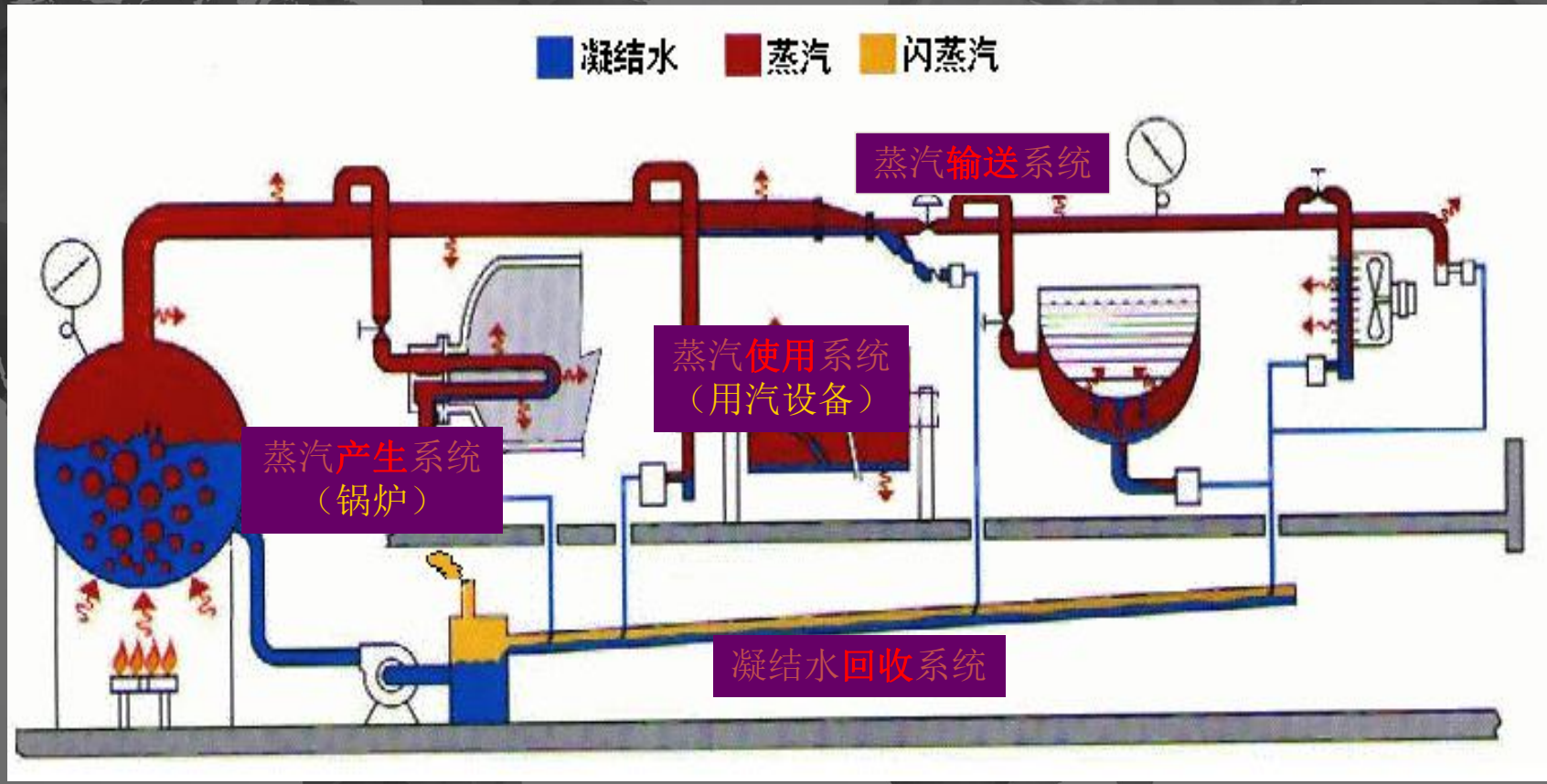
蒸汽品质监测
Armstrong Steam QM-3

蒸汽系统简图



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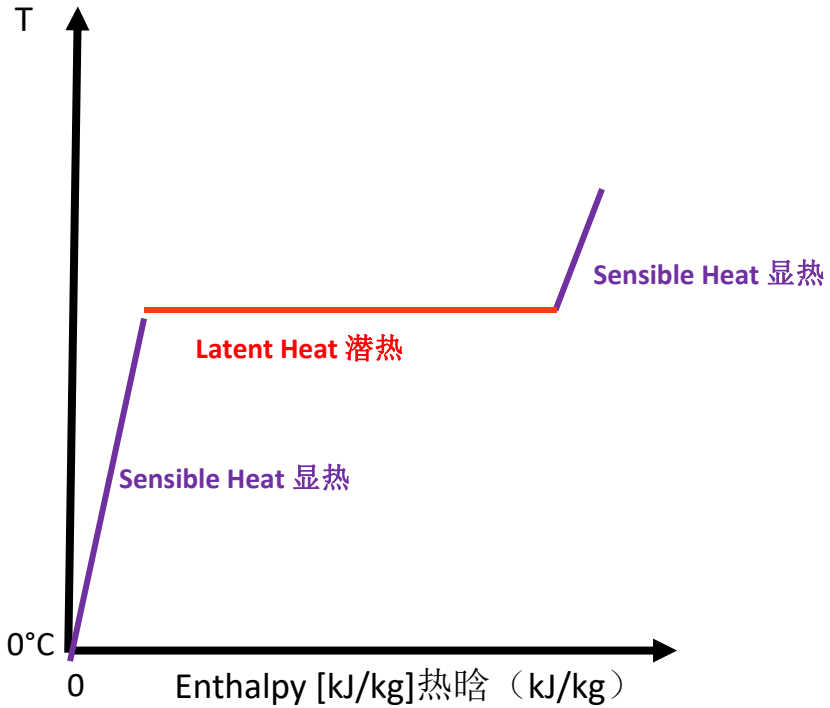
蒸汽基本特性 Steam Basics



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干度 Dryness Fraction

- Mathematically, the **dryness fraction** “X” is defined as follows:

$$X = \frac{M}{M + m}$$

X = Steam quality for saturated steam [%]

M = mass of steam

m = mass of water

饱和蒸汽主要特性

- 温度随压力升高而升高，成一一对应关系
- 显热随压力升高而增大，在三相点时为零
- 潜热随压力升高而减小，到临界点时为零

- 在中低压下，潜热占总热焓的绝大比重
- 蒸汽比容随压力升高而减小，到临界点时与水的比容相同
- 在低压下，蒸汽比容比水大许多倍

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空气带来的问题

- **道尔顿定律（分压力定律）**
- 混合气体总压力等于各组成气体的分压力之和

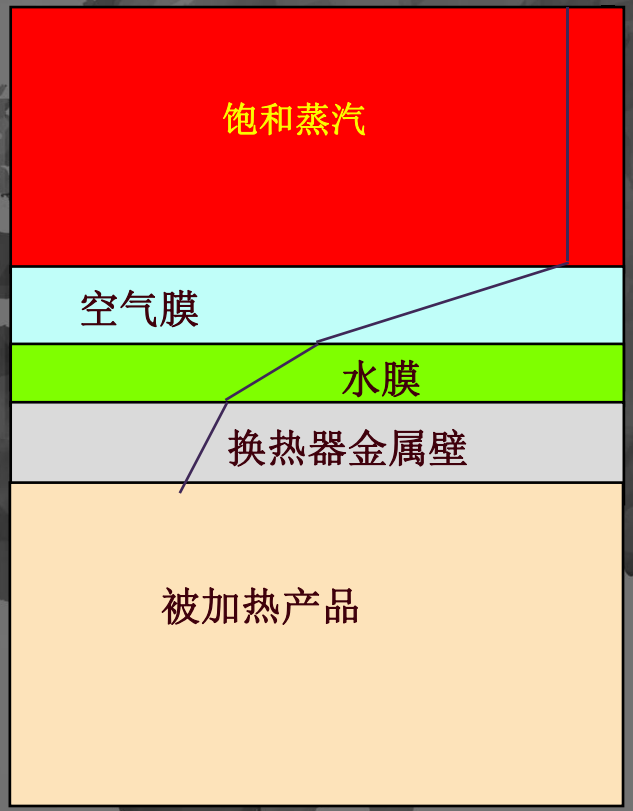
- **分容积定律**
- 混合气体总容积等于各组成气体的分容积之和

- **分压力与分容积成正比**
- $V_{总} = V_{蒸汽} + V_{空气}$
- $P_{总} = P_{蒸汽} + P_{空气}$
- **空气的存在降低了蒸汽分压力，从而降低系统温度**

空气带来的问题

阻碍热传递

蒸汽中容积占 0.5%的空气
降低传热效率 50%



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EN285 灭菌器灭菌室的蒸汽供应

Dryness 干度

- Steam dryness for sterilization 消毒用蒸汽干度

metal loads 金属负载> 0.95, non-metal loads非金属负载 > 0.9

Superheat 过热度

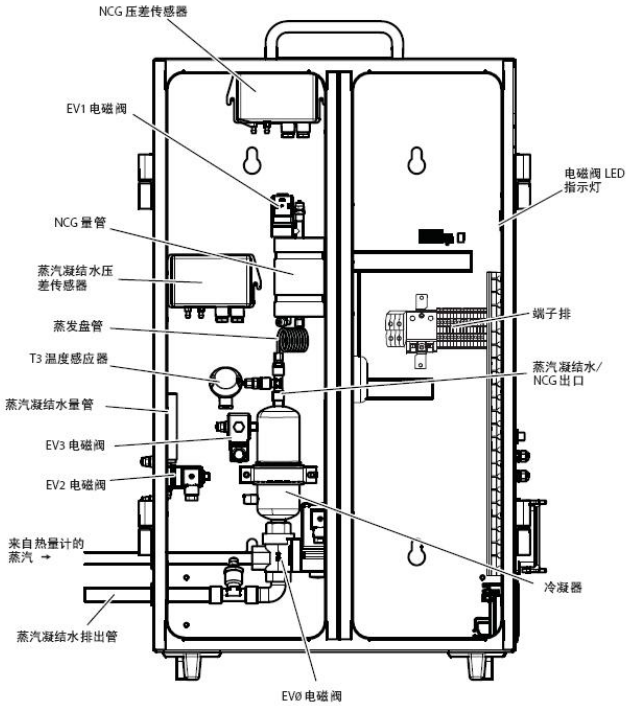
- Maximum superheat of steam after expansion to atmospheric pressure: 25°C 蒸汽最大过热度： 25°C

NCG 不凝性气体

- Non-condensable gases: max 3,5% of gas volume/liquid volume 不凝性气体： 气体/液体体积最大3.5%

检测方法 Detection Method

检测方法 QM3



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手动方式 Manual Method

Time consuming 费时费力

- Typically manual steam quality measurement requires two people, and can take up to three hours per measurement point. This does not include additional time required to complete necessary reports. 典型的手工方式测量蒸汽品质，每个测量点需要两人花费三个小时，这还不包括整理报告所需要的时间。

Unsafe 不安全

- There are inherent safety risks involved in sampling live steam and condensate in a water receiver. 新鲜蒸汽抽样并在集水罐中冷凝有安全隐患。

Spot 时点

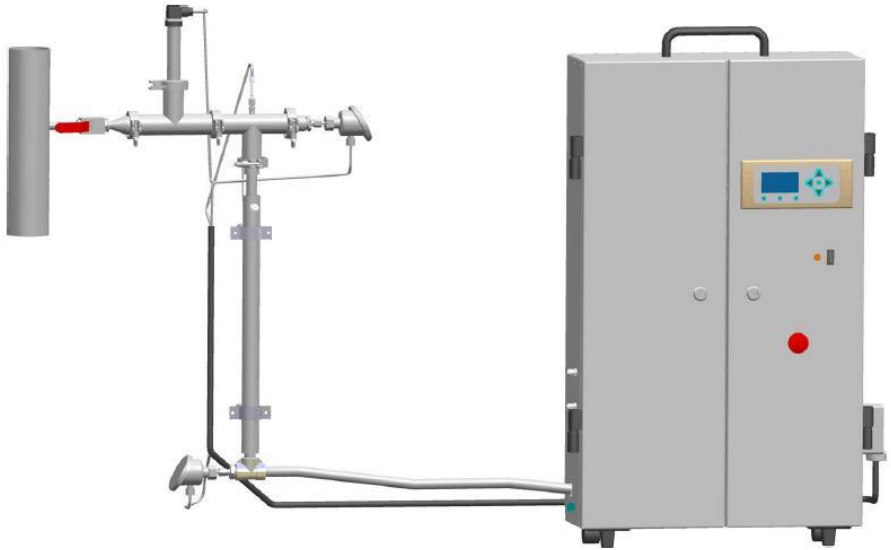
- It is impossible to monitor a trend over a period of time. 不可能监测一段时间内的趋势。

Unreliable 不可靠

- Measurement results depend on the skill of the technician conducting the test. 测量结果的准确性依赖于测试人员的技术水平。

Steam QM-3

- **Steam QM-3** is an automatic steam quality meter which determines and communicates steam moisture content, the amount of superheat present, and the concentration of non-condensable gases in steam.
- **Steam QM-3** 是自动蒸汽品质测量仪，监测并报告蒸汽的含湿量、过热蒸汽过热度，以及蒸汽中的不凝性气体含量。



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自动方式 Automatic Method

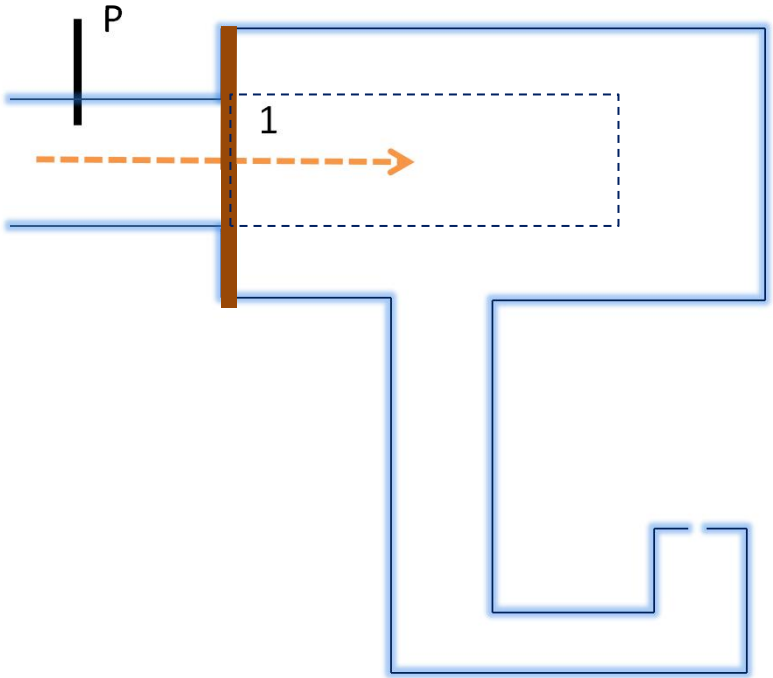
- Steam pressure reduction to atmosphere allows measuring dryness. To increase range ability at low steam pressure, electrode adds energy to superheating level. Its amount is removed in the calculations.
  蒸汽压力降至大气压力可以测量干度，为增加蒸汽压力较低时的量程，通过电极加热到过热水平。计算过程中所加的能源将予以扣除。

- Steam temperature & pressure measurements detect superheat .
  通过蒸汽温度和压力测量过热度

- Accumulation of NCGs to compare volume to condensate.
  通过冷凝后水量对比测量不凝性气体

Steam QM-3 | 原理 Concept

1. 蒸汽通过一个带刻度的小孔进入节气装置。在进入节气装置前测量蒸汽压力。（P1）



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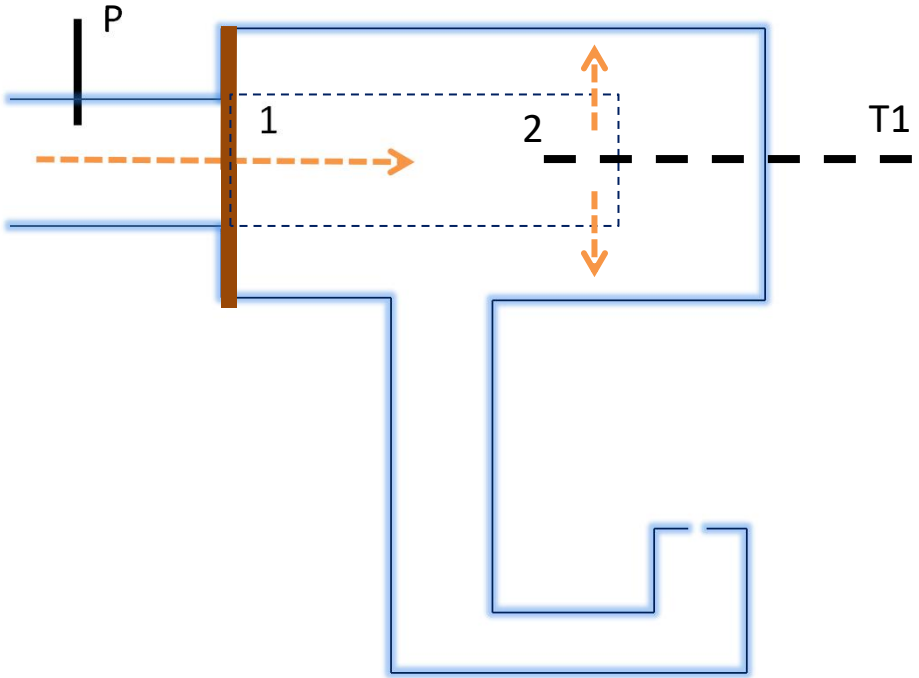
原理 Concept

2. 温度计测量蒸汽温度（T1）从而测量过热度。



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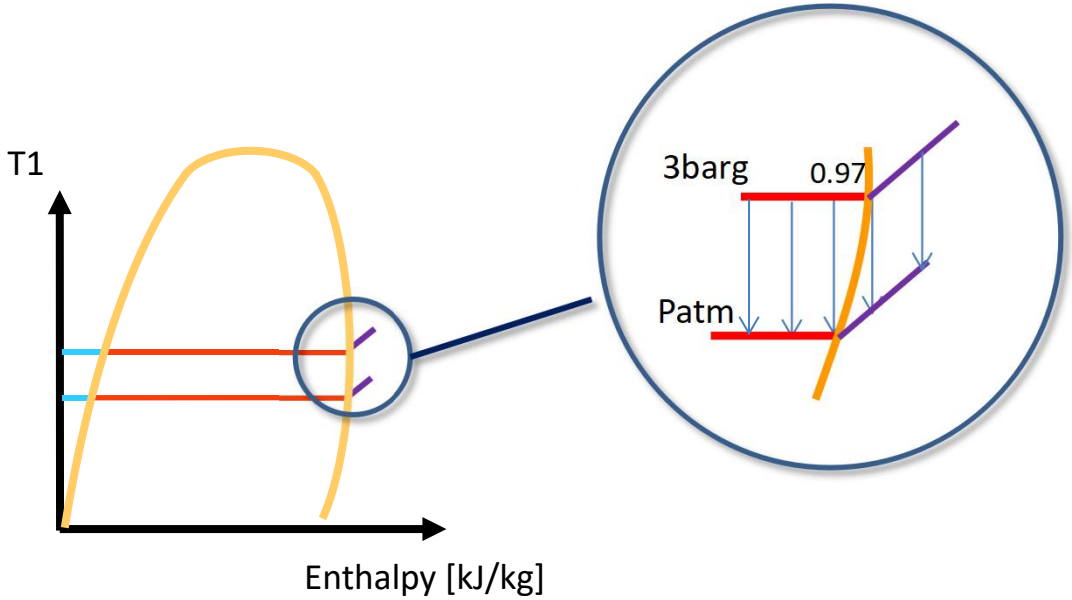
原理 Concept



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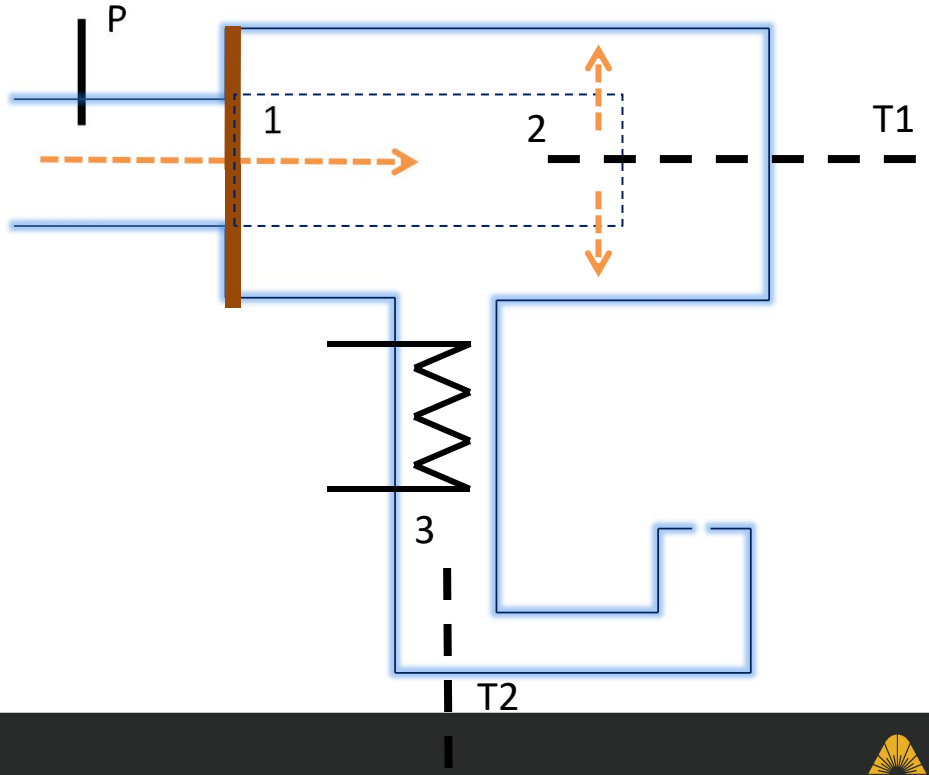
Steam QM-3 | 原理 Concept

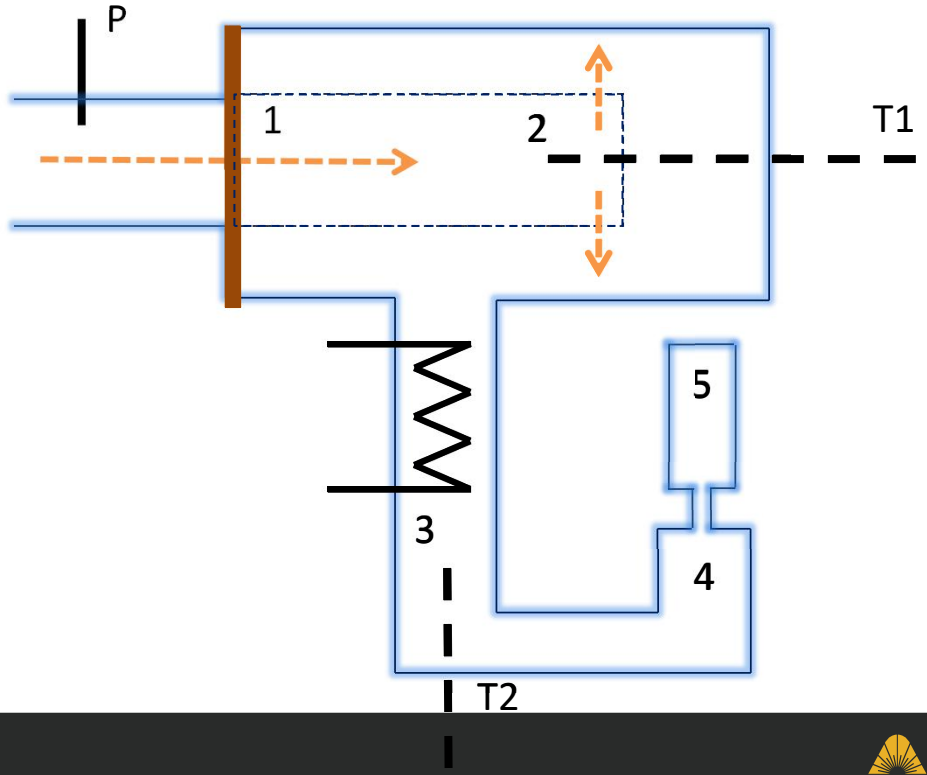
3.通过处理确保蒸汽为过热蒸汽，并用温度计测量温度（T2）。由此计算干度。



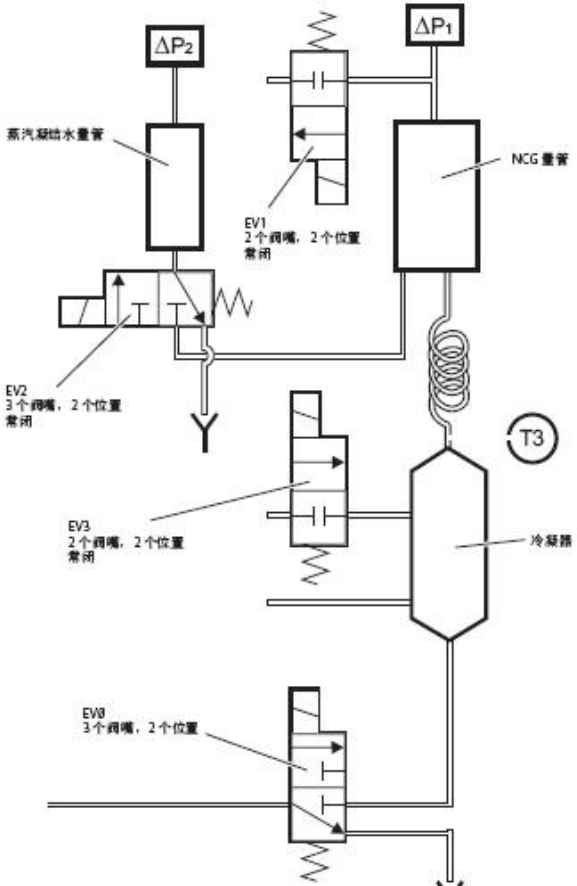
Steam QM-3 | 原理 Concept

4. 蒸汽冷凝。

5. 用一个有刻度的量管收集不凝性气体，并测量冷凝水量。



Steam QM-3 | 原理 Concept



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自动方式 Automatic Method

Quick and Easy 方便快捷

- Steam QM-3 is simple to install. 安装简单。

Safe 安全

- Because Steam QM-3 is installed while the steam valve is closed, it is much safer than manual measurement methods. 在蒸汽阀门关闭的时候安装，比手工测量方式更为安全。

Trending 趋势性

- Continuous measurements provide trending data over time. 连续测量可提供一段时间内的趋势性数据。

Reliable 可靠

- Steam QM-3 is both reliable and accurate within +/- 1% of steam dryness. 数据精确可靠蒸汽干度测量的准确率在+/- 1% 以内。

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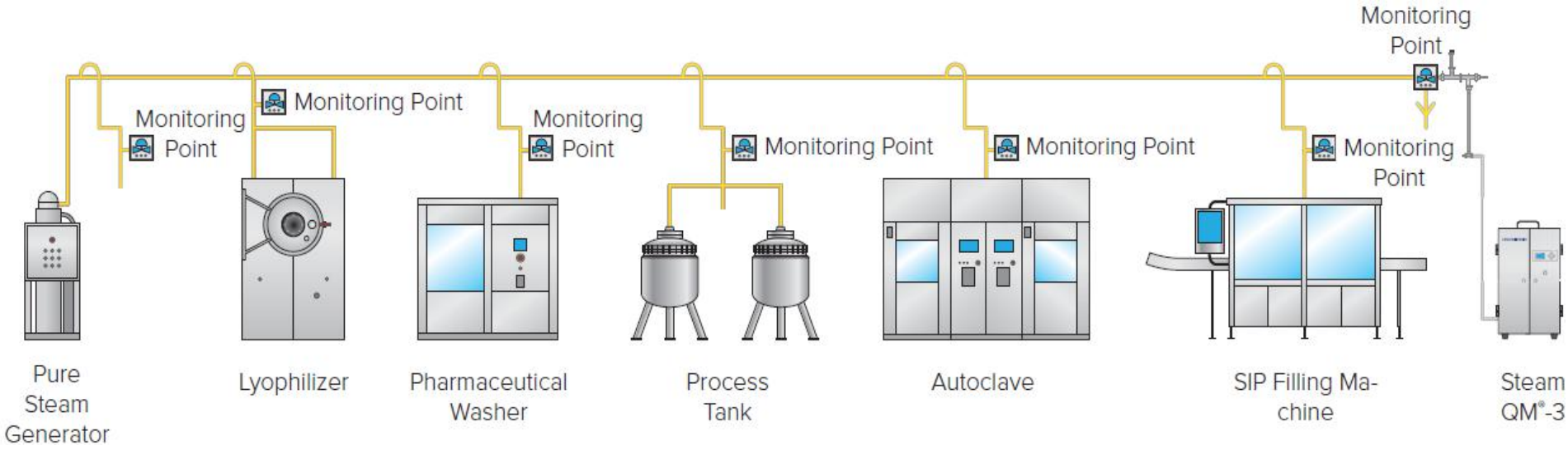
应用 Application



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安装 Installation

*Not Included In Package 机组中不含

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机组 Package

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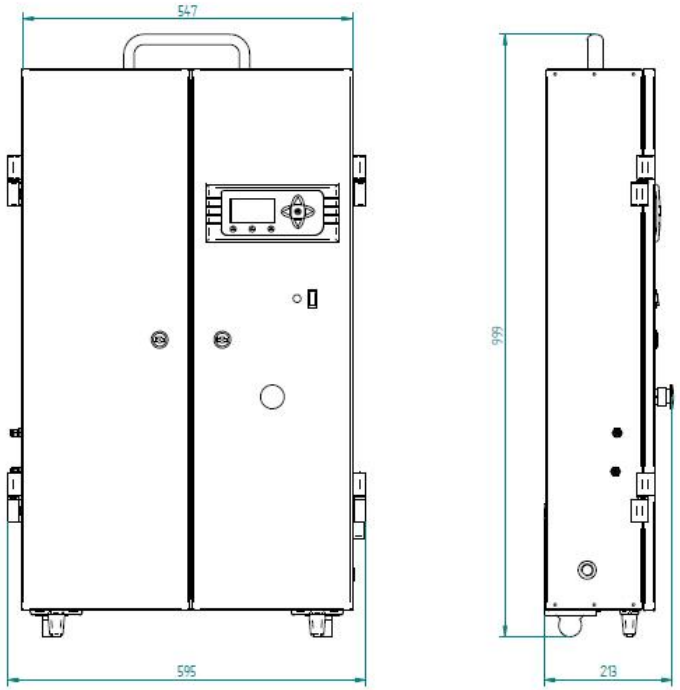
机箱 Cabinet



Weight重量
15kg

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通讯 Communication

- **MODBUS/RS485**
- **3 pre-programmed Alarms 三种预设报警**
  - The dryness is under the user-defined limit for more than 2s 干度低于用户设定范围2秒以上；
  - Two consecutive measurements of NCGs are over the user-defined limit. 两次连续测量的NCGs超过用户设定范围；
  - T1 is over 125°C for more than 2 sec. T1超过125°C2秒钟。
- **3 pre-programmed Defaults 三种预设失效**
  - Temperature T3 is above 85°C for more than 2 sec T3温度超过85°C2秒
  - No condensate has exit the condenser for more than 10min 冷凝器中无冷凝水超过10分钟
  - T2 is over 180°C for more than 2 secT2温度超过180°C 2秒

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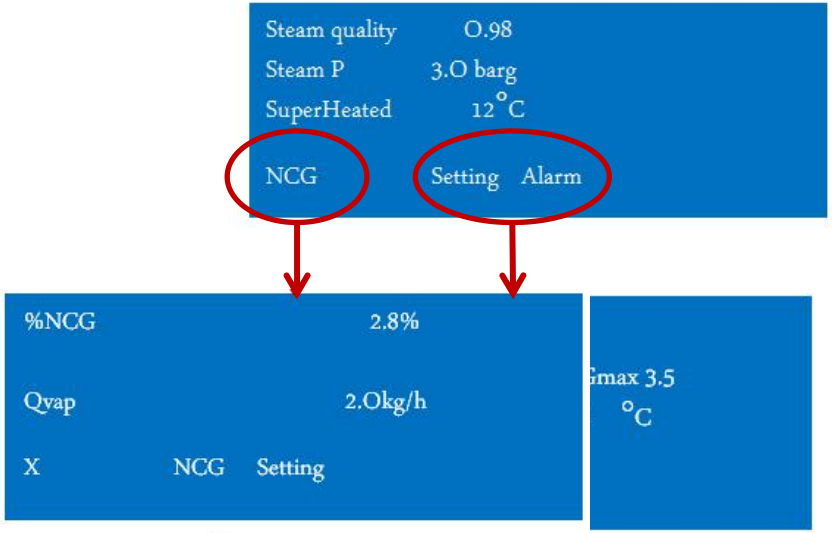
通讯 Communication

- **LCD Screen Steam QM-3 液晶屏**



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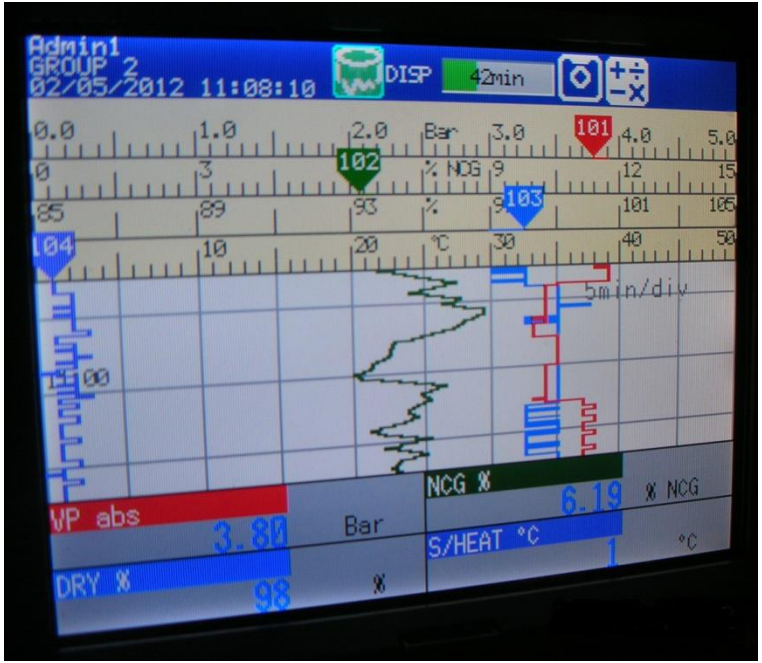
通讯 Communication

- 无纸记录仪



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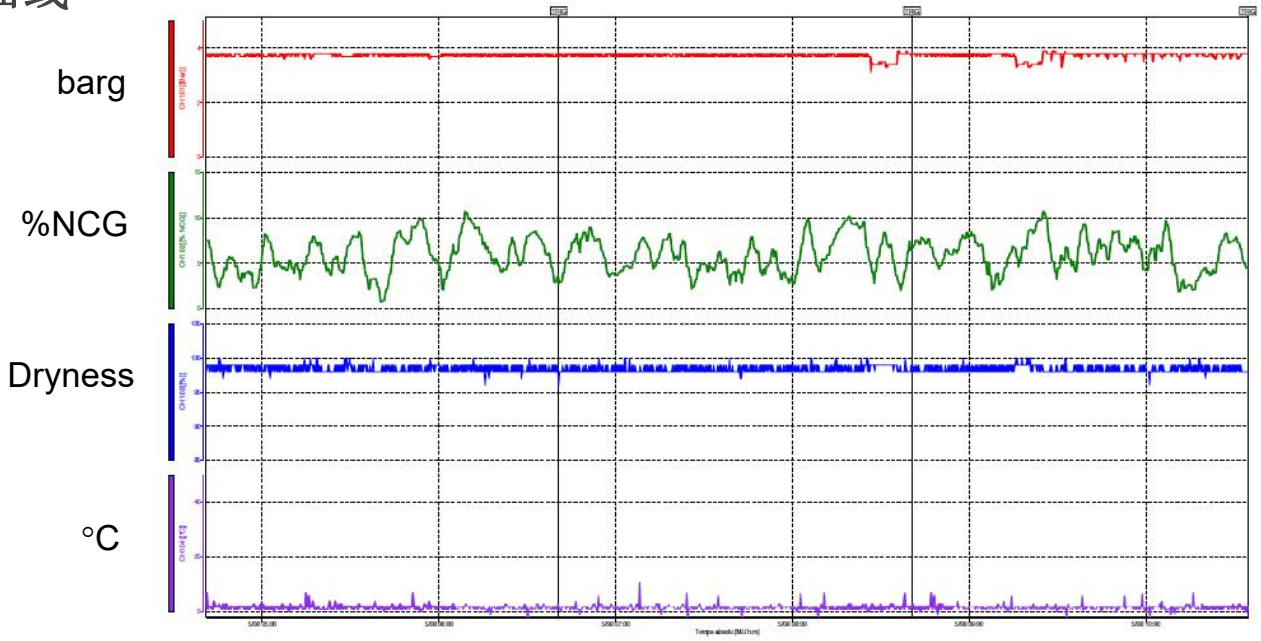
通讯 Communication

- 查看曲线



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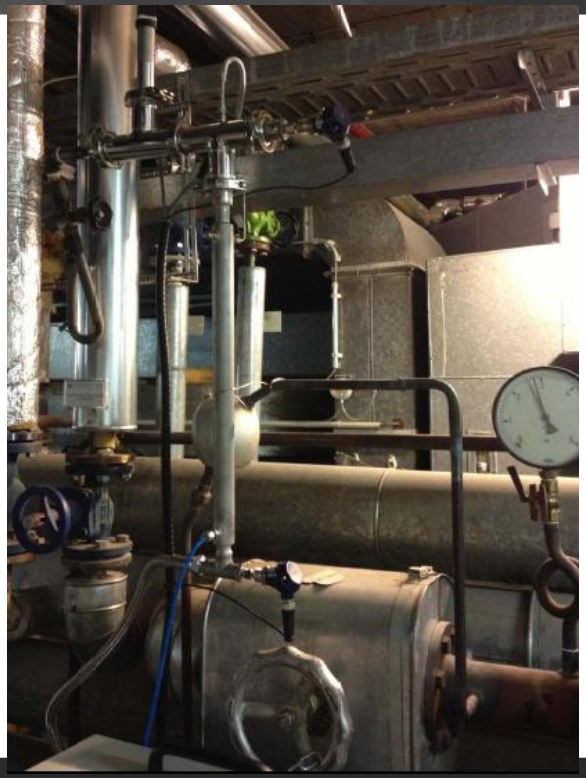
现场安装jobsit



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MSD

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扬子江药业集团
Yangtze River Pharmaceutical Group

护佑®

gsk GlaxoSmithKline

BeliMed
Infection Control

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阿姆斯壮公司介绍
Armstrong Introduction

阿姆斯壮国际 Armstrong International

百年基业，五代传承
Five Generations of Family Ownership and Leadership

Adam Elliott Armstrong | Lawrence F. “Army” Armstrong | Merrill H. “Gus” Armstrong | Patrick Armstrong | Kurt Armstrong

创立于1900年 Founded in 1900

Armstrong

全球生产基地 Armstrong Global Operations

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企业文化 Our Culture

愿景

为每位客户、合作伙伴和员工创造愉悦的体验。

核心价值

信仰、家庭、工作（*强调的是重要性顺序*）

诚实	尊严
公正	勤奋
尊重	友善
信任	无畏
忠诚	安全

策略

最快捷	惊喜
最简单	讲故事
最细微	微笑
做自己岗位上的企业家精神	可持续发展

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我们能够帮助您How Armstrong can help you?

通过现场走访,发现系统节能潜力,明确节能效益和改进空间
System optimization potential and identify saving benefits and improving

根据项目要求进行基础设计和施工图设计
According to the project requirement provide Basic Design and Detailed Engineering

负责项目的实施、质量和安全;进行原材料采购、安装和调试
Supervision of the project, Quality and safety control; Procurement of the raw material; Installation and Commissioning

初步考查 Pre-audit → 系统考查 Audit → 工程设计 Design & Engineering → 产品提供 Product Supply → 项目实施 Project Implementation → 运营和维护 O & M

通过实地测量取得应用数据,全面分析系统情况,研究开发优化项目,根据投资回收期和对工艺的重要程序确立优先行动计划 Comprehensive analysis of the complete system based on the application data collected on-site; Development of optimization Projects; Establishment of priority actions plan based on payback period and process application importance

对系统定期检测、分析并修正效率偏差;根据需求变化有效地调整系统;发现新的节能项目;持续对员工在安全、可靠和节能方面进行培训 On regular basis: detect, analyze and correct efficiency deviations; Adapt efficiently the system to increase or decrease of the needs

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蒸汽凝结水设备 Steam & Condensate

蒸汽疏水阀 Steam traps

凝结水回收泵 Pumping Traps

管道附件 Pipeline Accessories

压力温度控制 Pressure and Temperature Control

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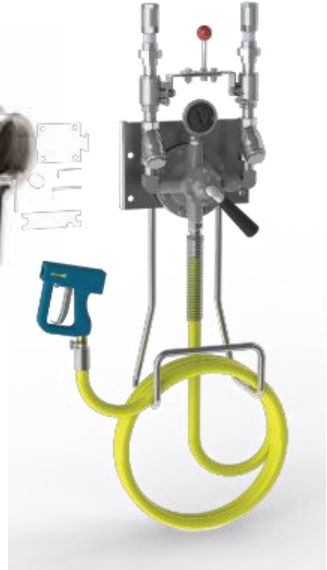
热水系统 Hot Water System

热水产生 Hot water generation

水温控制 Temperature Control



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加湿系统 Humidification System

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其他产品 Other Products

无线监控 Wireless Monitoring

蒸汽品质监测 Steam Quality Monitoring

流量计 Flow Measurement

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其他产品 Other Products

排空气阀 Air Vent

制冷除气器 Refrigerated Purger

排液阀 Liquid Drainer

加热和冷却盘管 Heating and Cooling Coils

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Knowledge Not Shared is Energy Wasted

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