

本特利内华达 (Bently Nevada)

石化行业典型应用和最佳实践

上海希麦斯工业仪器技术有限公司

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本特利内华达 (Bently Nevada)

针对石化行业不同设备的典型应用



BENTLY NEVADA*

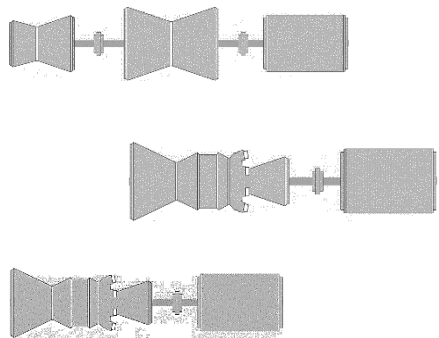
Machinery Condition Monitoring

石化行业的动设备类型

高关键设备：

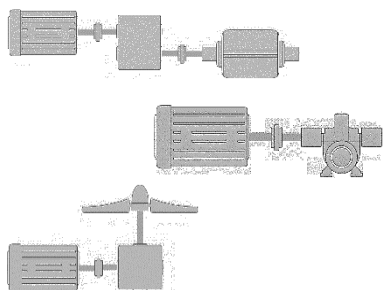
大型压缩机类设备
及其驱动机组

(如：离心压缩机、燃气轮机、汽轮机、超大型电机...)



次关键设备：

往复式压缩机、大型风机、重要的泵类设备及其驱动机组 (小型汽轮机、大中型电机、危险介质泵...)



一般设备：

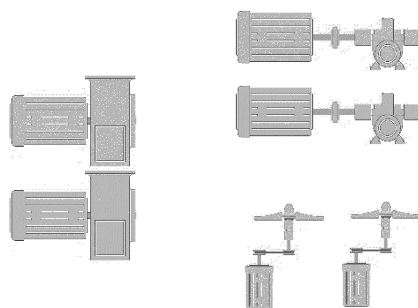
(低关键或非关键)

通风机

泵

电机

其他...



设备分类应考虑：

- 1、工作介质危险性
- 2、故障对环境的影响度
- 3、故障对人身安全的影响度
- 4、生产关键性
- 5、自身成本和维修成本
- 6、功率、体积、位置
- 7、设计、制造成熟度

离心式压缩机组的监测保护和状态分析

设备特点：

- 石化厂最关键机组；
- 通常无备机；
- 该设备的运转直接影响全厂的生产流程；
- 与生产安全相关度极高。

监测和维修管理要求：

- 实时监测保护，对监测保护表的要求极高；
- 故障诊断分析；
- 远程专家接入咨询；
- 高级别维修策略，如主动式和预测式维修

API670标准推荐 ---- 离心机组（滑动轴承）的MPS监测测点布置

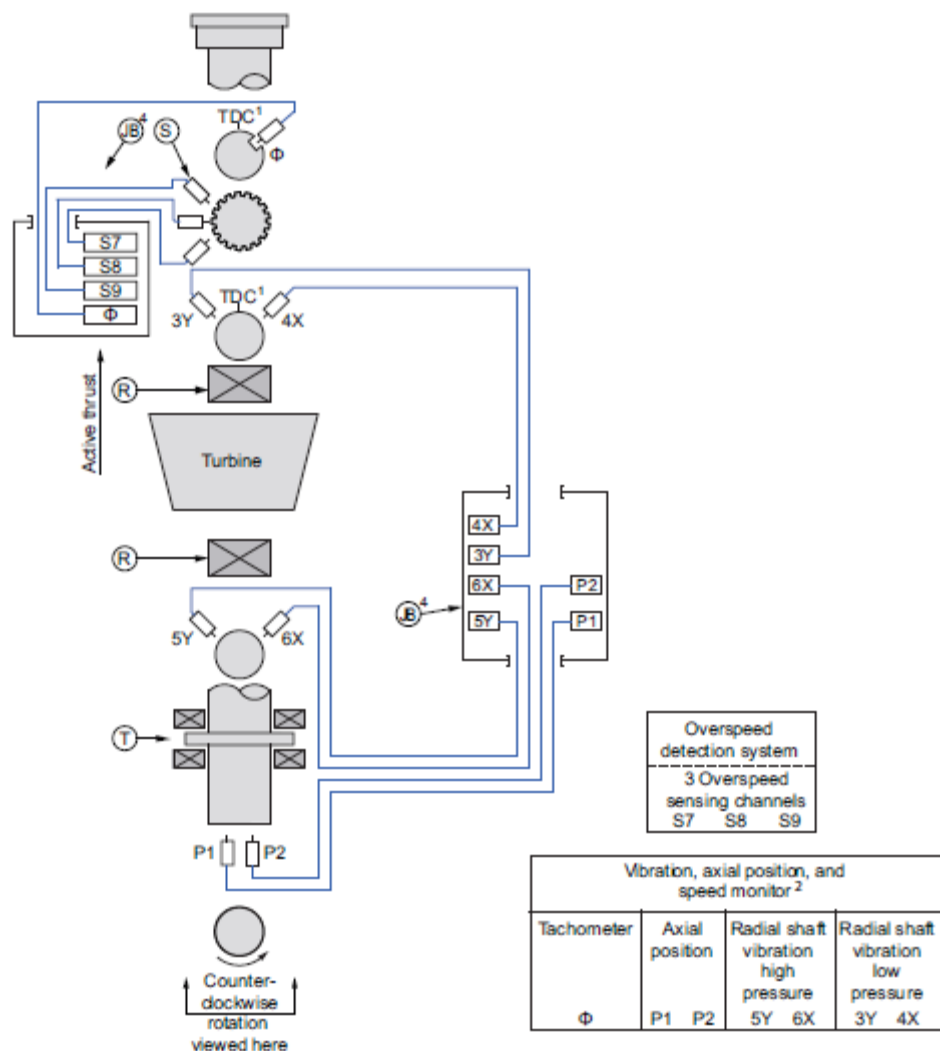


Figure H.1—Typical System Arrangement for a Turbine with Hydrodynamic Bearings

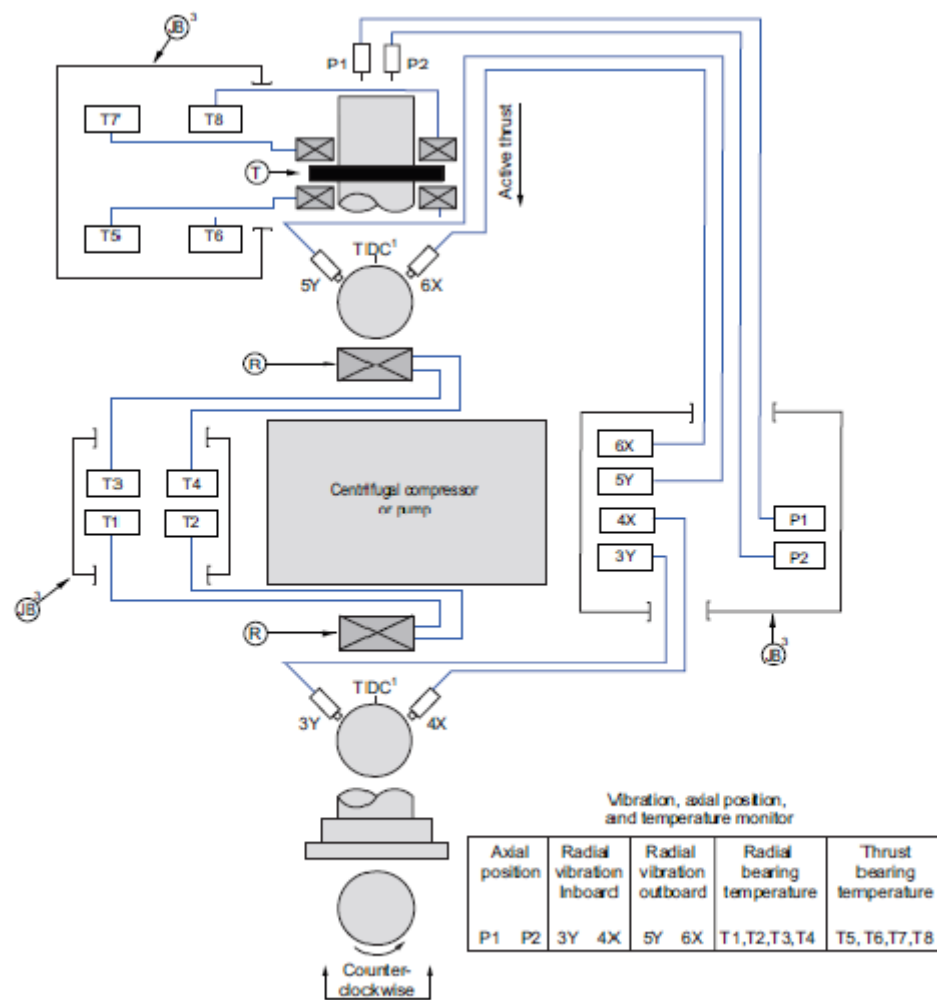


Figure H.3—Typical System Arrangement for a Centrifugal Compressor or a Pump with Hydrodynamic Bearings

Bently3500的信号流

第三方信号分析

硬接线安全性?

静态及动态数据
----System1

实时监测和保护



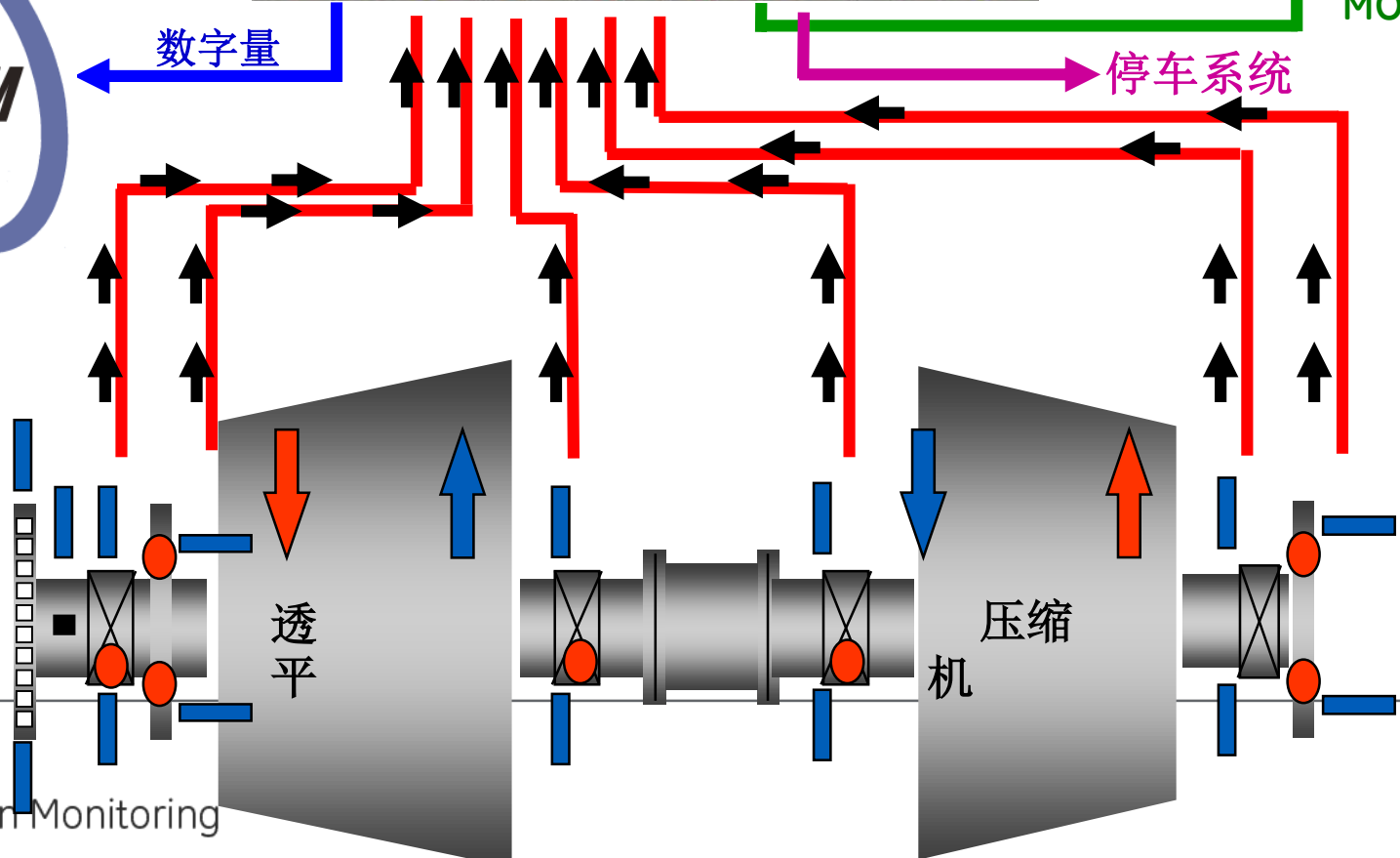
4-20mA

静态数据到DCS/ITCC
(最快刷新速度 1秒)

MODBUS

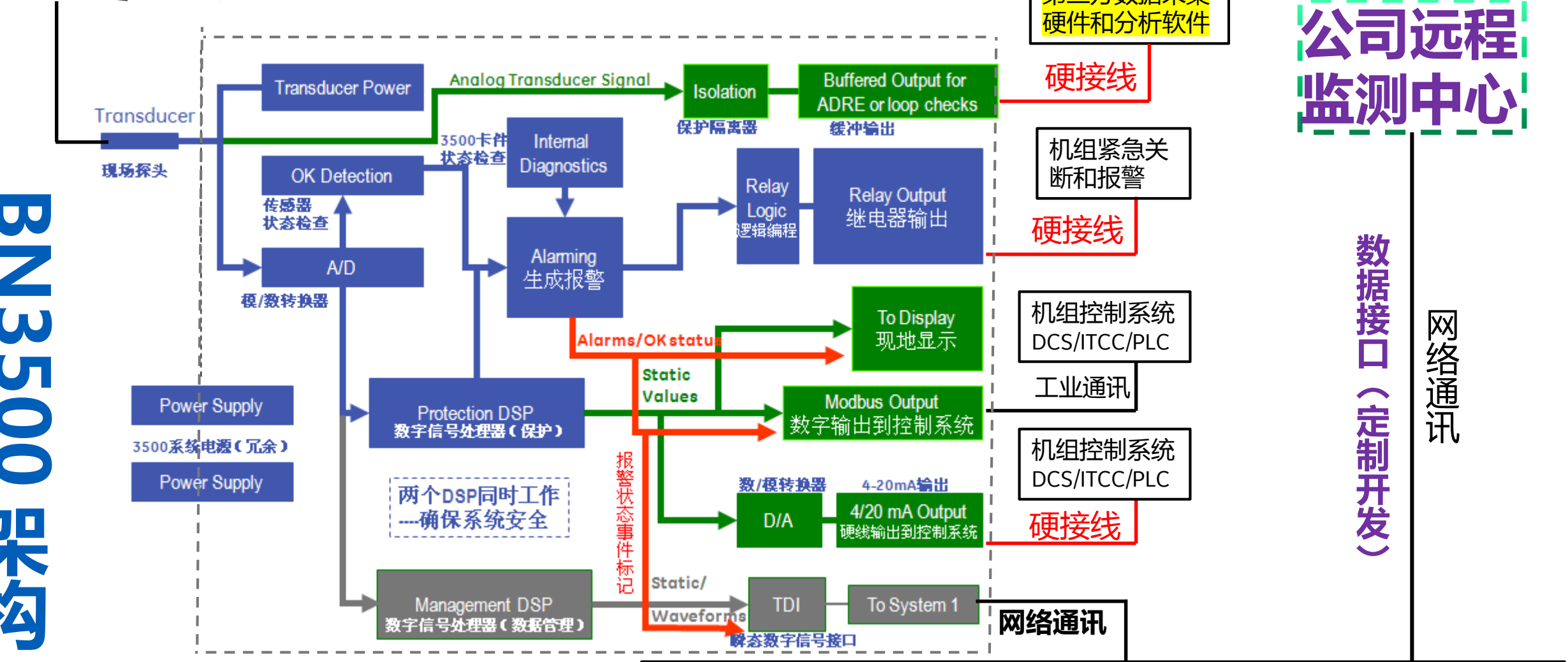
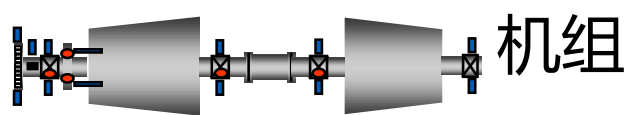
停车系统

数字量



高速数据采集和保存

BN3500 架构



MMS: Bently机组监测和诊断系统 (System1 EVO)

离心式压缩机组的监测措施总结

Bently推荐的监测保护和状态分析措施

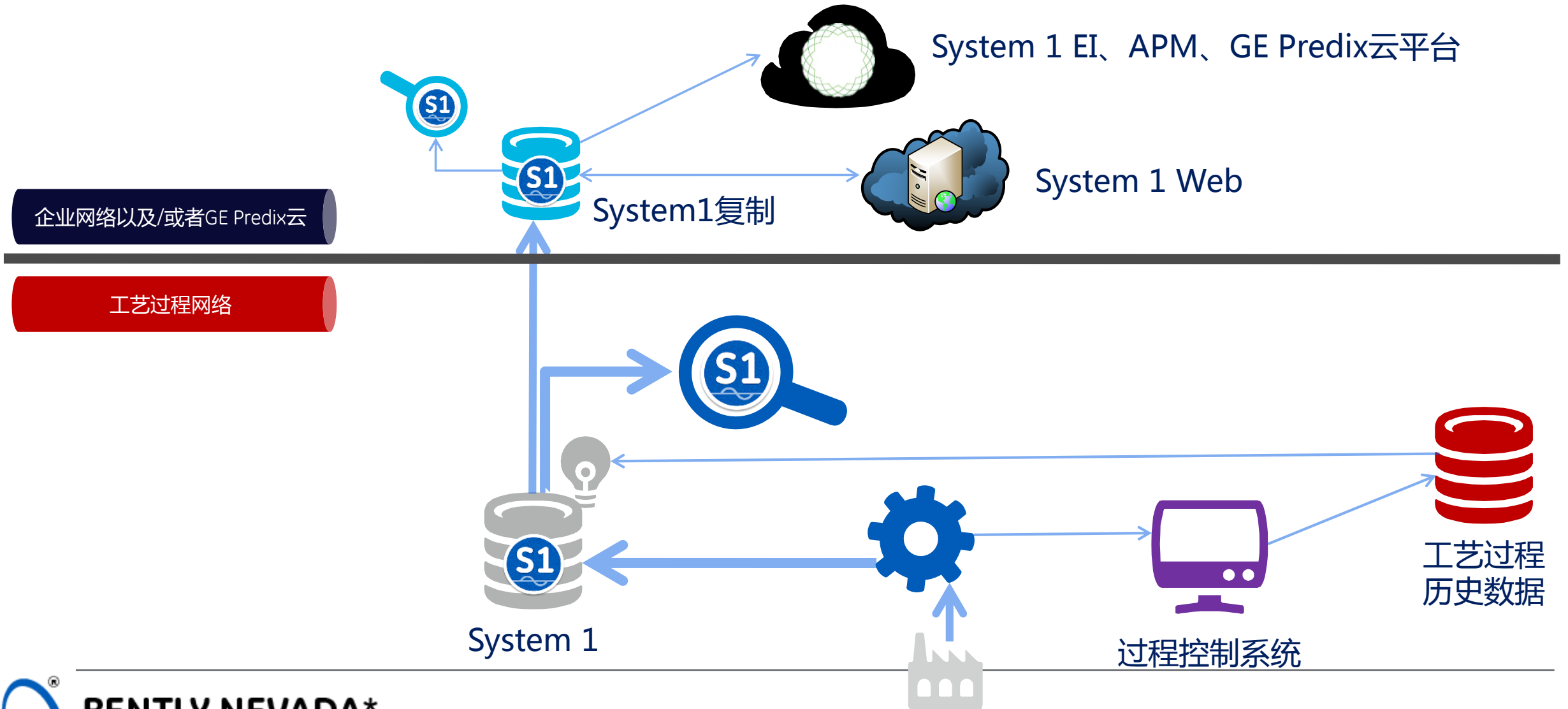
Bently探头+BN3500实时监测保护系统覆盖（振动、位移、键相；转速、超速保护、温度、其他过程量）

System1 EVO 故障诊断分析平台（BN3500数据采集、控制系统过程量OPC接入、数据库、分析平台）

远程专家接入咨询、SSA服务定制。

高级别维修策略的配套系统，监测系统专人、专责管理。

System 1 Evolution ---- 工业互联网数据基础和锚点



本特利内华达 (Bently Nevada)

石化行业的最佳实践

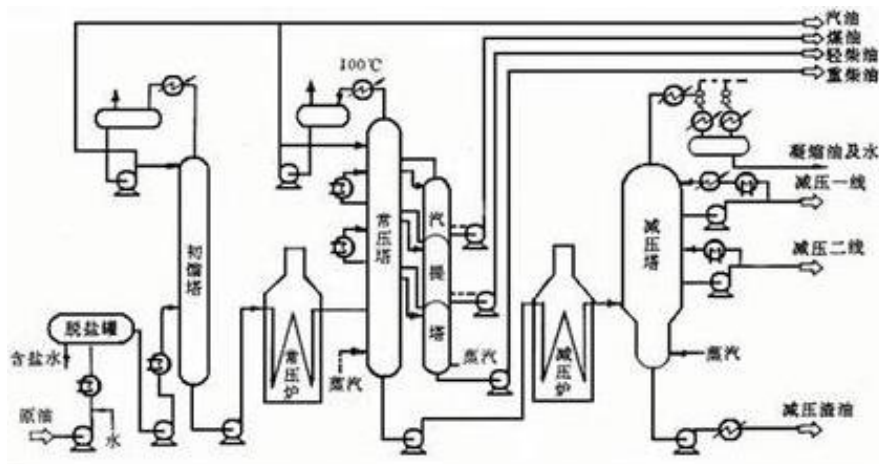


BENTLY NEVADA*

Machinery Condition Monitoring

设备统计和定义（全面、清晰）

- 可按照全企业生产流程、分厂、车间和装置等逐一进行统计。根据现有设备管理机制，对机、电、仪，以及静设备、管线等逐一梳理。
- 针对所有统计设备，进行清晰定义归档，包括设备在生产线上的位置、作用，其本身的结构、性能参数、使用手册等。



常减压工艺流程图



最佳实践第一要点：完整清晰的设备档案管理

动设备关键性评估 ---- 评分方法

介质类型

推荐的评估依据	评分>
无害	0
很低危险	2
较低危险、低温、低压	4
中度危险、中温、中压	6
高度危险、高温、高压	8

制造/施工复杂性

推荐的评估依据	评分>
简单	0
比较简单	2
比较复杂	4
复杂	6
极其复杂	8

人身安全影响程度

推荐的评估依据	评分>
无潜在人身安全危险	0
有限人身安全危险	2
重大人身安全危险	4
有限区域内高度人身安全危险	6
对公众高度危险	8

设计成熟度

推荐的评估依据	评分>
成熟设计，并且有很多记录	0
结合了成熟的设计要素	2
改造设计，有很多记录	4
较新设计，有一些记录	6
全新设计，初试	8

生产影响程度

推荐的评估依据	评分>
即使故障也不会造成后果	0
不影响	2
影响有限，且在短时间内可恢复	4
影响生产，且备用系统投入	6
停车，且导致停产	8

维修成本

推荐的评估依据	评分>
无费用影响或忽略不计	0
有限费用影响	2
显著费用影响	4
很大费用影响	6
巨额费用影响	8

环境

推荐的评估依据	评分>
对环境无影响	0
对环境影响可能性相当低	2
对环境造成损害可能性较低	4
对环境有潜在的破坏影响	6
对环境造成灾难性破坏	8

最佳实践第二要点：企业统一的设备关键性等级评估

动设备关键性评估 ---- 评分方法

例：在上述因素中，选取5个最重要的评价因素进行评估

重要性等级1（关键机组） – 分类量化评分总和等于或者大于40

如果非计划停机或故障将导致重大生产损失、或者严重威胁人身安全、或者可能违反环保法规、并且/或者需要高额维修费用，那么这类旋转机械就属于1级关键设备。

重要性等级2（重要机组） – 分类量化评分总和在21到40之间

如果非计划停机或故障将导致部分生产损失、或者威胁人身安全、或者可能违反环保法规、并且/或者需要中度到高额维修费用，那么这类旋转机械就属于2级关键设备。

最佳实践第二要点：企业统一的设备关键性等级评估

动设备关键性评估 ---- 评分方法

重要性等级3 (BOP-1) - 分类量化评分总和在11到20之间

如果非计划停机或故障不太可能造成生产损失、并且通常也不会威胁到人身安全或者对环境造成影响，那么这类旋转机械属于3级关键设备。

重要性等级4 (BOP-2) - 分类量化评分总和小于10

如果非计划停机或故障不会造成生产损失、并且通常也不会对人身安全或环境造成影响，那么这类旋转机械就属于4级关键设备。

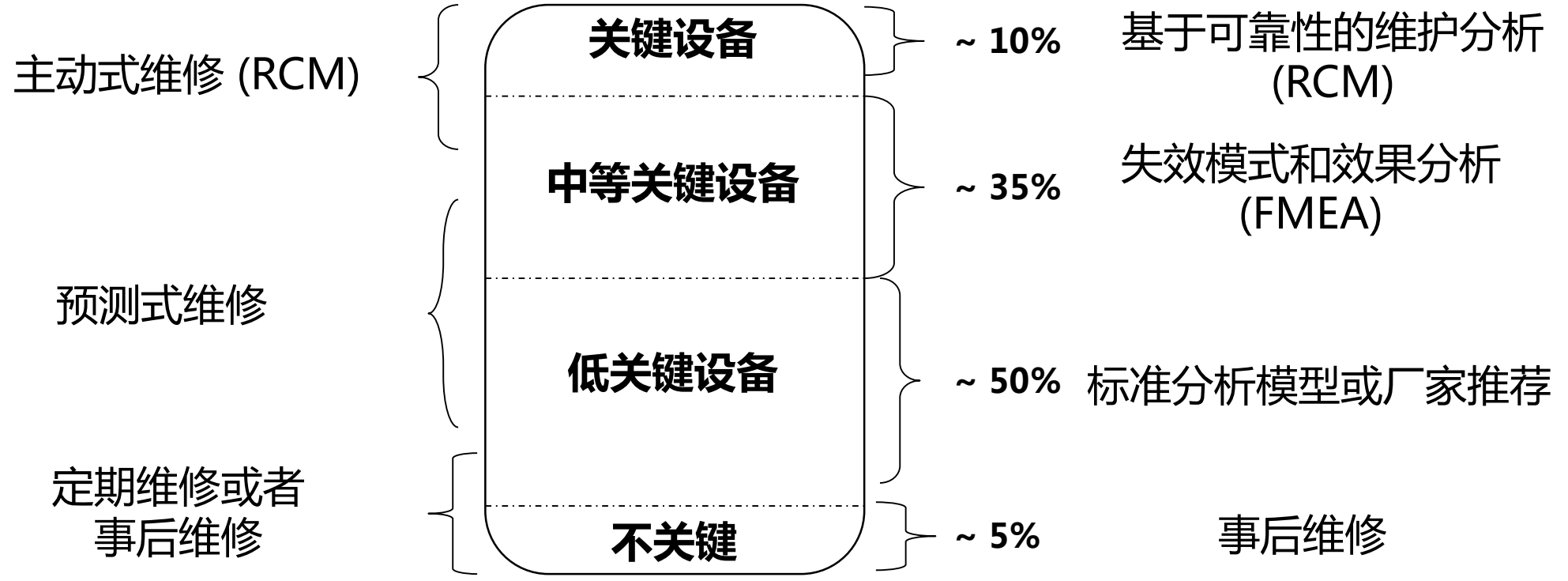
最佳实践第二要点：企业统一的设备关键性等级评估

监测策略的建立 ----- 基于企业的维修策略

设备维修策略

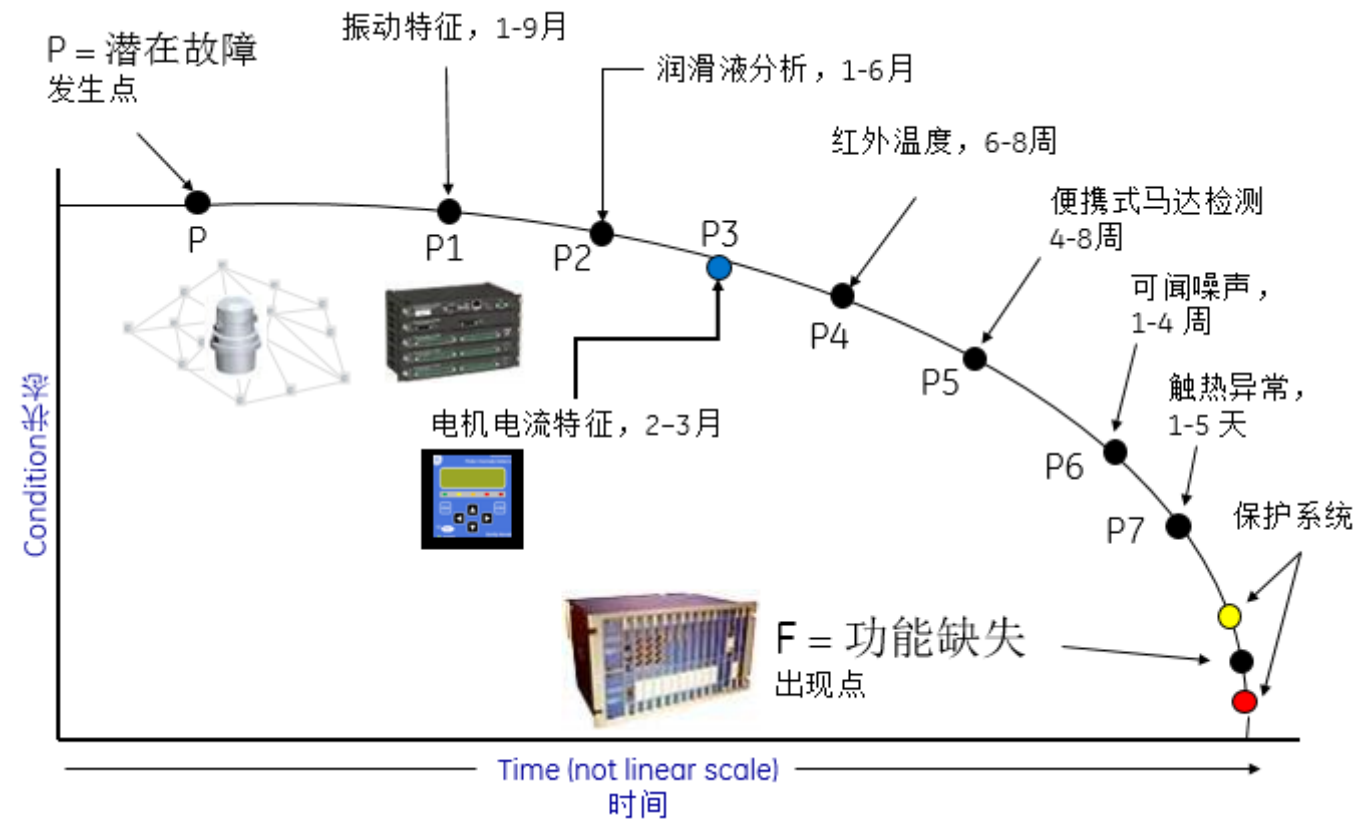
设备

监测策略



最佳实践第三要点：根据企业设备维修策略制定正确的监测策略

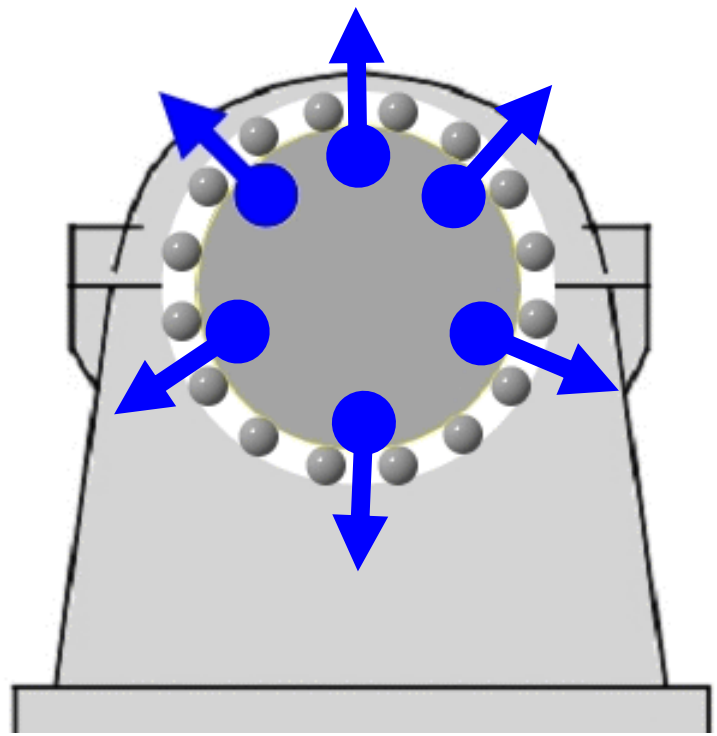
选择正确的监测手段（全面分析设备，选择适合的技术）



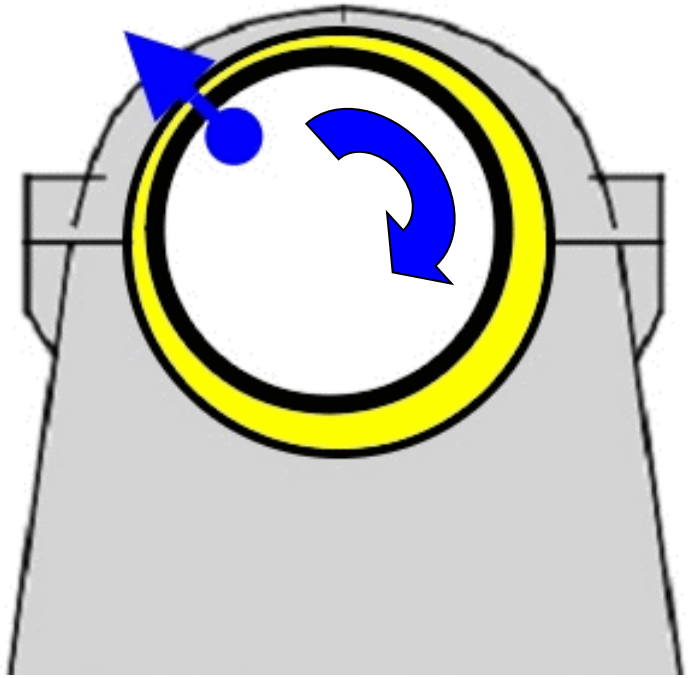
例·电机的下降曲线

最佳实践第四要点：根据设备类型和监测需求选择正确的监测手段

选择正确的监测手段（全面分析设备，选择适合的技术）



Rolling Element Bearings



Fluid Film Bearings

最佳实践第四要点：根据设备类型和监测需求选择正确的监测手段

选择监测系统和建设设备状态管理体系

通常的问题

- **机组招标要求不明确，造成传感器、监测器配置混乱**

- 误认为OEM厂家理应了解如何监测他们的机组，结果造成监测系统配置五花八门，后期系统整合十分困难；

- 设备监测专业人员未在第一时间（OEM阶段）介入机组的选择，未能及时提出有针对性、详细、可执行的选型标准。

- **上位软件系统相互不连接，造成多个信息孤岛，给使用者带来麻烦**

- 企业没有根据自己的维修策略统筹考虑设备监测策略；

- 没有设定设备监测专业人员，或未能全程参与监测系统架构设计和选型。

选择监测系统和建设设备状态管理体系

- **面向机组，正确选型，功能完善**

- 以关键性等级分级、机组结构分析为基础的选型和测点布置设计；

- MPS (Monitoring & Protection System) 和CMS (Condition Monitoring Software) 通盘考虑。

- **工作范围明确**

- 针对OEM选型、SI集成、现场安装、供应商技术支持等，提出具体可执行的要求。

- **验收和后续应用的考虑**

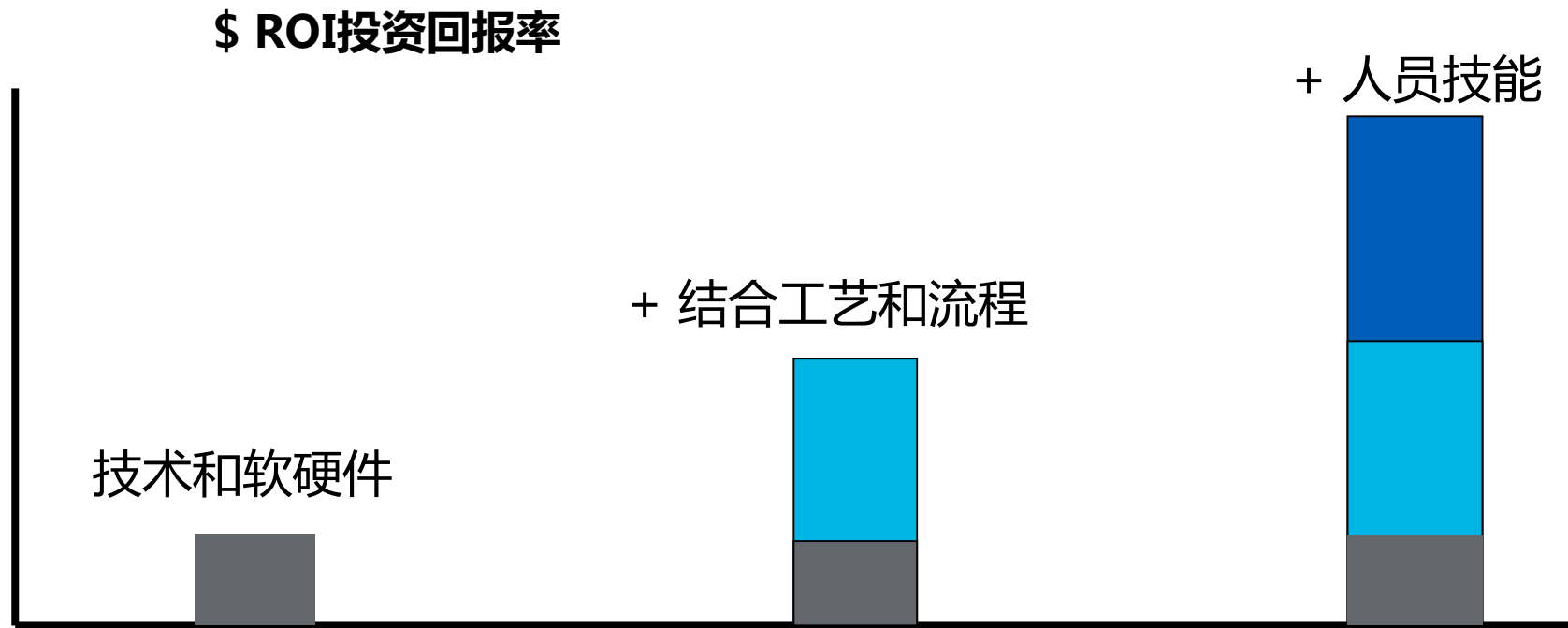
- 针对上述选型和工作范围分割，应该制定明确的验收步骤和方法；

- 充分考虑后续的可用性和可扩展性，注重数据接口及其输出/输入 (OPC、MODBUS) ；

- 后续的持续技术支持和系统扩展支持，关注如何获得正确的监测和诊断结果。

最佳实践第五要点：专业团队全程参与设计、选型、实施、验收和使用

Bently在石化行业的最佳实践 ----- 助力用户获得最大的投资回报率



石化行业最佳实践 (案例)

硫化催化裂化装置

FCC Unit
FCC Feed Pump
Main Air Blower Turbine
Power Recovery Turbine/Expander
Overhead Condensers
General Purpose Pumps
Reef Valves

加氢裂化装置

Hydro-Cracking Unit
AC Make-up Compressor
Recycle Compressor
Charge Pump
Heat Exchangers
Valves

烷基化装置

Alkylation Unit
Refrigeration Compressor
Condensers
Flares

蒸馏装置/管式炉

Distillation Unit/Pipestill
Feed pumps
Overhead Condensers/Refr
Refr Heat Exchanger
Feed Exchangers
General Purpose Pumps

脱盐装置

Desalter
Water Pumps
Transformers
Reef Valves

减压蒸馏装置

Vacuum Distillation Unit
Vacuum Ejection Pump
Bottoms Pump
VGO Pumps

催化重整装置

Catalytic Reforming Unit
Hydrogen Recycle Compressor
Net Gas Compressor
Refr Heat Exchangers
Motor Operated Valves

延迟焦化装置

Delayed Coker Unit
Coker Wet Gas Compressor
AC Water Pumps
Overhead Condensers
Coke Drift

饱和气体

Sat. Gas Plant
Wet Gas Compressor
Refr Heat Exchangers
Condensate Pumps

低温回收装置

Cryogenic Recovery Unit
Turbine Expander
Gas Compressor

加氢处理装置

Hydro-Treating Unit
AC Make-up Compressor
Recycle Compressor
Charge Pump
Heat Exchangers
Valves

脱硫尾气处理装置

Sulfur Unit/Tail Gas Unit
Boiler Feedwater Pumps
Reactor Air Blower
Sulfur Pumps

火炬气回收装置

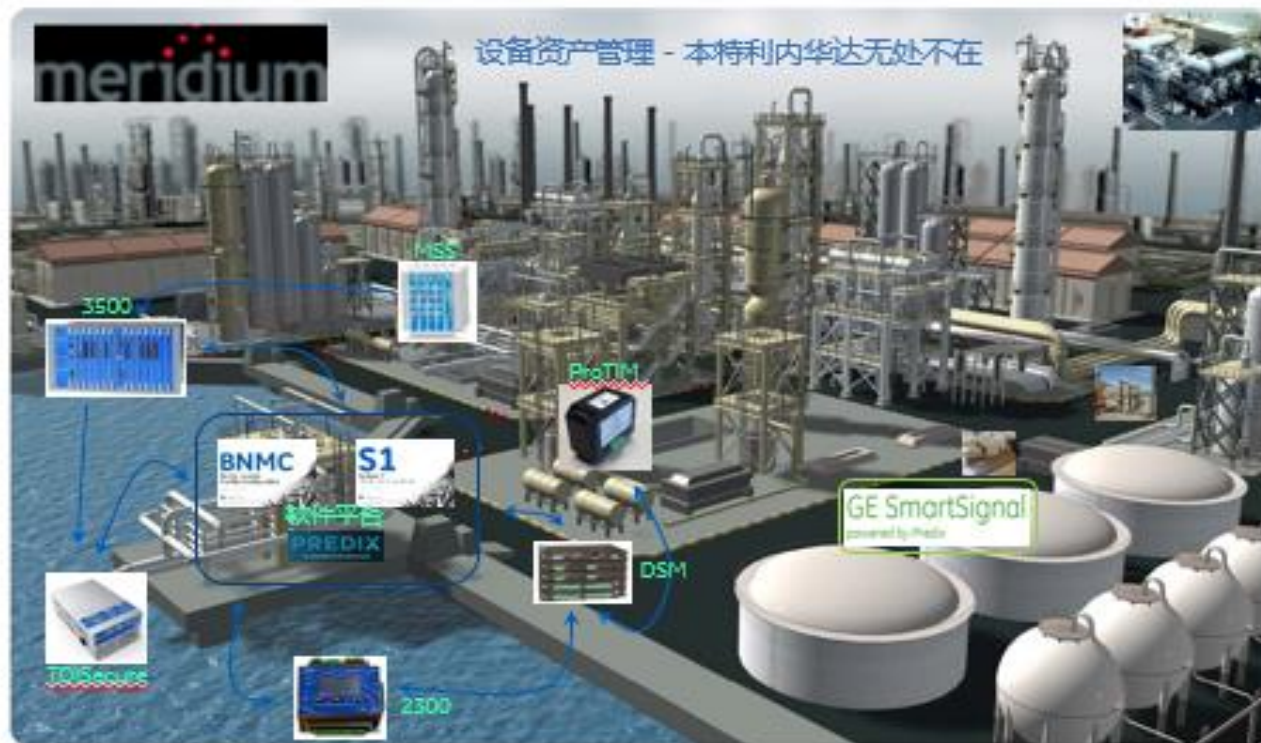
Flare Gas Recovery
Compressor
Cooled Water Circulation Pump
Water Sealing
Valves

公用设施

Utilities
Gas Turbine/Generator
Steam Turbine/Generator
Boiler Feedwater Pumps
Work Air Compressor
Instrument Air Compressor
Cooling/Water Pumps
Cooling Towers
Transformers
Valves

罐区

Tank Farms
General Purpose Pumps
Tank Flares



与工控系统及管理信息系统集成



Protection
Online, continuous machinery protection

设备保护

Condition Monitoring
Online, continuous
Online periodic (wired or wireless)
Offline periodic (portable instrument)

状态监视

Performance
Online, thermodynamic performance monitoring and optimization

性能优化

Bently在石化行业的最佳实践案例 ---- 大型炼油厂AMSS范本

TYPICAL REFINERY ASSET MANAGEMENT STANDARD SPECIFICATION

Facility Name:

Revision 4 May 2017



Reviewed by:	-----	-----	-----	-----
	signature	name	designation	date
Approved by:	-----	-----	-----	-----
	signature	name	designation	date

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Bently在石化行业的最佳实践案例 ----- 设备关键性等级分类

安全性、环境影响、生产影响、维修成本、产品质量影响 是进行设备关键性分级的五大因素

Quantitative ranking of relative criticality of equipment in five key categories:

(i) Safety; (ii) Environmental; (iii) Production; (iv) Maintenance; and (v) Quality

Plant Subject Matter Experts (SME's) join a cross-functional team to perform the actual ranking using a spreadsheet type tool as shown below to document the results. Final results are ranked in criticality order so that appropriate machinery management strategies may be assigned.

Location / Equipment	ID Number	36421	MFR	GE
4-ELE-ELECTRICAL DISTRIBUTION	Description	4-HSS-HYDRAULIC START SYSTEM	Record #	118579
4-FMP-FIRE PUMP SYSTEM	Location	SYSTEM*HYDRAULIC	Date	10/23/09
4-FPS-FIRE PROTECTION SYSTEM	Total Criticality Score	235	O.A. Rank	51
4-GEN-GENERATOR	Question	Answer	Question	Answer
4-HSS-STARTER RESERVOIR	Safety		Process Impact	50
4-HSS-HEAT EXCHANGER	Risk for Personal Injury	Little Risk	Process DT (Time)	Hours
4-HSS-HYDRAULIC START SYSTEM	Severity of Personal Injury	First Aid	Reduced Capacity while running	None
4-HSS-STARTER	Fire or Explosion Possible	None	Time To Impact Germeration	1-2 days
4-ILS-TANK	Safety Regulatory Requirements	No	Availability - Derate	None
4-ILS-INTERCOOLER LOOP SYSTEM	Critical Safety Device	No	Heat Rate	None
4-ILS-SILENCER	Health Hazard	Low	Not Used	
4-ILS-TANK CONDENSATE	Environmental		Maintenance Impact	60
4-LMS-TURBINE SYSTEM-ACCES DRI	Spill/Release Haz. Material	Non reportable spill	Repair Costs	Less Than \$5000
4-LMS-TURBINE SYSTEM-BOOSTER	Pollution Control Device	No	Spare Part Availability	No Spares on Site
4-LMS-TURBINE SYSTEM-INLET	Env Impact Potential	Low	Reduntant Equipment	No
4-LMS-TURBINE SYSTEM-SUB BASE	Env Regulatory Requirements	No	Not Used	
4-LMS-TURBINE SYSTEM-SUPERCOR				

关键性等级分类：工艺、设备、EHS、状态监测等多方人员参与制定

Bently在石化行业的最佳实践案例 ----- 设备监测项目一览表

2 Machinery Protection & Monitoring Requirements

2.1 Monitoring Requirements Matrix

TURBOMACHINERY AND RECIPROCATING MACHINES

Integrated Monitoring Applications in Refining

MACHINE TYPE	Criticality Ranking (Methodology)	Shaft Speed & Phase Reference	Tachometer	Crankshaft Position Reference	Overspeed Detection	Thrust Position	Axial Position	Shaft Radial Vibration	Bearing Housing Vibration	Bearing Temperature	Shaft Eccentricity	Differential Expansion	Case Expansion	Valve Position	Combustor Dynamic Pressure	Exhaust Gas Temperature	Casing Vibration	Gearbox Vibration	Oil Analysis
	HC	X	10			X		X	X	X									
FCC Feed Pump	HC	X	10			X		X	X	X									
Wet Gas Compressors	HC	X				X		X	X	X									
Main Air Blower	HC	X						X		X									

Bently在石化行业的最佳实践案例 ----- 设备监测项目一览表

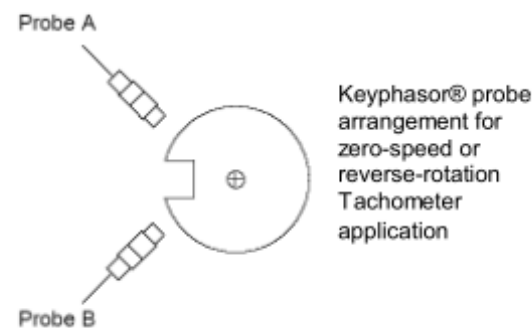
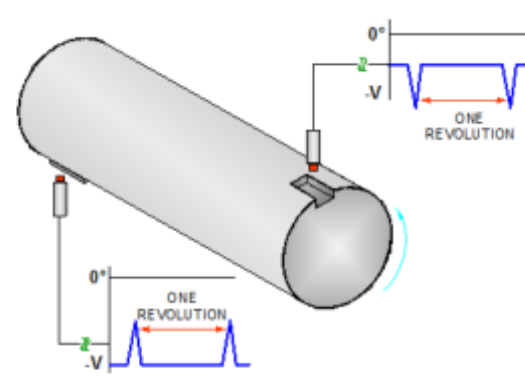
MACHINE TYPE	Criticality Ranking (Methodology)	Shaft Speed & Phase Reference	Tachometer	Crankshaft Position Reference	Overspeed Detection	Thrust Position	Axial Position	Shaft Radial Vibration	Bearing Housing Vibration	Bearing Temperature	Shaft Eccentricity	Differential Expansion	Case Expansion	Valve Position	Combustor Dynamic Pressure	Exhaust Gas Temperature	Casing Vibration	Gearbox Vibration	Oil Analysis	Recip Frame Vibration	Recip Crosshead Vibration	Recip Crosshead Shoe Temperature	Recip Rod Position	Recip Pressure Packing Temperature	Recip Vent Line Temperature	Recip Purge Gas Monitoring	Recip Valve Temperature	Recip Gas Discharge Temperature	Recip Cylinder Internal Pressure	Seal Temperature	Motor Protection Relay	Online Motor Anomaly Detection	Process Variables	Thermodynamic Performance	Automated Diagnostics
FCC Feed Pump	HC	X	10			X		X	X	X																				X		12	X	X	
Wet Gas Compressors	HC	X				X		X	X	X																						12	X	X	
Main Air Blower	HC	X						X		X																						12	X	X	
Main Air Blower ST./Motor	HC	X	1		2	X		X	X	X		X	X	X				X														12	X	X	
Power Recover ST./Expander	HC	X	1		2	X		X	X	X		X	X	X				X														12	X	X	
Overhead Condensers	MC								X	X																					11				
General Purpose Pumps	MC	X						X	X	X																					11				
Fin Fans	MC								X	X																					11				
Other Non-Critical Assets	NC																														13				
Hydrogen Recycle Recip. Comp	HC	X		X				X	X	9							X		X	X	X	X	X	X	X	X	X	X	X	X	X	11	12		X
Net Gas Compressor	HC	X				X		X	X	X																						12	X	X	

Bently在石化行业的最佳实践案例 ----- 测点和传感器定义

2.2.1. Keyphasor® Probe for Speed & Phase Measurement

A Keyphasor® transducer is necessary for accurate phase information and must, as a minimum, be mounted on the shaft of the driver machine. The target notch or protrusion should be suitable to generate the correct signal at all machine states, however the machinery manufacturer shall be responsible to confirm this.

- One non-contact proximity transducer shall be installed for once-per-rev phase reference measurements. For machines with internally mounted transducers, a spare transducer shall be installed, with extension lead delivered to the transducer interface housing, external to the machine.
- For Gearboxes, Fluid Couplings and Integrally Geared Compressors, one Keyphasor® sensor must be installed on each shaft for once-per-rev phase reference measurements (unless already installed on the driver or driven machine on the same shaft).
- For the Pinion shaft on an Integrally Geared Compressor, axial oriented Keyphasor® transducers may be used to observe a single machined depression in the shaft end if no other location is available. Specialized "Narrow Side View" transducers may be required in some installations, however this should be considered in consultation with the machinery OEM.
- Critical service pumps will typically require reverse rotation detection. In this case a Tachometer monitor is required in lieu of the Keyphasor module and Two Keyphasor® probes must be installed at a specific angular offset according to the system Vendor's recommendation.
- For Turbines and Compressors which require zero speed indication for control of turning gear (or to initiate other speed related events), the Tachometer installation with two probes must be selected in lieu of the simple Keyphasor® arrangement.



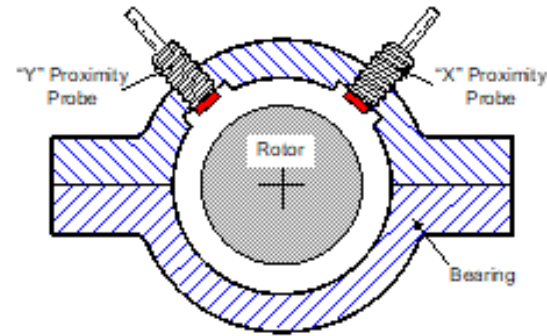
对于不同测点，定义了配置方法，使得OEM或者SI有据可查

Bently在石化行业的最佳实践案例 ----- 测点和传感器定义

2.2.5 Vibration Transducers – Radial Journal Bearings

The thin fluid film that supports the shaft, in a fluid film bearing, permits shaft movement relative to the bearing. Two orthogonally mounted proximity transducers are required to observe this shaft motion.

Protection parameters related directly to machinery internal clearances can be enabled using simply the overall amplitude and DC position measurement. A range of chronic problems and acute fault conditions (i.e. misalignment, unbalance, shaft rub) can be diagnosed effectively using the dynamic signal output from the proximity probes.



Two non-contact proximity displacement transducers in XY configuration shall be installed at each journal bearing in accordance with API 670 (Latest Edition).

The following items have been identified as required to meet this specification. The specific ordering details of thread sizes and probe lengths shall be confirmed in collaboration with the machinery manufacturer. No substitute components or systems will be permitted unless explicitly approved to be compatible with this specification by **THE COMPANY**'s Engineering Manager.

Component	Description	MFR Part Number
Sensor	Bently Nevada 3300XL 8mm Proximity probe system (probe, extension cable, proximator)	Typical
		33010X-aa-bb-cc-dd-ee
		330130-aaa-bb-cc (ext. cable)
		330180-aa-bb (proximator)

Bently在石化行业的最佳实践案例 ---- 监测器的通用要求

2.3 Monitoring Systems

TRS Note: All components to be supplied with appropriate Technical Regulations and Standards (TRS) where applicable.

RoHS – Fully ROHS Compliant (See ROHS Document: XXXXX)

Functional Safety (SIL) such as: - Complete Simplex SIL 1 and SIL 2 solution options from the Transducer to the Relay for Turbo and Reciprocating Machinery (See SIL Document: 162242-01). Also EMC, Low Voltage Directive, and CE compliance.

Cybersecurity such as: - ACC L1 and/or IEC 62443-2-4 Compliance (See Security Document: XXXXX).

Hazardous Area (Country Specific) such as: - CSA Class 1 Div. 2 / Zone 2 and ATEX/IECEX Zone 2 Hazardous Area Certifications (See Country Specific Approvals Document: 108M1756).

Country Specific Approval Example: (AM to update example with their specific country)



European Union ("CE Mark")

Required on a majority of Bently Nevada products to indicate that the product meets all regulations (non-hazardous area).

Bently在石化行业的最佳实践案例 ----- 监测器的要求（框架式）

2.3.1 Rack Based Online Continuous Monitoring & Protection System

In order to comply with **THE COMPANY** Machinery Management Specification for critical machines at this site, the following specific requirements must be met by the monitoring and protection system:

- Dual Redundant Power Supplies in accordance with API 670 (Latest Edition). The specific voltages and power sources (AC or DC) for each power module are site specific and shall be approved by the **THE COMPANY**'s Engineering Manager prior to delivery. For highest reliability each power supply should be connected to separate power feeds through UPS devices.
- Minimum of one alarm relay and one trip relay for each critical protection or monitoring function (additional to any SIL-3 protection functionality). Relays may be grouped onto a multi-channel card, so one Relay card may support the entire monitor rack. Unless otherwise specified by the site Engineering Manager, the following relay functions (and more) shall be supported by a common relay card:
 - Mechanical Protection: shaft vibration, bearing temperature (2 Relays)
 - Thrust Protection: when SIL-3 protection is not required (2 Relays)
 - Zero Speed or reverse rotation detection (if applicable) (2 Relays)
- The protection system shall collect, store and communicate dynamic vibration data and alarm and system events to the data acquisition system. The signal processing method must support a minimum 800 spectral lines and high resolution data at 3200 spectral lines, with F_{max} configurable from DC to 30 kHz. The system must be capable of automatically sampling more frequently for a set time period surrounding (both before and after) alarm events, and automatically sampling at configurable speed intervals during transient events (start-up and shut-down).

The following items have been identified as required to meet this specification. The specific ordering details for components to shall be confirmed in collaboration with the machinery manufacturer. No substitute components or systems will be permitted unless explicitly approved to be compatible with this specification by **THE COMPANY**'s Engineering Manager.

Component	Description	MFR Part Number
System Rack	Bently Nevada 3500 19 inch system rack	3500/05-01-02-02-00-01
	Monitor Rack Configuration utility	3500/01-01
Power Supply	Bently Nevada 3500 Dual Power Modules – Universal AC (110/ 220 VAC)	3500/15-05-05-01 (typical)
Transient Data Interface(TDI) *	Bently Nevada 3500/22M Rack Interface Module with Transient Data Internal interface.	3500/22-01-01-02 (typical)
Monitoring Card	Bently Nevada 3500/XX (point type specific)	3500/XX-aa-bb...
Relay Card **	Bently Nevada 3500/33 Sixteen Channel Relay Module	3500/33-01-01
Communication	Bently Nevada 3500/92 Communication Gateway -	3500/92-AA-BB-CC

Bently在石化行业的最佳实践案例 ---- 监测器的要求（分布式）

2.3.4 Basic Distributed Protection System

For Medium Critical machines with rolling element bearings, localized (distributed) basic protection system is required, along with periodic machinery monitoring.

- The monitor need to be software configurable, and includes configuration software.
- The monitor needs to have an integrated LCD screen to show the channels' real-time data showing vibration amplitude, setpoints, and speed and multiple LEDs status locally for channel alarm and danger status.
- The monitor should support two seismic and Keyphasor[®] transducers, and outputs include relays, 3 local BNC buffered outputs, TCP/IP Ethernet and 4-20 mA output and/or TrendMaster[®] SPA line interface.
- The monitor shall provide the capability of 3 contact inputs with terminals. One is used for configuration lock, one is for remote alarm reset function, and the 3rd one is used for monitor Alarm/Relay Inhibit.

Component	Description	MFR Part Number
Monitor	Bently Nevada 2300 Series Vibration Monitor	2300/20_KIT-AAA-BB

Note: All components to be supplied with "multi-approvals" (where applicable) to ensure complete hazardous area documentation is supplied with order.

It must be noted that for condition monitoring purposes there may be additional measurement points on a machine that are not connected to a protection system.

Bently在石化行业的最佳实践案例 ----- 上位监测软件平台的要求

3 Condition Monitoring Software Platform

The condition monitoring system (CMS) selected to meet THE COMPANY's requirements shall be vertically integrated with the monitoring and protection hardware system (i.e., software & hardware to be supplied from same manufacturer), and seamlessly integrates with the plant data historian and other information management systems on site. It fully meets the essential performance requirements adopted as a corporate standard by THE COMPANY. The CMS shall have a proven history or available references of 5 years of continual use by end user.

3.1 CMS Accessibility

3.1.1 Distributed Deployment (Display Client to CMS Server)

- The CMS shall provide the capability to be installed in a distributed client/server deployment environment
- The communication protocol between client and server shall be TCP/IP with a maximum of 2 ports required for communication between client and server
- A minimum of 10 clients shall be able to simultaneously access one or more condition monitoring databases running on the CMS server
- The CMS shall be capable of remote connectivity without computer access for transferring data from hand held data collection device
- The CMS shall provide Centralized Client licensing management with a concurrent user license model
- The CMS shall be capable of supporting Windows Server 2016 and Windows 10

3.1.2 Secure CMS Database Access

- The CMS shall provide the capability to control user access to CMS databases based on windows local and/or domain accounts (Group and User)
- The CMS shall provide the capability to classify users by different levels of database access ranging from read only access to comprehensive read/write access

3.2 CMS Capability

3.2.1 Condition Monitoring Machinery Health

- The CMS shall provide the capability to log machinery alarms based on alarms generated by integrated devices, such as machinery protection systems (Hardware Alarms)
- The CMS shall provide the capability to log machinery alarms based on alarms generated by the software (Condition Monitoring Alarms)
- The CMS shall have the capability to drive machinery state based on user defined logic and set points derived from any mapped parameters on a particular asset
- The CMS software alarms shall be capable of being triggered by any imported or native data source
- The CMS shall be capable of retroactively applying user changed alarm levels to previously collected data
- The CMS shall be capable of modifying the software alarm set points (per machine and machine state) based upon machinery statistical averages and standard deviations from this average

3.2.2 Single Vendor Hardware Device to CMS Integration

- The CMS shall provide the capability to integrate seamlessly with the same vendor's continuous online machinery protection devices(s), such that pertinent condition monitoring data can be securely captured, stored, and visualized
- The CMS shall provide the capability to integrate seamlessly with the same vendor's scanning device(s), such that pertinent condition monitoring data can be securely captured, stored, and visualized
- The CMS shall provide the capability to integrate seamlessly with the same vendor's portable data collection and analyser device(s), such that pertinent condition monitoring data can be securely captured, stored, and visualized
- The CMS shall provide the ability to configure condition monitoring hardware (non-protection) via the user interface

Bently在石化行业的最佳实践案例 ----- 系统集成实施和调试FAT的要求

6. Execution

6.1. INTERFACING REQUIREMENTS

6.1.1. Field cabling

Field Cabling between monitor racks and field devices to be stranded 3-wire shielded cable, 18AWG to 22AWG, with insulating sheath. The shielding shall be earthed in only one location, preferably at the monitor rack.

6.1.2. Barriers & Galvanic Isolators

Barriers or Galvanic Isolators will be required for sensors located in classified plant areas. These shall be supplied in accordance with THE COMPANY's general instrumentation standard for this site and shall be selected with advice from the Monitoring & Protection System vendor to ensure compatibility. The MPS hardware recommended in this Plan is compatible with either barriers or galvanic isolators, however the MTL range of Barriers is typically utilized.

6.1.3. Networking

Networking between MPS components shall use conventional Ethernet architecture with twisted pair cabling between monitor racks, display units and local rack-mounted MPS Ethernet hubs, and between the MPS Data Acquisition Servers and local Ethernet hubs. Networking between the MPS Ethernet hubs shall use fiber optic transport. Selection and installation of the networking components shall be done with advice from the MPS vendor.

6.1.4. OPC Communication

The Monitoring & Protection System (MPS) shall be configured for two-way OPC communication with the plant's Distributed Control System. The OPC Interface Package must be installed on the DCS and network access provided to interconnect the MPS server computer(s) with the Plant Data Network

6.1.5. MPS Modbus Data Export

For Critical and Essential Machines, the monitoring hardware system shall export machinery management parameters (including vibration, temperature, pressure and position amplitudes, alarm status) using conventional Modbus over Ethernet protocol. Machinery data export shall be independent of the monitoring software and

6.2.4. INTEGRATED FACTORY ACCEPTANCE TEST

An Integrated Factory Acceptance Test (IFAT) shall be performed by Vendor in order to provide THE COMPANY opportunity to test the complete signal path from the source, through the Condition Monitoring System (CMS) to the Distributed Control System (DCS) Operator Workstations prior to deploying these systems to the installation site.

The IFAT shall include test system communications between the CMS and the DCS. Key communication protocols that will be tested include Modbus (serial or Ethernet) and OPC. Depending on project standards, the communications infrastructure may be in either simplex or redundant configurations. This network infrastructure configuration shall be replicated during the IFAT. If redundant communications are employed, then failure modes shall be tested to ensure proper operation of the redundant communications links. Any hardwired trip signals to an Emergency Shutdown (ESD) system shall be tested with the ESD systems to ensure compliance to the project standards.

All DCS materials and equipment required for IFAT or other system testing shall be supplied by DCS Vendor as required.

IFAT testing shall include the following:

- Shipping the project hardware, including system cabinets and monitoring systems, marshalling cabinets if applicable, server cabinets and networking hardware to the DCS Vendor's premises.
- In some instances it may not be practical or desired to ship all of the project hardware to the DCS Vendor's premises. In these cases just an appropriate portion of the equipment will be shipped or in some instances representative test systems rather than the actual project equipment will be shipped.
- Scheduling CMS Vendor's service personnel to assist with system set up and testing.
- Replicating the site network (or part thereof).
- Providing simulated inputs to the monitoring systems.