SECTION F CONTROL & MONITORING

F.1: Treatment, Abatement and Control Systems

Describe the proposed technology and other techniques for preventing or, where this is not possible, reducing emissions from the installation/facility. Details of treatment/abatement systems (air and effluent emissions) should be included, together with appropriately scaled schematics (≤A3) as appropriate.

For each Emission Point identified complete Table F.1 of the Annex, and include detailed descriptions and appropriately scaled schematics (≤A3) of all abatement systems.

Attachment F.1 should contain any supporting information.

Please see Attachment F.1 and Table F.1 in Annex 1 Standard Forms

Attachment F.1
Treatment, Abatement and Control Systems

ATTACHMENT F. 1. - EMISSIONS AND ABATEMENT

To Atmosphere – Flow diagram

The proposed concept comprises two identical waste to energy lines each with separate boilers and flue gas cleaning. The flue gas cleaning system will be a semi-dry type with injection of lime and activated carbon. Subsequent to the semi-dry cleaning is a two-stage wet scrubber system in order to fully meet the requirements in the EU waste incineration directive (2000/76/EEC).

The recommendations of EU's BREF document on waste incineration[6], listing systems which are considered Best Available Techniques, has been implemented throughout the design of the facility.

The two lines will supply steam to one complete turbine/generator set with high-voltage system that will be connected to the electrical grid. Cooling of the exhaust steam from the turbine will take place in a seawater-cooled condenser. The net power output from the facility is expected to be approximately 60 MW electrical.

6 Reference Document on the Best Available Techniques for Waste Incineration

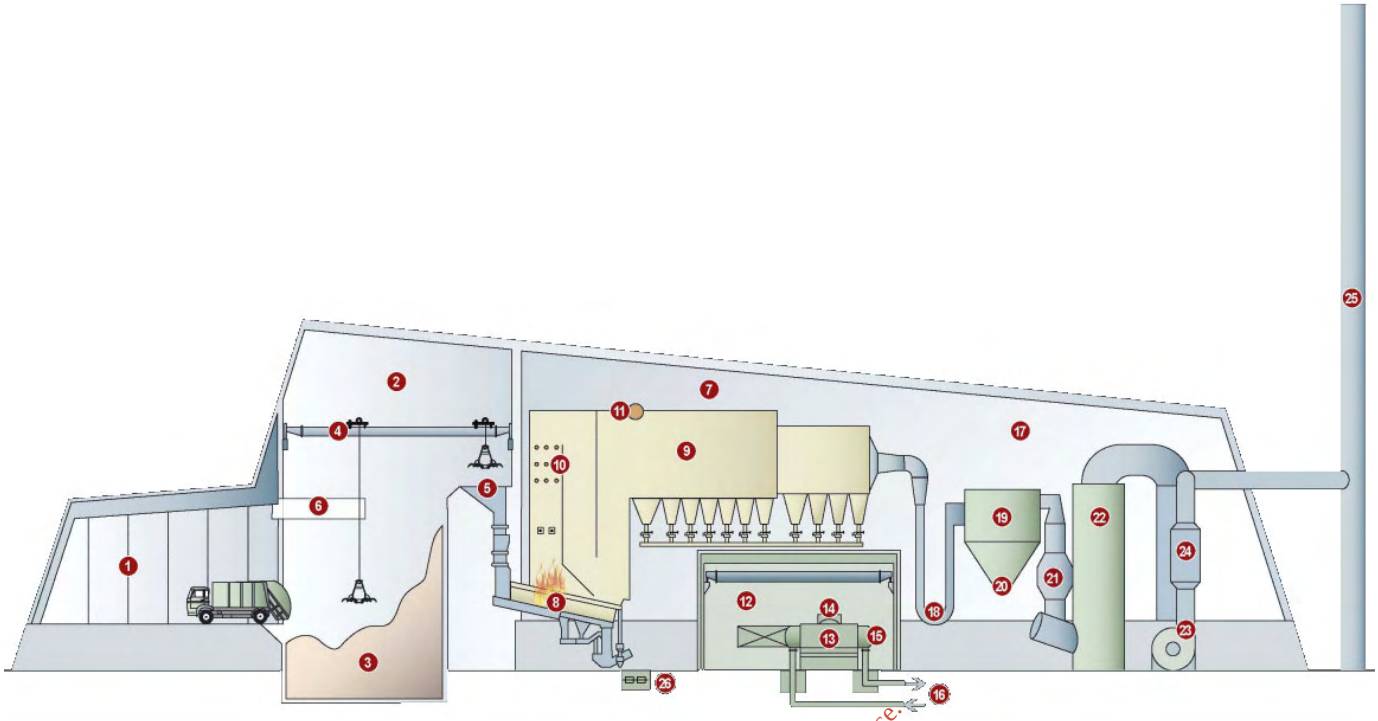


Figure 1: Schematic illustration of the anticipated process

1. Waste reception hall
2. Waste bunker building
3. Waste bunker
4. Waste crane for feeding the boiler grate
5. Waste hopper
6. Control room
7. Boiler building
8. Grate
9. Boiler, where the heat energy is transferred from the flue gas to the boiler water
10. NO_x reduction by spraying ammonia water into the flue gas
11. Boiler drum, where water and steam are separated
12. Turbine building
13. Steam turbine
14. Generator, producing electricity
15. Condensator, where the remaining heat energy in the steam is cooled
16. Cooling system
17. Flue gas cleaning building
18. Activated carbon and lime are added to the flue gas to bind dioxins and other components to the fly ash
19. Fabric filter, where the fly ash is removed from the flue gas
20. Fly ash for deposit
21. Flue gas cooler
22. Two-stage wet scrubber for reduction of HCl, SO2, HF and Hg emissions
23. ID fan
24. Silencer
25. Stack
26. Bottom ash for recycling

The main criteria for the selection and design of the flue gas treatment system have been to secure full compliance with current legislation and thus the requirements of the Waste Incineration Directive 2000/76/EEC. Furthermore, due consideration has been given to the BREF document on waste incineration.

The process will include an active carbon and semi-dry lime scrubbing process followed by particle removal in a fabric filter followed by a two-stage wet scrubbing process. The wet scrubbing process will remove most of the HF, HCl, SO_2 and Hg remaining from the semidry stage. In order to obtain a plant free of wastewater from the flue gas treatment, the small amount of wastewater from the wet process is evaporated in the boiler and subsequently captured by the semi-dry process.

The reduction of dioxin will take place by adding activated carbon to the flue gas prior to the fabric filter, where dioxins and activated carbon will be collected together with the flue gas treatment - residues.

The reduction of NOx from the combustion process will take place in an SNCR process by injecting ammonia water (NH_4OH) or urea into the first pass of the boiler securing compliance with the Waste Incineration Directive 2000/76/EEC.

To Surface water/Sewer

The effluent emissions will include the following water streams:

1. Cooling water discharge to the estuary
2. Storm water discharge to sewer
3. Sanitary water discharge to sewer

Cooling water discharge to the estuary

The cooling water flow and temperature will be monitored at the inlet and outlet. Biocides will be added at the inlet as described in Chapter 12 of the EIS. The biocide flow will be specifically monitored.

For further information regarding cooling water discharge to the estuary please see Chapter 12 of the EIS.

Storm water discharge to sewer

As shown in drawing GD / MQ001 the overflow from the reservoir storage tank will be discharged to sewer.

Sanitary discharge to sewer

As shown in drawing GD / MQ001 the sanitary water will be discharged to sewer.

F.2- F. 9. Monitoring and Sampling Points

Programmes for environmental monitoring should be submitted as part of the application. These programmes should be provided as **Attachments F.2 to F.6** and meet the advice published by the Agency in the relevant BAT Note. For Landfills the additional **Attachments F.7 to F.8** should be completed. Furthermore for a landfill application the applicant must refer to the Agency *Landfill Monitoring Manual (2003)* for further details on monitoring requirements for proposed facilities.

Include details of monitoring/sampling locations and methods.

F.2 Air
- to include Dust, Odour

Monitoring Arrangements specified	**Yes** ☒	**no** ☐	**not applicable** ☐
Monitoring points identified, (plus 12-figure grid references)	**Yes** ☒	**no** ☐	**not applicable** ☐
Attachment included	**Yes** ☒	**no** ☐	**not applicable** ☐

Please see Attachment F2.

Attachment F.2
Monitoring and Sampling Points
Air

ATTACHMENT F.2 - AIR MONITORING AND SAMPLING POINTS

Please see drawing UZT/BE008b in which the following emission points to atmosphere and control/ monitoring points are marked:

A2-1 Waste to Energy line 1, 100-metre stack
A2-2 Waste to Energy line 2, 100-metre stack
A2-3 Emergency Diesel Generator exhaust

The control and monitoring of emissions to air will be done according to the requirements in EU legislation[7], national legislation and according to the requirements of the competent authority.

The Dublin Waste to Energy facility will, by applying the **European Standards EN 14181: 2004** and **EN 13284-2: 2004**, meet the requirements for quality assurance of automated measuring systems:

- EN 14181:2004 describes quality assurance procedures related to Automatic Measuring Systems (AMS) installed to measure stationary source emissions.
- EN 13284-2:2004 describes quality assurance procedures related to Automatic Measuring Systems for the determination of dust in flue gas.

Continuous measurements, spot checks and parallel measurements will be performed at the two stacks allowing independent operation of each of the two waste processing lines:

Continuous measurements will be performed using the Facility's own equipment, where a connecting piece is installed at the stack inside the Facility and the stack is supplied with platforms to enable operating personnel to check the equipment. The system will be designed and constructed in a way that makes it possible to extend the system by additional units and components as well as to modify/optimise the existing system in case more stringent requirements for emissions are introduced in the future.

In accordance with EU Directive 2000/76/EC continuous measurements of the following substances in the flue gas will be performed:

- NOx
- SO2
- CO
- Total organic carbon (TOC)
- HCL
- HF
- Total dust

Continuous measurements of the following process operation parameters will be performed:

- temperature near the inner wall or at another representative point of the combustion chamber as authorised by the competent authority.
- concentration of oxygen, pressure, temperature and water vapour content of the exhaust gas. Please see the attach screen dump from the Elsam Odense Waste to Energy facility.

Periodic measurements/spot checks will be performed by an external accredited analysis and measuring company in order to control the observance of emission values, which are not measured continuously:

- At least two measurements per year of heavy metals (Pb, Cu, Cr, Mn, Ni., As, Cd, Hg, Co).
- One measurement at least every three months will be carried out for the first 12 months of operation.

7 EU Directive 2000/76/EC of 4 December 2000 on the incineration of waste

Parallel measurements will be performed by an external accredited analysis and measuring company in order to control that the equipment is in accordance with the **European Standards EN 14181: 2004** and **EN 13284-2: 2004**.

Emissions monitoring will also include the measurement of dioxin emissions on a fortnightly basis. A monitoring filter will be removed and analysed in an independent laboratory with the subsequent results being representative of dioxin emission concentrations for that period. It should be noted that such monitoring is not a requirement of EU or Irish legislation.

Monitoring Equipment Calibration
All monitoring equipment will be calibrated by facility staff on a monthly basis, as part of the routine planned maintenance system. In addition the equipment will be calibrated annually by an external consultant. There will be a maintenance contract in place with the monitoring equipment suppliers to ensure that if a problem occurs with an item of equipment, it will be remedied as soon as practicable.

Monitoring Equipment Interface with Plant Control System
The readings from the continuous measuring devices will be sent for processing to two separate systems, the plant computerised control system and to the emission registration software system. The plant operators will be able to view the monitoring data on the plant computerised control system, while the plant is in operation. The system will send an alarm when a parameter reaches a preset level, which will be well below the emission limit for the parameter. Corrective actions will be initiated either by the computerised control system or the operator. For example if the NOx level rises the rate of injection of ammonia/urea will be adjusted manually or automatically.

The emission registration software system will be certified by an external body. In the system, the data from monitoring will be stored on hard disk and used to generate hourly, daily, monthly and annual average results, as appropriate.

Dioxin and Furan Monitoring
A volume stream will be extracted isokinetically from the flue gases. Dioxins and furans will be collected on a cartridge filled with adsorbent resins. The samples will be sent for analysis to an accredited laboratory. Results for the PCDD/PCDF analysis will be presented as individual 2,3,7,8-containing congener concentrations, total homologue (tetra- to octa-) concentrations and I-TEQ values.

Focus on dust measurement
According to EU Directive 2000/76/EC on waste incineration, it is only required to measure “total dust”, which means PM10: dust particles smaller than 10µm.

Nevertheless, periodic measurements of ultra fine particles emissions (< $PM_{2.5}$) from municipal solid waste incineration are proposed. The dust samples will be filtered out in fractions down to 1µm. All measurements will be performed in accordance with EN 13284-2: 2004 (quality assurance procedures related to Automatic Measuring Systems for the determination of dust in flue gas).

Odour
All waste will be stored in the waste bunker which will be operated under a negative air pressure system therefore there will be no odour emissions from the Facility.

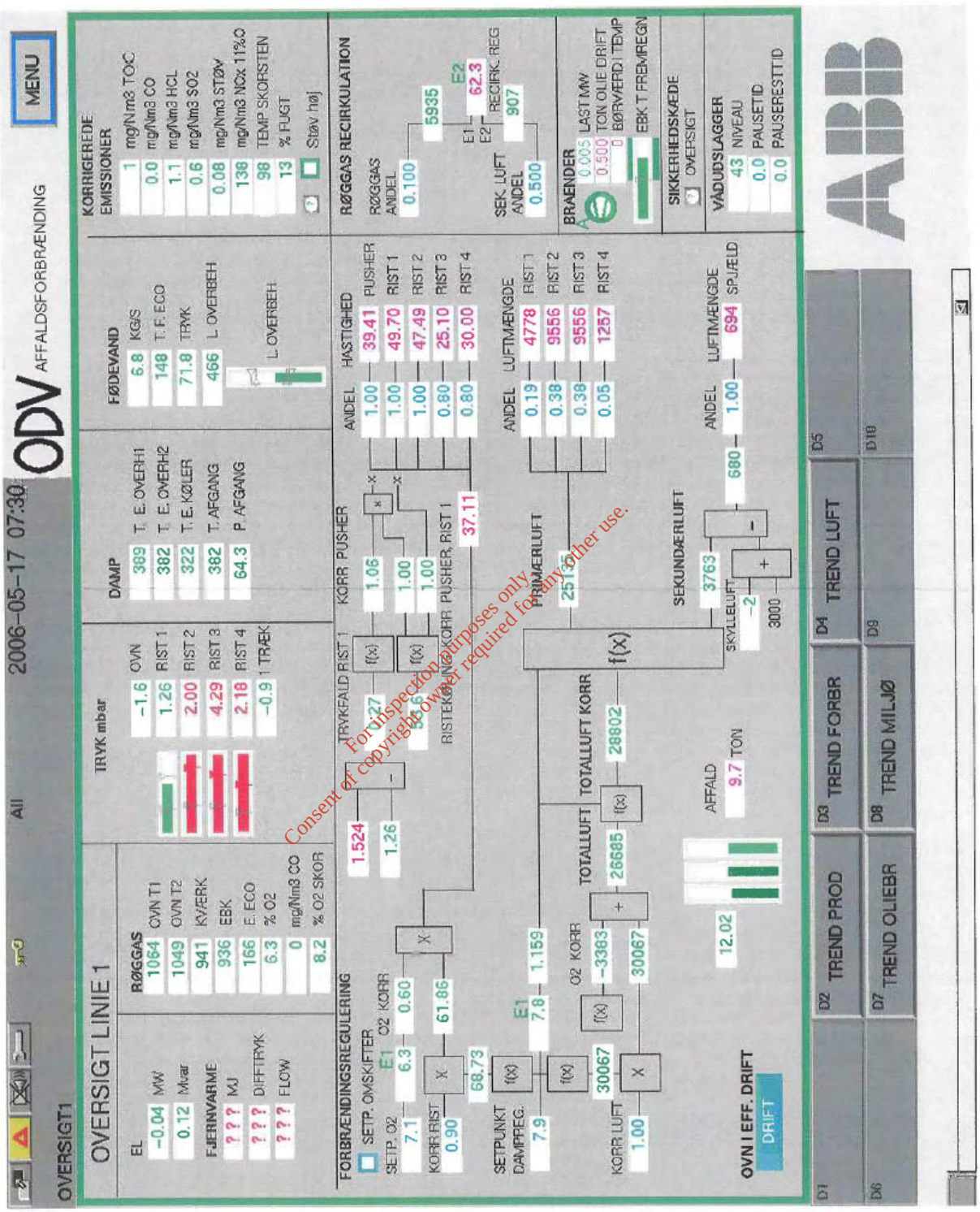
The size of the entrances to the waste reception is limited and the combustion air will be taken from the waste storage area. This reduces the risk of odour releases and ensures that fugitive emissions will be destroyed in the incinerator rather than released.

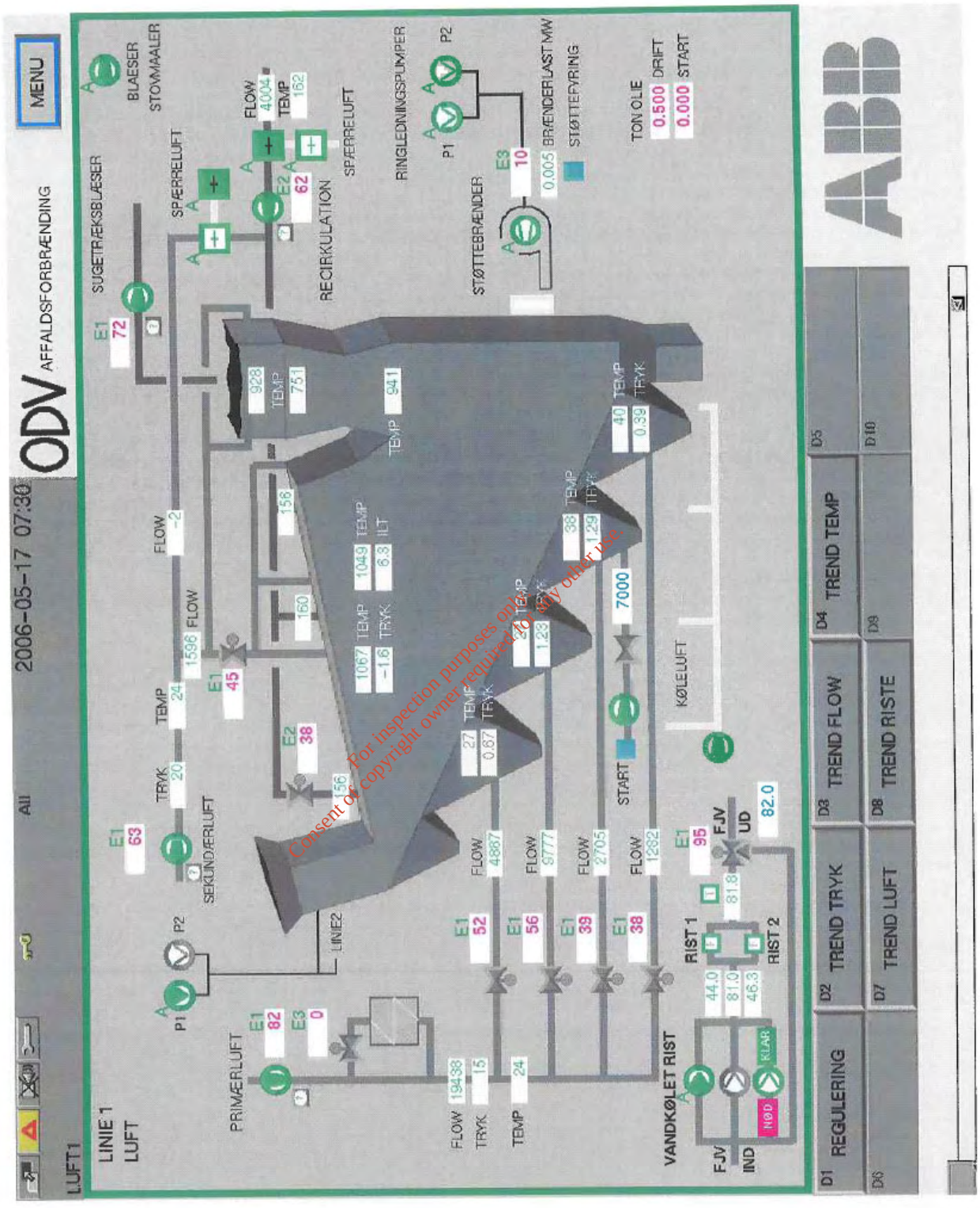
List of Terms

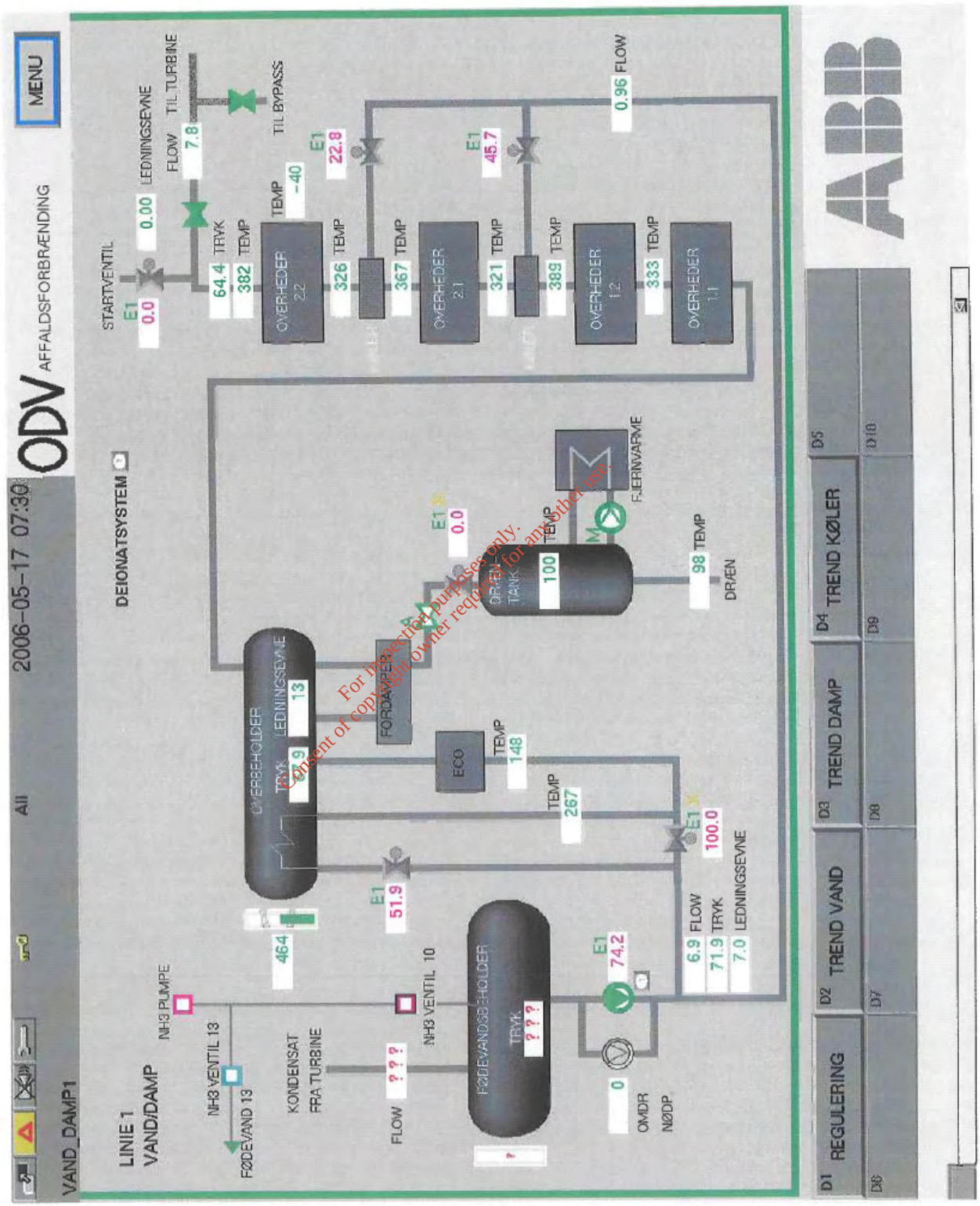
Danish term	English term
AC oliepumpe	AC oil pump
Afkøling	Cooling
AFLUFT. Filter	Ventilation filter
Aske-anlæg	Ash plant
Asketransport	Ash transport
Atmosfære	Atmosphere
Bankeværk	Beater
Begrænser	Limiter
Belastningsfaktor	Load factor
Big bag	Big bag
Blæser	Fan
Brænder	Burner
Brænderlast MW	Burner load MW
Buffertank	Buffer tank
Bulderhus	Sound hood
Bypass ej klar	By pass not ready
Bypass fjernvarmeregulering	By pass district heating control
By-pass system	By pass system
By-pass veksler	By pass exchanger
Børværdi	Set point value
COS PHI	Power factor (PF)
Damp	Steam
Dampsystem	Steam system
Deionatsystem	Deionate system
Demistorspuling	Demistor cleaning
DIFF. TEMP FLANGE	Differential temperature at flangeconnection
Dioxinfilter	Dioxin filter
Drift	Operation
Dræn	Drain pipe
Dræntank	Drain tank
Effekt børværdi	Output set point value
El	Electricity
Elfilter	Electricity filter
Evakuering	Evacuation
Filteraske	Filter ash
Fjernvarme	District heating
Fjernvarme temperatur	District heating temperature
Fjernvarmeveksler	District heating exchanger
Flyveaskesilo	Fly ash silo
Flyveaske	Fly ash
Flyveaskebuffer	Fly ash buffer
Forbrændingsregulering	Combustion control
Fordamper	Evaporator
Frigive	Extract
Fødevand	Feed water
Fødevandsbeholder	Feed water tank
Generator	Generator
Grov sep.	Coarse Separator
Hjælpeudstyr	Auxiliary equipment
HT-Damp	HP steam
Indsprøjtnings reg.	Injection control
Induktiv	Inductive
Instrumentluft	Instrument air

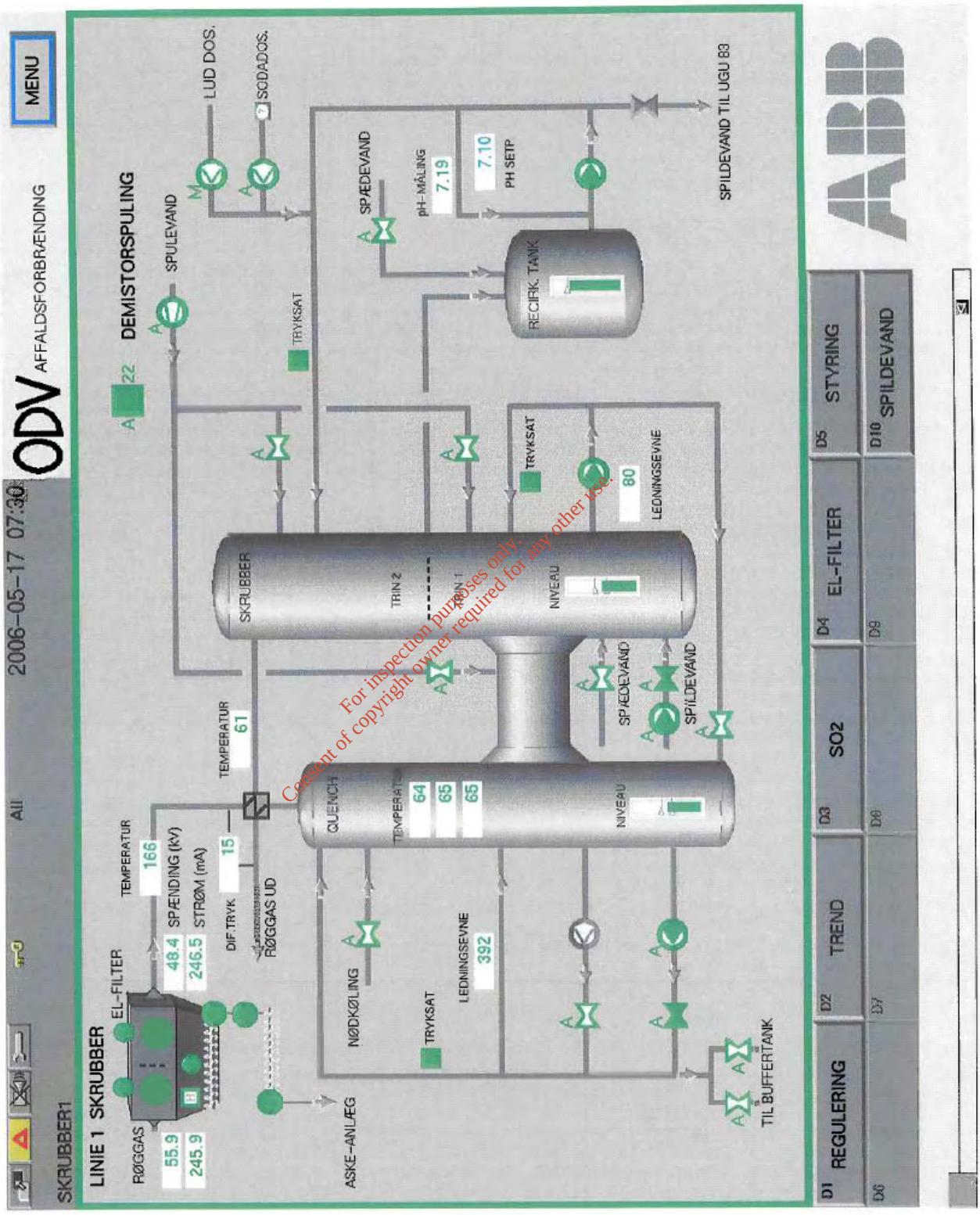
Kedel	Boiler
Kedelaske	Boiler ash
Knuser	Crusher
Kondensat	Condensate
Kondensat fra turbine	Turbine condensate
Kondensatfilter	Condensate filter
Korr pusher	Pusher
Korrigerede emissioner	Adjusted emissions
Kvitterer turbine trip	Release turbine trip
Kvitterer bypass trip	Release by pass trip
Køleluft	Cooling air
Kølevand	Cooling water
Ledningsevne	Conductivity
Lejetemperatur	Bearing temperature
Linie 1	Line 1
Lokalbetjening af turbine	Local control of turbine
LUD DOS.	Lye dosing
Luft	Air
Luftmængde	Air volume
MAG SPÆND	Excitation voltage
MAG STRØM	Excitation current
Magnetisering	Excitation
MODBUS	MODBUS
Modtage	Receive
MUEM	MUEM
Nedkøling	Cooling
Net	Net
NH3 pumpe	NH3 pump
NH3 ventil	NH3 valve
Niveau	Level
Nød oliepumpe inde	Emergency oil pump activated
Olie separator fejl	Oil separator defect
Oliefilter	Oil filter
Olietemperatur	Oil temperature
Olievarme	Oil heating
OMDR børværdi	Rev. set point value
OMDR nødpumpe	Rev. emergency pump
Opvarmning	Heating
Overbeholder	Top tank
Overheder	Super heater
Oversigt	Summary
OVN I EFF. DRIFT	Furnace in efficient operation
Pause-resttid	Remaining standby time
Pausetid	Standby time
pH-måling	PH metering
Posefilter	Filter bag
Primærluft	Primary air
Quench	Quench
Recirkulation	Re-circulation
Recirkulationstank	Re-circulation tank
Renseautomatik	Cleaning system
Ringledningspumper	Supply pumps
Ristekøling	Grid cooling
Røggas	Flue gas
Røggas recirkulation	Flue gas re-circulation
Sekundærluft	Secondary air
Sende	Send
Sendebeholder	Storage tank

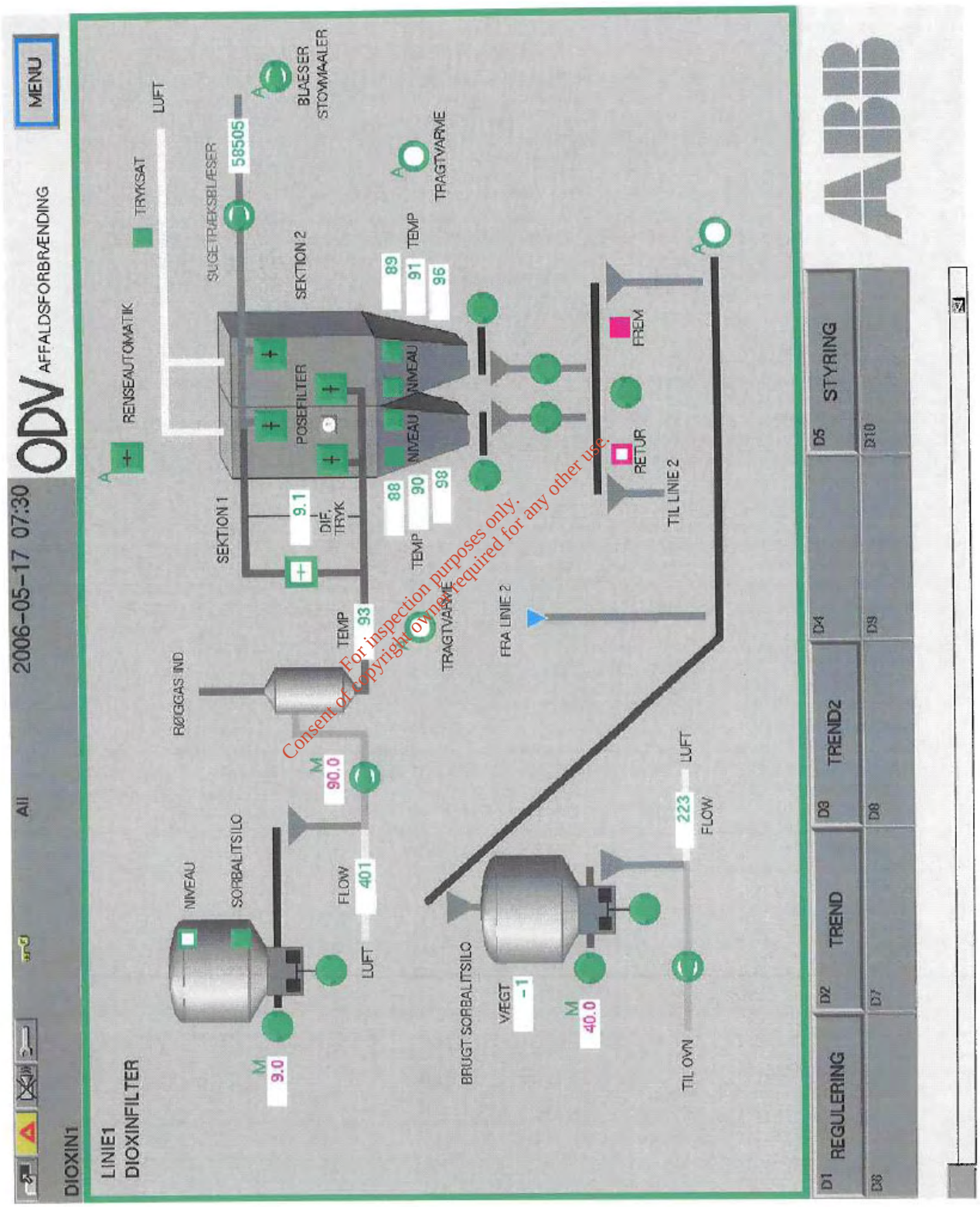
Setpunkt (Setp.) Omskifter	Set point reverser
Sikkerhedskæde	Safety chain
Skrubber	Scrubber
Skylleluft	scavenging air
SLD	SLD
Smøreolie test	Lubricant oil test
SODADOS.	Soda dosing
Sorbalit-silo	Sorbalit silo
Spildevand	Wastewater
Spjæld	Damper
Spulevand	Flushing water
Spædevand	Additional water
Spænding	Voltage
Spærredamp	Sealing steam
Spærreluft	Sealing air
Start	Start
Startventil	Starting valve
Strøm	Current
Styreolie	Control fluid
Styreolie beskyttelsesblok	Control fluid protective device
Styreolie test	Control fluid test
Styreoliefilter	Control fluid filter
Støttebrænder	Auxiliary burner
Støttefyring	Auxiliary firing
Støvmåler	Dust monitoring
Sugetræksblæser	Induced draught fan
TEMP. Ventilhus	Valve housing
Til bypass	To by pass
Til turbine	To turbine
Tragtvarme	Funnel heat
Trin 1	Step 1
Trin 2	Step 2
Trip	Trip
Tryk børværdi	Pressure
Tryk mbar	Pressure mbar
Tryksat	Pressurised
Turbine	Turbine
Turbineudtag	Turbine tap
Tørring ej i auto	Drying not in auto mode
Tørring ej inde	Drying not activated
Vand/damp	Water/Steam
Vandbehandling	Water treatment
Vandkølet rist	Water-cooled grate
Varme	Heat
Vibration	Vibration
Vægt	Weight
Vådudslagger	Wet bottom ash extraction

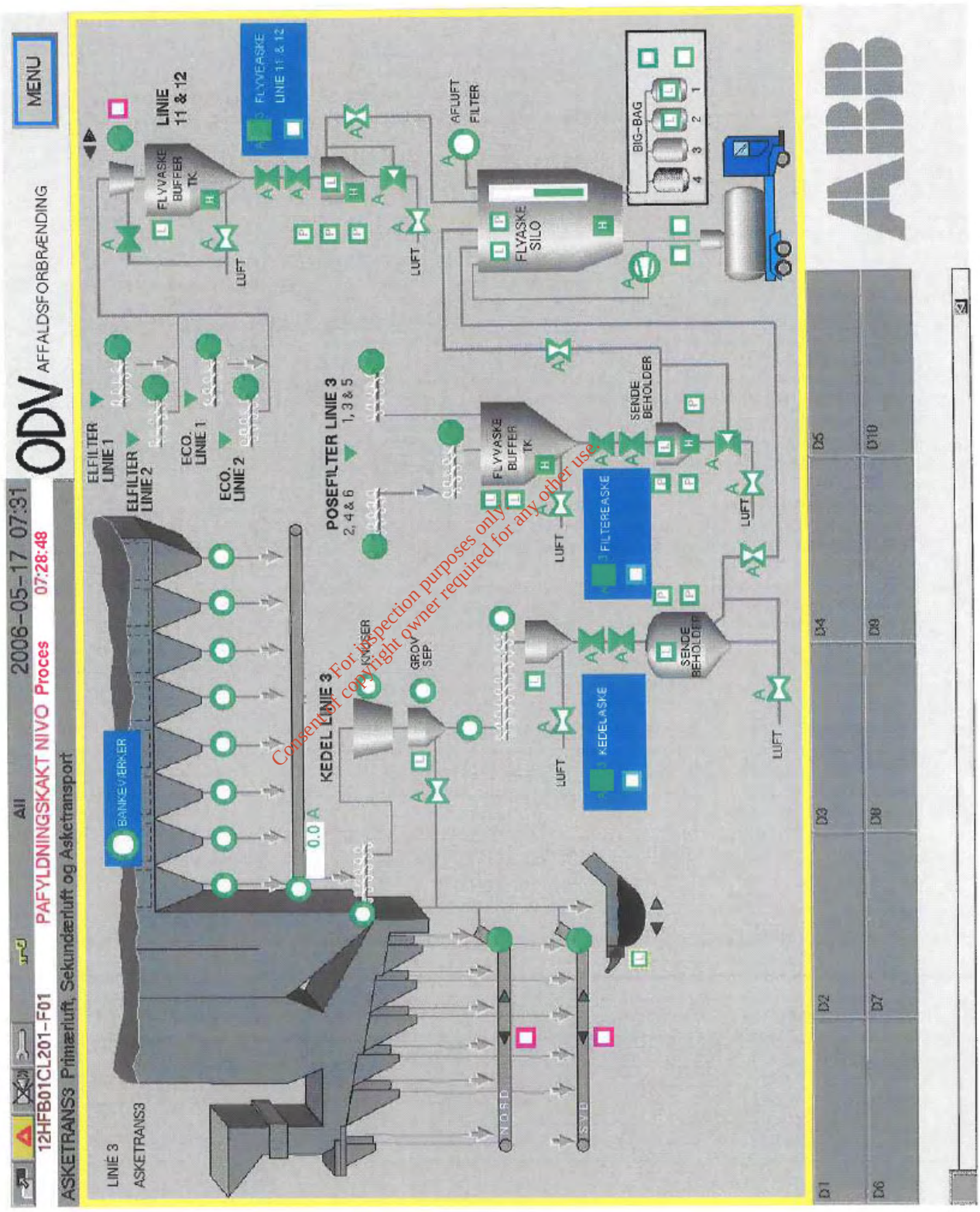


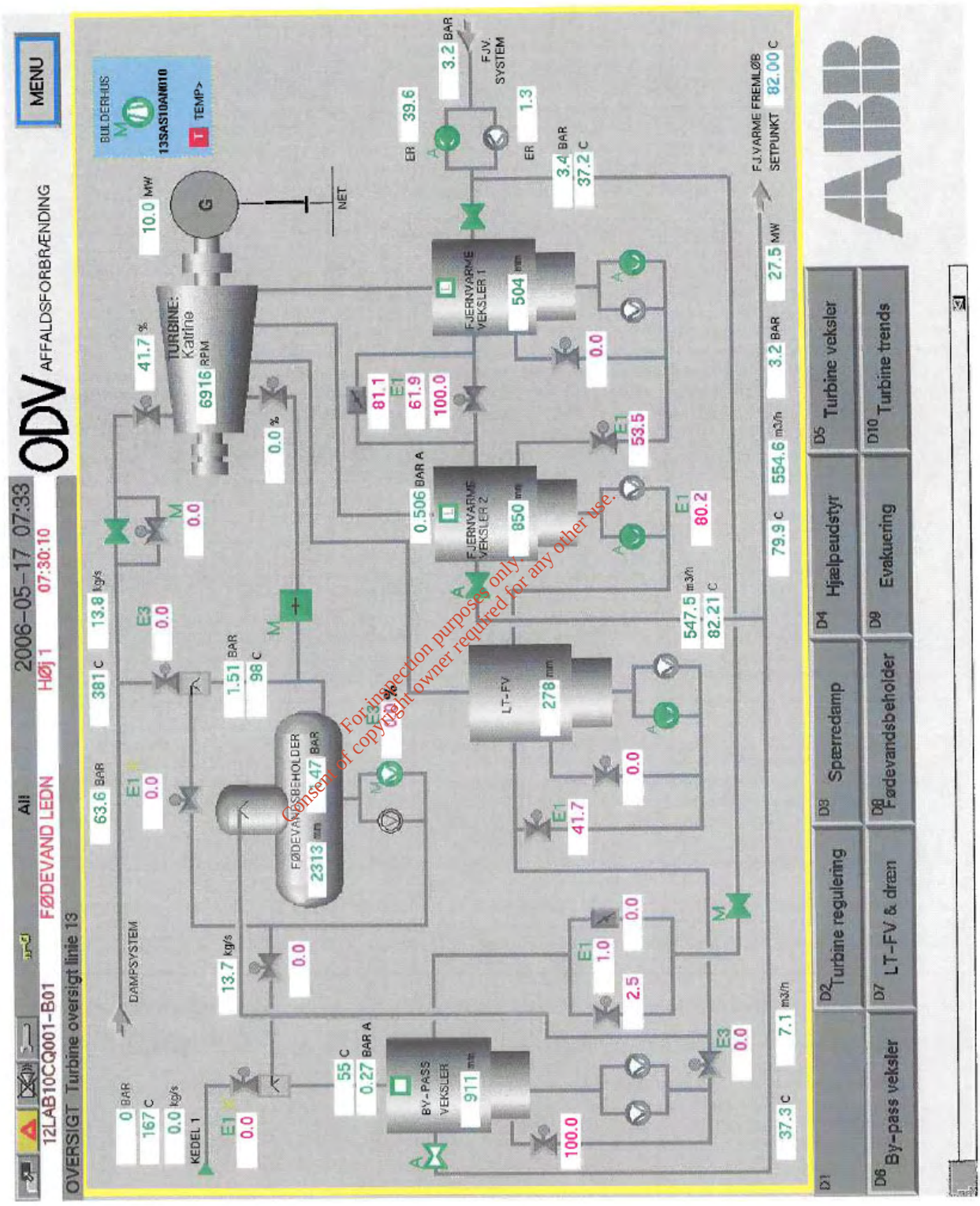


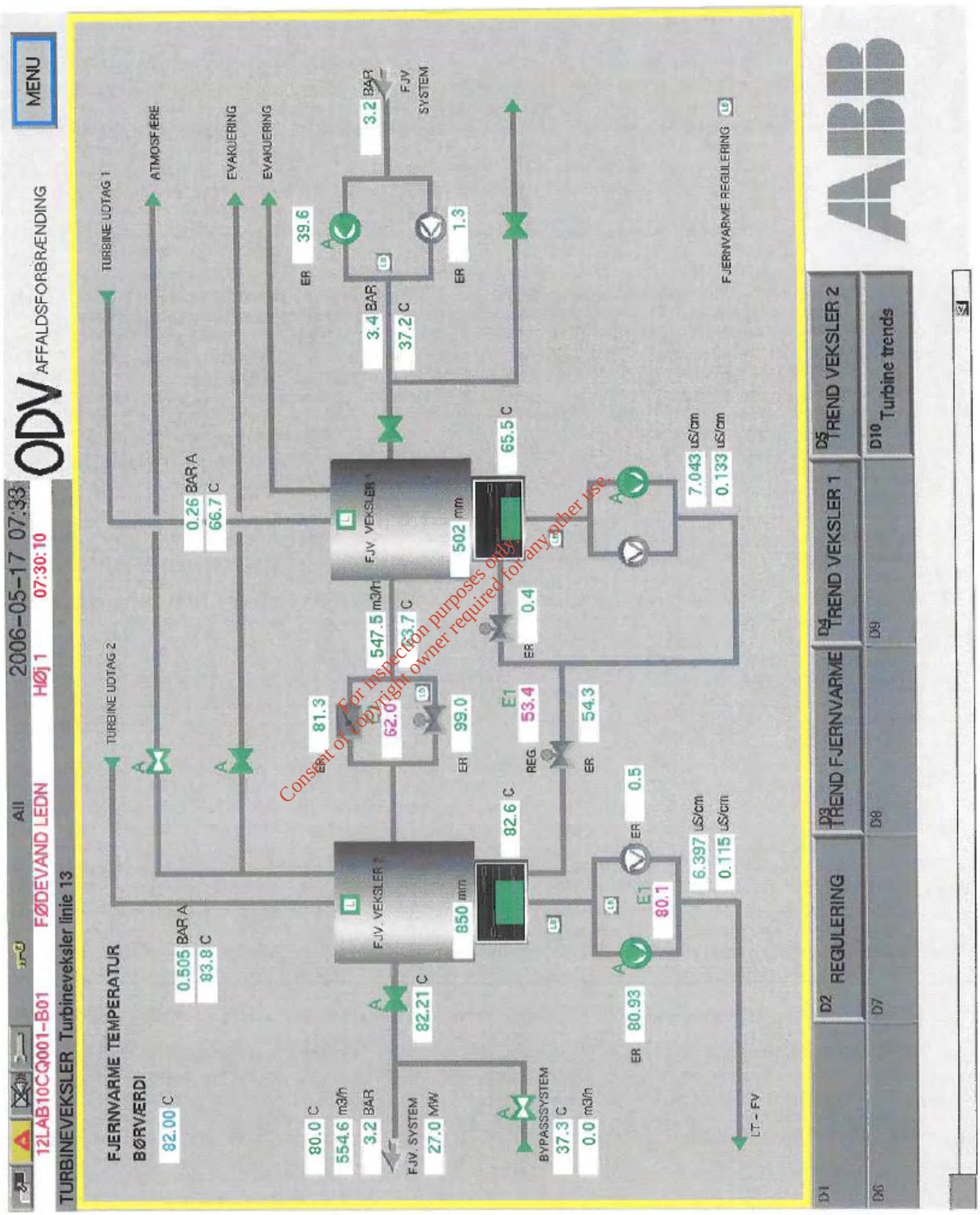


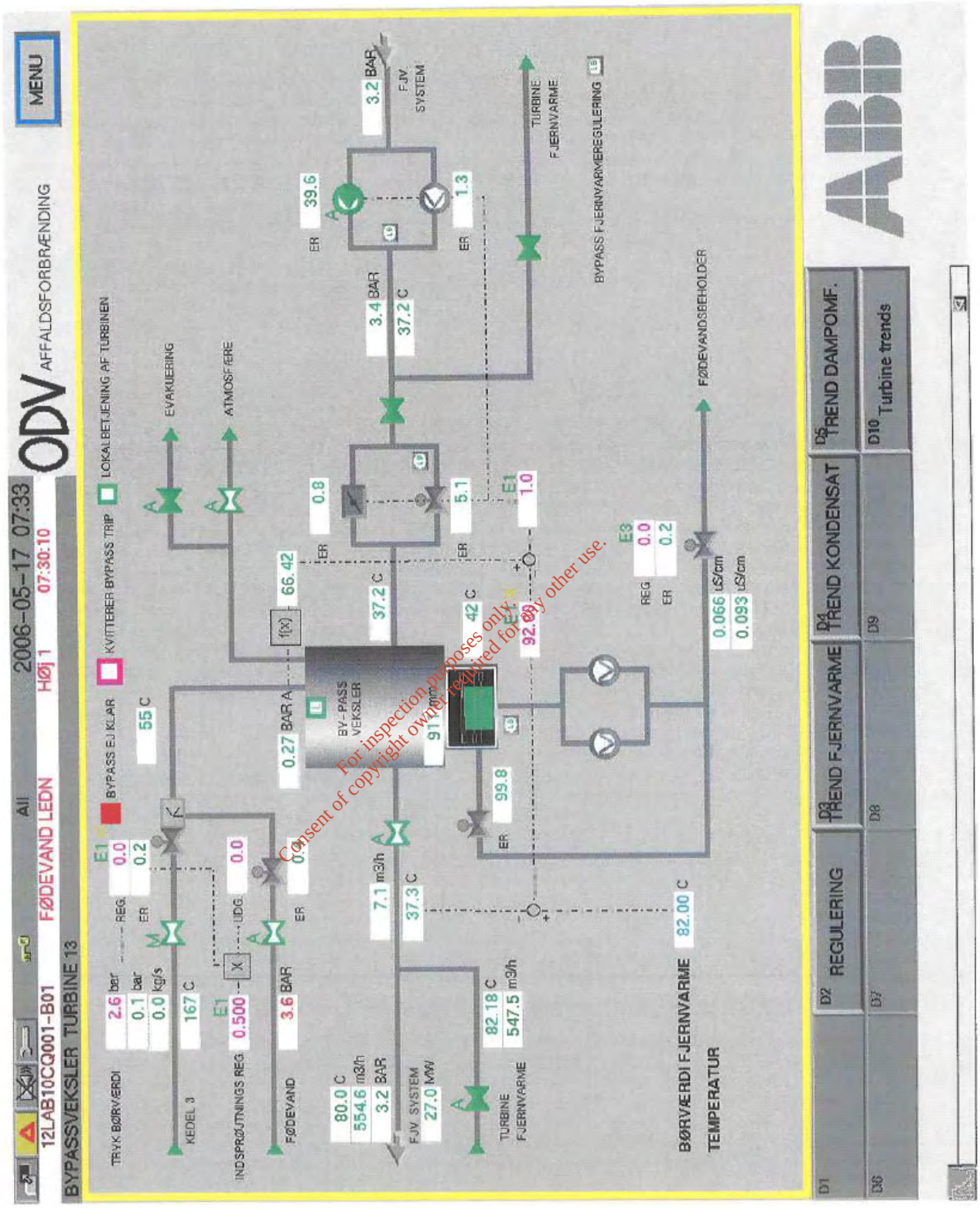


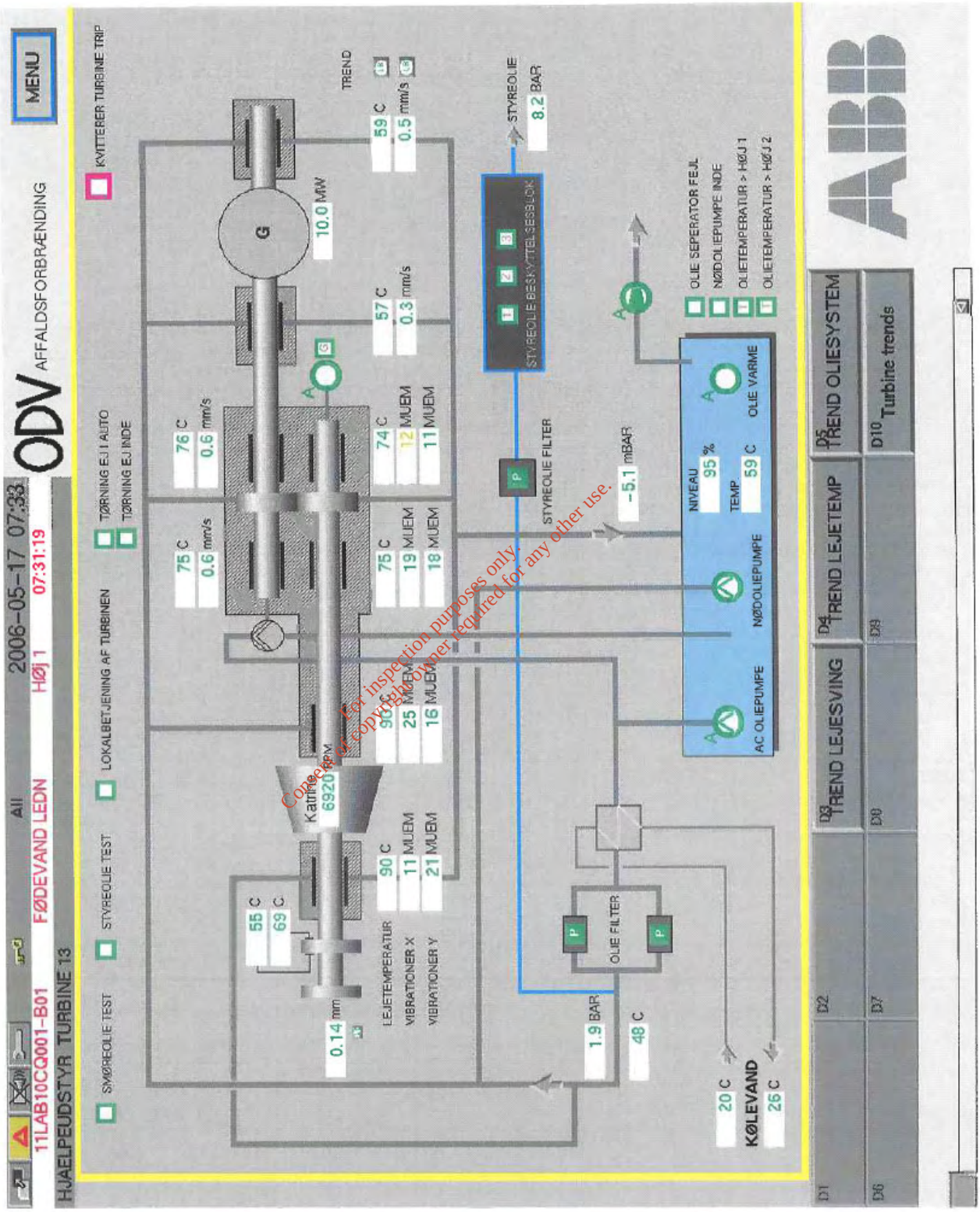


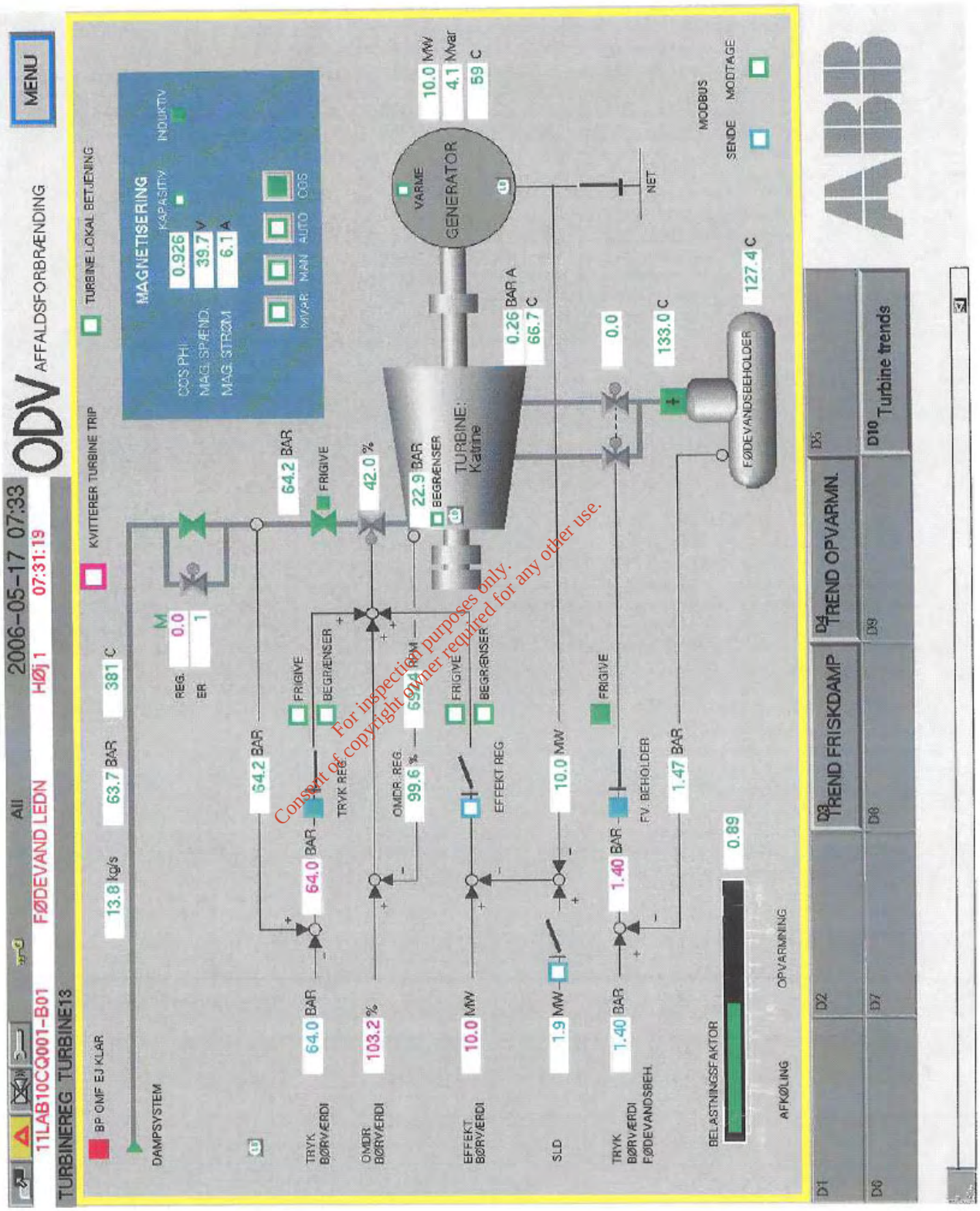


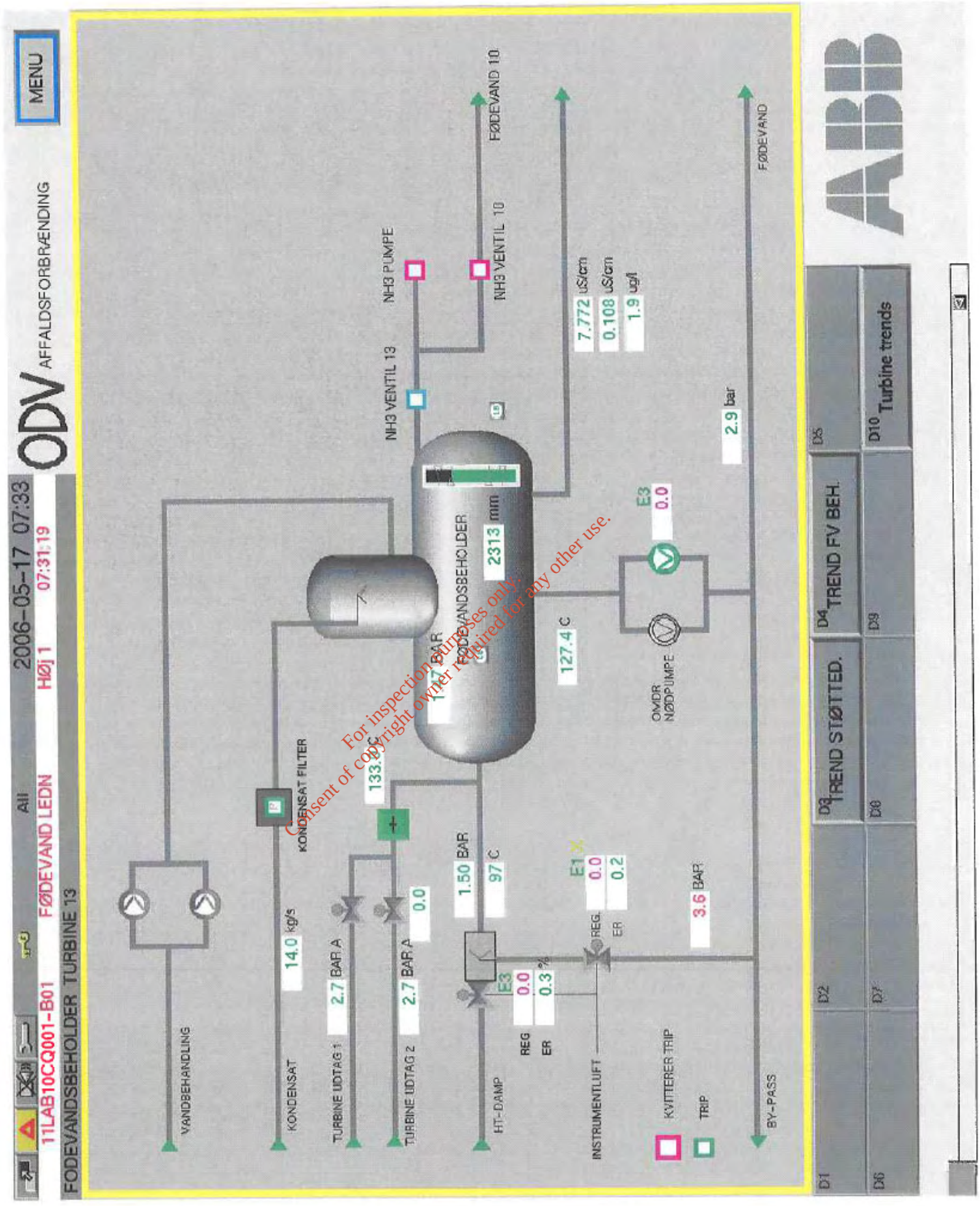


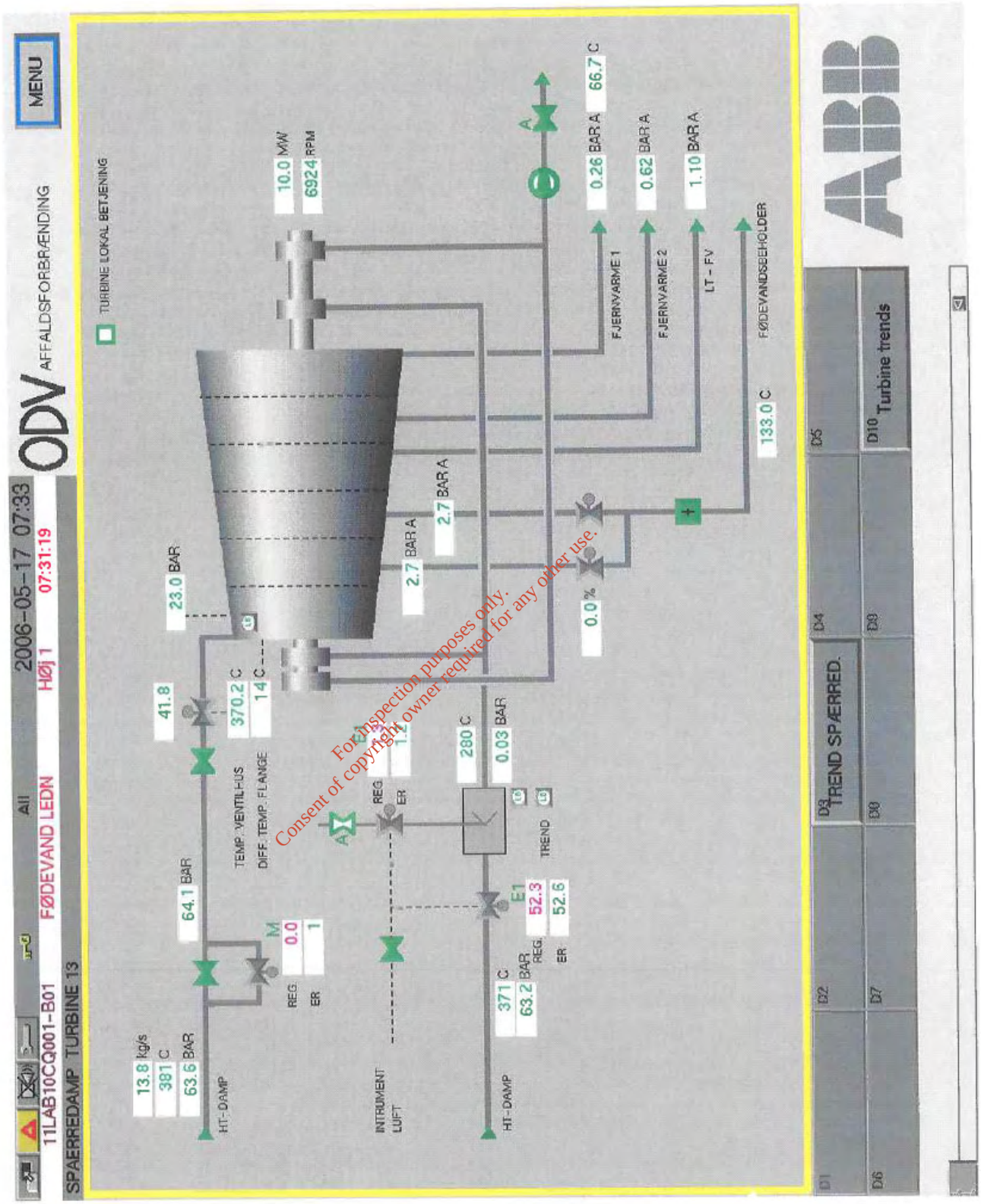












F.3 Surface Water

Monitoring of surface water shall be carried out at not less than two points, one upstream from the waste facility and one downstream.

Monitoring Arrangements specified	**yes** ☒	**no** ☐	**not applicable** ☐
Monitoring points identified, (plus 12-figure grid references)	**yes** ☒	**no** ☐	**not applicable** ☐
Attachment included	**yes** ☒	**no** ☐	**not applicable** ☐

Please see Attachment F3 and Drawing UZT/ BE008.

Attachment F.3
Monitoring and Sampling Points
Surface Water

ATTACHMENT F.3 - SURFACE WATER - MONITORING AND SAMPLING POINTS

Control and monitoring of surface water emissions will be performed in accordance with the requirements of EU legislation (EU Waste Incineration Directive 2000/76/EC), of national legislation and in accordance with the requirements of the Agency. The European Standard for Stationary source emissions – Quality assurance of automated measuring systems (EN 14181 of June 2004) will be used for monitoring.

At the Dublin Waste to Energy facility there will be a number of different surface water systems:

1. All *clean* surface water (rainwater) from the roof drainage system and from the hardstanding outside areas (access roads, paved areas) will be collected separately into the technical water tank for use in the process. There will be an overflow to the combined sewer in Pigeon House Road. This will be a discharge to sewer and is addressed in F4. The overflow to the sewer will go through an oil separator and silt trap. Any water going to the sewer from the tank will be monitored continuously for pH and total organic carbon (TOC).

2. The Facility is designed with seawater cooling. Monitoring and control of this cooling water system will be performed at three points:

    - At the cooling water intake (pump house) at River Liffey
    - At the condenser next to the turbine and at the discharge point. Please see drawing UZT/ BE009: emission point SW1 and M-SW1.

    Control and measurement will be carried out continuously for the parameters:
    - temperature difference
    - volume (only necessary at one point, A)
    - intake velocity

3. All surface water from the internal operations such as wash water at the waste reception hall, drainage water from the boiler and turbine, bottom ash cooling and wash water will be recycled in a closed process system. There will be no emissions from this system.

No emission monitoring is planned of the closed water process system. Internal monitoring will however be carried out. In this relation please see Attachment F.2 containing example screen dumps from the SCADA system at the Elsam Odense Waste to Energy facility.

F.4 Sewer Discharge

Monitoring of sewer discharge shall be carried out at the point specified by the local authority/Agency.

Monitoring Arrangements specified	**yes** ☐	**no** ☒	**not applicable** ☐
Monitoring points identified, (plus 12-figure grid references)	**yes** ☐	**no** ☒	**not applicable** ☐
Attachment included	**yes** ☐	**no** ☒	**not applicable** ☐

Monitoring of sewer discharge will be carried out at locations specified by Dublin City Council Drainage Division and/or the Agency.

F.5 Groundwater

Groundwater monitoring is required at all landfill facilities; and certain other waste facilities depending on waste activities and the underlying aquifer vulnerability.

Monitoring Arrangements specified	**yes** ☒	**no** ☐	**not applicable**
Monitoring points identified, (plus 12-figure grid references)	**yes** ☐	**no** ☒	**not applicable**
Attachment included	**yes** ☐	**no** ☒	**not applicable**

There will be no emission to the ground or direct discharge to groundwater from the facility. Nevertheless, it is proposed to monitor the quality of groundwater in the vicinity of the site on an annual basis.

Following the completion of major site works and the establishment of new groundwater flow directions groundwater wells will be installed at locations to be agreed with Agency. Monitoring wells will be installed upstream and downstream of the main process activities on site. Due to the present site location, it is expected that four monitoring wells will be required.

F.6 Noise

It is proposed to conduct annual noise monitoring and calculations at the Facility in accordance with BS4142:1997. It is proposed to conduct noise monitoring at locations NI01 to NI10. Refer to figure in Section E5 for noise monitoring locations.

Monitoring Arrangements specified	**yes** ☒	**no** ☐	**not applicable** ☐
Monitoring points identified, (plus 12-figure grid references)	**yes** ☒	**no** ☐	**not applicable** ☐
Attachment included	**yes** ☐	**no** ☒	**not applicable** ☐

F.7 Meteorological Data

Monitoring Arrangements specified	**yes** ☒	**no** ☐	**not applicable** ☐
Monitoring points identified, (plus 12-figure grid references)	**yes** ☒	**no** ☐	**not applicable** ☐
Attachment included	**yes** ☐	**no** ☒	**not applicable** ☐

Meteorological monitoring will be carried out by collecting data for the following parameters:

Temperature (min/ max.) - daily
Wind Speed and Direction - continuous
Atmospheric pressure - continuous

The monitoring location is to be agreed with the Agency, please see interim location on drawing UZT/ BE008: AA-1 Weather station.

Application for Landfills require the additional Attachments F.7 to F.8, to be completed:

F.8 Leachate

Monitoring Arrangements specified	**yes** ☐	**no** ☐	**not applicable** ☒
Monitoring points identified, (plus 12-figure grid references)	**yes** ☐	**no** ☐	**not applicable** ☒
Attachment included	**yes** ☐	**no** ☐	**not applicable** ☒

F.9 Landfill Gas

Complete each of the following tables to show whether information has been included on aspects of landfill gas monitoring. **Attachment F.9** should also contain information to show whether the data given in Tables F.9.(a) and F.9(b) below represents actual or anticipated data. Complete Table F.9 as follows:

Not Applicable