be forgotten resulting in high warranty claims.



The seven different screws were put into bins with photoelectric switches. When a screw is removed, the beam is broken. The part cannot move on to the next operation until the beam is broken on all seven bins.



CD ROM 驱动器的最后装配使用七根不同大小的螺丝. 经常性的遗漏一根螺丝会构成很大的质保问题。



将七个不同螺丝装到带有光电开关的箱柜上。当一颗螺丝被移动后就切断光线感应。部件将不能移动到下一个程序除了7个箱柜上的光线感应都被切断。

Typical Mistake Proofing Tools

Limit Switches

Guide Pins

Counters

限制开关

定位针

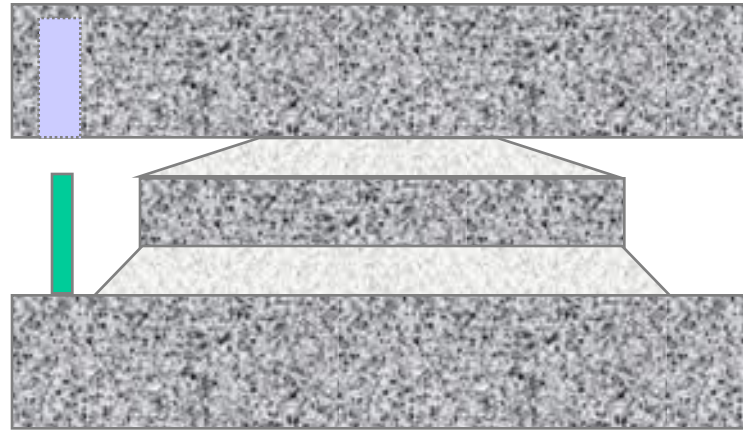
计算器



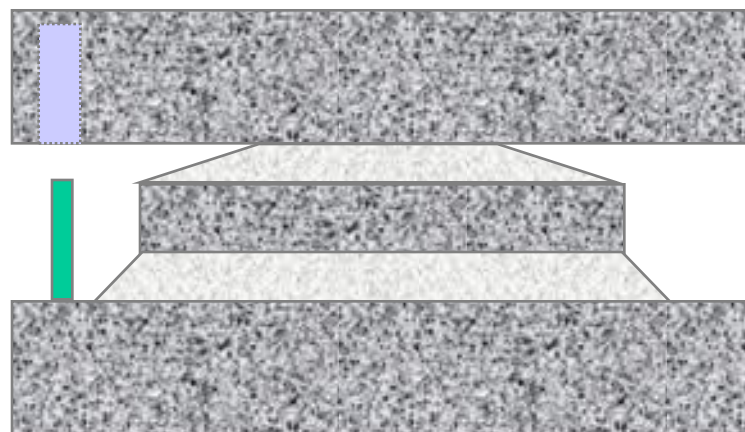
- A forklift truck has a limit switch that will not allow the truck to move forward or in reverse with the mast raised. Another limit switch shuts the forklift down when the load exceeds the maximum weight capacity.



- 堆高车装有一个限制开关，它防止堆高车在铲刀升高后开动或倒退。另一个限制开关是当堆高车超重时自动停止。

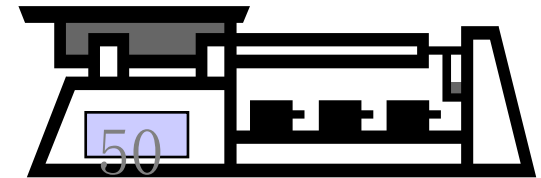
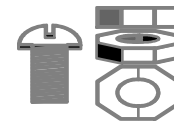


- If during setup, the operator could set the top and bottom jig incorrectly resulting in defective parts and possible damage to the die, installing a guide pin prevents the press from closing unless the proper jig is used and it is correctly set up. In such an installation, each jig has its own unique guide pin.



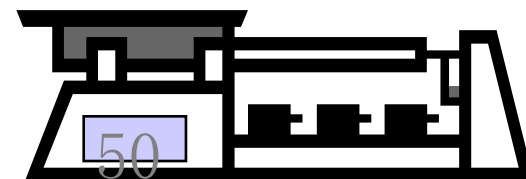
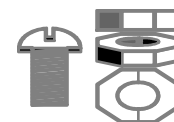
- 如在设置时操作员配置错误上下夹具，会导致产生不合格部件和印模的损坏。安装了定位针可以阻止印压机的压缩直到正确的使用和配置上下夹具。在这样的安装中，每个夹具均由它独特的定位针位置。

A scale, specially designed for the screw and bolt packaging operation, digitally displayed the number of screws in the package based on the weight of the screw. The operator no longer had to convert the weight of the screws and bolts into number of pieces.



An enamel spraying operation required each part to have short sprays of enamel applied before the part was baked. It was determined that five short sprays gave the optimum coverage. A limit switch was put on the pump that would allow only an 0.5 second spray. A counter was also installed on the spray trigger. Only when the spray trigger was squeezed five times would the part be released to the oven.

一个专门为包装螺丝和螺钉的电子天平，会自动根据螺丝的重量显示出包装中应有螺丝的数量。操作员不需要自己将螺丝的重量转化为数量。



一个瓷釉喷雾器需要在部件烘焙前，每部件都有喷到瓷釉。我们发现在短喷五下是覆盖性最好的。一个限制开关装在泵上，只允许每次喷**0.5** 秒。在扳机上安装上一个计算器。只有扳机被扳动五下，该部件才会送到烘焙阶段。

- Identify items by their characteristics
 - Provide clear standards and graphic reminders
- Detect Deviation from procedures or omitted procedures
 - Use sensing devices to prevent sequential operations
- Detect Deviation from Standards
 - Use a counter
 - Use exact Lots
 - Use critical parameter design

- 以物品的特性作出识别
 - 提供清晰的标准和图表提示
- 在程序或遗漏的程序侦测偏离
 - 利用感应设备防止连续操作
- 侦测对标准的偏离
 - 使用计算器
 - 使用准确批量
 - 使用关键参数设计

Mistake Proofing Challenges

1. ATM customers complain that they never know the right way to insert their ATM card and usually it takes a couple of tries.
2. A local bottling company wants to make sure that all bottles are filled with exactly the right amount of soda.
3. A large pharmaceutical company is trying to develop a way to assure elderly people living alone take their prescription medicine at the right time and in the correct dosage.
4. A manufacturer of home power tools wants to make sure that customers are wearing eye and hand protection before using their equipment.
5. A consumer electronics company has had several customer complaints lately that their instructions were missing from their product.

1. 自动提款机客户投诉他们从不知道正确的查卡方式，所以通常要试好几次。
2. 装瓶公司想确认所有的瓶子里装的都是正确容量的苏打水。
3. 大型的制药公司希望确保一个独处的老人能适时服药及服用正确剂量。
4. 家用电力工具生产商希望确保顾客在使用他们的设备前能带上护目镜及护手套。
5. 家用电器公司近来有几个客户投诉产品内未有附上说明。

Mistake Proofing Challenges cont.

6. 9 different tools are needed to change a jig and die. Often, in the middle of the change-over, the set-up operator realizes a tool is missing and has to stop to look for the tool.
7. An easy-to-assemble-furniture manufacturer has received several complaints about holes not being tapped for all screws. Because the furniture is made from hardwood, the customers have to drill the holes themselves.
8. A contact lens solution manufacturer received complaints from distributors that some customers found empty boxes with their shipments. The company wants to make sure no more empty boxes are shipped.

6. 转换夹具和硬模需要9种不同的工具。通常，在转换当中，设置人员发现一个工具遗失，就得停下手上工作去找它。
7. 简装家具厂商接到一些关于未有为所有的螺丝钻孔的投诉。因为家具使用硬木制造，消费者需要自己钻孔。
8. 隐形眼镜生产商接到分销商的投诉说一些客户在他们的货中发现了空盒子。公司想确定在所运送的货品中不再有空盒子。

Mistake Proofing Advantages

- No formal training programs required.
- Eliminates many inspection operations.
- Relieves operators from repetitive tasks.
- Promotes creativity and value adding activities.
- Results in defect-free work.
- Provides immediate action when problems arise.

- 不需要正规的培训计划。
- 删除很多检验的运作。
- 为操作员消除重复的工作。
- 促进创造力和可增值的工作。
- 实现无缺陷运作。
- 当出现问题时可提供即时行动。