

Understanding of Measurement

2018.01



Contents

I The importance of the measurement and data management

II Introduction and utilization of instruments

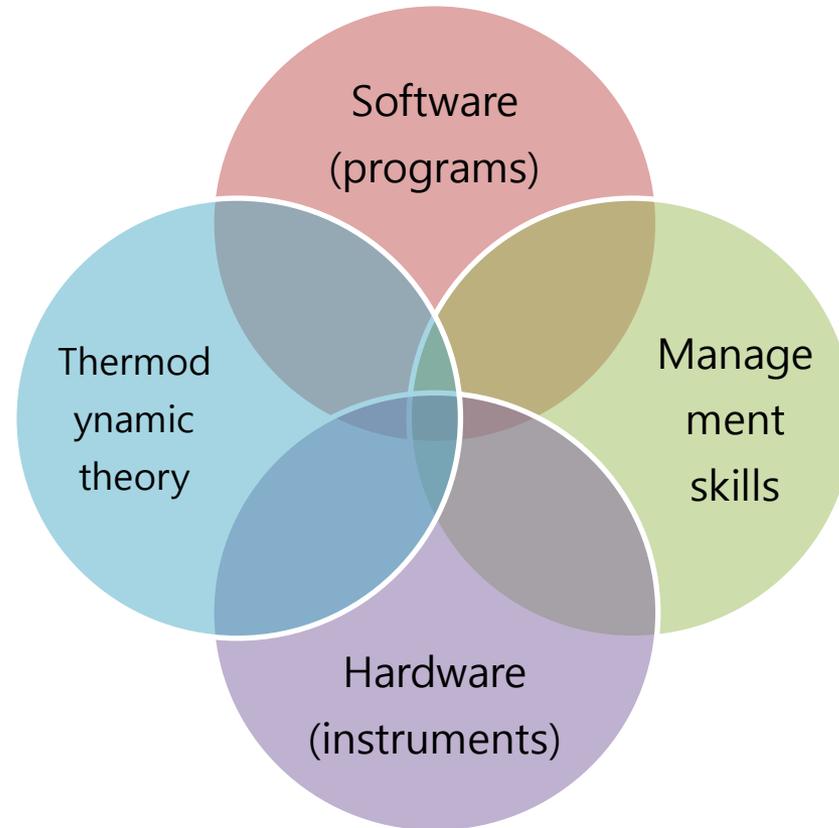
Contents

I The importance of the measurement and data management

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Energy saving technology

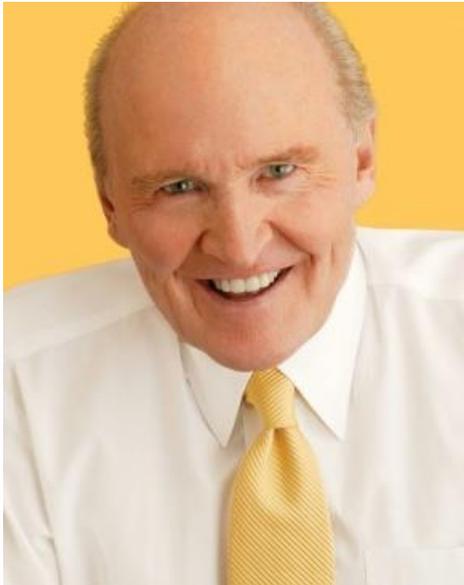
- Energy-saving technology is a comprehensive management which is combined of hardware and software



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

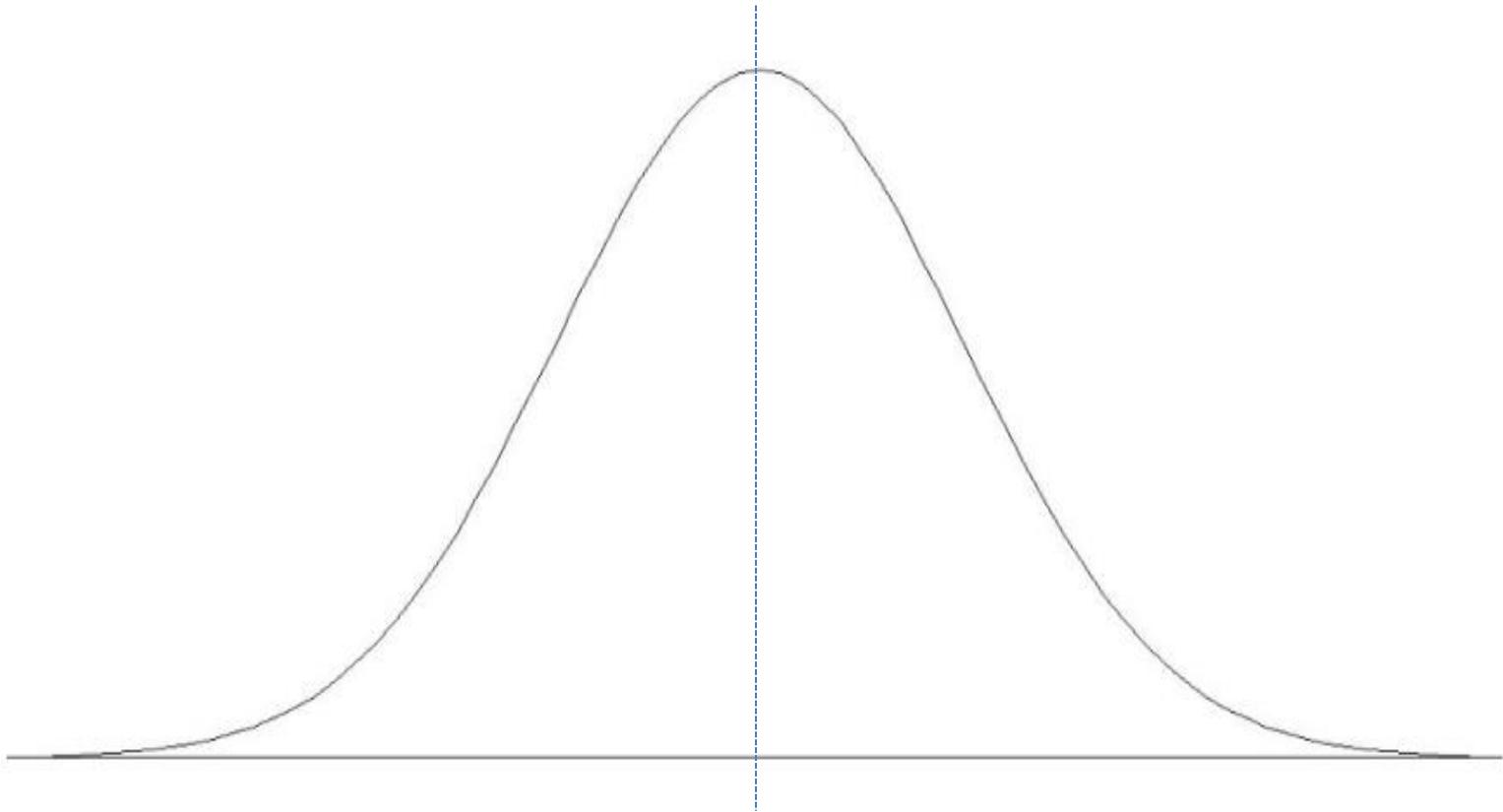
The importance of the data analysis

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

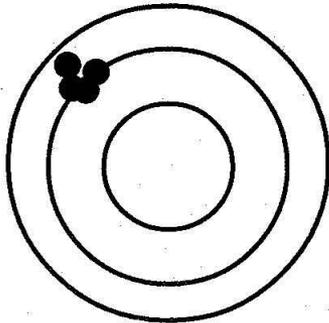


Error value and the uncertainty of Measurement

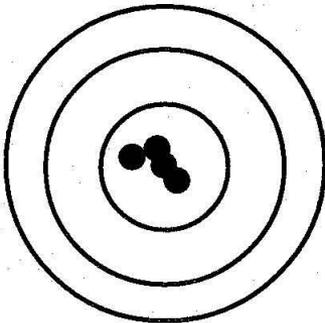
- To minimize the error value and uncertainty



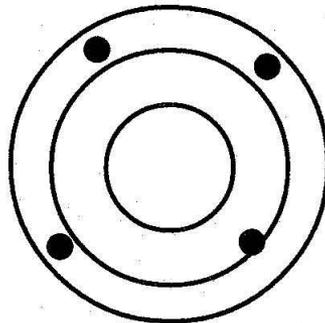
Precision and accuracy



**High Precision
Low Accuracy**



**High Precision
High Accuracy**



**Low Precision
Low Accuracy**

The Importance of Calibration

교정성적서 CALIBRATION CERTIFICATE

| | | | | |
|--|--|---|---|---------------------------------|
| 한국산업기술시험원 경기도 안산시 상록구 현암로 723 TEL : 031-500-0217 FAX : 031-500-0389 | | 성적서 번호 : 13-053875-01-27 Certificate No. 페이지 (1) / (총 2) Page of Pages |  | |
| 1. 의뢰자 (Client) 기관명 (Name) : 에너지관리공단 주소 (Address) : 경기도 용인시 수지구 포현대로 388(동막성동) | | | | |
| 2. 측정기 (Calibration Subject) 기기명 (Description) : 디지털 온도도계 제작회사 및 형식 (Manufacturer and Model Name) : TESTO / 635 기기번호 (Serial Number) : 01714150/908 | | | | |
| 3. 교정일자 (Date of Calibration) : 2013년 12월 23일 | | | | |
| 4. 교정환경 (Environment) 온도 (Temperature) : (23.0 ± 0.4) °C 습도 (Humidity) : (49 ± 1) % R.H. 교정장소 (Location) : <input checked="" type="checkbox"/> 한국표준시험 (KTL Lab.) <input type="checkbox"/> 이동교정 (Mobile Lab.) <input type="checkbox"/> 현장교정 (On Site Calibration) | | | | |
| 5. 측정방법 및 소급성 (Traceability) 교정방법 및 소급성 기술 (Calibration method and/or brief description) : 해당 기기는 (디지털 온도도계)의 교정연구기관 (CP601-50302-2, KTL)에 따라 국가측정표준기관으로부터 소급성이 유지된 표준기를 사용하여 교정되었습니다. 교정에 사용한 표준재의 명세 (List of used standards/specifications) | | | | |
| 기명 (Description) | 제작회사 및 형식 (Manufacturer and Model) | 기기번호 (Serial Number) | 최기교정유효일자 (The due date of next calibration) | 교정기관 (Calibration Laboratory) |
| Humidity Generator | SHINYEI / SRH-1 | 1604-490 | 2014. 12. 03 | 한국산업기술시험원 |
| Dew Point Hygrometer | G. E. / OPTICA | 0910903 | 2014. 06. 18 | 한국산업기술시험원 |
| Temp. & Humidity Chamber | ESPEC / PL-SKP | 1401007 | 2014. 07. 26 | 한국산업기술시험원 |
| Digital Thermometer | HART / 1529 | A3B474 | 2014. 11. 26 | 한국산업기술시험원 |
| 6. 교정결과 (Calibration Results) : 교정결과 참조 | | | | |
| 7. 측정불확도 (Measurement Uncertainty) : 교정결과 참조 | | | | |
| 확인 (Attestation) | 측정자 (Measurements performed by) 성명 (Name) : 박근우 | | 승인자 (Approved by) 직위 (Title) : 기술책임자 성명 (Name) : 지진관 | |
| 위 성적서는 국제시험기관간 협력위원회 (International Laboratory Accreditation Cooperation) 상호인정협정 (Mutual Recognition Arrangement) 및 시험의 정확성을 평가 (ILAC)로부터 승인받은 정보에 의해 교정되었습니다. (The above calibration certificate is the accredited calibration facts by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.) | | | | |
| 2013년 12월 23일 | | | | |
| 한국산업기술시험원 Accredited by KOLAS, Republic of KOREA | | | | |
| 한국산업기술시험원 Korea Testing Laboratory | | | | |
| (B) 이 성적서는 측정기의 측정 불확도 및 정확도를 나타내는 요소 (교정차, 분포, 승차, 열차)의 영향을 받거나 불확정 공여하는 부분이 없습니다. (NOT) If any significant variability or other adverse factor(s) (method, temperature, humidity etc.) can affect the validity of the calibration, and is likely to affect the validity of the calibration. | | | | |

FPB12-01-00

교정결과

| 교정결과 CALIBRATION RESULTS 경기도 안산시 상록구 현암로 723 TEL : 031-500-0217 FAX : 031-500-0389 E-mail : standard@koti.ro.kr | | 성적서번호 : 13-053875-01-27 Certificate No. 페이지 (2) / (총 2) Page of Pages |  | | | | | | | | | | | | |
|--|--------------|--|---|--------------|--------------|--------------|------|------|-----|------|------|-----|------|------|-----|
| ◇ 기기명 : 디지털 온도도계 ◇ 제작회사 및 형식 : TESTO / 635 ◇ 기기번호 : 01714150/908 ◇ SENSOR : 20199089/905 | | | | | | | | | | | | | | | |
| 1. 온도 (TEMPERATURE) | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th>기준값 (°C)</th> <th>지시값 (°C)</th> <th>불확도 (°C)</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> | | | | 기준값 (°C) | 지시값 (°C) | 불확도 (°C) | 10.5 | 10.5 | 0.6 | 20.6 | 20.6 | 0.6 | 30.4 | 30.5 | 0.6 |
| 기준값 (°C) | 지시값 (°C) | 불확도 (°C) | | | | | | | | | | | | | |
| 10.5 | 10.5 | 0.6 | | | | | | | | | | | | | |
| 20.6 | 20.6 | 0.6 | | | | | | | | | | | | | |
| 30.4 | 30.5 | 0.6 | | | | | | | | | | | | | |
| 측정불확도 (신뢰수준 약 95 %, k = 2) | | | | | | | | | | | | | | | |
| 2. 습도 (HUMIDITY) (at 20 °C) | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th>기준값 (% R.H.)</th> <th>지시값 (% R.H.)</th> <th>불확도 (% 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> | | | | 기준값 (% R.H.) | 지시값 (% R.H.) | 불확도 (% R.H.) | 30.9 | 32.8 | 1.9 | 60.5 | 62.4 | 2.8 | 79.3 | 80.8 | 3.4 |
| 기준값 (% R.H.) | 지시값 (% R.H.) | 불확도 (% R.H.) | | | | | | | | | | | | | |
| 30.9 | 32.8 | 1.9 | | | | | | | | | | | | | |
| 60.5 | 62.4 | 2.8 | | | | | | | | | | | | | |
| 79.3 | 80.8 | 3.4 | | | | | | | | | | | | | |
| 측정불확도 (신뢰수준 약 95 %, k = 2) | | | | | | | | | | | | | | | |
| 끝. | | | | | | | | | | | | | | | |
| ◇ 국가교정기관지정제도 운영요령 제 41조 관련주기 : 12개월 | | | | | | | | | | | | | | | |

FPB12-02-00

The Importance of Calibration

시험 성적서 TEST REPORT

시험사번호
13-053875-02-1

신청자: 변종림
Applicant

회사명: 에너지관리공단
Name

주소: 경기도 용인시 수지구 모은대로 388(홍석전동)
Address

시험규격/방법: 환경측정기기 시험.검사 절차서
Test Standard/Procedure

시험결과: 합격중조
Test Result

성적서용도: QAVQC
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
일소가스분석기

모델/형식:
Model/Ref No
tstn300-M

제조사명 및 주소:
Name and Address of Manufacturer
Testo AG

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

| | | |
|--------------------|--|--|
| 확인 Confirmation | 시험자(Tested by): Shin Jik | 승인자(Approved by): Park Jo Hong |
| | 직위(Title): 책임연구원 Principal Engineer | 직위(Title): 기술책임자 Technical Supervisor |
| | 성명(Name): 신재건 Shin, Je kwon | 성명(Name): 박진홍 Park, Jo Hong |

본 성적서의 시험결과는 신청자로부터 제공된 시험품에만 적용되며, 본문의 사전 승인없이 본 성적서의 전부 혹은 일부를 복사하여 사용될 수 없습니다.
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 : 02-890-1121 FAX : 02-890-1299
87, Digital-ro 26-gil, Guro-gu, Seoul, KOREA http://www.ktil.co.kr
FP204-05-01

본 시험은 한국 산업기술 시험원 (KTL)에서 실시된 시험입니다.

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 | |
| NO | 0.0 ppm | 0 ppm | |
| | 450,5 ppm | 447 ppm | |
| | 850,4 ppm | 851 ppm | |
| O ₂ | 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 ₂ : 0 ~ 25 %, 0.1 % |
| 측정방식 | 자동흡입식 |
| 표시방식 | Digital Display |
| 시험회수 | 3 회 |
| 표준가스 | CO, NO, O ₂ 는 N ₂ 밸런스 |
| 관장유효기간 | 12 개월 |

- 이 하 여 백 -

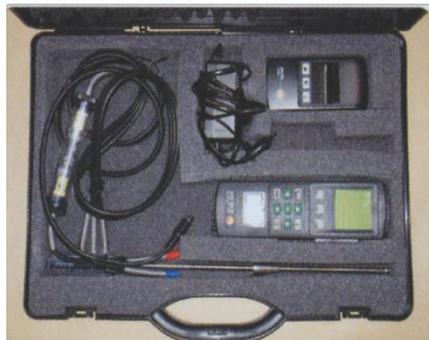
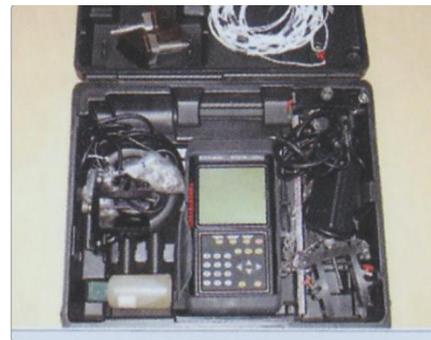
FP204-05-01

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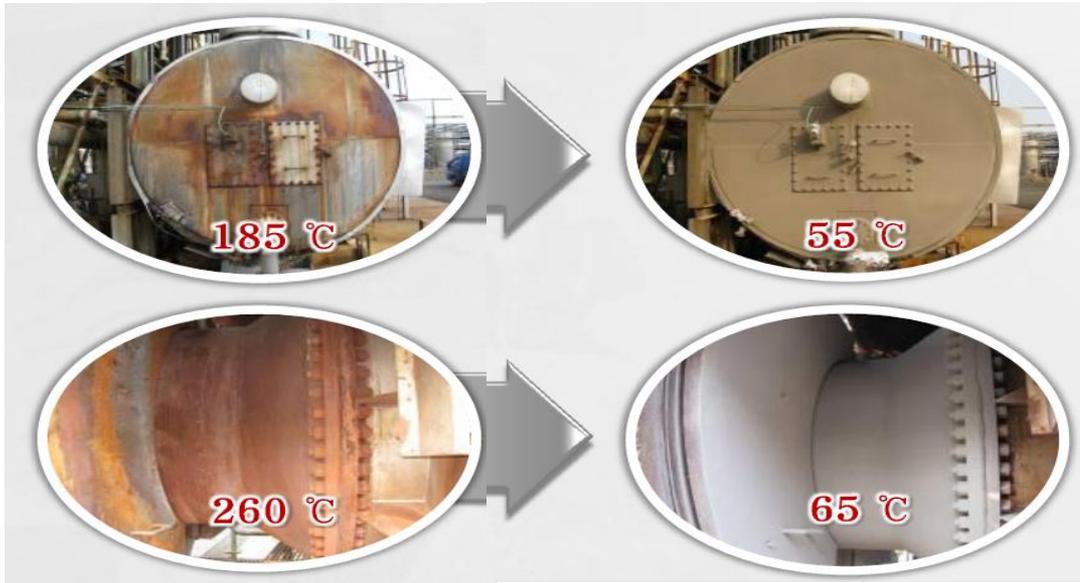


| Instruments Type | Quantity | Instruments Type | Quantity |
|------------------------|----------|-----------------------|----------|
| Data Logger | 29 | Ultrasonic Flow Meter | 12 |
| Digital Pressure Meter | 10 | Power Analyzer | 17 |
| Digital Flow Meter | 12 | Digital thermometer | 18 |
| Flue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

● Infrared Camera



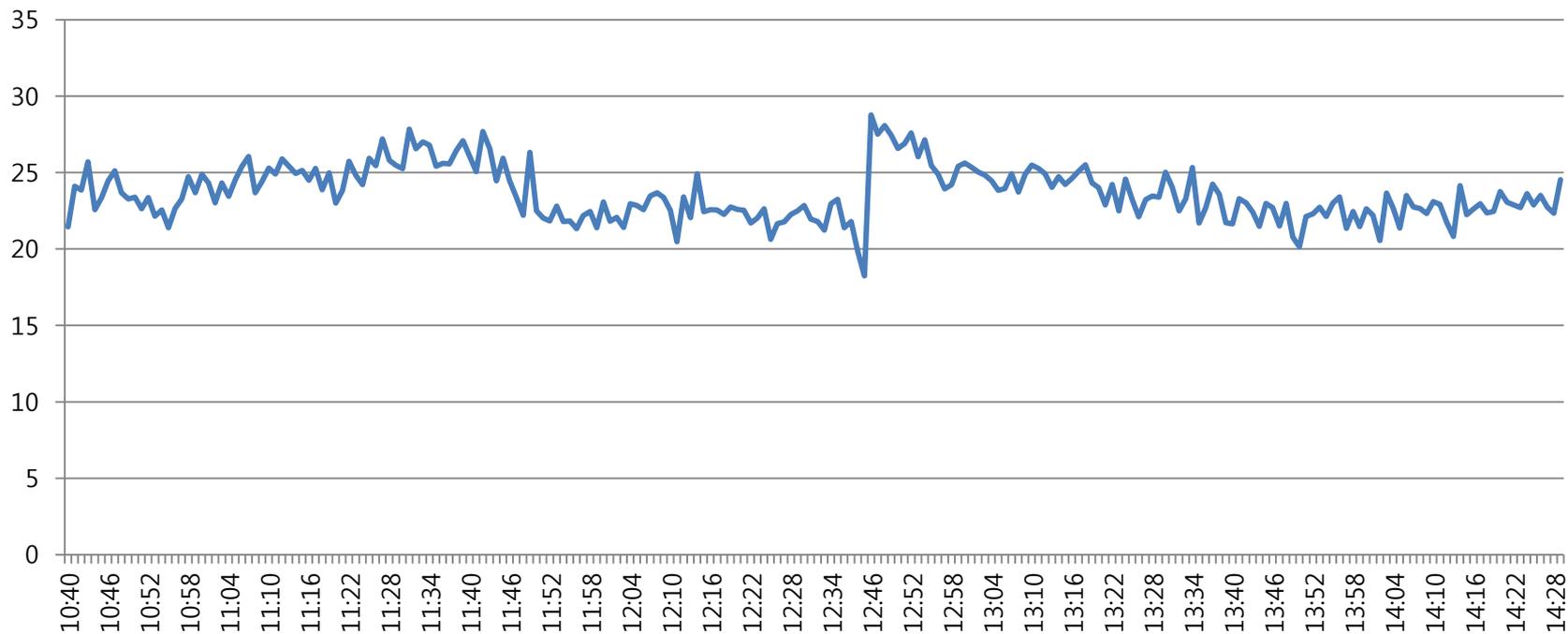
To identify energy loss and breakdowns by measuring loss of high and low temperature heat, insulation conditions of the facilities, and exothermic conditions of the facilities in operation including the electric facilities.



- Ultrasonic flow meter



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

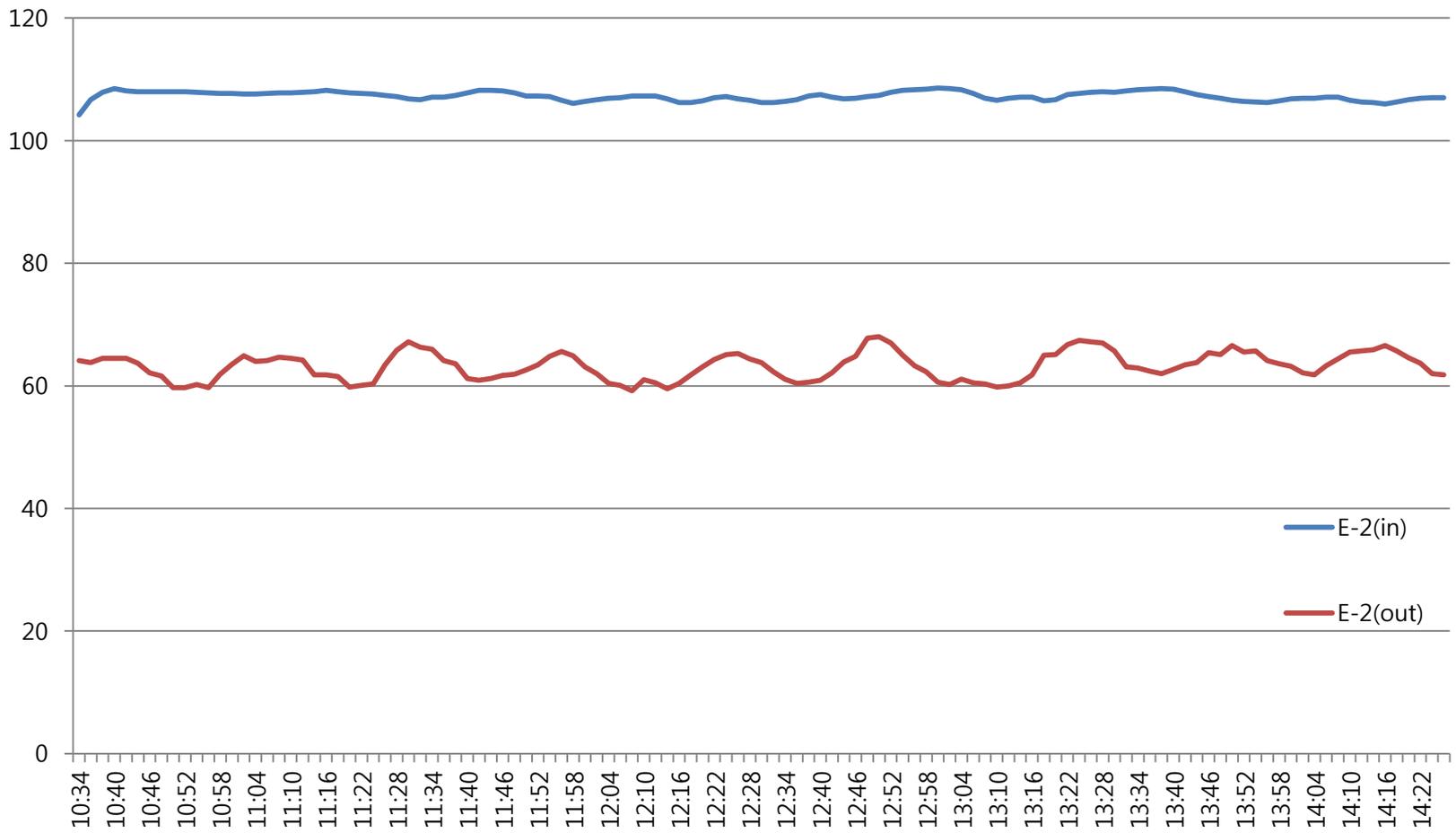


< Flow measurement data(K company) >

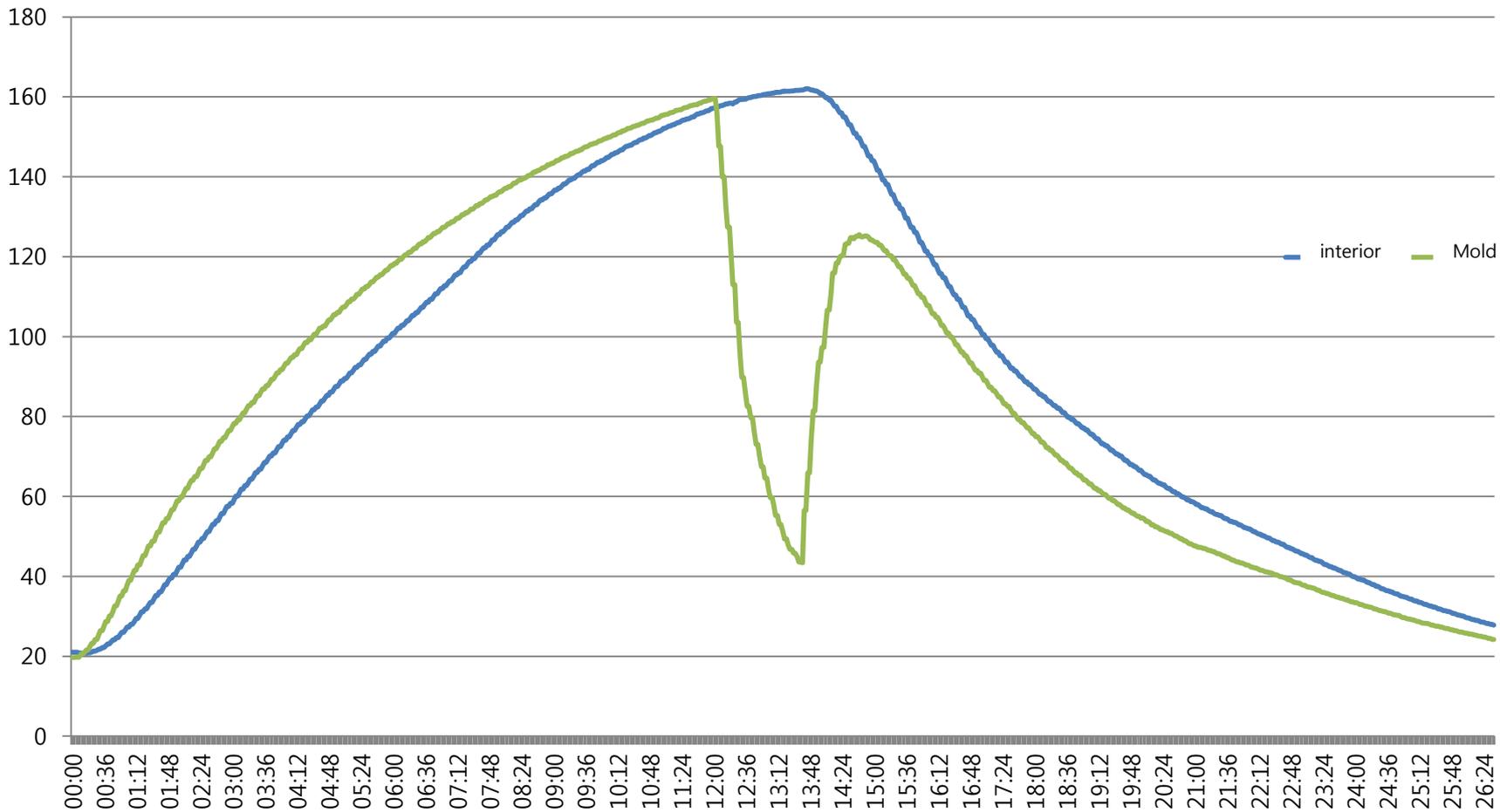
- Multi-functional thermometer



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, NOX , 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 O₂, CO, CO₂, temperature, NOX, and so forth in a ventilation duct in order to check combustion conditions, for example, in boilers.

2.10 11:00 201 (4.5%)

testo 300

- Testo -
" "
"

21.01.03 18:49h

Fuel: NATURALGAS

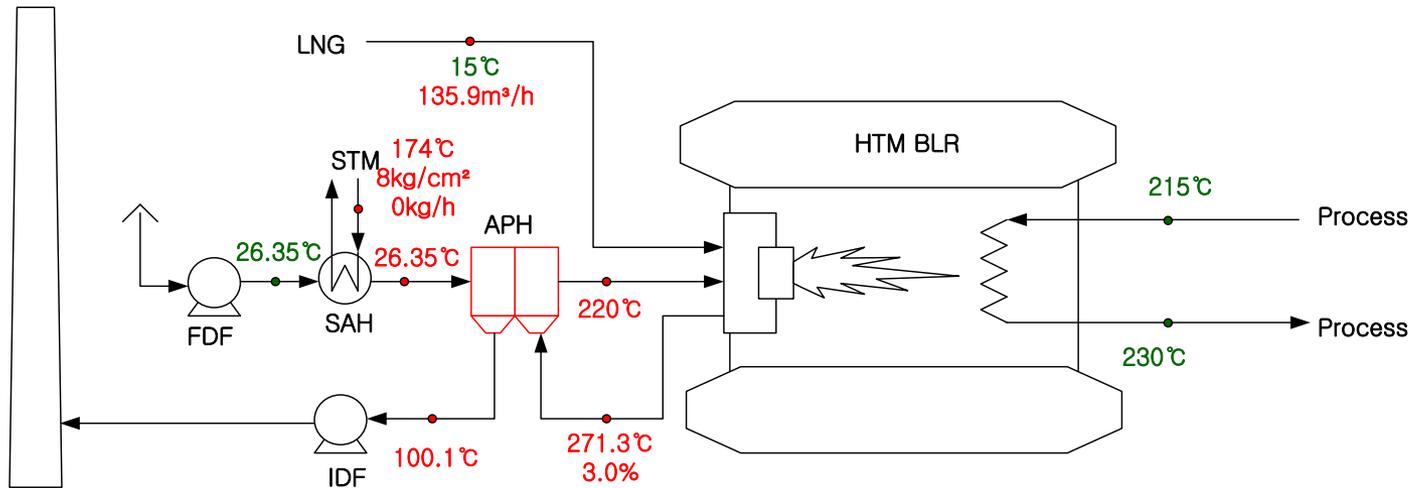
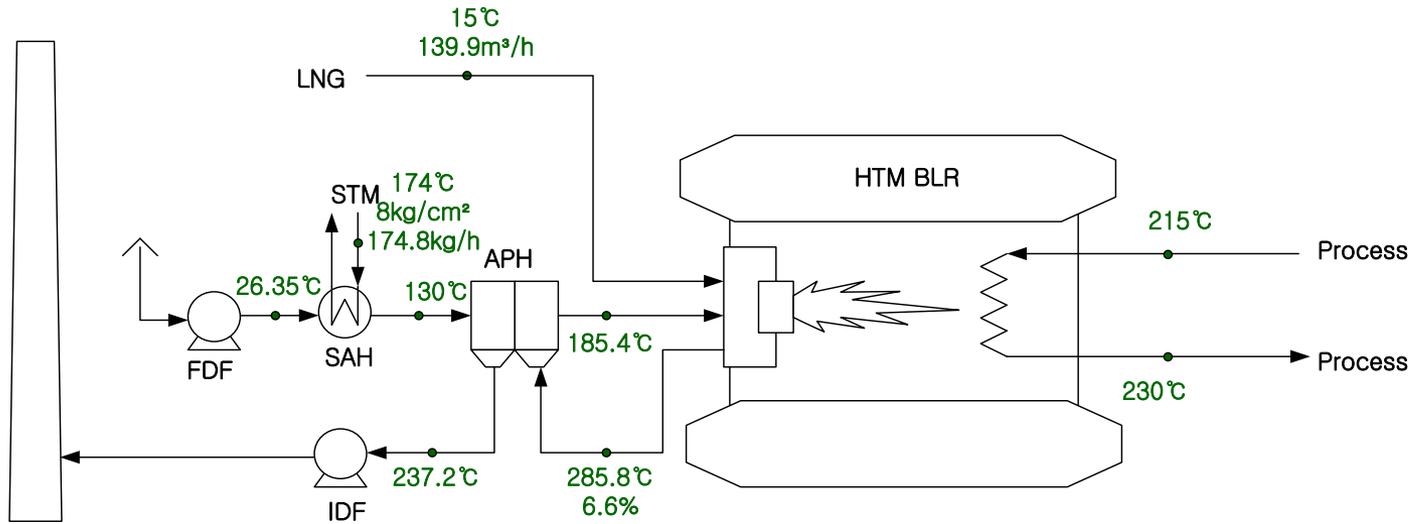
| | |
|-----------|--------------|
| 249.0 °C | FlueGas.Temp |
| 6.6 % | O2 -content |
| 0 ppm | CO -content |
| 8.1 % | CO2 content |
| .0000 | Ratio |
| 78.9 % | EffGross |
| 86.9 % | EffNet |
| 46.2 % | Excess air |
| 0 ppm | CO undil. |
| ----4 ppm | NO -content |
| 99 ppm | NOx content |

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)

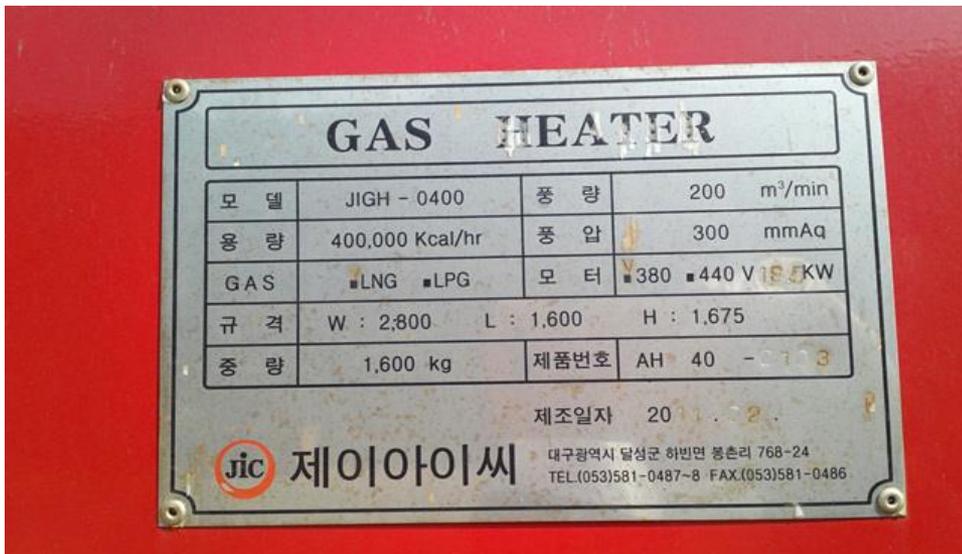
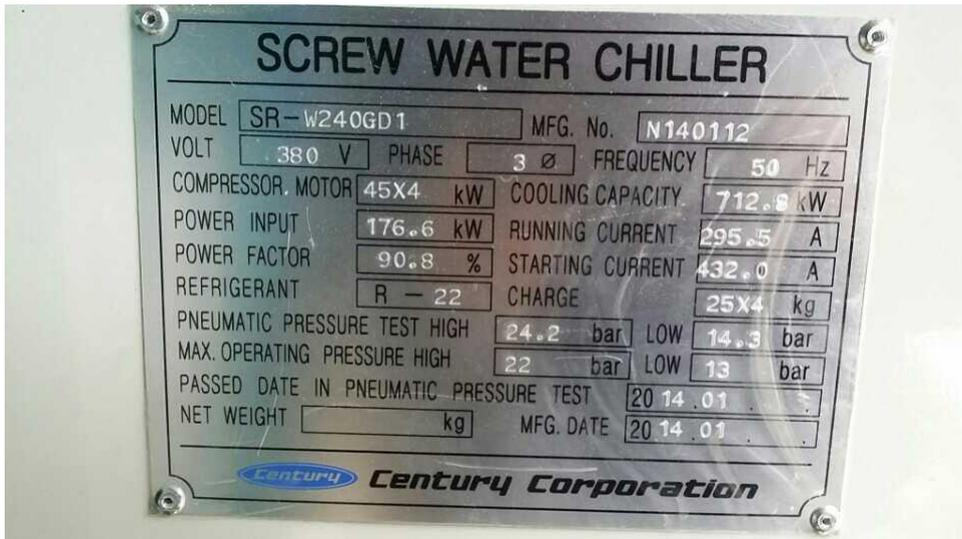
- Wattmeter (NANOVIP/RMS)



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.

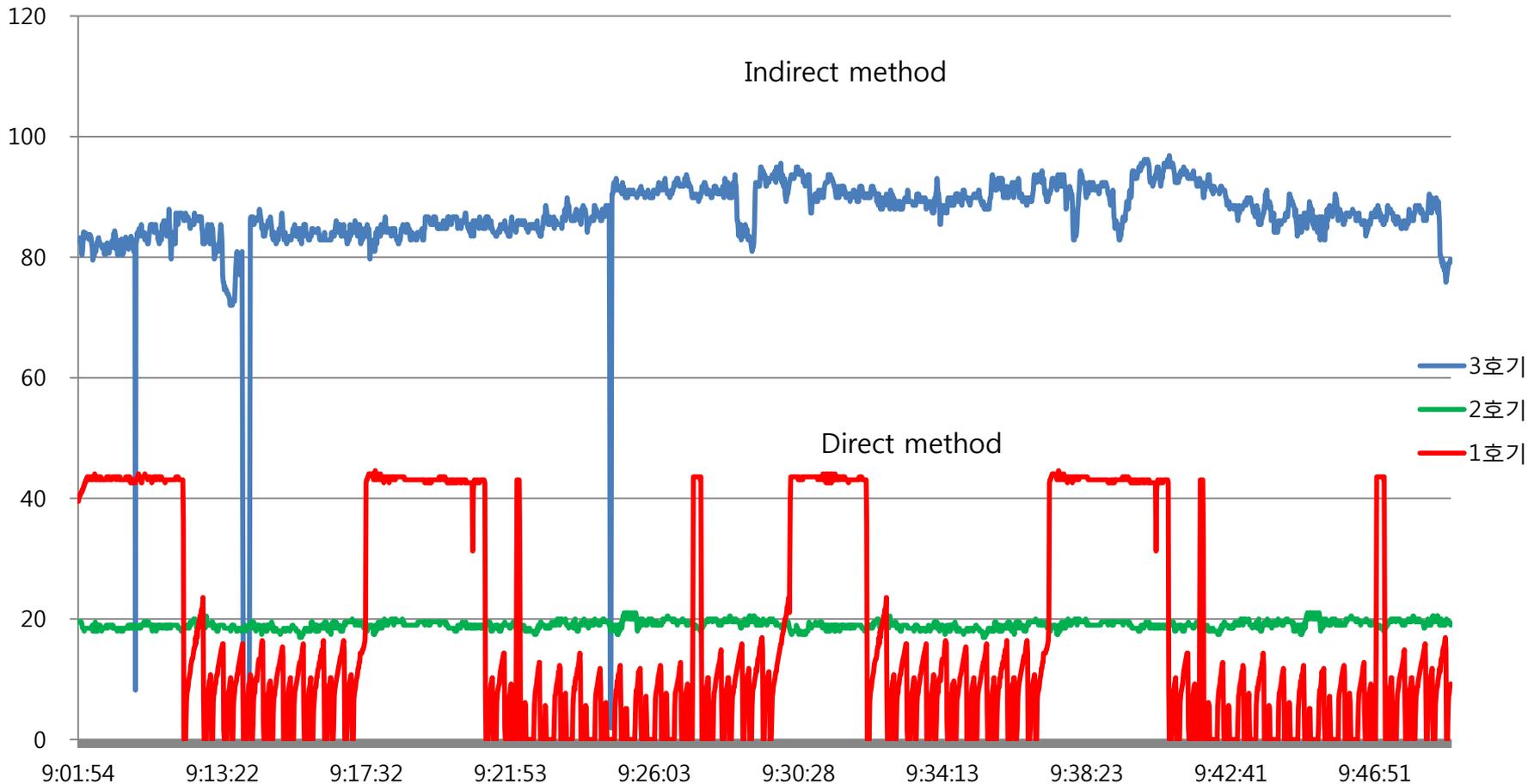


- Power analyzer (AR5)



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"