

# Understanding of Measurement

2018.01



# Contents

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**I** The importance of the measurement and data management

**II** Introduction and utilization of instruments

# Contents

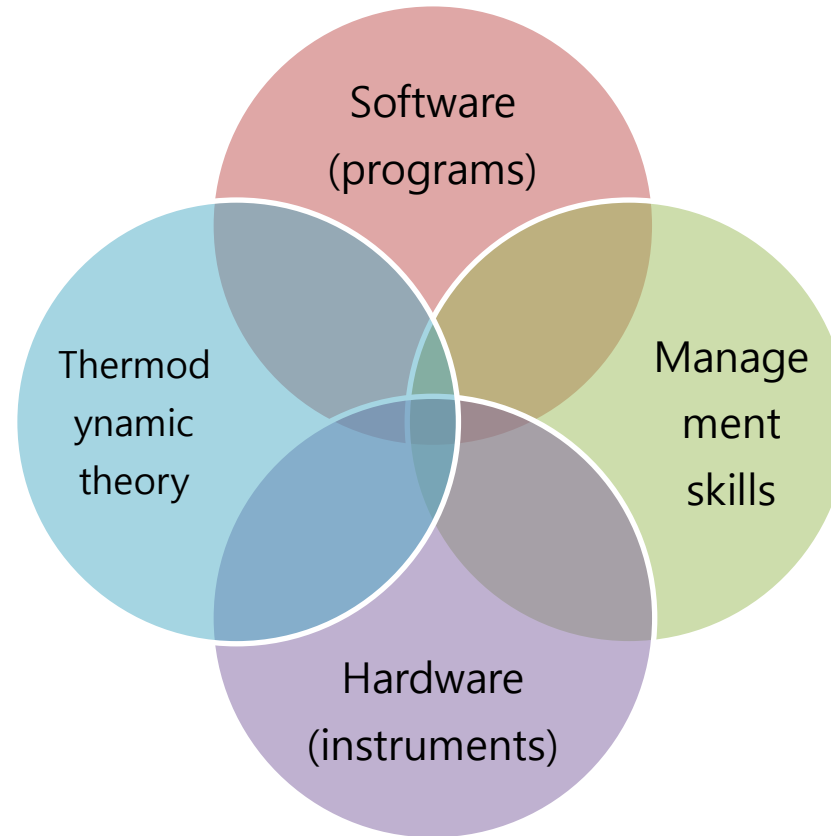
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**I** The importance of the measurement and data management

**II** Introduction and utilization of instruments

# Energy saving technology

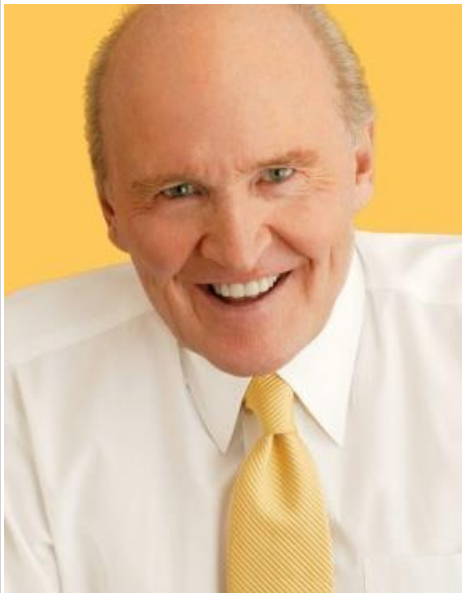
- Energy-saving technology is a comprehensive management which is combined of hardware and software



# Data



- The success of the business will be determined by how to collect, manage, and utilize information



- Give me the money,  
Show me the data !!



- The Art of War(Ancient China book for War) : If you know your enemies and yourself, you will not be imperiled in a hundred battles

# The importance of the data analysis

- Through the instrument panel in the cockpit of the aircraft, safe operation is possible



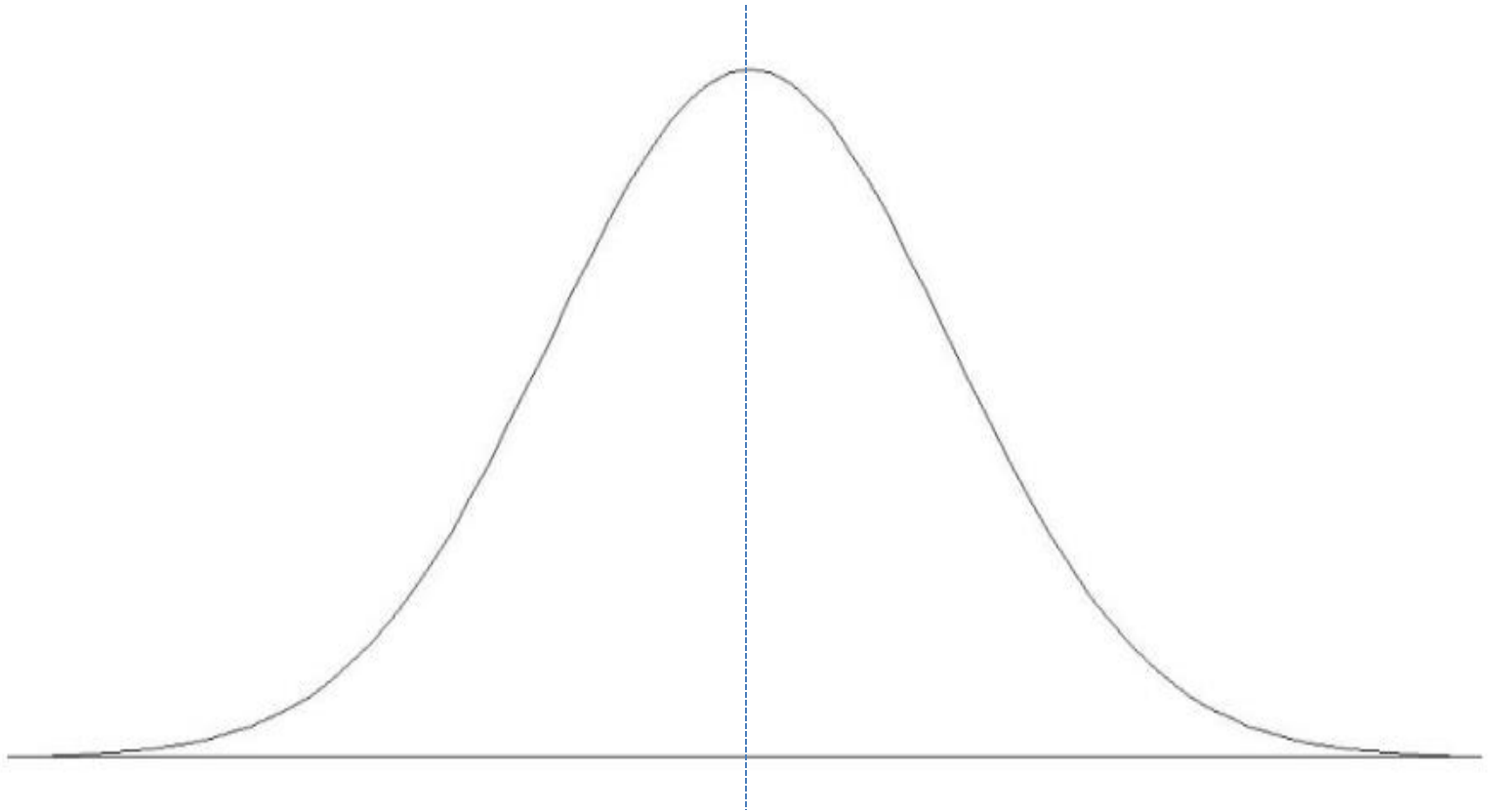


## ●Data screen at chemical plant(DCS,RTDB)



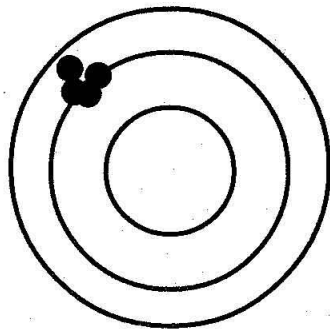
# Error value and the uncertainty of Measurement

- To minimize the error value and uncertainty

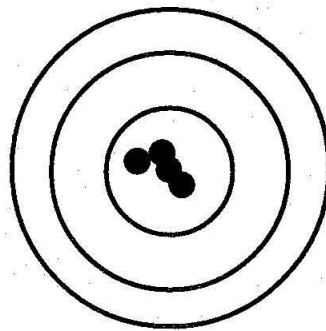




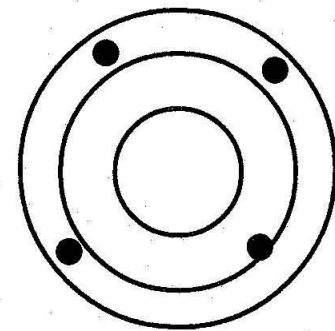
# Precision and accuracy



**High Precision  
Low Accuracy**



**High Precision  
High Accuracy**



**Low Precision  
Low Accuracy**

# The Importance of Calibration

<b>교정성적서</b> <b>CALIBRATION CERTIFICATE</b>			
<b>한국산업기술시험원</b>		출력서 번호 : 13-053075-01-27 Certificate No.	
경기도 안산시 상록구 해운로 723 TEL : 031-500-0217 FAX : 031-500-0389		제어지 ( ) / 총 2) Page of Pages	
<b>1. 의뢰자 (Client)</b> 기관명 (Name) : 예나테크놀로지 주소 (Address) : 경기도 용인시 수지구 포문대로 388(동백중동)			
<b>2. 측정기 (Calibration Subject)</b> 기가명 (Description) : 디지털 온도계 제작회사 및 형식 (Manufacturer and Model Name) : TESTO / 635 기기번호 (Serial Number) : 01714159/905			
<b>3. 교정일자 (Date of Calibration)</b> : 2013년 12월 23일			
<b>4. 교정환경 (Environment)</b> 온도 (Temperature) : (23.0 ± 0.4) °C      습도 (Humidity) : (49 ± 1) % R.H. 교정장소 (Location) : <input checked="" type="checkbox"/> 고정교정실 (KTL Lab.) <input type="checkbox"/> 이동교정 (Mobile Lab.) <input type="checkbox"/> 현장교정 (On Site Calibration)			
<b>5. 측정표준의 소급성 (Traceability)</b> 교정방법 및 소급성 기술 (Calibration method and/or brief description) : 위기의 거치는 (디지털 온도계의) 교정방법기준 (JIS S-0302-2, KTL)에 따라 국가측정표준기관으로부터 소급성이 유지된 표준을 사용하여 교정되었습니다. 교정에 사용한 표준정보 명세 (List of used standards/specifications)			
기름 Description	제작사 및 형식 Manufacturer and Model	기기번호 Serial Number	국가측정표준 The date of last calibration
Humidity Generator	SHRIVE / SRH-1	1604-490	2014. 12. 03 한국산업기술시험원
Dew Point Hygrometer	G. E. / OPTICA	0510903	2014. 06. 18 한국산업기술시험원
Temp. & Humidity Chamber	ESPEC / PL-SKP	1401007	2014. 07. 26 한국산업기술시험원
Digital Thermometer	HART / 1529	A38474	2014. 11. 26 한국산업기술시험원
<b>6. 교정결과 (Calibration Results) :</b> 교정결과 참조			
<b>7. 측정불확도 (Measurement Uncertainty) :</b> 교정결과 참조			
<b>확인 (Affirmation)</b>	작성자 (Measurements performed by)	승인자 (Approved by)	
	성명 (Name) : 박근우	직위 (Title) : 기술책임자	
		직명 (Name) : 지진환	
이 성적서는 국제기술협력위원회(International Laboratory Cooperation) 상호인정협약(Mutual Recognition Arrangement)을 체결한 공인인증기관(KOLAS)에서 발행한 것으로, 유효성을 증명합니다. (This above calibration certificate is the accredited calibration issued by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.)			
2013년 12월 23일			
<b>한국산업기술시험원</b> Accredited by KOLAS, Republic of Korea			
<b>한국산업기술시험원장</b> <b>Korea Testing Laboratory</b>			

(주)에 명시되는 측정기의 작동원리 또는 측정 방법 (예를 들어 온도, 습도 등)이 정확히 설명되어 있지 않은 경우에는 이를 보완합니다.  
 (NOTED if any specified instability or other adverse factor(s) exist, temperature, humidity etc.) manifests itself before, during or after calibration, and it may be affected the validity of the calibration.

FPR12-01-00

<h2 style="margin: 0;">교 정 결 과</h2> <p style="margin: 0;">CALIBRATION RESULTS</p> <p style="margin: 0;">경기도 안산시 상록구 해안로 723</p> <p style="margin: 0;">TEL : 031-500-0217 FAX : 031-500-0389</p> <p style="margin: 0;">E-mail : standard@kci.re.kr</p>	<p style="margin: 0;">성적서번호 : 13-053875-01-27</p> <p style="margin: 0;">Certificate No.</p> <p style="margin: 0;">페이지 { 2 } / { 총 2 }</p> <p style="margin: 0;">Page of Pages</p>													
<div style="display: flex; justify-content: space-between;"> <span>◇ 기 기 명</span> <span>:</span> <span>디지털 온도계</span> </div> <div style="display: flex; justify-content: space-between;"> <span>◇ 제작회사 및 형식</span> <span>:</span> <span>TESTO / 635</span> </div> <div style="display: flex; justify-content: space-between;"> <span>◇ 기 기 번 호</span> <span>:</span> <span>01714159/908</span> </div> <div style="display: flex; justify-content: space-between;"> <span>◇ S E N S O R</span> <span>:</span> <span>20199089/905</span> </div>														
<h3>1. 온 도 (TEMPERATURE)</h3>														
<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 33%;">기 준 값 (℃)</th> <th style="width: 33%;">자 시 값 (℃)</th> <th style="width: 33%;">불 확 도 (℃)</th> </tr> </thead> <tbody> <tr> <td>10.5</td> <td>10.5</td> <td>0.6</td> </tr> <tr> <td>20.6</td> <td>20.6</td> <td>0.6</td> </tr> <tr> <td>30.4</td> <td>30.5</td> <td>0.6</td> </tr> </tbody> </table>			기 준 값 (℃)	자 시 값 (℃)	불 확 도 (℃)	10.5	10.5	0.6	20.6	20.6	0.6	30.4	30.5	0.6
기 준 값 (℃)	자 시 값 (℃)	불 확 도 (℃)												
10.5	10.5	0.6												
20.6	20.6	0.6												
30.4	30.5	0.6												
<p>측정불확도 (신뢰수준 약 95 %, <math>k=2</math>)</p>														
<h3>2. 습 도 (HUMIDITY) (at 20 ℃)</h3>														
<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 33%;">기 준 값 (% R.H.)</th> <th style="width: 33%;">자 시 값 (% R.H.)</th> <th style="width: 33%;">불 확 도 (% R.H.)</th> </tr> </thead> <tbody> <tr> <td>30.9</td> <td>32.8</td> <td>1.9</td> </tr> <tr> <td>60.5</td> <td>62.4</td> <td>2.8</td> </tr> <tr> <td>79.3</td> <td>80.8</td> <td>3.4</td> </tr> </tbody> </table>			기 준 값 (% R.H.)	자 시 값 (% R.H.)	불 확 도 (% R.H.)	30.9	32.8	1.9	60.5	62.4	2.8	79.3	80.8	3.4
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<p>공.</p>														
<p>◇ 국가교정기관지정제도 운영요령 제 41조 관련주기 : 12개월</p>														

# The Importance of Calibration

## 시험 성적서 TEST REPORT

검정사번호  
13-053875-02-1

신청자: 변종립  
Applicant

회사명: 에너지관리공단  
Name

주소: 경기도 용인시 수지구 모운대로 388(종석동)  
Address

시험규격/방법: 환경측정기기 시험, 검사 결과서  
Test Standard/Procedure

시험결과: 합격검조  
Test Result

검정서용도: QAVC  
Purpose of Report

접수일자: 2013. 12. 11  
Date of Application

시험기간: 2013. 12. 23 ~ 2013. 12. 24  
Test Period

발급일자: 2013. 12. 24  
Date of Issue

시험품  
Test Item

시험품명:  
Name of Product  
원소가스분석기

모델/형식:  
Model/Ref No  
test300-M

제조사명 및 주소:  
Name and Address of Manufacturer  
Testo AG

기타 시험품 정보:  
Remarks  
제조번호: 00971679/406 (1724 001 0 049)

확인 Confirmation	시험자(Tested by) <i>shin jk</i> 직위(Title): 책임연구원 Principal Engineer 성명(Name): 신재건 Shin, Jaekwon	승인자(Approved by) <i>park jh</i> 직위(Title): 기술책임자 Technical Supervisor 성명(Name): 박진홍 Park, Jin Hong
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The test results contained apply only to the test sample(s) supplied by the named applicant, and this test report shall not be reproduced in full or in part without the written approval of the KTL.

한국산업기술시험원장  
Korea Testing Laboratory

서울특별시 구로구 디지털로26길 87 (152-718) TEL : 02-850-1121 FAX : 02-850-1299  
87, Digital-ro 26-gil, Guro-gu, Seoul, KOREA http://www.ktl.co.kr  
FP204-05-01

본서면에는 추후 판공위원을 대표로 구성된 심사위원회의 심사결과가 기재되어 있습니다.

## 시험 결과 TEST RESULT

### 1. 성능시험 Performance Test

시험가스명	기준가스농도	지시값 (평균값)	비고
CO	0.0 ppm	0 ppm	
	451.4 ppm	444 ppm	
	854.1 ppm	849 ppm	
시험가스명	기준가스농도	지시값 (평균값)	비고
NO	0.0 ppm	0 ppm	
	450.5 ppm	447 ppm	
	850.4 ppm	851 ppm	
시험가스명	기준가스농도	지시값 (평균값)	비고
O <sub>2</sub>	0.00 %	0.1 %	
	10.51 %	10.4 %	
	18.99 %	19.1 %	

### 2. 기타 Etc.

시험실 조건	온도 20 ± 5 °C, 습도 60 ± 10 %
측정범위, 최소농도	CO, NO : 0 ~ 1000 ppm, 1 ppm, O <sub>2</sub> : 0 ~ 25 %, 0.1 %
측정방식	자동흡입식
표시방식	Digital Display
시험회수	3 회
표준가스	CO, NO, O <sub>2</sub> 는 N <sub>2</sub> 밸런스
검정유효기간	12 개월

- 이하 여백 -

FP204-05-01

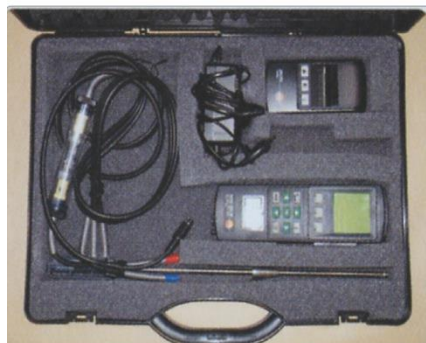
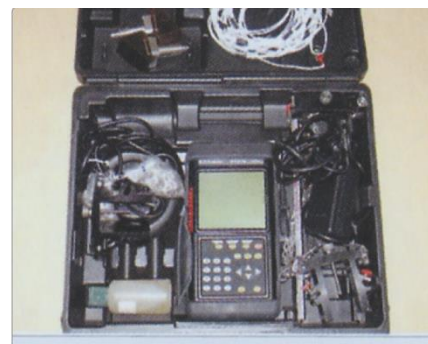
본서면에는 추후 판공위원을 대표로 구성된 심사위원회의 심사결과가 기재되어 있습니다.

# Contents

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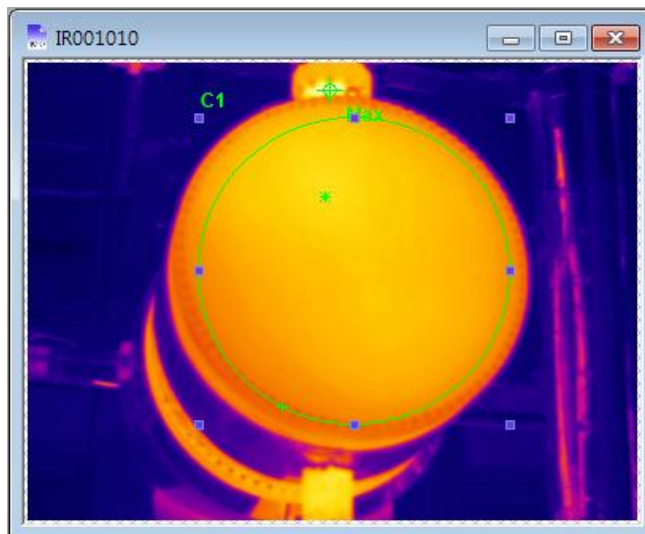
Instruments Type	Quantity	Instruments Type	Quantity
Data Logger	29	Ultrasonic Flow Meter	12
Digital Pressure Meter	10	Power Analyzer	17
Digital Flow Meter	12	Digital thermometer	18
Flue Gas Analyzer	22	Infrared Thermometer	13
AC Power Meter	25	Infrared Camera	5

## ● Infrared Camera



To identify energy loss and breakdowns by measuring loss of high and low temperature heat, insulation conditions of the facilities, and exothermic conditions of the facilities in operation including the electric facilities.





객체	온도	속성
Max	234.7°C	온도
C1	226.5°C	최고온도
	220.7°C	평균온도
	171.1°C	최저온도

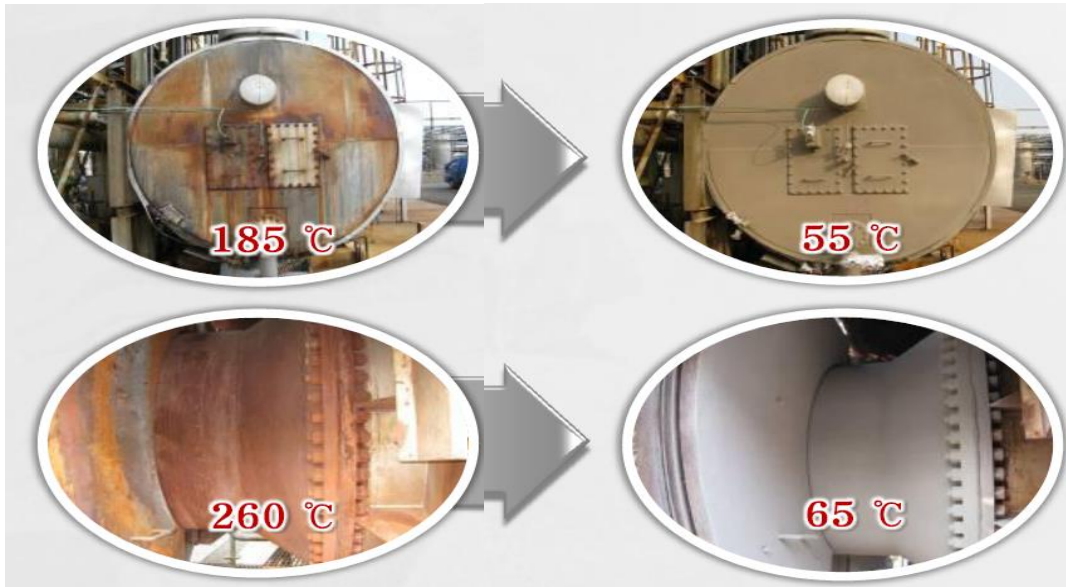
정보 데이터창 게이지



객체	온도	속성
Max	151....	온도
L1	115....	최고온도
	104....	평균온도
	99.4°C	최저온도
L2	119....	최고온도
	105....	평균온도
	96.9°C	최저온도

이미... 정보 데이... 게이지





-Flange 코팅 전 효과 : 180 °C

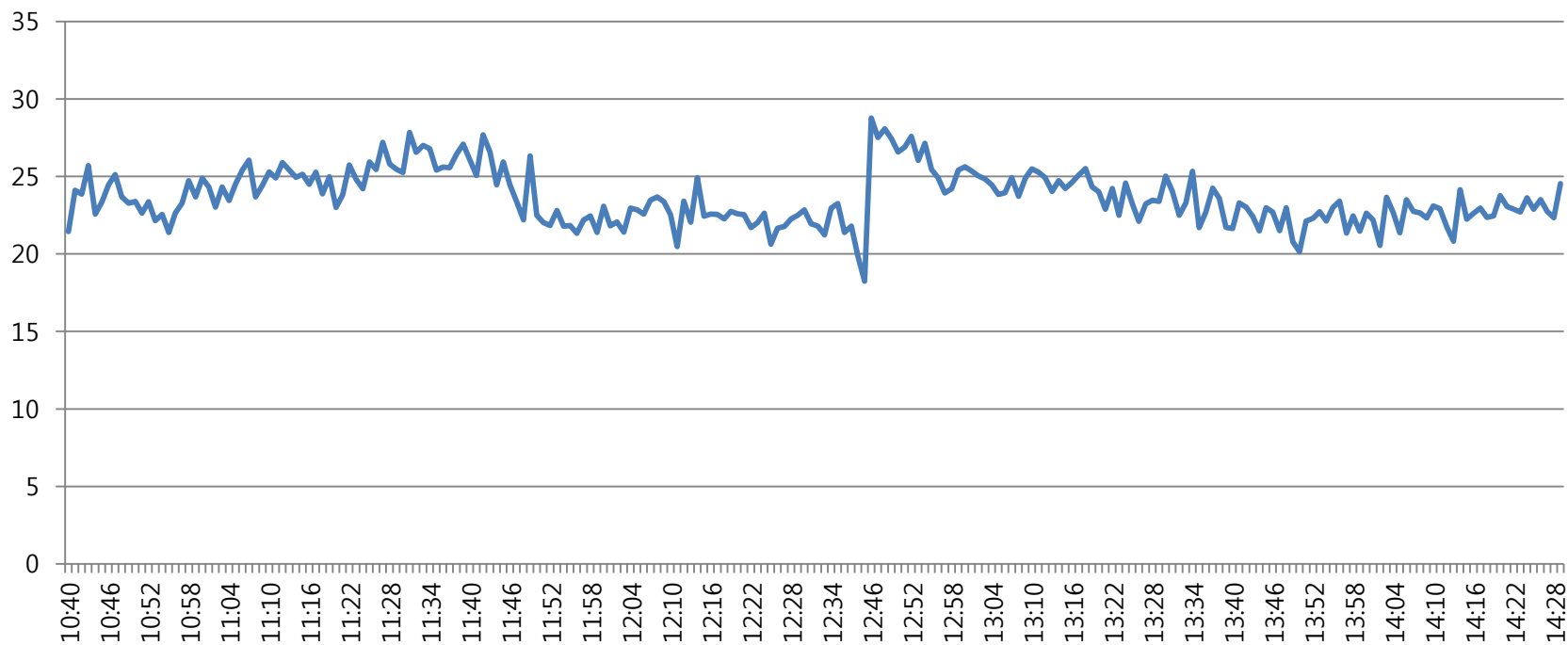


-Flange 코팅 후 효과 : 55 °C

- Ultrasonic flow meter



To measure, using ultrasonic wave, the flow rate and flow direction of fluid which is transmitted through pipes.

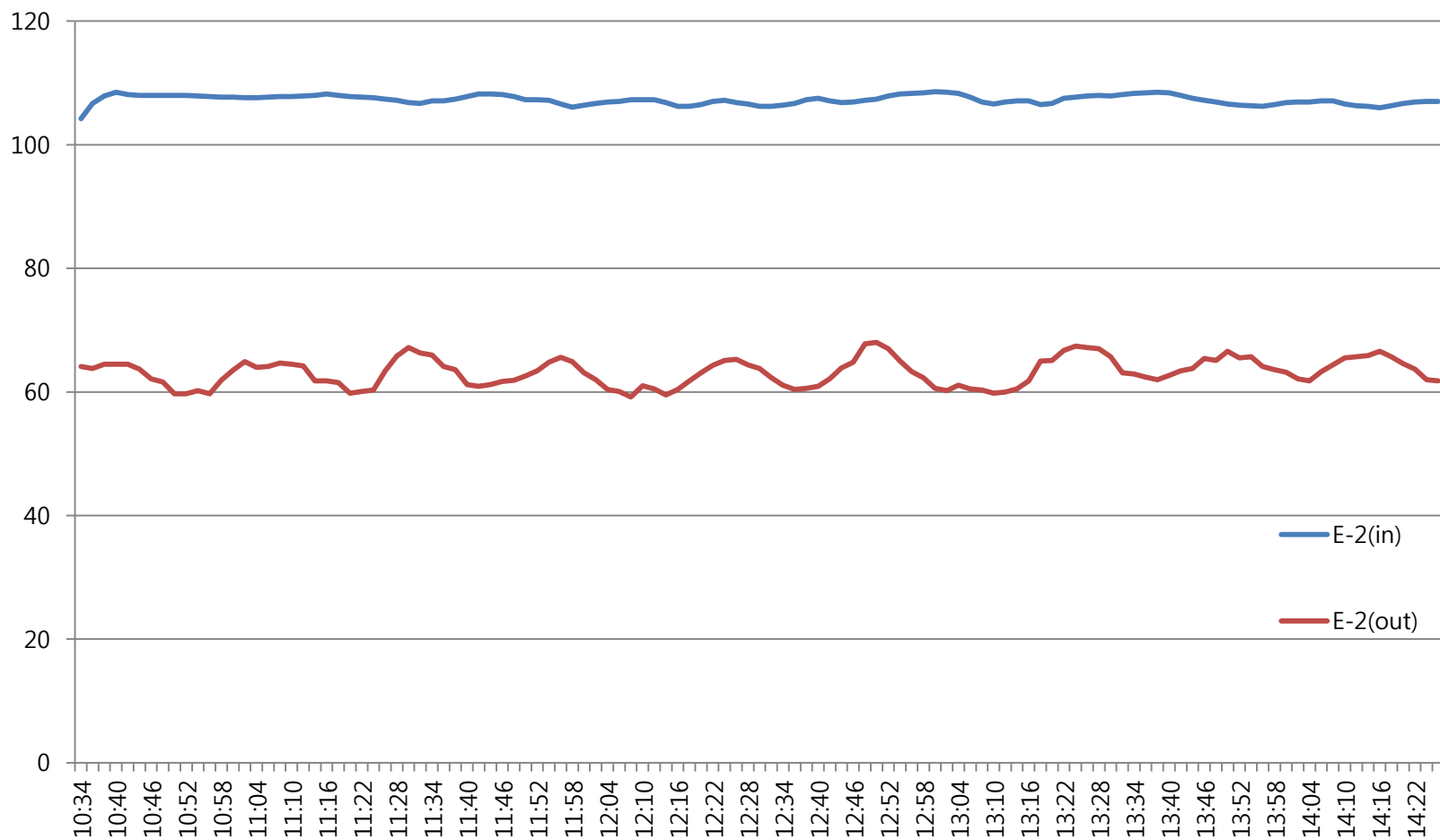


< Flow measurement data(K company)>

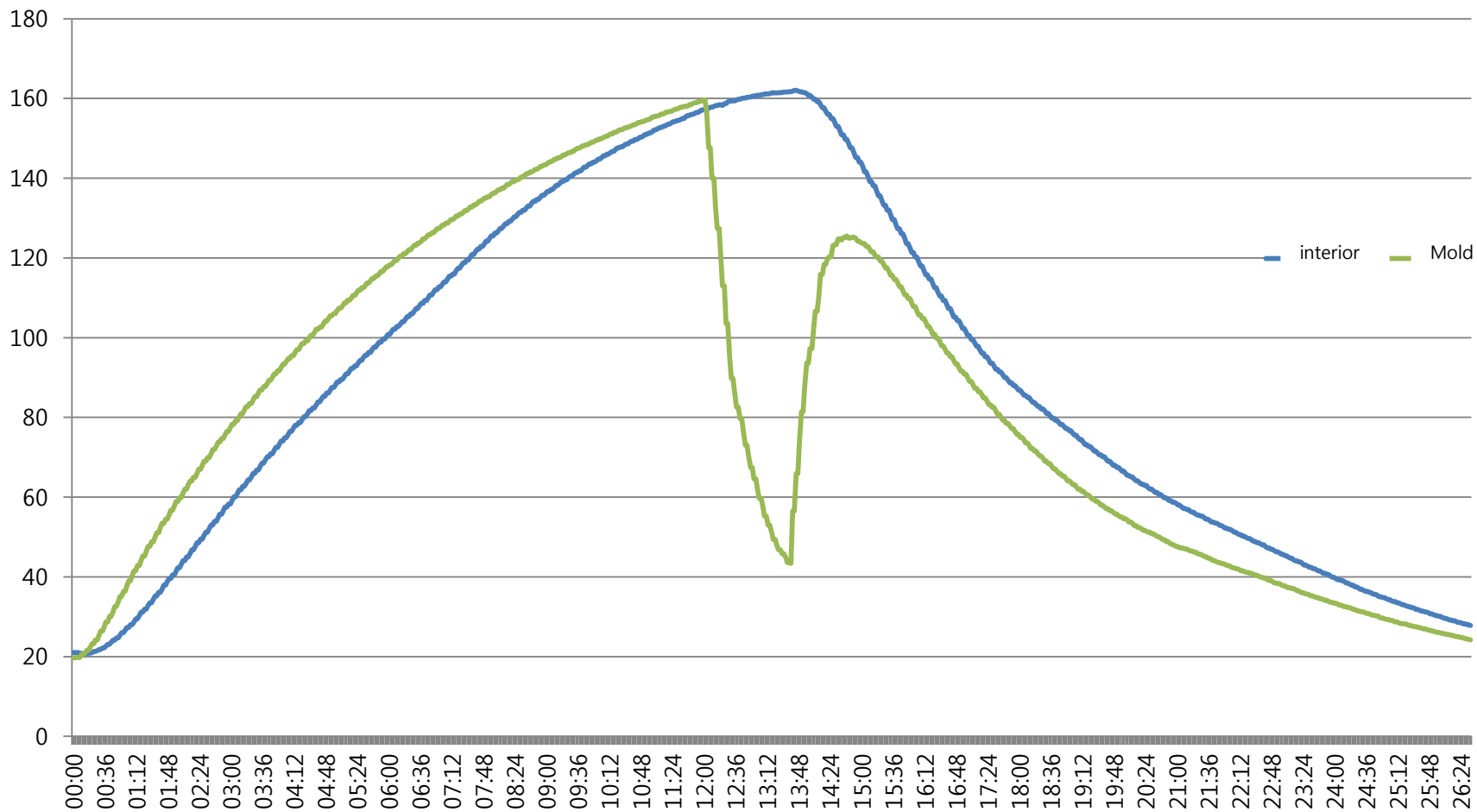
- Multi-functional thermometer



To measure temperature and humidity using various sensors. The equipment is often used in analyzing operating conditions of, for example, air conditioners as temperatures at several points can be measured at a time (multi-contact temperature).



< Temperature measurement data(K company)>



< Temperature measurement data(T company)>



- Combustion flue gas analyzer



To measure the concentration of  $O_2$ ,  $CO$ ,  $CO_2$ , temperature,  $NO_X$ , and so forth in a ventilation duct in order to check combustion conditions, for example, in boilers.



- Continuous combustion flue gas analyzer



To measure the concentration of  $O_2$ ,  $CO$ ,  $CO_2$ , temperature,  $NOX$ , and so forth in a ventilation duct in order to check combustion conditions, for example, in boilers.

2.10 11:00 204 (4.5%)

-----  
testo 300  
-----  
- Testo -  
"  
"

21.01.03 18:49h

Fuel: NATURALGAS

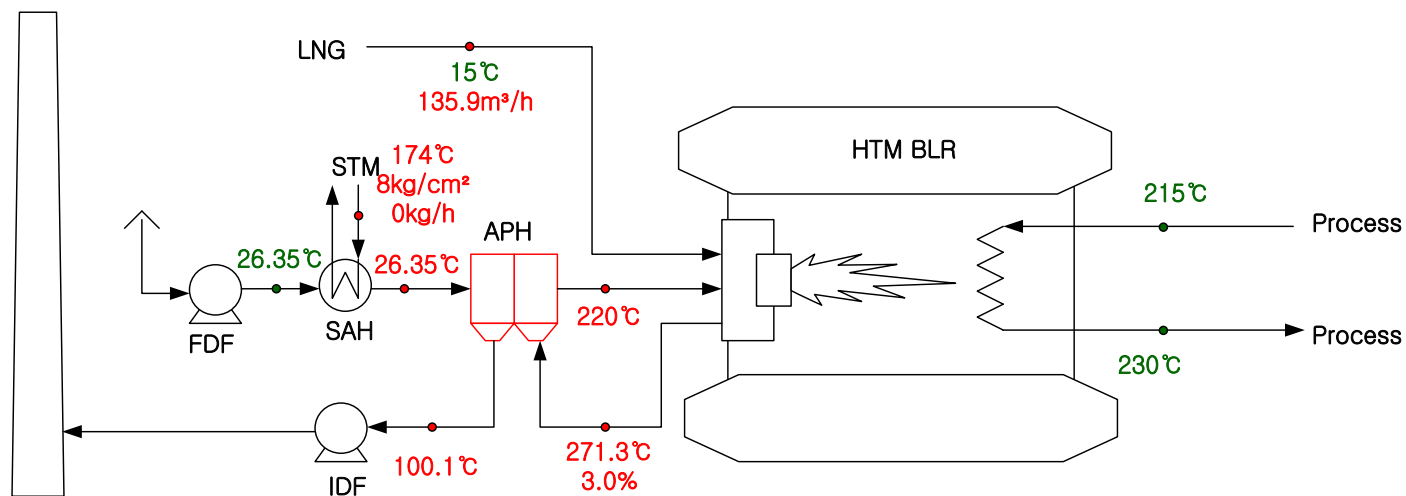
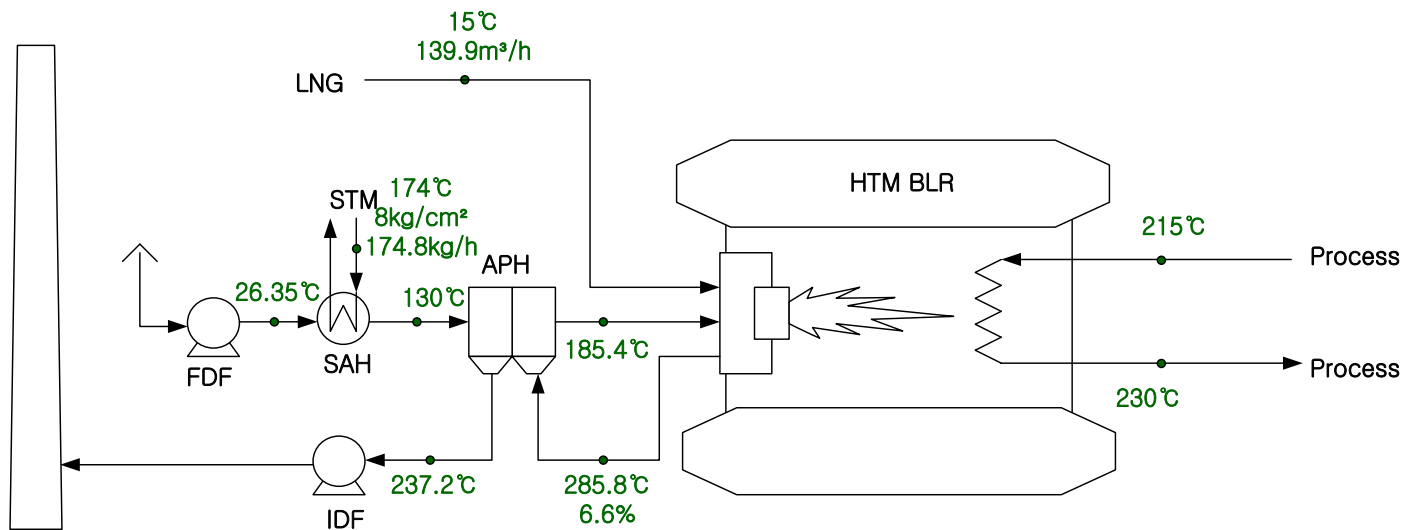
249.0 °C	FlueGas.Temp
6.6 %	O2 -content
0 ppm	CO -content
8.1 %	CO2 content
.0000	Ratio
78.9 %	EffGross
86.9 %	EffNet
46.2 %	Excess air
0 ppm	CO undil.
---4 ppm	NO -content
99 ppm	NOx content

2/10 11:00 #4 B

-----  
\* testo-----  
\*  
21.01.03 18:41h

Fuel: NATURALGAS

228.6 °C	FlueGas.Temp
3.5 %	O2 -content
0 ppm	CO -content
9.9 %	CO2 content
.0000	Ratio
80.5 %	EffGross
88.7 %	EffNet
20.3 %	Excess air
0 ppm	CO undil.
--- hPa	FlueDraught
64 ppm	NO -content
67 ppm	NOx content



- Digital surface thermometer



To measure room temperature and surface temperature of facilities and pipes (Left side: sensor for measuring surface temperature, Right side: sensor for measuring water and air temperature)

- Wattmeter (NANOVIP/RMS)

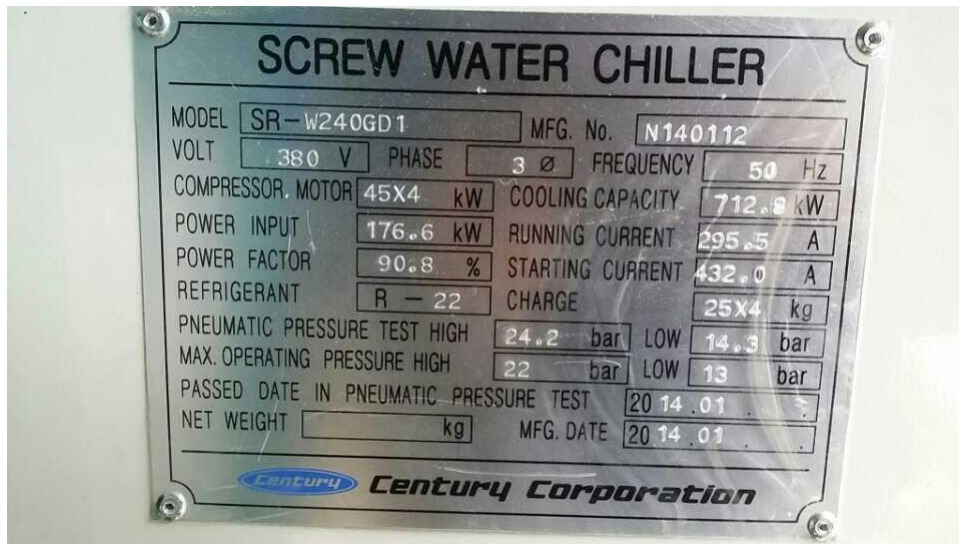


To measure instantaneous power of electric equipment including motors. The equipment can accurately and simply measure voltage, current, power, and power factor at a time by changing the state of equipment under measurement including frequency.



To measure instantaneous power in the electric facilities by connecting CT (Current transformer), a part of the meter, with a wire and then connecting two terminals for PT (Voltage transformer) with the remaining wire.





- Power analyzer (AR5)



To measure instantaneous power of electric equipment and be able to analyze the current state of electricity consumption by setting the time period variously when necessary. (The equipment is often used in analyzing the operating state of, for example, compressors)



A



- Photoelectric tachometer



To measure the number of revolutions of a rotating machine including a fan. The equipment is to analyze reduction of operating efficiency when the torque is not exerted sufficiently due to breakdown of a rotating machine.

- Anemometer for air-conditioning



To measure temperature, humidity, wind speed, and so forth with a hot wire attached to the end of a sensor and measuring stick adjusted easily. The equipment can check average value after measuring instantaneous values and values at each point.

- Digital manometer



To measure water pressure and air pressure by fixing the bolt attached to the end of a hose, to the facilities under measurement. (up to 30 bar at maximum)

- High temperature anemometer



To measure wind volume and wind pressure in order to analyze operating conditions of air conditioners and fans.

- Illuminometer



To measure, as essential equipment for energy audits of a lighting fixture, the illuminance at each point thereby identifying measures to improve illuminance appropriately.



Emblem Name : **SeSe**

Thank You  
**감사합니다**



**"Save energy, Save earth"**