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RECIRCULATION FILTER DESIGN FOR WOOD PROCESSING FACTORIES

MSc thesis

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AUTHOR's DECLARATION

I declare that I have written this graduation thesis independently.
These materials have not been submitted for any academic degree.
All the works of other authors used in this thesis have been referenced

The thesis was completed under ..... supervision

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Accepted for defence.

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FOREWORD

Graduation thesis topic was proposed by Hekotek AS electro-automation department manager. Topic was chosen in order to implement acquired knowledge for company purposes in which I currently work. Tackling the task I hope to achieve additional experience and knowledge to help with everyday tasks in current company position. Thesis was written in the company mentioned above with assistance from electro-automation department employee. Thesis is based on a new project using information and experience gathered in previous filter projects.

LIST OF ABBREVATIONS

PLC	Programmable Logic Controller
ATEX	***AT****mosphères* ***EX****plosibles* - Two EU directives describing what equipment and work environment is allowed in an environment with an explosive atmosphere.
PL	Performance Level
PLr	Performance Level Required
SIL	Safety Integrity Level
$MTFF_d$	Mean Time to dangerous Failure of the components
DC	Diagnostic Coverage or Direct Current
CCF	Common Cause Failure
PFH_d	Probability of dangerous failure per hour
F	Frequency
P	Possibility
S	Severity
NO	Normally Open contacts
NC	Normally Closed contacts
HMI	Human Machine Interface
CPU	Central Processing Unit
U_n	Power Supply
I_n	Nominal Current
I_K	Short-Circuit Protection
P_n	Installated poewr
N	Neutral Conductor
PE	Protective Conductor
I/O	Inputs/Outputs
SM	Signal Modules
TON	Timer on delay
IP	Ingress Protection

1. INTRODUCTION

Project on which this thesis is based on is to design, manufacture, assemble and run recirculation filter for wood processing factory in Estonia. Client's problem is large amount of wood waste, dust and chips from wood processing and recirculation filter task is to gather and collect the waste while re-circulating air back to the factory. Thesis is concentrated on electrical and automation part of this filter with thesis author's focus in safety systems.

AS Hekotek is a mechanical engineering company founded in 1992; its main operations include design and production of woodworking technologies and facilities. The company was founded by Finnish specialists who had been for decades working in the field of wood processing. Due to their experience Hekotek has now grown into the largest manufacturer of sawmill and bio-energy sectors equipment in the Baltic region. Beside wood processing sector, Hekotek has also produced and delivered various installations and conveyors for other industrial sectors. [1]

For several years already the turnover of Hekotek exceeds the level of 30 million EUR. In spite of good results already achieved, we go further on the way of sustainable development.

Currently Hekotek employs over 110 people. Hekotek activities in the basic export markets are strongly supported by the local representatives. When producing our equipment we cooperate with several reliable materials sub-suppliers. The production plant has over 5000 m^2 of manufacturing and storage space; the whole plant area making up approximately 6 hectares. [1]

Hekotek produces and delivers equipment for most of the largest sawmills of the Baltic region, as well as to Finland, Sweden, Russia, Belarus, Poland and Germany. The furthest delivery destination for Hekotek has so far been Republic of South Africa, Argentina and Uruguay. [1]

Hekotek designs and produces equipment for collecting and cleaning the air containing sawdust and fine particles and reversing clean air back to production area. Our recirculation filters enable to optimize production area heating costs, as well as ensure cleaner working environment for enterprise workers. Filters consist of standard units for air volume from 10000 m3/h up to 120000 m3/h, enable to revert hot air fully or partially back to the production area. An example of a working filter is shown in figure 1.1. [1]

Figure 1.1 Hekotek recirculation filter [1]

Currently in Estonia there are only few companies who sell and service aspiration systems for large wood processing factories, but all of them are out sourcing the whole system which gives our company advantage. Most of the solutions are similar everywhere, the difference comes in programming and experience. Compared to other Estonian competitors Hekotek has the flexibility to adjust to customer needs by having a design department and production plant for manufacturing new solutions or making changes to old ones according to customer feedback. In case customer wants to make some hardware changes we can quickly adjust automation system by reprogramming PLC (Programmable Logic Controller) via remote access.

All of the project schematics are designed in CADS Planner electric which is user-friendly and offers all the required tools at a reasonable price. Siemens TIA Portal was used for programming Siemens controllers. Both of software offer very good user support which is the one of the main reasons for its popularity.

First steps working on this thesis will be learning how recirculation works and how automation has been done in previous projects. There are a lot of European Union standards requirements this filter has to fill and some of those limit our choices for electrical and automation parts.

In current project 100% of the air is returned to the workshop with our 80000 m3/h recirculation filter. Wood processing particles like dust, chips or waste are transported by the exhaust fan in to the recirculation filter. Recirculation filter input lines have non-return flaps

for stopping particles traveling back. Input air is filtrated while traveling through filter bags and is directed in to the workshop. Maximum dust throughput is less than 0,2 mg/m3.All the wood processing particles are collected by the screw conveyor at the bottom of the recirculation filter and directed through rotary valve in to transfer line. Transfer pipeline sends particles into silo using transfer fan. Rotary valve allows 100% of the air to be recycled. Maximum processing particles are rated at 2500kg/h or 20m3/h. Silo fill level is possible to see in real-time through internet browser visual interface. Recirculation filter is designed to work with the entire workshop machines or separately. [2]

Recirculation filter and silo are controlled by Siemens S7-1200 controllers. Recirculation filter status is displayed touch screen displays located on electrical cabinet doors. On filter startup there is a sequence to launching. First transfer pipeline is activated, and then filter is starting with initial cleaning sequence for cleaning filter sections one by one according to program. At the same time exhaust fans are starting. Recirculation filter sections are constantly cleaned according to program and cleaning cycle rate and length is changeable manually or automatically. After wood processing operator should turn of the exhaust fan which should turn recirculation filter in to after cleaning mode. Recirculation filter sections will be cleaned according to program and then transfer system is turned off with a slight delay. Delay is required for getting all the wood processing particles out and removing any obstruction possibilities. All alarms can be programmed to be warning or stopping alarms, recirculation filter and silo are equipped with sound and light signals. When temperature rises to dangerous level (usually 70 °C) safety lock activates, fire hatch closes and recirculation filter stops. [2]

2. GROUNDWORK

Every recirculation filter project starts with customer, his wood processing machines and future needs on which whole aspiration system is calculated - filter size, aspiration piping, fan wattage and other components. Filter sizes are standardized by air filtration rate in cubic meters per hour. Transfer piping to silo is calculated according to filter size and wood particles separated. Every conveyor and rotary valve size has a rated volume feed rate on which they are chosen. Some of the wood processing factory output may peak higher than transfer piping is rated - in those cases rotary valve helps to smoothen filtrated wood particles flow.

Recirculation filter is always placed outside for fire safety reasons but as close to factory as possible to decrease the cost of materials for piping and wiring but also to minimize pressure loss due to long piping.

2.1. Main Design

Our standard filter is designed to comply is EVS-EN 12779:2015 „Safety of woodworking machines – Chip and dust extraction systems with fixed installation – Safety related performances and safety requirements“. [7]

Filter consist standard modules (sections) and is built to be installed outside. The filter is supported on strong steel base-frame. Base-frame is fastened to foundation. Maintenance platform, ladders and safety gates are attached to base-frame. The dust and chips from wood processing are transported using pneumatic flow from devices to the filter.

Filtering elements are needle bunched woven polyester bags (16 bags in one section). The cleaned air is returned to manufacturing building or into atmosphere. Service doors, safety gate and other critical components are monitored using sensors for safety reasons. Filter consists of service doors, service platform, summer/winter valves, screw conveyer, air return channel and sub frame as seen on figure 2.3. [6]

Recirculation filter summer/winter hatches are used for directing recalculated air in to atmosphere during summer to stop recirculation filter from heating factory air and directing already heated air back in to the factory during winter.

The recirculation filter is designed in accordance to ATEX 94/9/C Directive. All electric devices are placed outside the risk zone. The devices in the risk zone (screw conveyor and rotary valve) work at low speed and are not an ignition source. The moving parts of transport ventilators are placed farther from the filter. The control hatch at the lower part of the filter and service doors at the upper part of filter are equipped with special fastenings and

weatherproof contacts and act as explosion hatches the same time. The service platform is restricted with gates that stop the filter in case of opening. Additionally the transfer route can be equipped with spark detector and extinguisher. [6]

The explosion relief doors are a protective system for re-circulating modular filter unit (zone 20 inside), relieving by their opening pressure $p_{red.max}$ from inside area of the filter unit with combustible dust class k_{stmax}. The doors open with the value of their static opening pressure p_{stat}. Thereby explosion pressure is reduced to the value which is lower than the allowable pressure resistance of the protected modular filter unit. The series of modular filter unit with the explosion door for explosion venting located at the cell of the dirty section and also at the cell of the clean section fulfill this condition till the values $p_{red.max} = 30kPa$, $p_{stat.max} = 1{,}9kPa$ and $k_{stmax} = 20MPa\ ms^{-1}$. [6]

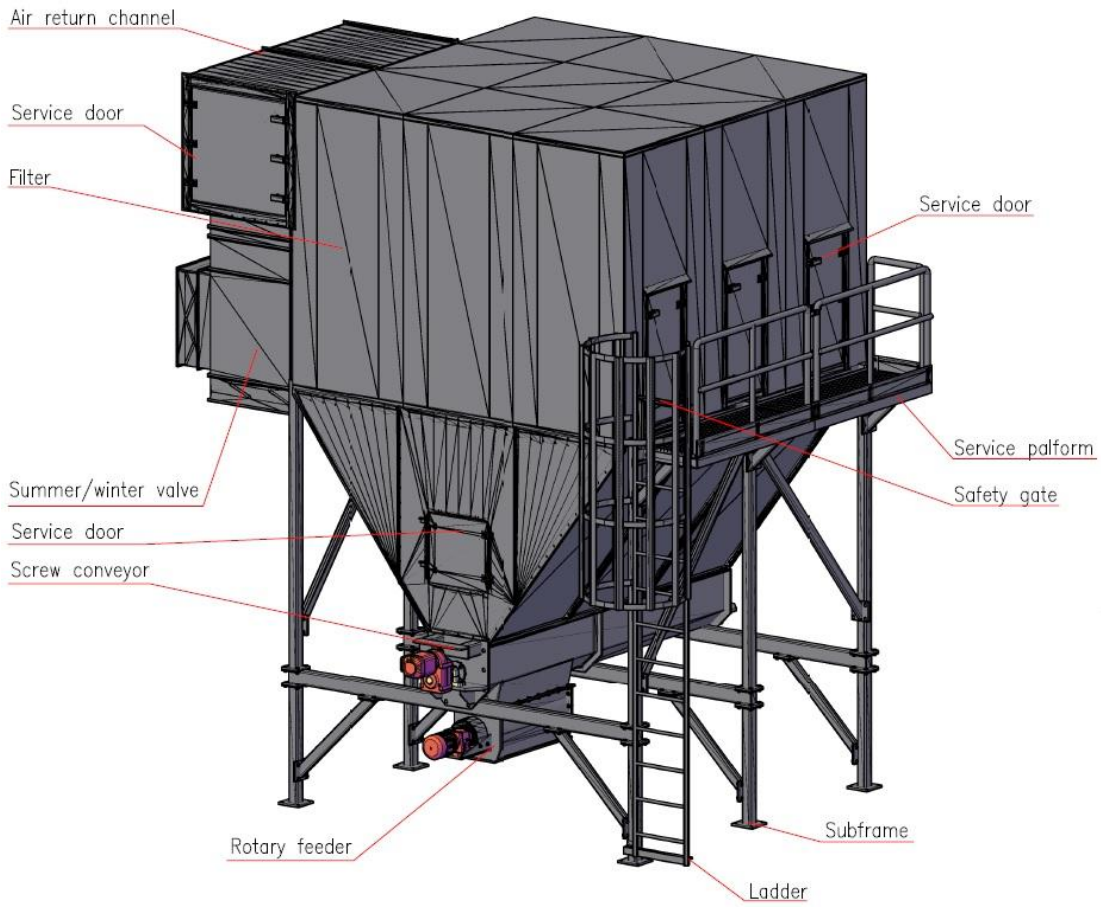


Figure 2.3 Hekotek Recirculation filter construction [6]

2.2. ATEX

ATEX is mainly two European directives controlling explosive atmosphere:

- The Directive 94/9/EC covers equipment and protective systems intended for use in potentially explosive atmospheres (ATEX). The Directive defines the minimum technical requirements and conformity assessment procedures, to be applied before equipment is placed on the EU market. [5]
- The ATEX 'Workplace' Directive 1999/92/EC deals with the minimum requirements for improving the level of health and safety protection of workers potentially at risk from explosive atmospheres. [5]

Explosive atmospheres can be caused by flammable gases, mists or vapors or by combustible dusts. If there is enough of the substance, mixed with air, then all it needs is a source of ignition to cause an explosion. Explosions can cause loss of life and serious injuries as well as significant damage. Preventing releases of dangerous substances, which can create explosive atmospheres, and preventing sources of ignition are two widely used ways of reducing the risk. Using the correct equipment can help greatly in this. An explosive atmosphere is defined as a mixture of dangerous substances with air, under atmospheric conditions, in the form of gases, vapors, mist or dust in which, after ignition has occurred, combustion spreads to the entire unburned mixture. Atmospheric conditions are commonly referred to as ambient temperatures and pressures. That is to say temperatures of –20°C to 40°C and pressures of 0.8 to 1.1 bar. [5]

To ensure the safety the work process has to be organized in accordance with Directive 1999/92/EC on minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres. [6]

2.3. Market analysis

As noted in introduction there are many manufactures in wood waste and chips recirculation filters market segment. We took a look at few competitor filter systems in 80000m^3/h range for comparison shown in table 2.1.

Table 2.1. Filters comparison [1] [3] [4]

Manufacturer	Nederman	Nestro	Hekotek
Compared model	NFKZ 3000 baghouse dust collector	Intermediate filter	Regular recirculation filter
Air volume	6000 - 500000 m^3/h	4000-200000 m^3/h	10000 - 120000 m^3/h
Operation air pressure	Up to 5000 Pa	2800 - 4300 Pa	2000 - 4000 Pa
Modular design	Yes	Yes	Yes
Cleaning method	Reverse air	Shaking, reverse air or jet pulse	Reverse air
ATEX compliance	Yes	Yes	Yes
Manufactured in	Sweden	Germany	Estonia

As seen in table 2.1 there isn't much difference between different competitors if 80 000m3/h filter is required. It's hard for others to compete in Estonian market with us because of lesser cost of manufacturing, logistics and better local customer support. Nestro's intermediate filter with shakers is shown in figure 2.2. The main design stays the same and competitors also use rotary valve. Shaking cleaning method may have few advantages depending on wood processing type and surrounding environment but also includes more moving parts and complex design.

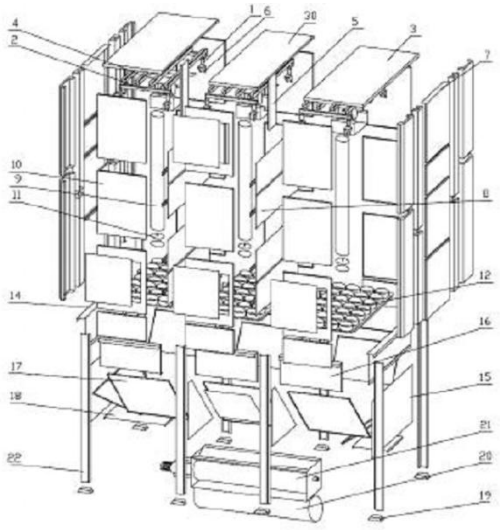


Figure 2.2 Nestro Intermediate filter with shakers [4]

2.4. Current project design

As seen in figure 2.1 current project has five aspiration pipelines for collecting wood waste from processing machines and transfer piping to first silo. In total there are two silos, one for loading wood waste on to a trailer and second for feeding boiler system. Both silos are connected so operator can choose what to do with the wood processing waste. It can be burned for heat during winter or loaded on to trailer and stored somewhere during summer. As mentioned in introduction current project 100% of the air is returned to the workshop with

our 80000 m3/h recirculation filter and both the filter and the silo are controlled with Siemens S7-1200 controllers and status displayed with HMI as requested by client.

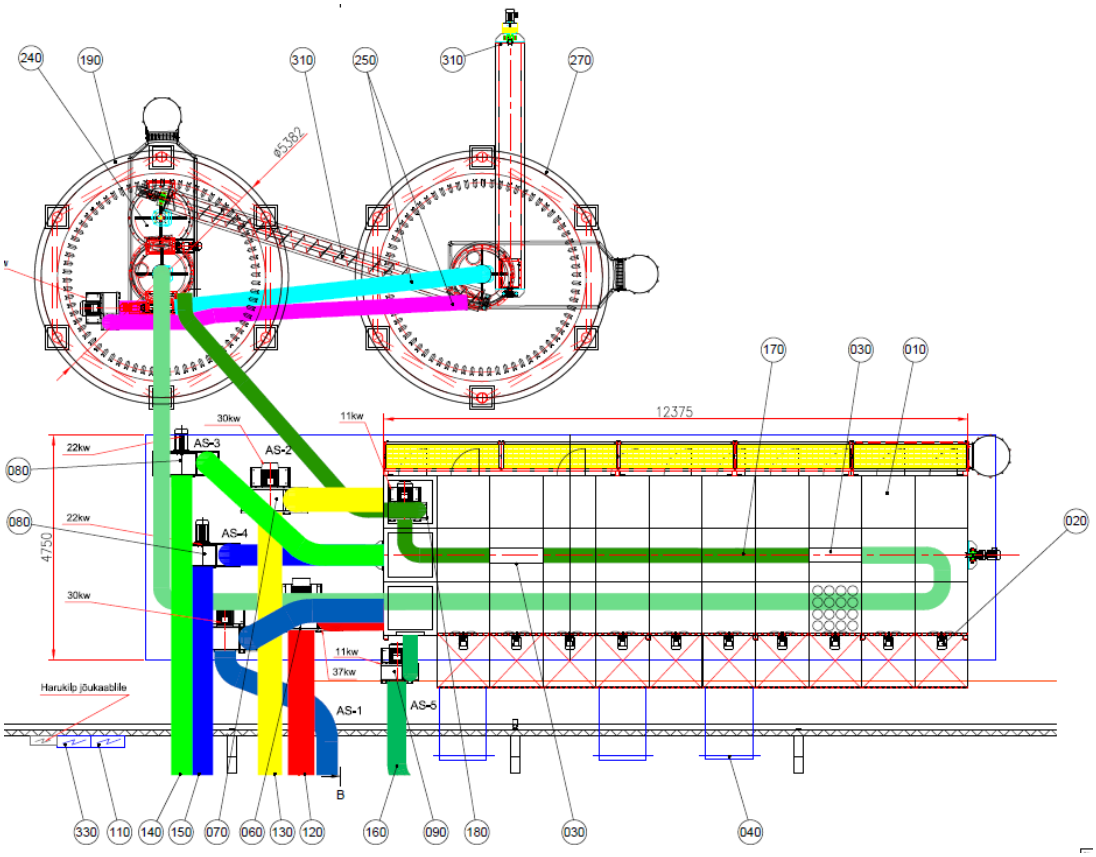


Figure 2.1 Current project recirculation filter layout with two silos [2]

Main components from layout (figure 2.1):

010 - filter (includes screw conveyor and rotary feeder);

020 - regeneration fans;

030 - rotary feeder;

040 - return piping;

060, 070, 080 & 090 - exhaust fans;

110 - electrical switchboard for filter;

120, 130, 140, 150 & 160 - exhaust piping;

170, 250 - transfer piping;

180, 260 - transfer fan;

190, 270 - silos;

210, 290 - cyclones;

310, 320 - transfer screw conveyors;

330 - electrical switchboard for silo.

2.5. Thesis task

Our task is to design safety and alarm circuits for recirculation while the main part is done by electro-automation department employee and then implement our part in to the final PLC program. Task includes choosing components, writing HMI manual, electrical switchboard inspection and on site startup. Before choosing components we gather knowledge about safety of machinery, do a risk assessment and check components compliance to EN ISO 13849 standard and ATEX directives. Electrical circuits design was done using CADS Planner electric and PLC programming using Siemens TIA Portal as mentioned in introduction.

3. SAFETY OF MACHINERY

Safety of machinery is regulated by EN ISO 13849 which divides in two parts - first defining general design principles and second describing validation. EN ISO 13849 is the new replacement for EN 954-1 standard which was used till 31.12.2011. Designers can also use EN 62061instead of EN ISO 13849 for designing safety functions in protection system in order to provide sufficient reliability. EN 62061 defines the structures slightly differently. [9][10] [11]

Difference between EN ISO 13849 and EN 62061[9]:

- EN ISO 13849 uses PL (Performance Level) which is a technology-neutral concept that can be used for electrical, mechanical, pneumatic and hydraulic safety solutions;
- EN 62061 uses SIL (Safety Integrity Level) that can only be used for electrical, electronic or programmable safety solutions.

Since we have no preferences set by the customer and use mechanical safety solutions as well as electrical we chose to use EN ISO 13849 which uses PL. PL is measure of reliability of a safety system and is divided into five levels (a-e). PL level e gives best reliability and is equivalent to that required at the highest level on risk. [9]

To calculate system PL level following requirements must be met [9]:

- Knowing the system's structure;
- Knowing $MTFF_d$ (Mean Time to dangerous Failure of the component);
- Knowing the system's DC (Diagnostic Coverage);
- Protecting the system against a failure that knocks out both channels (CCF);
- Protecting the system from systematic errors built into the design;
- Following rules to ensure software can be developed and validated correctly.

The five PL levels (a-e) correspond to certain ranges of PFH_d (probability of dangerous failure per hour) values, in calculation PFH_d provides more accurate results because PL is a simplification. To minimize calculation error ABB products have pre-calculated PFH_d values and ABB offers a freeware calculation application. [9]

Anyone who builds or modifies a machine is required to perform risk assessment for the machine design and also include an assessment of all the work operations that need to be performed. A risk assessment begins with determining the scope of the machine. This includes the space that the machine and its operators need for all of its intended applications, and all operational stages throughout the machine’s life cycle. Risk assessment is made according to figure 3.1. [9]

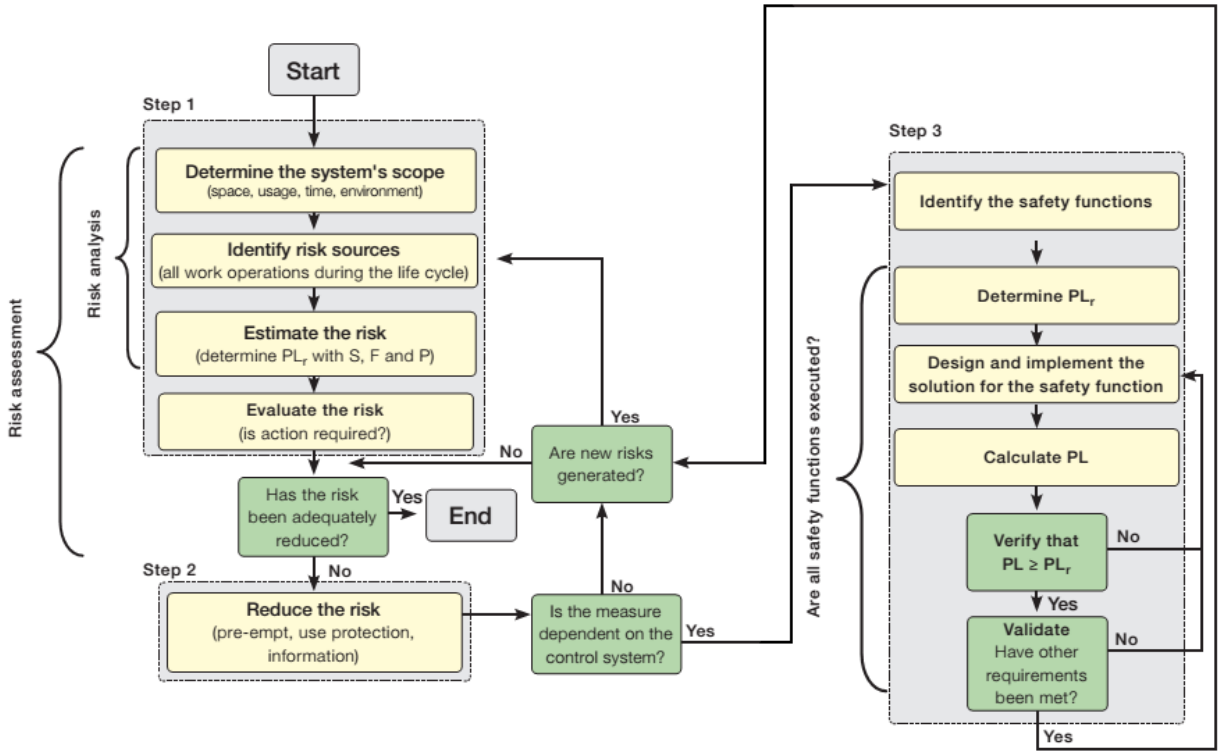


Figure 3.1. Risk assessment [9]

All risk sources must then be identified for all work operations throughout the machine's life cycle. Risk estimation is made for each risk source, i.e. indication of the degree of risk. According to EN ISO 13849-1 the risk is estimated using three factors: injury severity (S, severity), frequency of exposure to the risk (F, frequency) and the possibility you have of avoiding or limiting the injury (P, possibility). For each factor two options are given. Boundary between the two options is not specified in the standard but is commonly interpreted: [9][10][11]

S1 - bruises, abrasions, puncture wounds and minor crushing injuries;

S2 - skeletal injuries, amputations and death;

F1 - less frequently than every two weeks;

F2 - more often than every two weeks;

P1 - slow machine movements, plenty of space, low power;

P2 - quick machine movements, crowded, high power.

Risk estimation scheme is shown in figure 3.2 [9]

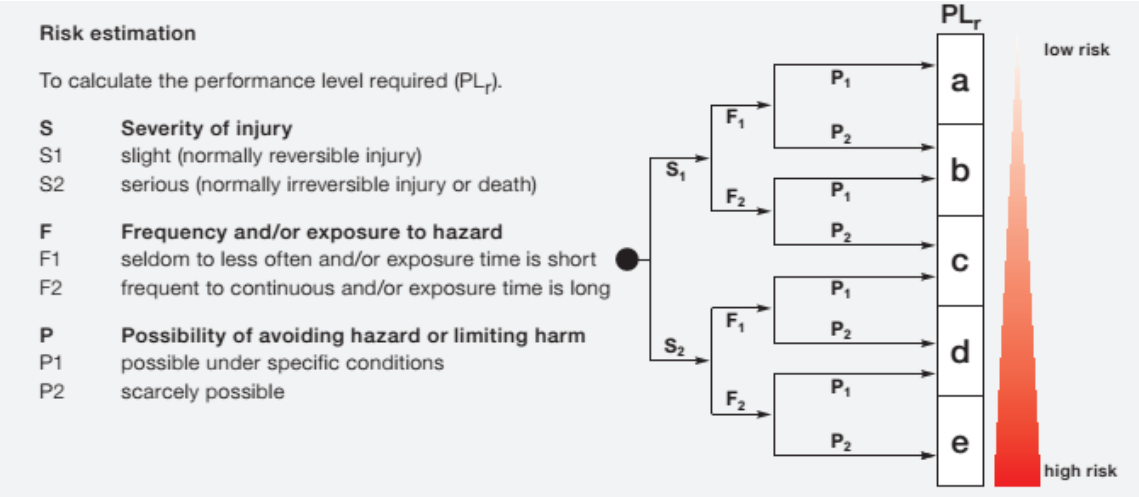


Figure 3.2. Risk estimation [9]

For recirculation filter based on previous risk analysis we estimate severity of injury to be serious, exposure to hazard less often and possibility of avoiding hazard to scarcely possible leaving us with performance level PL_r = d.

ABB RT9 24DC (product ID 2TLA010029R0000) universal safety relays are used in safety circuits which falls into safety category 3, PL d (because we're using dual channel two normally open contacts). This means our safety relay category fits our needs perfectly. In order to achieve category 4 there is need to have two channels that can cut the power to the machine individually so incase of dual channel NO contacts would need to wire ABB RT9 relay for use for dual channel on normally open and on normally closed contacts which would result safety cat 4, PL e. In current case individual failures do not result in any loss of safety function. ABB RT 9 relay maximum PFH_d is rated at 9,55E-09. [9]

ABB CEPY1-2001 emergency button has two NC (normally closed) contacts that allow it to fit safety category 3, if one of the contacts fail it will still be able to stop the recirculation filter.Figure 3.3 shows relationship between categories.[9]

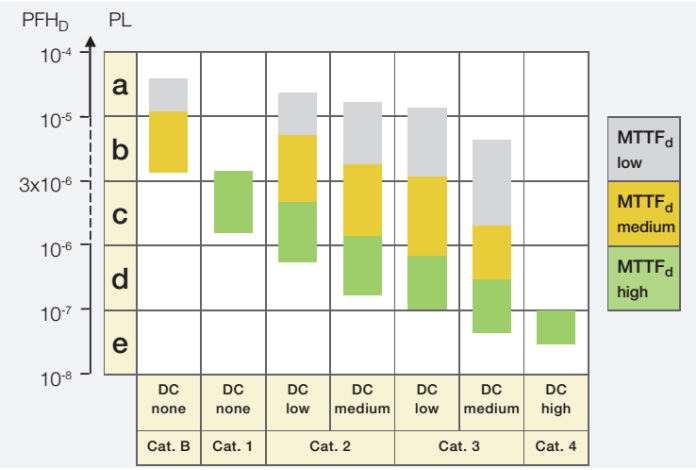


Figure 3.3 The relationship between categories [9]

According to risk analysis and switchboard location in addition to emergency stop button located at switchboard we add additional emergency stop buttons near recirculation filter where there is easy access. Near every electrical motor we have safety switch for making maintenance safer.

All maintenance hatches have magnetic sensors to detect hatch opening so that filter cannot be started while filter bags are visually checked. Magnetic sensors SMS02 are used in this project, they have normally open and normally closed contacts and are suitable with ISO 13849-1 category 4. [10]

Alarm sirens and indication lights are built in to notify factory workers as soon as possible, all alarms are logged into PLC and recirculation filter cannot be started without high level alarms.

3.1. The choice of components

Main factor for choosing component manufacturer is prior experience in reliability, durability and client specifications from the contract. Our electrical switchboard subcontractor is using ABB components which is why we use it in our circuit diagrams and have great experience so far. Siemens programmable logic controller (PLC) and human machine interface (HMI) is used for controlling filter process if not stated otherwise in the contract. Component parameters are chosen by application. In current project main component for automation is Siemens S7 1200 controller defined by contract, before starting with schematics all information should be gathered from project leader and project layout. When main layout drawing is confirmed we can start calculating short circuit currents, voltage drop and calculated power. To keep project budget down all cables are manually selected and ordered to calculated length. Cable type depends on number of signals and voltage drop.

Siemens S7 1200 (seen in figure 3.4) is a basic controller for compact automation systems, we're using controller with 1214C CPU which has 24 integrated input/outputs and can be expanded by one signal board, eight signal modules and three communication modules. Siemens S7 1200 controller with CPU1214C has six fast counters (three with max 100 kHz and three with max 30 kHz). CPU1214C is the midrange option for our controller, it has the most integrated input/outputs without any unneeded options, of course 24 integrated inputs/outputs is not enough for this project and expansion modules have to be used. Controller used in recirculation filter program is chosen DC/DC/DC which means the controller supply voltage is DC (Direct Current), inputs are DC and outputs are DC. [8]

Figure 3.4 Siemens S7 1200 controller [8]

ABB offers various safety relays like JSB series, BT series and RT series. The JSB series consist of specialized safety relays for e.g. two hand devices with dual channel synchronization. The BT series consist of safety relays designed to connect safety devices, such as emergency stops, directly in the voltage supply circuit to the relay. Despite a compact width of 22.5 mm the relays are very powerful. These relays can also be used as expansion relays for Pluto to increase the number of outputs. The RT series consists of universal relays that have the most common functions used in safety situations. These safety relays can supervise both your safety devices and the internal safety of your machinery. In addition you can select the safety level required for each installation. We've chosen RT series for our application. Three relay models are available with the main difference in output type and count. ABB RT9 safety relay with 2 NO (normally open) relay outputs is best fit for our needs, it can be configured for dual channel input and both channels are monitored for correct

operation before resetting (configuration seen in figure 3.5). When configured to use dual channel with two normally opened contacts, both input contacts (s14 and S34 in figure 3.5) must be closed before relay output is activated. If one of the input contacts opens the output contacts will open. A manual reset requires reset input to be closed and opened before activating safety relay outputs. [9]

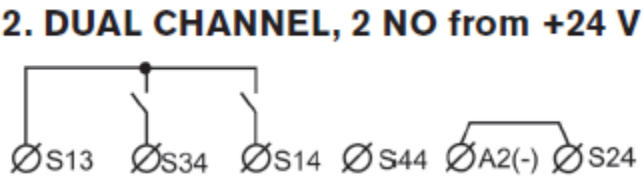


Figure 3.5. ABB RT9 dual channel 2 NO wiring [9]

Emergency stop buttons are chosen from ABB product line. For mounting outdoors and indoors we've chosen ABB CEPY1-2001 emergency button which has IP66 enclosure rating (dust tight and protected against powerful jets of water). This safety switch uses two normally closed contacts so if one of the contacts fail while emergency stop button is activated a relay will not activate. Safety switch is seen in figure 3.6. [16]

Sensors - to ensure safety of machinery service doors and safety gate are monitored. After previous experience with optical sensors in our company we had problems with optical sensors in price point where we currently use magnetic sensors. For magnetic sensors our supplier offers Carlo Gavazzi magnetic sensors with two models, SMS-01 and SMS-02. These sensors only difference is in operating distance as seen in figure 3.7, we're using SMS02 model just because it is not always possible to mount sensors and magnets within 10mm range in our application. [13]

Specifications

Operating Distance ON		**Max Switching Voltage**	100 Vac
SMS-01	10 ± 3 mm	**Max Switching Current**	0.25 A
SMS-02	20 ± 3 mm	**Max Switching Power**	5 VA
Release Distance OFF		**External Dimensions**	88x25x13 mm
SMS-01	15 ± 3 mm	**Protection Degree**	IP 67
SMS-02	30 ± 5 mm	**Operating Temperature**	-25 to +70 °C
RESET Distance		**Storage Temperature**	-25 to +70 °C
SMS-01	20 ± 3 mm	**Output Connection**	Cable (PVC, AWG 26, L=2m 4x0.15 mm²)
SMS-02	35 ± 5 mm	**Case**	Plastic
Suitable Magnetic Unit	CLS		
Output Function	NO+NC		

Figure 3.7. Carlo Gavazzi magnetic sensors specification [13]

For silos we're using full detector from UWT. Model RN4001 sensor is has a rotating plastic housing with rope extension for vertical installation and adjustable sensitivity (technical data

figure 3.8). If the rotation stops the recirculation filter is stopped and alarm signal is sent to operator. RN4001 sensor has ATEX II certificate which means it's intended for use in explosive atmosphere and category II stands for use in surface industries. Detector housing is rated dust tight and protected against low pressure water. [14]

Technical Data	
Housing	Plastic PA, IP 66
Certificates	ATEX II 1/3D
Process temperature	-20°C up to +80°C (-4°F up to +176°F)
Pressure	max. +0.8bar (11.6 psi)
Sensitivity	from 100g/l (6lb/ft³) – adjustable in 3 steps
Mains voltage	110-120V or 220-240V AC, 50-60Hz, 24V or 48V AC, 50-60Hz, 24V DC
Process connection	G1 and G1½ inches, NPT 1 inch, M30x1.5, M32x1.5
Bearing	slide bearing with shaft sealing

Figure 3.8 UWT RN 4001 technical data [14]

Silo filling level is measured with UWT Nivobob 3200 series sensor, this is done in order to give operator information and empty silo before its full and recirculation filter is stopped. This sensor from UWT has also ATEX II certificate and is housing enclosure rating is IP66. Technical data is shown in figure 3.9. [14]

Technical Data

Model	NB 3100 / 3200	NB 3300 / 3400
Housing	Aluminium IP 66 (Type 4)	
Pressure	Max. +1.7 bar (+25 psi)	
Supply voltage	AC version: 98...253V 50-60Hz DC version 20...28V	
Measuring range	Rope version max. 30m; tape version max. 50m	
Signal output/ Communication	0/4-20mA; relay counting pulse; Modbus; Profibus DP	
Certificates	CE; ATEX II 1/2 D FM Cl. II, III, Div. 1, TR-CU	CE; FM general purpose
Process temperature	-40°C up to +250°C (-40°F up to +482°F)	-40°C up to +80°C (-40°F up to +176°F)
Sensitivity	From 20g/l (1.2lb/ft³) depending on sensor weight	-
Process connection	Flange DN 100 PN16 Flange 4" 150lbs Flange 2" and 3" 150lbs Thread R 1 ½" Thread NPT 1 ½" Thread NPT 3"	Flange DN 100 PN16 Flange 4" 150lbs

Figure 3.9 UWT NB3200 technical data [14]

Screw conveyor below recirculation filter has a bearing housing in direct contact with wood waste so in order to meet ATEX regulations we have a PT100 temperature sensor inserted in bearing housing for monitoring. If temperature reaches higher than 70°C the recirculation filter is shut down. PT100 technical data is shown in figure 3.10. [15]

Technical Data

Standard sensor	
Measuring range	-50...205°C
Ambient temperature	-50...205°C
Marking label	-30...105°C
Pressure range	≤ 25 bar (water flow 3m/sec.)
Humidity	< 98% RH, condensing
Protection class	IP 65
Cable type	High-flexible silicone, grey
Wires	4 (2 x Red, 2 x white)
Length	up to 99.99 metres

Common data for both types	
Case material	Acid-proof, stainless steel AISI 316 Ti (W 1.4571)
Case dimensions	ø5.8 mm x 60 mm
Time constant $\tau_{0,5}$	See table
Accuracy	DIN/EN/IEC 60751
1/1 DIN B	±(0.3 + 0.005 x t) °C
1/3 DIN B	±1/3 x (0.3 + 0.005 x t) °C
1/6 DIN B	±1/6 x (0.3 + 0.005 x t) °C
Vibrations	Lloyds Register, test 2
Mechanical tolerances	ISO 2768-m

Figure 3.10 PT100 technical data [15]

4. SAFETY CIRCUIT DESIGN

Safety circuit is designed according to Safety of Machinery standard ISO 13849 and Equipment Safety Act. Components are chosen based of chapter 3 and 3.1. Electrical installation data is shown below in Table 4.1 and Table 4.2. [10]

Table 4.1 Electrical installation data for switchboard 1025EK1

Power supply	U_n=400/230V
Nominal Current	I_n=380A
Short-Circuit protection	I_k=10kA (calculated short-circuit current ~8,3kA)
Installed power	P_n=190kW (cosφ =0,82)
System	TN - S (not directly earthed)

Table 4.2 Electrical installation data for switchboard 1025EK2

Power supply	U_n=400/230V
Nominal Current	I_n=63A
Short-Circuit protection	I_k=10kA (calculated short-circuit current ~1,6kA)
Installed power	P_n=32kW (cosφ =0,82)
System	TN - S (not directly earthed)

Power supply is specified in client contract and is according to EVS-EN 60038:2012. Nominal current I_n is calculated with adding together electrical motors nominal current seen in table 4.3. 1025EK1 is the main switchboard for whole filter, silo switchboard 1025EK2 is connected through switchboard EK1025EK1 so that for nominal current only electrical motors 9-17 are included in calculation.

Short-circuit protection I_k can be calculated using information gathered from client (main power cable type, length and installation, transformer apparent power, fuse type and location), to avoid human errors we're using software "Lühisvoolud" to calculate as seen in figure 4.1 and figure 4.2. Short-circuit current calculation has two objectives - determination of the maximum possible short-circuit currents helps to check wiring and apparatus short-circuit withstand capability and determination of the minimally possible short-circuit currents helps to check safety components effectiveness. For the first object 3-phase short-circuit current is calculated in the closest point to provide the highest current, the second objective short-circuit is calculated for single phase at the end of the line to get the lowest current. Symmetrical three-phase simplified short-circuit current can be calculated with formula 4.1. [17]

$$i = \sqrt{2}I_p sin\left(\omega t - \frac{\pi}{2}\right) + \sqrt{2}I'' e^{\frac{-t}{\tau}} = i_p + i_a \quad (4.1)$$

where i_p - short-circuit periodic component current value,

i_a - short-circuit aperiodic component current value,

I_n - short-circuit periodic component effective value,

I'' - short-circuit periodic component initial effective value,

τ - circuit electromagnetic time constant,

t - time.

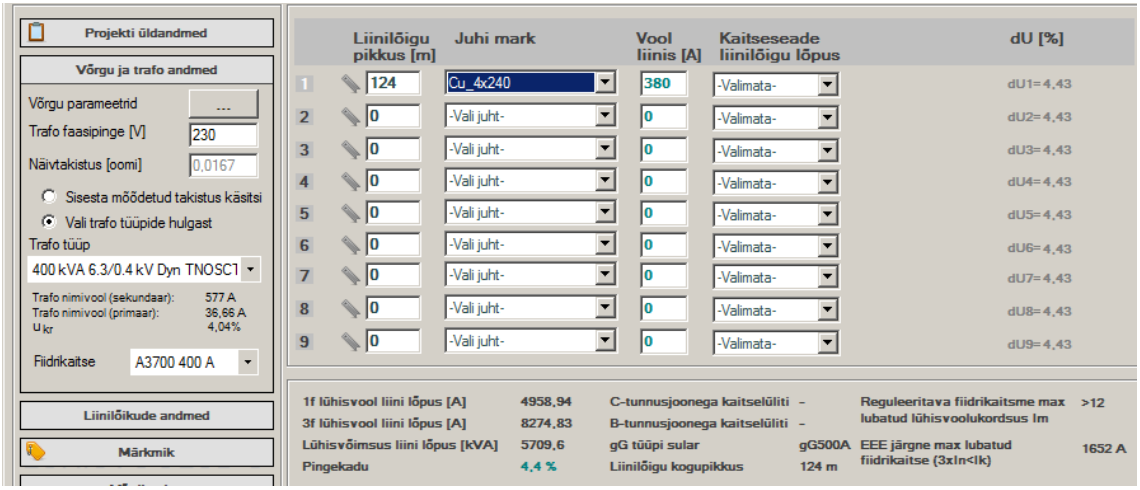


Figure 4.1 1025EK1 short-circuit calculation

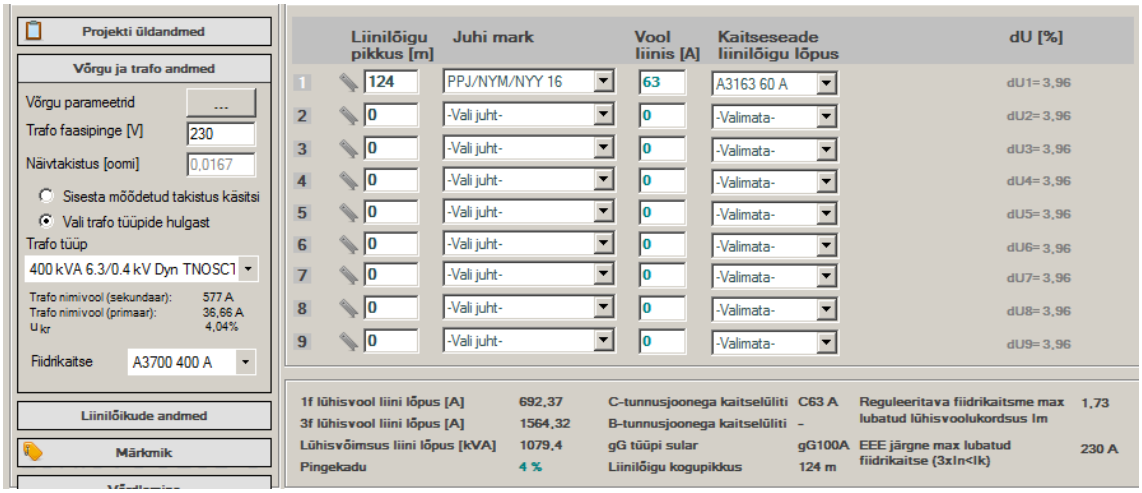


Figure 4.2 1025EK2 short-circuit calculation

Short circuit calculated is lower than 10kA so our switchboard subcontractor uses components to withstand minimum of 10kA short-circuit by default. 10kA short-circuit components are more widely used and lowers the switchboard cost than using a 5kA short-circuit switchboard for instance. Installation power P_n can be calculated adding together power specification from

electrical appliances data sheets, efficiency factor is also specified in electrical appliances data sheet. Darker rows in table 4.3 show appliances that are used in switchboard 1025EK2.

Table 4.3 Electrical appliances data [18] [19]

No.	Motor application	P_n (kW)	I_n (A)	Cosf	Quantity
1	Filter screw conveyor	2,2	4,6	0,80	1
2	Regeneration fans	2,2	5,0	0,79	10
3	Rotary valve	1,1	2,5	0,79	2
4	Exhaust fan 1	37,0	67,0	0,85	1
5	Exhaust fan 2	30,0	54,5	0,85	1
6	Exhaust fan 3	22,0	41,5	0,85	2
7	Exhaust fan 4	11,0	21,0	0,85	1
8	Transfer fan1	11,0	21,0	0,85	1
9	Silo 1	4,0	8,0	0,82	1
10	Rotary valve between cyclone and silo 1	0,8	1,7	0,79	1
11	Rotary valve for transfer piping	0,8	1,7	0,79	1
12	Store bunker	3,0	6,2	0,81	1
13	Transfer fan 2	11,0	21,0	0,85	1
14	Silo 2	4,0	8,0	0,82	1
15	Rotary valve between cyclone and silo 2	0,8	2,1	0,65	1
16	Transfer screw conveyor to heater	2,2	4,6	0,80	1
17	Transfer screw conveyor for unloading	4,0	8,0	0,82	1

Earthling system info is given by client. TN-S system is widely used in Europe and has neutral conductor (N) and protective conductor (PE) separated as seen in figure 4.3. [12]

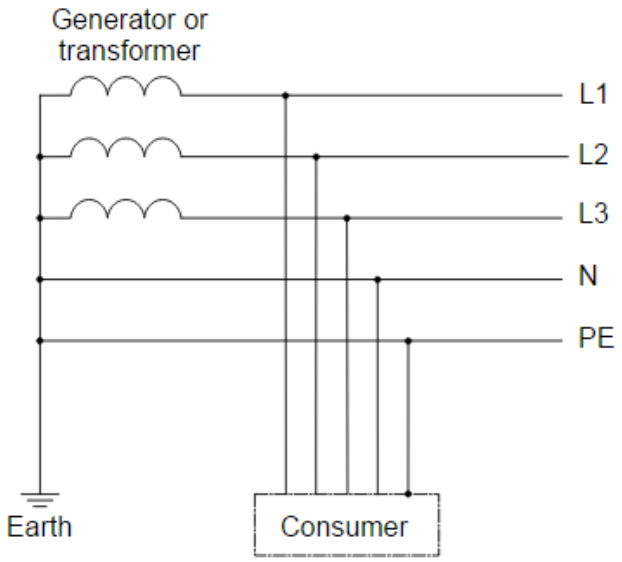


Figure 4.3 TN-S System [12]

Switchboard is designed in metal enclose with IP54 protection level (IP68 for control switches and signal laps). Switchboard is installed vertically to the wall with only one service side. Door is lockable without a handle and power-coated in RAL 7032. All the cable entries are from above. All the conductors have to be numbered yellow or black by the terminal point connection number and 20% of spare space is required for future installations.

4.1. Switchboard 1025EK1 and 1025EK2 safety circuits

Appendix A.1 switchboard 1025EK1 circuit page 2, the safety circuit part begins at switchboard where the filter is controlled. On Switchboard door there is an indication light for emergency, emergency stop button with twist release and emergency reset button to the far right (figure 4.4).

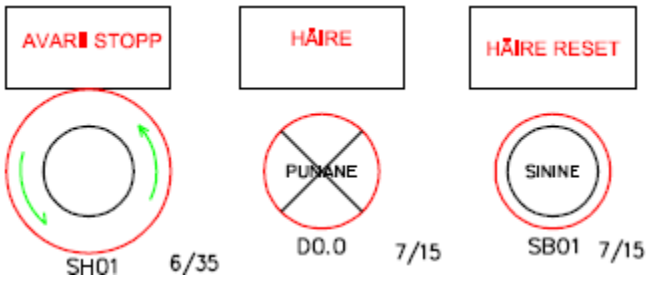


Figure 4.4 Appendix A.1 switchboard 1025EK1 circuit page 2

Appendix A.1 switchboard 1025EK1 circuit page 5 and 6, emergency stop buttons have two NC contacts, one of the contacts is in serial connection with the safety relay port S14 and when activated ABB RT9 safety relay removes all power from the control circuit. Second contact from each emergency stop button goes in to input module so we can monitor which button was pressed. Input E0.1 monitors if contactor is activated. Secondary safety function is controlling last three controller modules on with connection 5/18:B (figure 4.5).

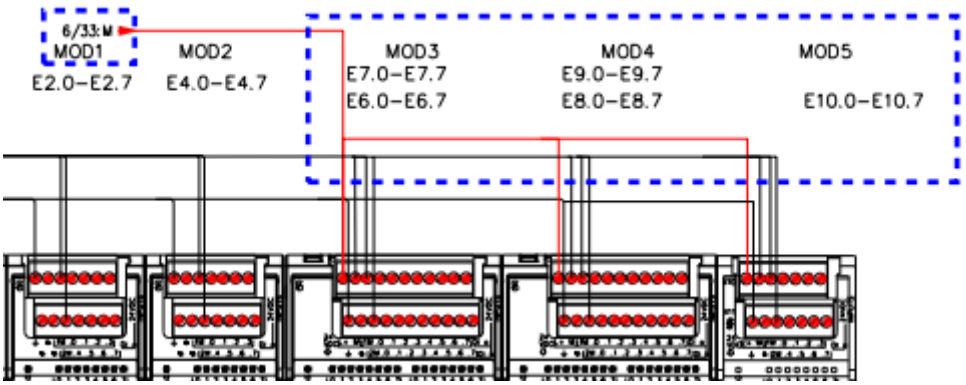


Figure 4.5 Appendix A.1 switchboard 1025EK1 circuit page 5

Appendix A.1 switchboard 1025EK1 circuit page 7, emergency reset button is connected to input module and emergency LED (light-emitting diode) is connected to output module. Process is controlled by PLC program and in normal working conditions the LED is turned off (figure 4.6).

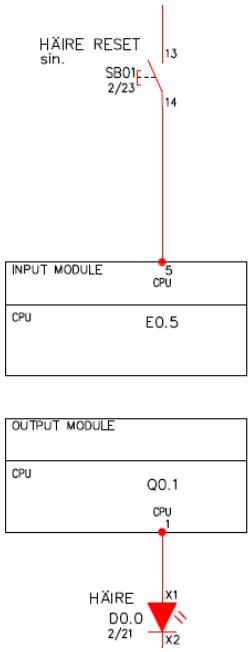


Figure 4.6 Appendix A.1 switchboard 1025EK1 circuit page 7

Appendix A.1 switchboard 1025EK1 circuit page 8 and 9, SMS-02 magnetic sensors are in serial connection through a junction box and used as an input to the controller module. In this case just one of the magnetic sensors is needed to be triggered for shutting down the whole recirculation filter.

Appendix A.1 switchboard 1025EK1 circuit page 10, 21, 22, 28 and 29 for controlling the gear motor a regular module is used because gear motor feedback is monitored with contactor. Motor protection switch and safety switch are connected to the input module. Output module controls gear motor via PLC program (figure 4.7).

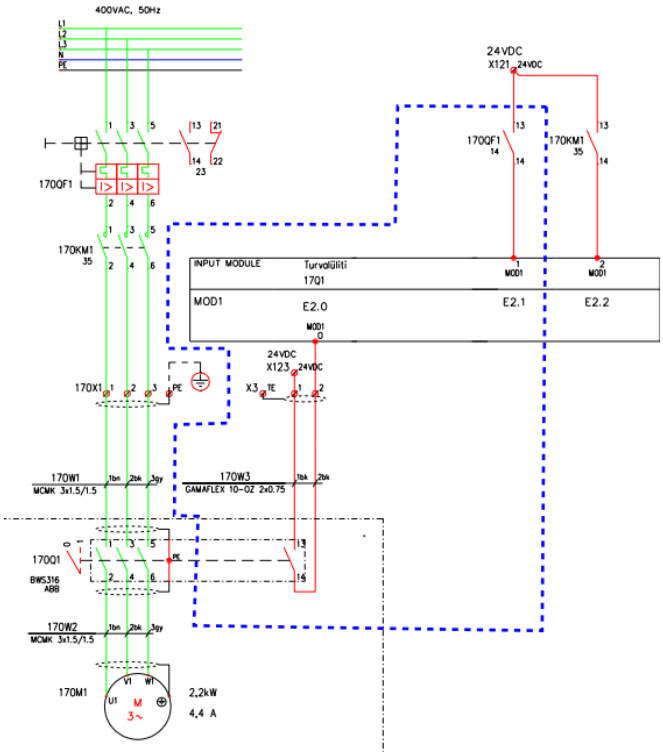


Figure 4.7 Appendix A.1 switchboard 1025EK1 circuit page 10

Appendix A.1 switchboard 1025EK1 circuit page 11-20, motor protection switch is connected to the input module. Safety relay is not used, motor feedback is monitored with contactor (figure 4.8).

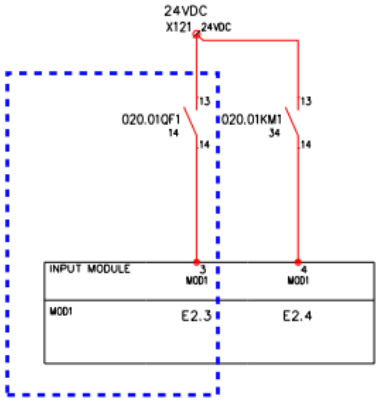


Figure 4.8 Appendix A.1 switchboard 1025EK1 circuit page 11

Appendix A.1 switchboard 1025EK1 circuit page 23-27, electronic softstarter wiring diagram for our transfer pipeline fan. If safety switch 120Q1 is turned on then PLC gets information from input E5.5. Turning on motor protection switch sends signal to relay 120K4. Relay 120K4 NO contact closes and sends power to contactor 120KM1 and power to electronic softstarter 120U1. This only powers up the softstarter, in order for it to start transfer pipeline

fan 120K3 and 120KM1 need to be activated. Activation signal to relay 120K3 is sent via program from PLC output Q13.5

Appendix A.1 switchboard 1025EK1 circuit page 33, fire hatch NC contacts are connected to input module.

Appendix A.1 switchboard 1025EK1 circuit page 34, screw conveyor bearing housing temperature is monitored using PT100 sensor. Sensor resistance rises with temperature, this information is transferred through analog module extender to plc analog input and is later converted into degrees (figure 4.9).

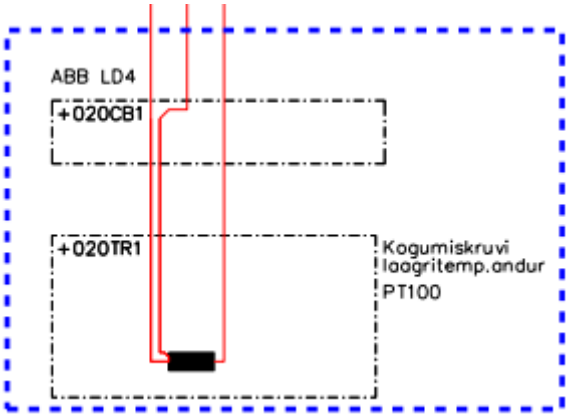


Figure 4.9 Appendix A.1 switchboard 1025EK1 circuit page 34

Appendix A.1 switchboard 1025EK1 circuit page 37, PLC output controls relays K444 and K445 that activate the blinker and the siren (figure 4.10).

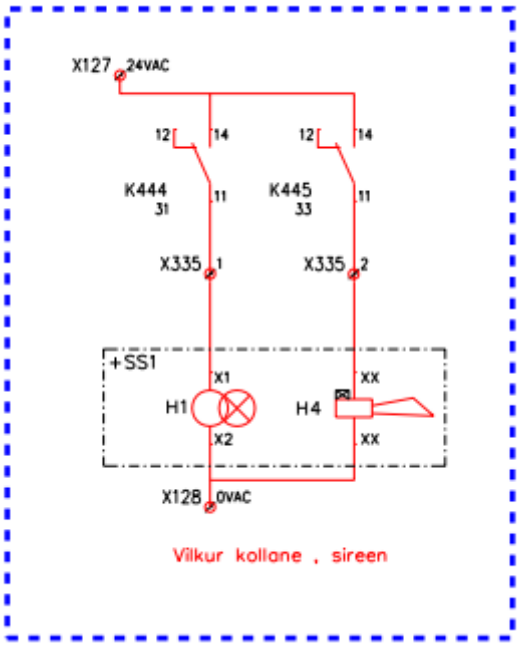


Figure 4.10 Appendix A.1 switchboard 1025EK1 circuit page 37

Appendix A.2 switchboard 1025EK2 circuit page 17, silo full detector pendulum shaft stops turning when wood waste reaches it, sends info to PLC input E1.4 and stops the recirculation filter. Silo level control sends pin down, calculates the fill percentage and sends information to PLC via input E1.5 (figure 4.11).

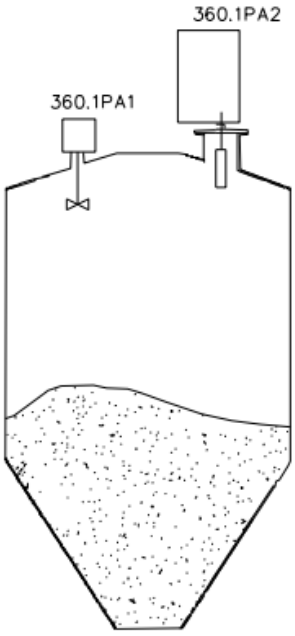


Figure 4.11 Appendix A.2 switchboard 1025EK2 circuit page 17

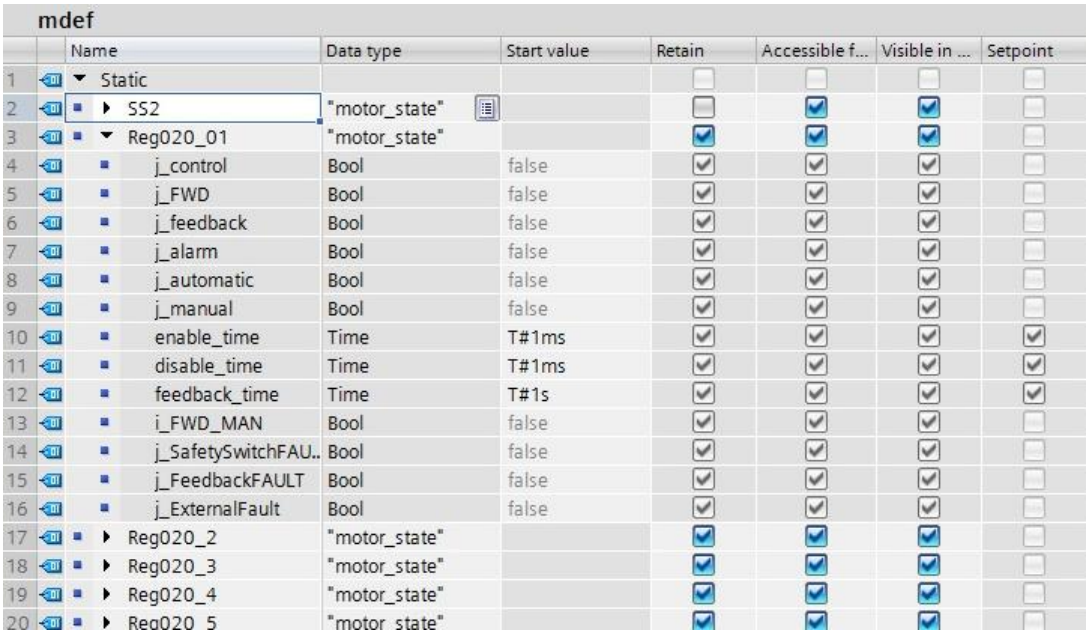
5. PROGRAMMING PLC

If electrical schemes are ready and all the information is marked up we can start the plc programming part. Our task was to add safety circuits and alarms to the program.

First we have to check:

- How many alarms we need to describe
- What types of alarms we need to describe
- How many safety circuits inputs do we have

After that we set up I/O (inputs/outputs). Then we can start writing a data block for reading information. We gather all the information in to the data block and give each input a memory address which is used to make programming easier (figure 5.1). Memory bits are used in together as words (in Siemens PLC data types 1 word is made up of 16 bits) this saves up programming time.



mdef

	Name	Data type	Start value	Retain	Accessible f...	Visible in ...	Setpoint
1	Static						
2	SS2	"motor_state"			☑	☑	
3	Reg020_01	"motor_state"		☑	☑	☑	
4	j_control	Bool	false	☑	☑	☑	
5	j_FWD	Bool	false	☑	☑	☑	
6	j_feedback	Bool	false	☑	☑	☑	
7	j_alarm	Bool	false	☑	☑	☑	
8	j_automatic	Bool	false	☑	☑	☑	
9	j_manual	Bool	false	☑	☑	☑	
10	enable_time	Time	T#1ms	☑	☑	☑	☑
11	disable_time	Time	T#1ms	☑	☑	☑	☑
12	feedback_time	Time	T#1s	☑	☑	☑	☑
13	i_FWD_MAN	Bool	false	☑	☑	☑	
14	j_SafetySwitchFAU..	Bool	false	☑	☑	☑	
15	j_FeedbackFAULT	Bool	false	☑	☑	☑	
16	j_ExternalFault	Bool	false	☑	☑	☑	
17	Reg020_2	"motor_state"		☑	☑	☑	
18	Reg020_3	"motor_state"		☑	☑	☑	
19	Reg020_4	"motor_state"		☑	☑	☑	
20	Reg020_5	"motor_state"		☑	☑	☑	

Figure 5.1 mdef datablock

When data blocks are ready and alarm inputs have assigned to each memory address we can start using them in program. We add alarms to HMI (Human Machine Interface) alarms table. Memory addresses are classified and each memory address is given an alarm text (for example exhaust fan 1 engine safety switch is triggered) shown in figure 5.2.

Discrete alarms

	ID	Alarm text	Alarm class	Trigger tag	Trigge..	Trigger address	HMI acknowl...	HMI a...	HMI acknowl...
	1	Kogumiskruvi TURVALÜLITI	No Acknowle...	AlarmWord1	8	%M200.0	<No tag>	0	
	2	Kogumiskruvi Tagasiside VIGA	No Acknowle...	AlarmWord1	9	%M200.1	<No tag>	0	
	3	Kogumiskruvi MOOTORIKAITSELÜLITI	No Acknowle...	AlarmWord1	10	%M200.2	<No tag>	0	
	4	Reg 020.01 Turvalüliti VIGA	No Acknowle...	AlarmWord1	11	%M200.3	<No tag>	0	
	5	Reg 020.01 Tagasiside VIGA	No Acknowle...	AlarmWord1	12	%M200.4	<No tag>	0	
	6	Reg 020.01 MOOTORIKAITSELÜLITI VÄ	No Acknowle...	AlarmWord1	13	%M200.5	<No tag>	0	
	8	Reg 020.02 Turvalüliti VIGA	No Acknowle...	AlarmWord1	14	%M200.6	<No tag>	0	
	9	Reg 020.02 Tagasiside VIGA	No Acknowle...	AlarmWord1	15	%M200.7	<No tag>	0	
	10	Reg 020.02 MOOTORIKAITSELÜLITI VÄ	No Acknowle...	AlarmWord1	0	%M201.0	<No tag>	0	
	11	Reg 020.03 Turvalüliti VIGA	No Acknowle...	AlarmWord1	1	%M201.1	<No tag>	0	
	12	Reg 020.03 Tagasiside VIGA	No Acknowle...	AlarmWord1	2	%M201.2	<No tag>	0	
	13	Reg 020.03 MOOTORIKAITSELÜLITI VÄ	No Acknowle...	AlarmWord1	3	%M201.3	<No tag>	0	
	14	Reg 020.04 Turvalüliti VIGA	No Acknowle...	AlarmWord1	4	%M201.4	<No tag>	0	
	15	Reg 020.04 Tagasiside VIGA	No Acknowle...	AlarmWord1	5	%M201.5	<No tag>	0	
	7	Reg 020.04 MOOTORIKAITSELÜLITI VÄ	No Acknowle...	AlarmWord1	6	%M201.6	<No tag>	0	

Figure 5.2 Alarms table

Finally alarm screen is created where recirculation filter operators can read and reset alarms for this we need to create a platform that reads alarm memory statuses from data blocks shown in figure 5.3 and alarms classification in figure 5.4. Alarms are saved with description of the alarm and alarm time.

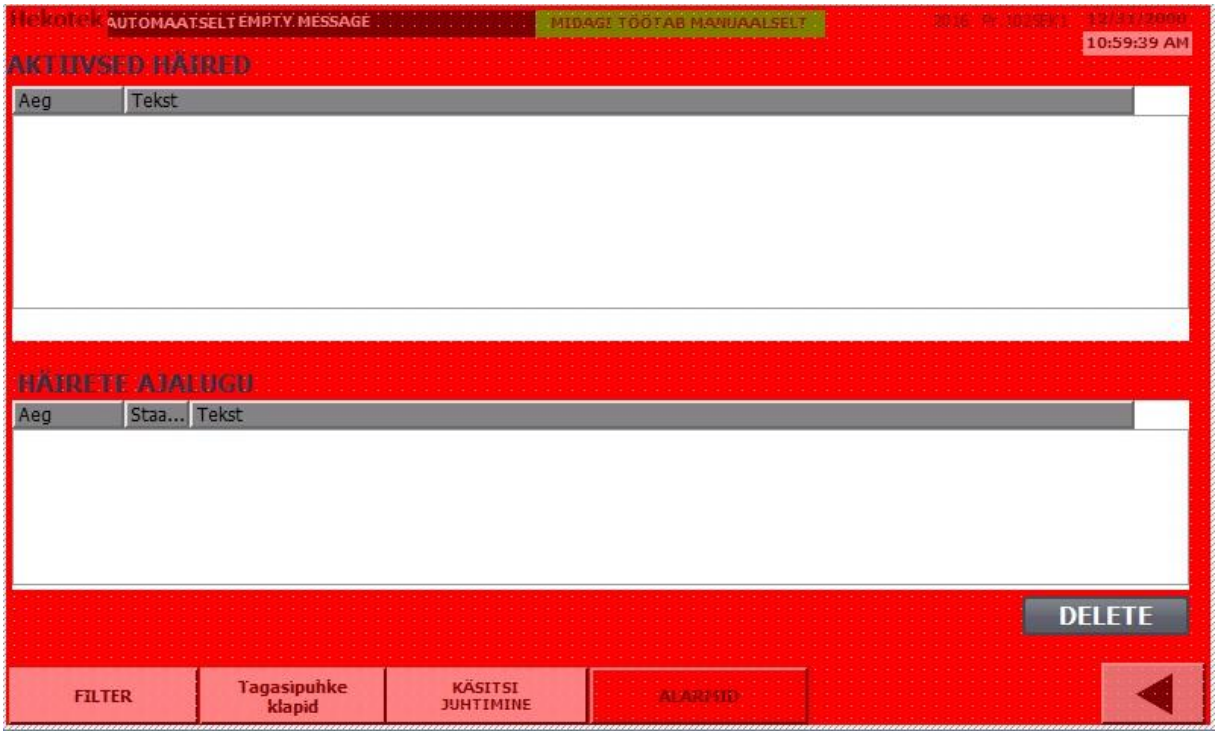


Figure 5.3 HMI alarms screen

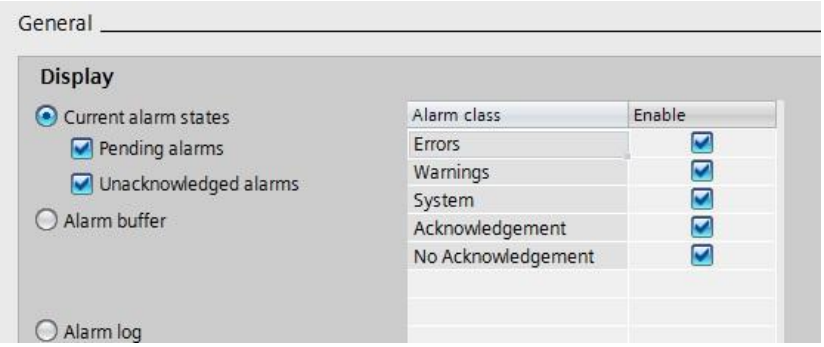


Figure 5.4 Alarms screen classification

Main safety logic is shown in figure 5.5 where we can see that in order to start the filter (set motor control bit M5.0) all the safety switches and motor protection switches must be activated and none of the emergency stop buttons, service doors, fire alarms or screw conveyor bearing temperature bit is set. After one of these conditions fails filter start bit is reset through negation logic

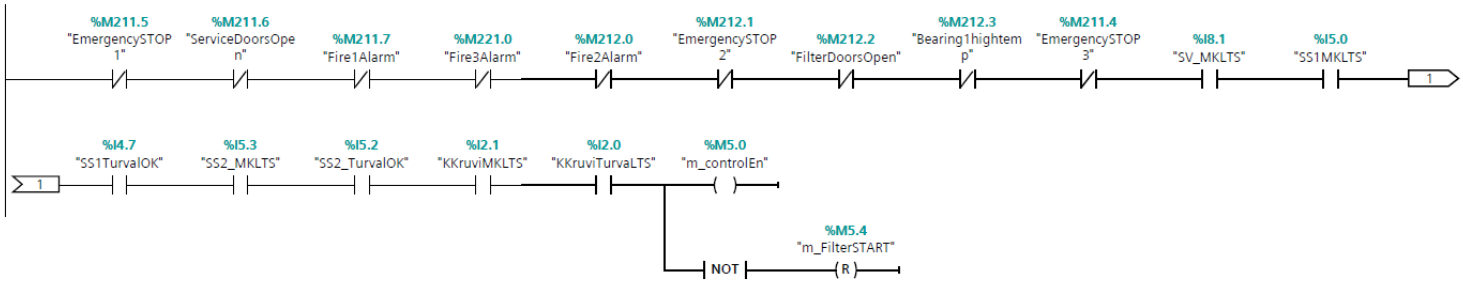


Figure 5.5 Main safety logic in TIA Portal

For safety reasons a little timer on delay is added into the control logic (figure 5.6).

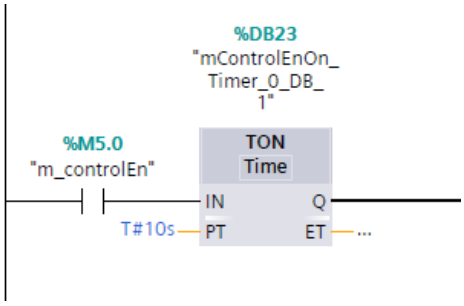


Figure 5.6 Motor control timer in TIA Portal

Safety reset button SB01 as seen from switchboard 1025EK1 circuit (Figure 4.6) input E0.5 is marked I0.5 in TIA Portal, as we can when triggered it activates output Q0.0 and Q0.2 that resets RT9 relays on 1025EK1 circuit page 6 and page 8 because both of these RT9 relays require manual reset before its outputs can be activated after emergency. Also reset button sets memory bit M5.1 so that the system knows reset was pressed (figure 5.7).

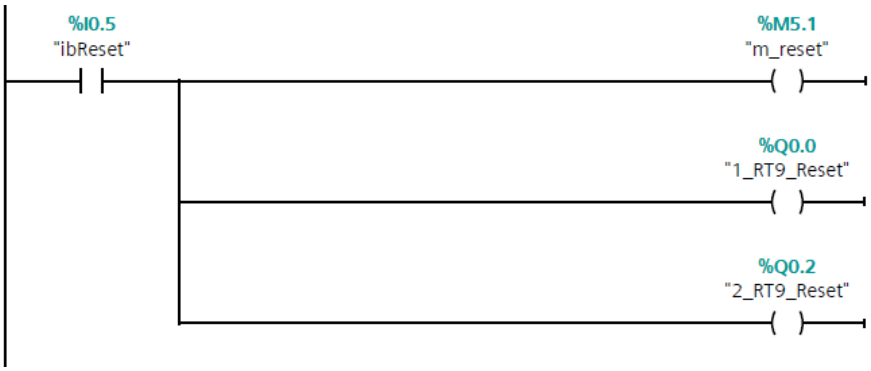


Figure 5.7 Safety reset button SB01 logic in TIA Portal

Input I0.0 (E0.0) and I0.1 (E0.1) from switchboard 1025EK1 circuit page 6 shows if emergency stop safety relay outputs are activated. This emergency stop safety relay outputs operate PLC last three control modules (Figure 4.5) and maintenance hatches safety relay input. Since both of these outputs are switched simultaneously, if one of the emergency stop buttons is pressed or anything else happens these outputs are switched off and memory bit M211.5 will be set and emergency stop will be activated (figure 5.8).

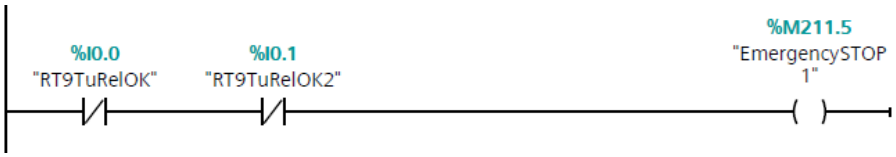


Figure 5.8 Emergency stop in TIA Portal

Maintenance hatch safety relay RT9 that is controlled by magnetic position sensors and when one of the hatches is open safety relay contact Y14 which is internally closed to 0 V when RT9 is not reset and memory bit M211.6 will be set. Memory bit M211.6 will set its contact to keep memory bit activated until reset button is pressed. Y14 is internally closed to +24V when relay is reset (figure 5.9).

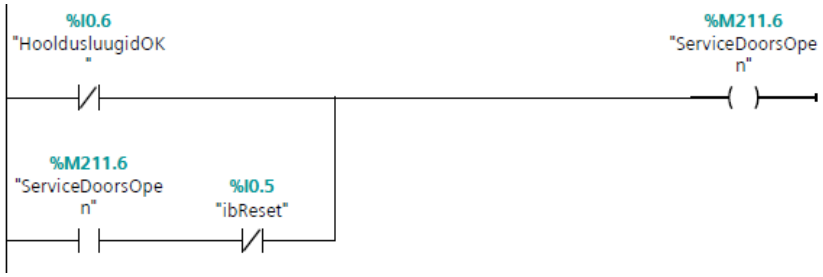


Figure 5.9 Maintenance hatches safety relay in TIA Portal

When first fire hatch temperature sensor reads high temperature that may lead to explosion (+70°C) the hatch closes, and sends info to input I0.7 that sets alarm bit which needs to be reset before restarting the filter (figure 5.10)

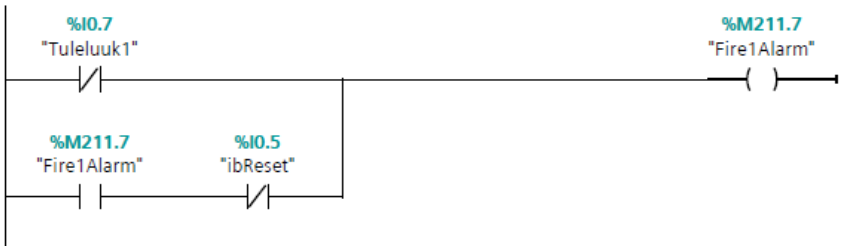


Figure 5.10 fire hatch in TIA Portal

Converting temperature in done by measuring temperature with the PT100 sensor which has output range from converting current from 4 to 20 mA. Analog input for controller is used with a range from 0 to 27648 that is converted to a temperature in Celsius, if temperature exceeds allowed temperature (from the manual) for screw bearing a memory bit M212.3 will activate and keep it activated until reset (figure 5.11).

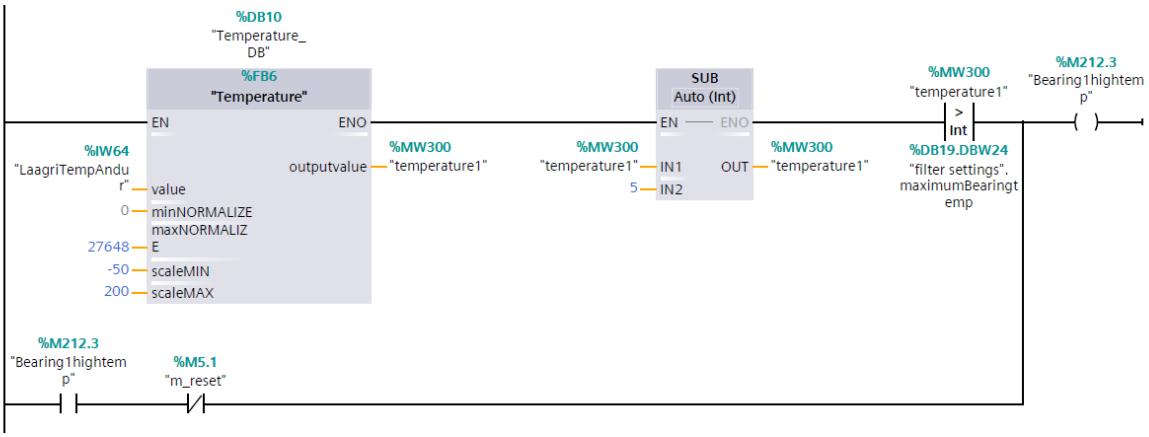


Figure 5.11 Temperature converting and comparing in TIA Portal

Motor controlling is done with a little sub program, in the alarms block are all the alarms listed and if any of them are active then no signal is going to motors control block and none of the motors will be turned on (figure 5.12).

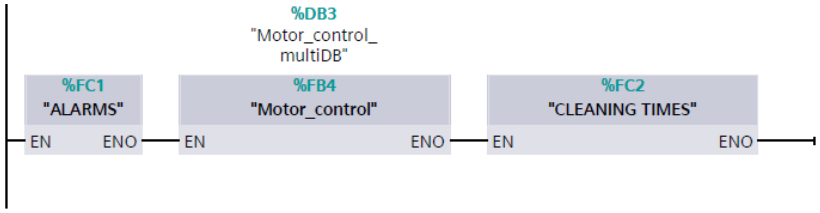


Figure 5.12 Motor controlling in TIA Portal

A large proportion of the programming can be written in user blocks that can be used for many motors just by specifying block inputs and outputs. For example motor error blocks that wait for some time (set in TON) for the contactor feedback after motor has been powered on

to see if it starts. When no feedback from contactor is received an error is set and depending on filter component the whole system may be stopped (figure 5.13).

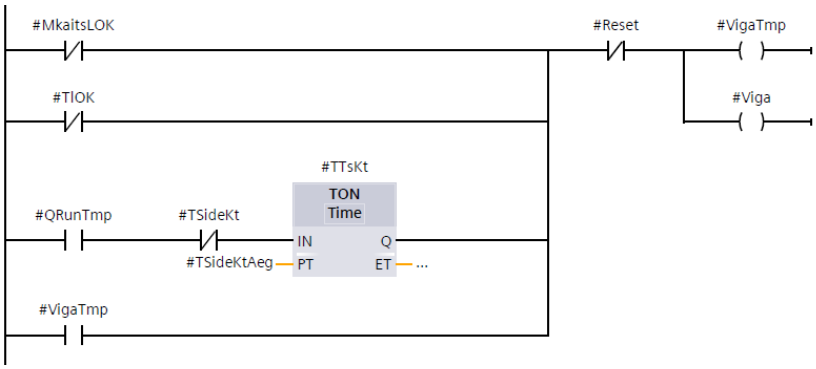


Figure 5.13 User block for motor feedback in TIA Portal

6. SWITCHBOARD INSPECTION

After the whole circuit for recirculation filter is designed and inspected by department manager it's sent to subcontractors with components to be assembled. After subcontractor finished assembling switchboard it will be inspected by our electro-automation department workers. Switchboard inspection is divided in several parts:

- Visual inspection - checking that every component is according to designed circuit, all fuses and circuit breakers match calculated value, wiring is straight and all covers are in place.
- Short-circuit inspection - whole circuit is inspected with a tester, all circuit breakers are inspected in both positions
- Power up - after short-circuit inspection switchboard is turned on.
- PLC and SM communication - to save time on working site programs are loaded, settings configured and communication established.
- Circuit inspection with simulating filter work process - after our entire program is loaded and communication working we should test it by simulating various switches and sensors to check if our program is working as it should.

After finishing these inspection points the final adjustment to the program will be made on working site, inspection prior to sending switchboard to working site can save a lot of time and gives time to make last minute changes if some problems are found.

7. ON SITE STARTUP

Preparations begin with feedback from installation crew 2-3 days ahead. We got to make sure all the required components and installation materials are on site and everything is set up before heading out. Since most equipment manuals are in English there are always few problems installing new type of sensors so installation crew has to be on site on the day of startup to eliminate any installation mistakes made or make quick changes.

If everything is ready and installation crew is waiting we head out with the required tools. Everything starts with visual inspection of installation:

- checking if installation is according to layout;
- checking if there are any cables, sensors or buttons need to be relocated;
- checking cables (correct cross-section and marking).

After visual inspection we must check for short circuit just in case (during the transport or installation a lot can happen). Startup begins with checking if the motors are working and rotate in the correct direction. The hardest is to check if regeneration fan rotates in the correct direction because of its location, the only way is to climb up and check near the return pipe. If regeneration fan rotates in the wrong direction filter bags will quickly become clogged. After all the motors are working and rotating in the correct direction the installation crew can be sent home, this gives an advantage to listen every motor one by one checking for various problems like bad bearing.

When we load the ready program we have to make some minor network changes depending on local network and even after that there are almost every time some changes need to be made. First we check if every motor can be started from touch screen panel and if it turns in the correct direction. Second we setup an algorithm based on clients request with changeable variables for later adjustments. After all of the programming project leader inspects if everything is working according to clients request and if he's satisfied hands it over to the client.

Final stage is filter operators training according to user manual. If everything works and training is complete then our job is one.

8. USER MANUAL

8.1. General overview

Control modes - There are two options for controlling main recirculation filter apparatus

- Manual mode - apparatus works independently from others;
- Automatic mode - apparatus works along with others according to PLC program.

Emergency stop - Emergency stop buttons are located on switchboard door and near working components. If emergency stop button is activated the filter will stop.

In order to re-start recirculation filter after emergency stop users needs to:

- Find the reason why emergency stop was activated, and deactivate emergency stop button if problem is eliminated;
- Press emergency reset button;
- Turn on one of the waste exhaust fans (any waste exhaust fan).

Emergency stop button is only for emergency use!

Safety switch - electric motors that use safety switch can be disconnected from power source if required. Safety switches are not intended for switching appliance on/off in normal operating state. Safety switches are only for use when devices are turned off from the operating panel or when an emergency situation requires it.

All safety requirements must be followed during equipment maintenance, unauthorized personnel operations must be prevented. During maintenance and repairs recirculation filter must be stopped from the operation panel and corresponding device safety switch must be switched to position "0" and locked in position with a padlock. Repairing devices that do not have a safety switch recirculation filter must be stopped from the operation panel and switchboard main switch must be switched to position "0" and locked in position with a padlock.

Switching devices on-off can be done from operating panel. Restoring power does not automatically activate recirculation filter. Alarms can be reset by pressing "Häire reset" button on switchboard door or by operating panel. During alarms blinker is turned on indicating an alarm and it stays on while situation is active.

8.2. Recirculation filter working principles

When recirculation filter is turned off and no alarms are active the filter can be started by pressing "Puruventilaator start" button on switchboard door.

During recirculation filter startup following conditions must be met:

- emergency stop switches are deactivated;
- all explosion hatches are closed;
- all fire hatches are closed;
- all maintenance hatches are closed.

Startup is blocked if one of these conditions is not met, if during recirculation filter working one of these conditions fail the filter will be stopped, blinker and siren will be turned on and problem will be displayed on operating panel.

To start filtration system one of the exhaust fans should be started, this activates transfer fans. Transfer fans have some time to empty transfer piping before rotary feeders are activated. Rotary feeders have also some time to empty before screw conveyor activates. Screw conveyors empties filter from settled particles. After filter cleanup exhaust fans are starting and filter is ready for use. During startup green indicator lamp "Filter Sisselülitatud" is blinking. After the cleaning process green indicator will stay on.

Regeneration fans launching conditions:

- transfer fans are working;
- rotary feeders are working;
- screw conveyor is working.

Regeneration fans cleaning cycle:

- Initial cleaning - after recirculation filter startup when wood waste is properly working an initial cleaning will start. Initial cleaning lasts 90 seconds during which all regeneration fans are sequentially activated. Regeneration fan is activated for two seconds, there is two seconds pause and next regeneration fan is activated for two seconds.
- Normal operation cycle - while recirculation filter is working regeneration fans are activated after every three minutes during 57 seconds. Sequentially all regeneration fans are activated for two seconds, with two seconds pause before next fan is activated (similarly to initial cleaning cycle).
- Cleaning after shut down phase one - starts when filter is stopped. Phase one lasts for five minutes during which all the regeneration fans are sequentially activated for 2 seconds, with four seconds pause before next fan is activated.

- Cleaning after shut down phase two - starts after phase one. Phase two lasts for five minutes during which all the regeneration fans are sequentially activated for 4 seconds, with four seconds pause before next fan is activated

Exhaust fan launching conditions:

- transfer fans are working;
- rotary feeders are working;
- screw conveyor is working;
- recirculation filter is working.

Exhaust fan can be manually started with the following green start button and stopped with a red stop button.

Exhaust fan is stopped if

- critical recirculation filter error occurs;
- power loss.

Filter is stopped if none of the transfer fans are working for a set period of time (time can be adjusted from operating panel). Transfer piping system is stopped only after shut down cleaning phase one and two are done.

Recirculation filter is stopped immediately if:

- critical recirculation filter error occurs;
- power loss.

8.3. Using operating panel

Operating panel (figure 8.1) is used for:

- displaying system alerts;
- displaying devices status;
- devices configuration (restricted access);
- system parameters configuration.

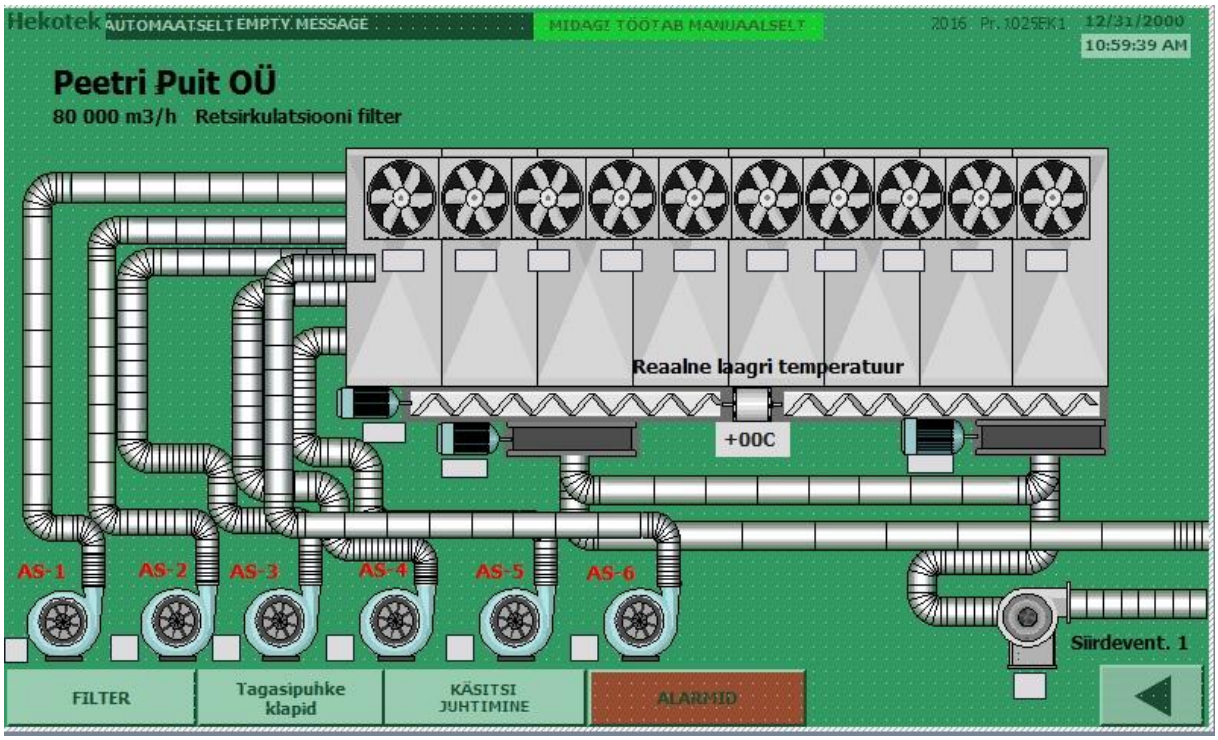


Figure 8.1 Operating panel

Recirculation filter controls	
Button	Function
F1	Home screen
F2	Summer/winter valves
F3	Devices and functions selecting
F4	Alarms
F5	HMI Panel settings
F6	Selecting devices and functions
F7	Selecting devices and functions
F8	Other settings
◀	Previous tab
▶	Next tab
FILTER	Filter home screen
Tagasipuhke klapid	Summer/winter valves manual control
KÄSITSI JUHTIMINE	Manual control of filter motors for maintenance or manual filter startup
ALARMID	Alarms

8.4. Manual control of filter motors

Manual control is shown in figure 8.1, "ON" button activates motor in manual mode and the button starts to flash, "OFF" turns manual mode off and setting lets user configure timer parameters. "Tööaeg" configures for how long the motor will be turned on, "Seismise aeg" configures time how long motor will wait after start command to turn the motor on and "Tagasiside aeg" configures how long the program will wait for the motor feedback after giving start command.

Figure 8.2 Filter motors manual control in HMI

8.5. Filter settings

Filter settings are divided in to four main categories (figure 8.2):

- Filter cleaning settings
- HMI panel settings
- Time settings
- Other settings

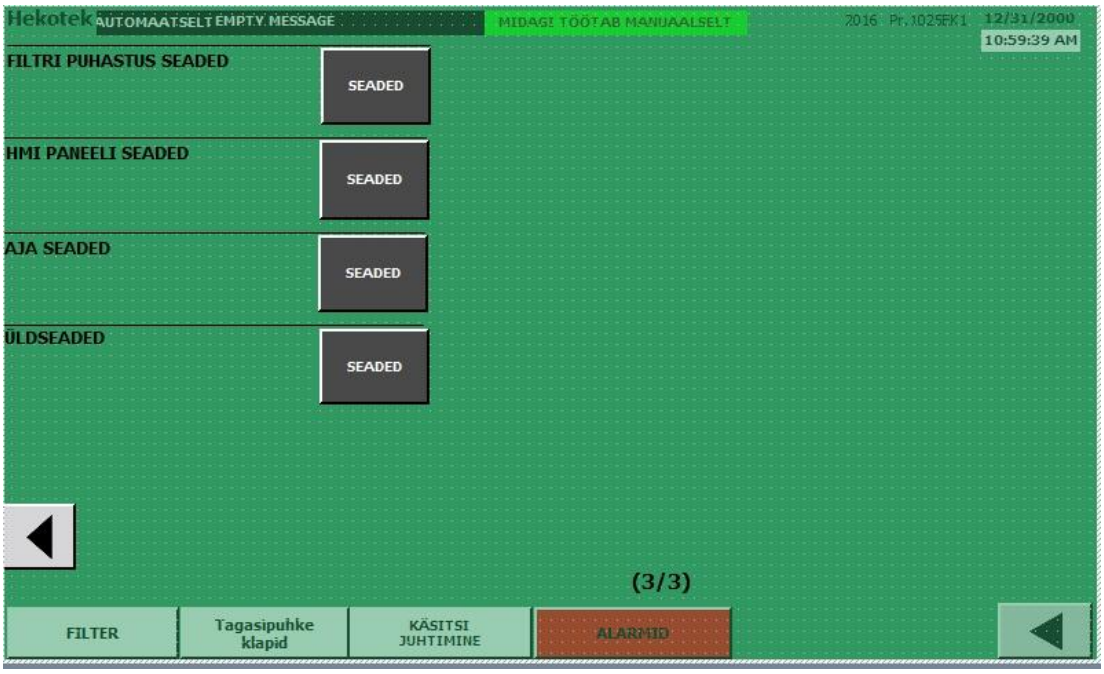


Figure 8.3 Filter settings control in HMI

Filter control is based on timers so filter cleaning settings lets user configure time for startup cleaning cycle, working cycle and shutdown cycle including time between cycles, regeneration filter working time and pause time, screw conveyor time (figure 8.3).

Figure 8.4 Filter cleaning settings control in HMI

A HMI panel setting has two functions, panel cleaning and calibration. Panel cleaning disables touch screen for 30 seconds for user to clean HMI panel which is essential in wood processing factories. Screen calibration calibrates automatically with no further user input required (figure 8.4).

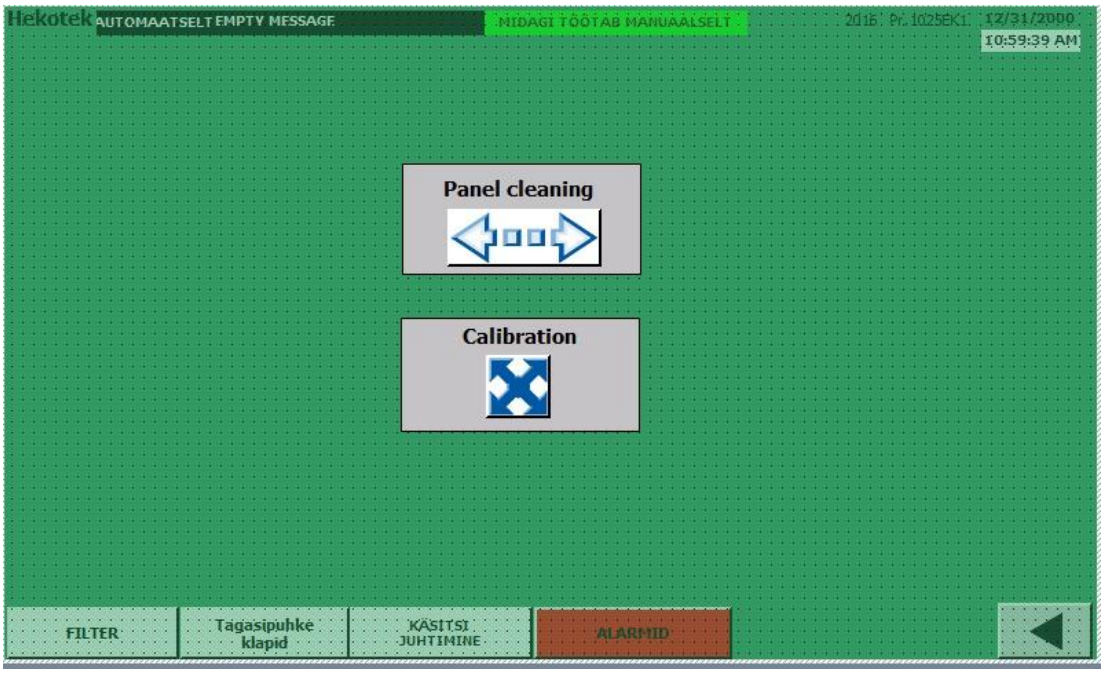


Figure 8.4 HMI settings

Time settings give user option to set local time which is later useful for checking alarm times. Other settings (figure 8.5):

- Filter shutdown timer - time after last fan has been switched off.
- Screw conveyor bearing maximum temperature - sets temperature maximum temperature after which filter is shut down (fire hazard)
- Siren maximum time
- Blinker maximum time

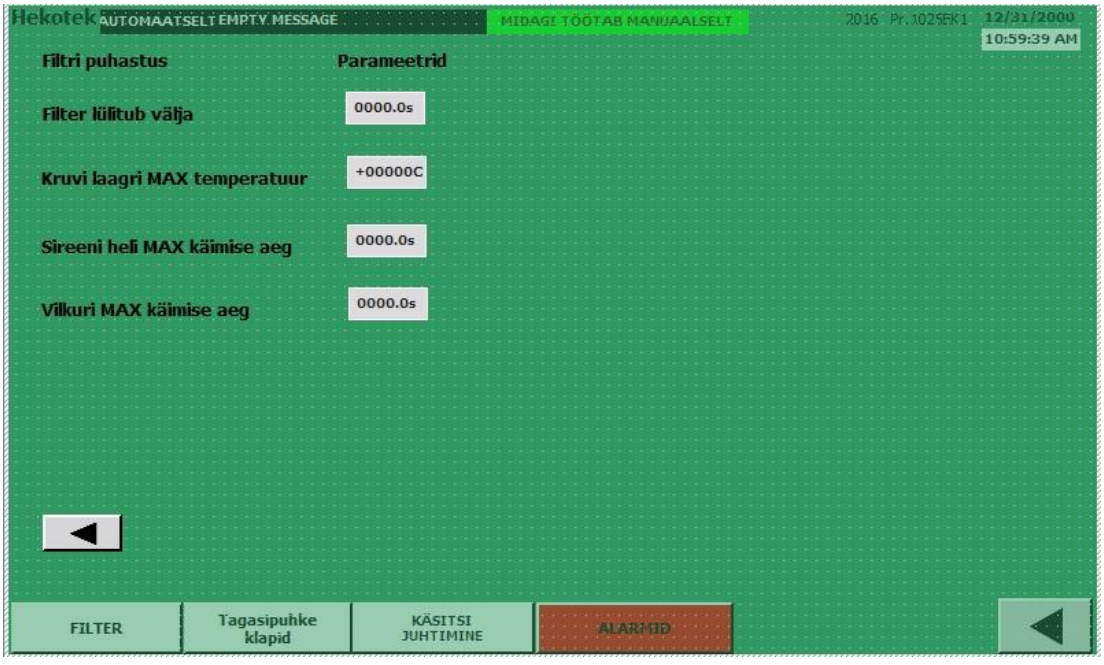


Figure 8.5 Other settings in HMI

8.6. Alarms

All alarms and warnings are displayed in HMI alarms screen (figure 5.3). "Aktiivsed häired" shows all active alarms that have not been reset. If alarms stay in active window after alarm reset then it means alarm is still active. "Häirete ajalugu" shows history of alarms, history can be cleared with "delete" button.

SUMMARY

Information gathered from previous recirculation filters helped to achieve the required task. Using requirements specified by client in contract we designed and programmed safety and alarms portion of the filter control system starting from risk estimation. Risk estimation was done to choose components to fit required category for safety of machinery which is controlled by EN ISO 13849 standard and our performance level was estimated at "d". Components were chosen according to required safety of machinery standard performance level, ATEX certification and IP rating. Safety relays were used in critical electrical circuit control parts to ensure safety performance level. Electrical circuit safety and alarms part was designed according to task, inspected and later tested on site to ensure everything was working the way it should be.

PLC programming part was later added to main program successfully whiteout any complications. HMI panel gives filter operator feedback on filter working process and if any emergency stop or safety switches are pressed filter operator can see from HMI panel where, what and when it happened. As with every program we have made a simple user manual with visual aid.

In conclusion recirculation filter was working according to contract and client was satisfied with the end result. Topic helped to implement acquired knowledge for company purposes and tacking the task gave additional experience and knowledge to help with everyday tasks is current company position and future projects.

KOKKUVÕTE

Antud projekt valmis vastavalt kliendi poolsetele nõudele, millest selles töös käsitleti turvaahelate ja häirete osa elektriskeemides ja nende integreerimises kontrolleri lõpp programmi.

Vastavalt standardile EN ISO 13849 hindasime antud seadme riskitasemeks "d". Vastavalt riski tasemele valisime turvaahela komponendid ning nende ühendusviisid (RT9 turvarelee puhul). Komponentide valikul jälgisime ka ATEX direktiividele vastavust, ilmastikukindlust ja meie põhiliste tarnijate tootevalikut.

Elektriskeemide projekteerimise osas arvestasime kliendi poolt tarnitavate komponentidega. elektrikilbi tellimisel valmistati see majanduslikel põhjustel suuremale lühisvoolule kui arvutuslikult vaja kontrollides samal kaitse rakendumist.

PLC lõppprogrammi alarmide ja turvaahelate integreerimisel probleeme ei esinenud. Filtri operaatorile visuaalse tagasiside jaoks on kliendi poolt nõutud HMI paneele, millelt on võimalik jälgida lisaks erinevatele mootorite seisunditele ja häirete tabelile näiteks ka tigukonveieri laagri temperatuuri reaalajas. Häirete tabelis kuvatakse hetkel aktiivseid olevaid häired (mida pole lähtestatud) ja ka häirete ajalugu, igal häirel on juures ka häire tekkimise aeg. Filtri paneeli kasutamiseks on koostatud ka kasutusjuhend ja kõik filtri operaatorid koolitatakse välja antud kasutusjuhendi põhjal filtriga töötama.

Kokkuvõtteks võib öelda, et seatud eesmärgid said täidetud ja klient on rahul. Antud töö käigus sai rakendatud omandatud teadmisi, saades juurde vajalike kogemusi ka edaspidisteks projektideks.

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APPENDICES

Appendix 1. Electrical switchboard 1025EK1.

Appendix 2. Electrical switchboard 1025EK2

Appendix 3. PLC Program

Appendix 4. Electrical switchboard

Appendix 5. Controls on switchboard door

Appendix 6. Filter after installation

Appendix 1 Electrical Switchboard 1025EK1

1. Elektrotehnilised andmed

1.1 Nimipinge	Un= 400/230V
1.2 Nimivool	In= 380A
1.3 Vastupidavus lühisele	Ik= 10 kA
1.4 Arvutuslik võimsus	Pn= 190 kW (cos fii = 0.82)
1.5 Juhistiku süsteem	TNS

2. Ehituslikud andmed

2.1 Keskuse tüüp	Metallkilp
2.2 Kaitseaste	IP 54
2.3 Paigaldusviis	Seinale
2.4 Kinnitusviis	Seinale
2.5 Ukse lukustus	Lihtsa pöördlukuga
2.6 Teenindusviis	1-poolne
2.7 Pinnakate	Pulbervärv RAL7032

3 Kaabliühenduste teostus

3.1 Toide	Ülevalt
3.2 Jõukaablid	Ülevalt
3.3 Juhtimiskaablid	Ülevalt

4 Tähistus

4.1 kilbisisesed juhtmed	Tähistada aparaadi klemmi põhiselt
5 Signaalaparatuur	Tavalised kilpides kasutatavad lambid

7 Tellija poolt tarnitavad seadmed
5 Pehmekäiviti
Kontroller, paneel ,lisamoodulid
Safety relay RT9 2tk

8 1025EK1 juurde kuuluvad joonised:
1025EK1

9 Seletused:

Aadress 3 numbrit 1025EK1/3/4
- 4 — kordinaat(joonise ülemine rida)
- 3 — lehe nr
- 1025EK1 — joonise nr

Aadress 2 numbrit 3/4
- 4 — kordinaat(joonise ülemine rida)
- 3 — lehe nr

Aadress 1 number 4
- 4 — kordinaat(joonise ülemine rida)

6 Märkused

Kilbis jätta ruumi 20% ulatses iga aparatuuri tüübi väljal (releede, kaitseaparatuuri, kontaktorite jne väljal)
Iga klemmi rea lõppu jätta 20% vaba ruumi. Toite jaotuspunktis jätta samuti 20% vaba ruumi.
⏚ – selliselt tähistatud potensiaali punktis tuleb juhtmed paigaldada antud punkti ja joonisel näidatud järjekorras.
⊤ – võib valmistaja ise valida kuhu juhtmed paigaldada.
Kontaktoritele ja releedele arvestada kontakte mitte vähem kui joonisel näidatud (arvestada ka reserv kontaktid)
Paigaldada kaablikinnitus liist, kus on võimalik kasutada juhtmesidemeid.
Kõik klemmliistud tõsta alusplaadist kõrgemale vähemalt 40mm.
Klemmliistu tähised panna nii, et neid on võimalik kaablite montaazi käigus hõlpsasti näha.
Kõik klemmid ühe klemmliistu nr piirides, millelt minnakse välja ühe kaabliga, panna üksteise kõrvale ühte ritta(näit QX1 kaabel W1-xxx)
Samuti peaks ühe klemmliistu nr piires klemmid olema kas ühes reas või mitmes reas aga üksteisele võimalikult lähedal(näit JX1)
Kontrollerile jätta külje peale vähemalt 200mm ruumi lisamoodulite paigaldamiseks
Kilbi sisene võõrpinge >50V tuleb vedada eri värvi juhtmega ja märkida kilbi uksele sisse poole kollasel taustal kiri "VÕÕRPINGE *juhtme värv* JUHTMEGA"
Kõikidele 24VDC releedele panna vastudioodiga valgusdioodmoodulid

Hädaseis lüliti fikseeruv ja pöörates tagastuv
Juhtkeskuse korpuse konstruktsioonielemente ei tohi kasutada kaitsemaandus- ja varjestuse maandusjuhina

D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:

Hekotek

Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h

Tehniline ülesanne

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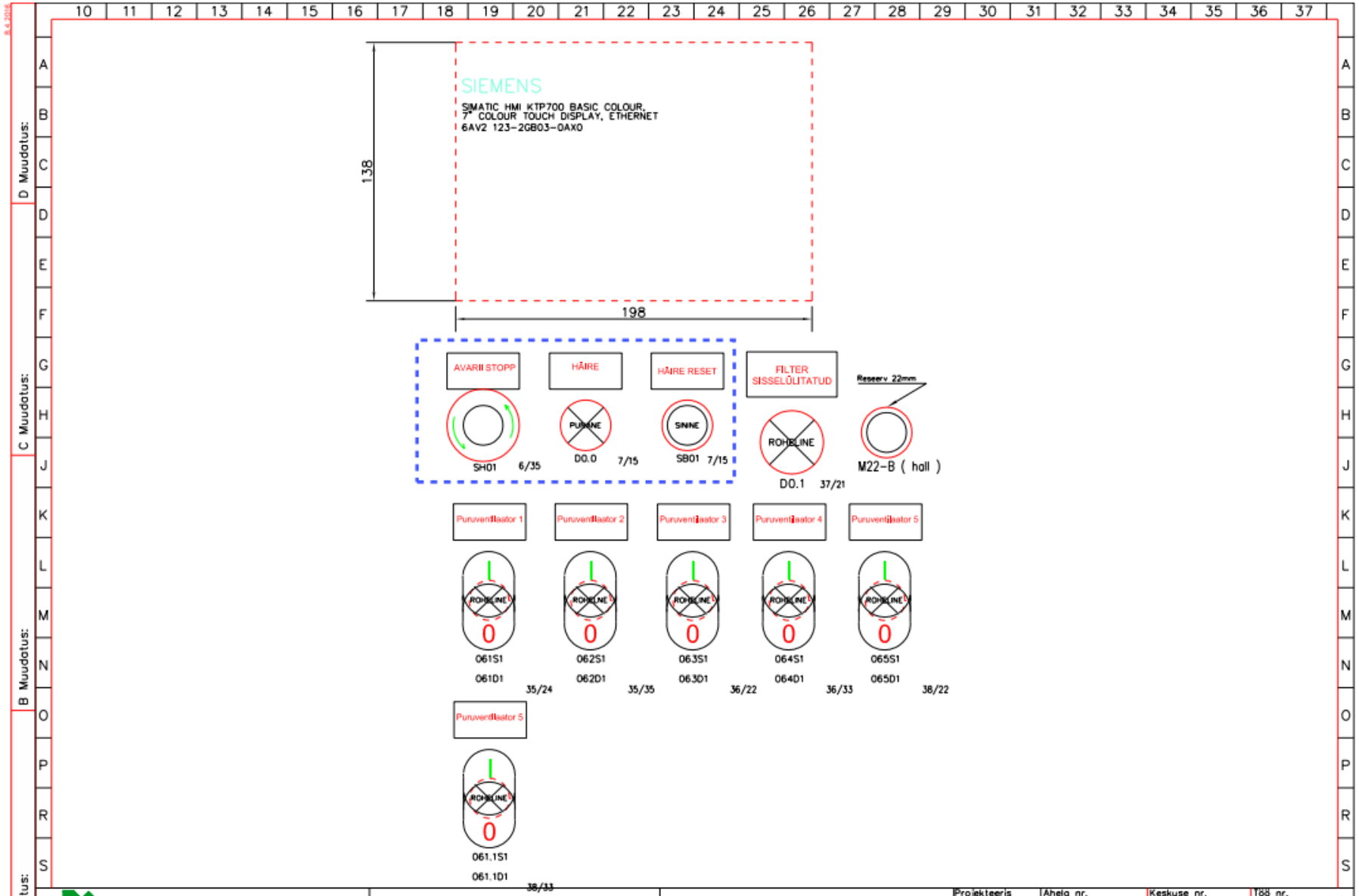
Kontrollis M.Sims	Leht 1/40	Joonise nr. 1025EK1	
Kinnitas A.Raigla			



Hekotek

Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h

Ukse eskiis

Projekteeris E.Henno 9.2.2016	Ahela nr.	Keskuse nr. +1025EK1	Töö nr. 1025
Kontrollis M.Sims	Leht 2 / 40	Joonise nr. 1025EK1	
Kinnitas A.Raigla			

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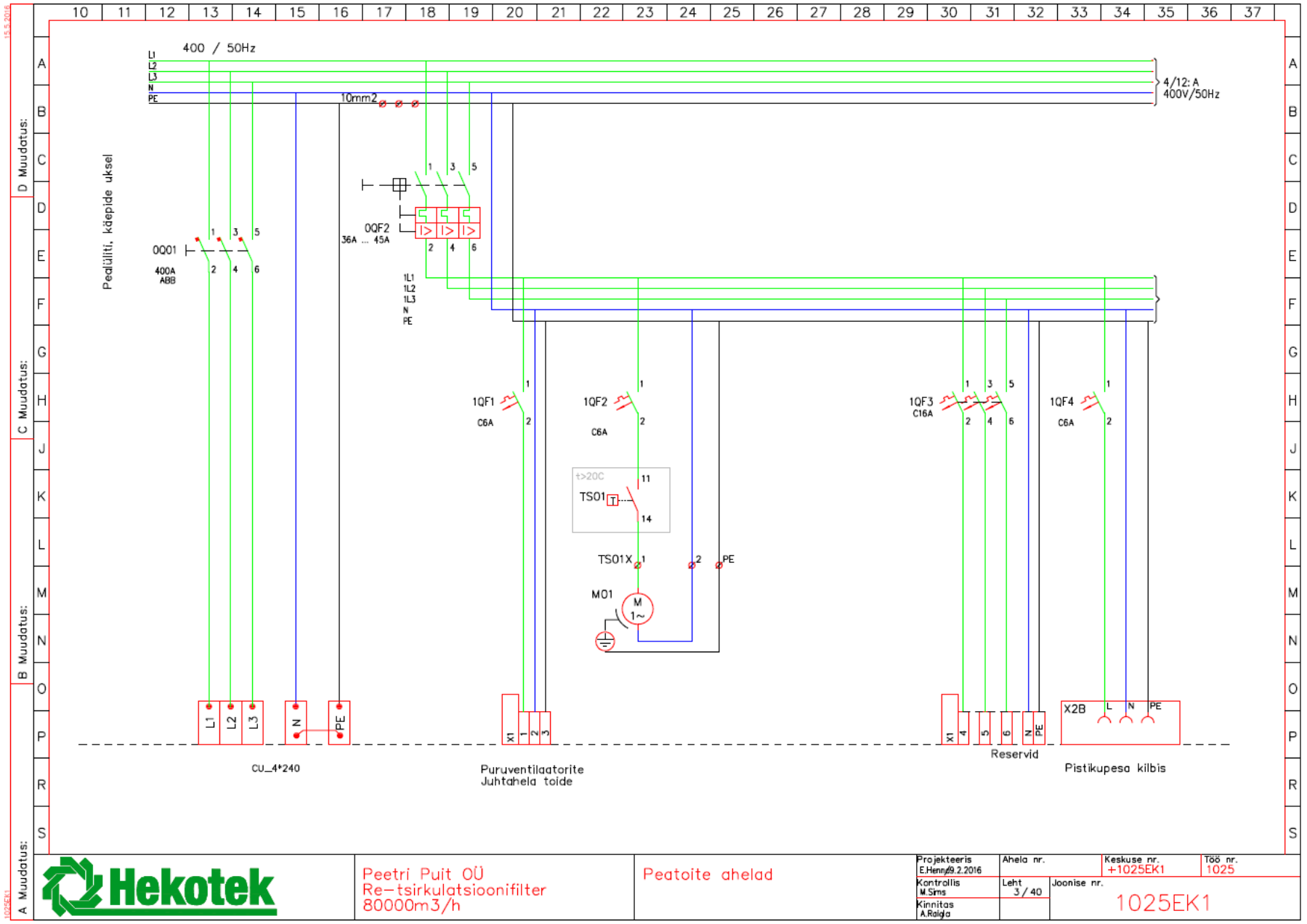
B Muudatus:
C Muudatus:
D Muudatus: 8.4.2016


400 / 50Hz
L1
L2
L3
N
PE
10mm2
4/12: A
400V/50Hz
Pealüliti, käepide uksel
0QQ1
400A
ABB
0QF2
36A ... 45A
1L1
1L2
1L3
N
PE
1QF1
C6A
1QF2
C6A
t>20C
TS01
TS01X
PE
M01
M
1~
1QF3
C16A
1QF4
C6A
X2B
L
N
PE
L1
L2
L3
N
PE
CU_4*240
X1
1
2
3
Puruventilaatorite
Juhtahela toide
X1
4
5
6
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Pistikupesa kilbis
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B Muudatus:
A Muudatus:
15.5.2016
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A.Raiga
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Töö nr.
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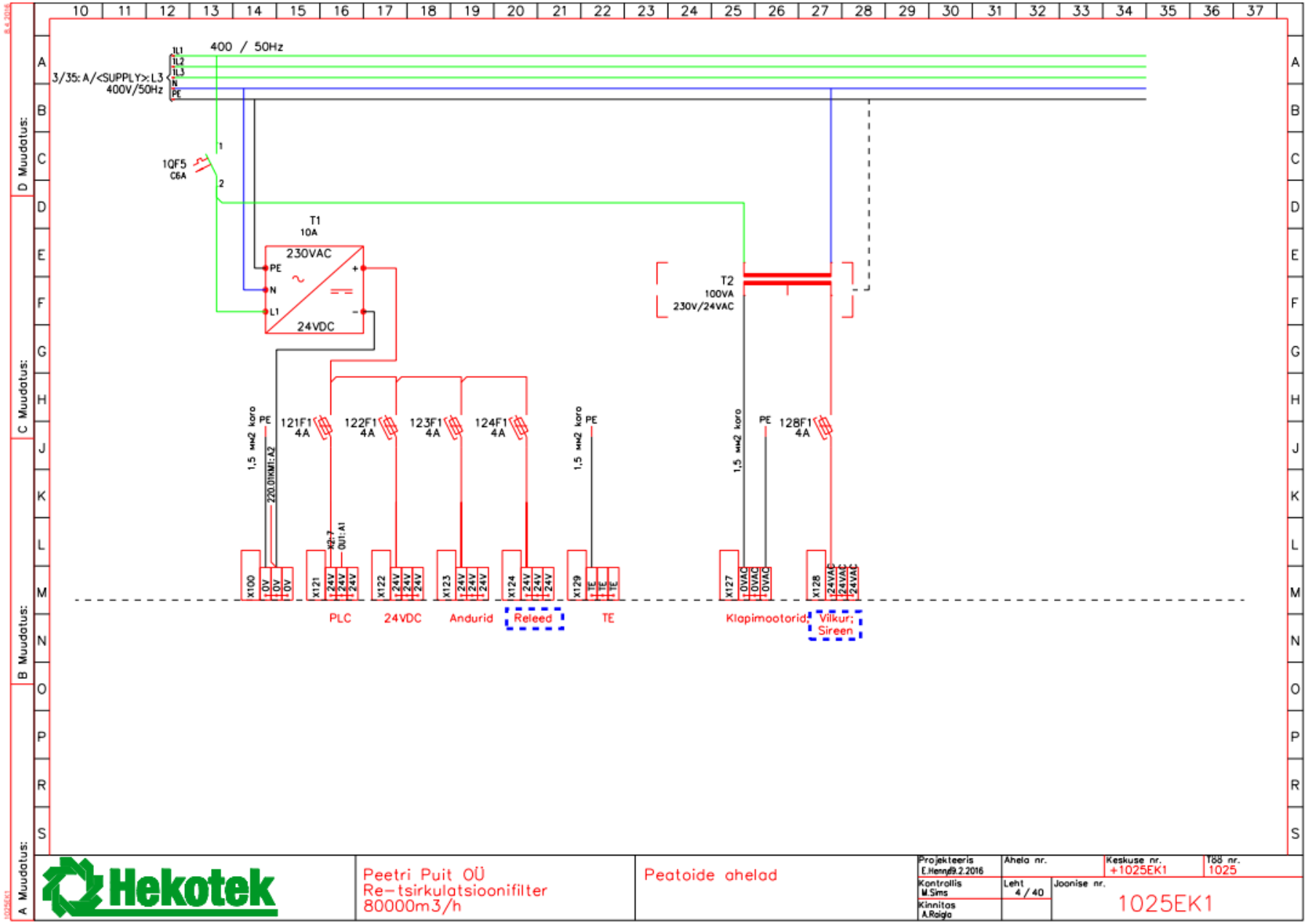
Joonise nr.
1025EK1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3/35: A/<SUPPLY>: L3
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1L1
1L2
1L3
N
PE
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10A
230VAC
24VDC
PE
N
L1
T2
100VA
230V/24VAC
121F1
4A
122F1
4A
123F1
4A
124F1
4A
128F1
4A
1,5 мм2 koro
220.01KM1:A2
K2:7
OUT:A1
X100
X121
X122
X123
X124
X129
X127
X128
0V
24V
TE
0VAC
24VAC
PLC
24VDC
Andurid
Releed
TE
Klapimootorid
Vilkur;
Sireen
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B Muudatus:
C Muudatus:
D Muudatus:
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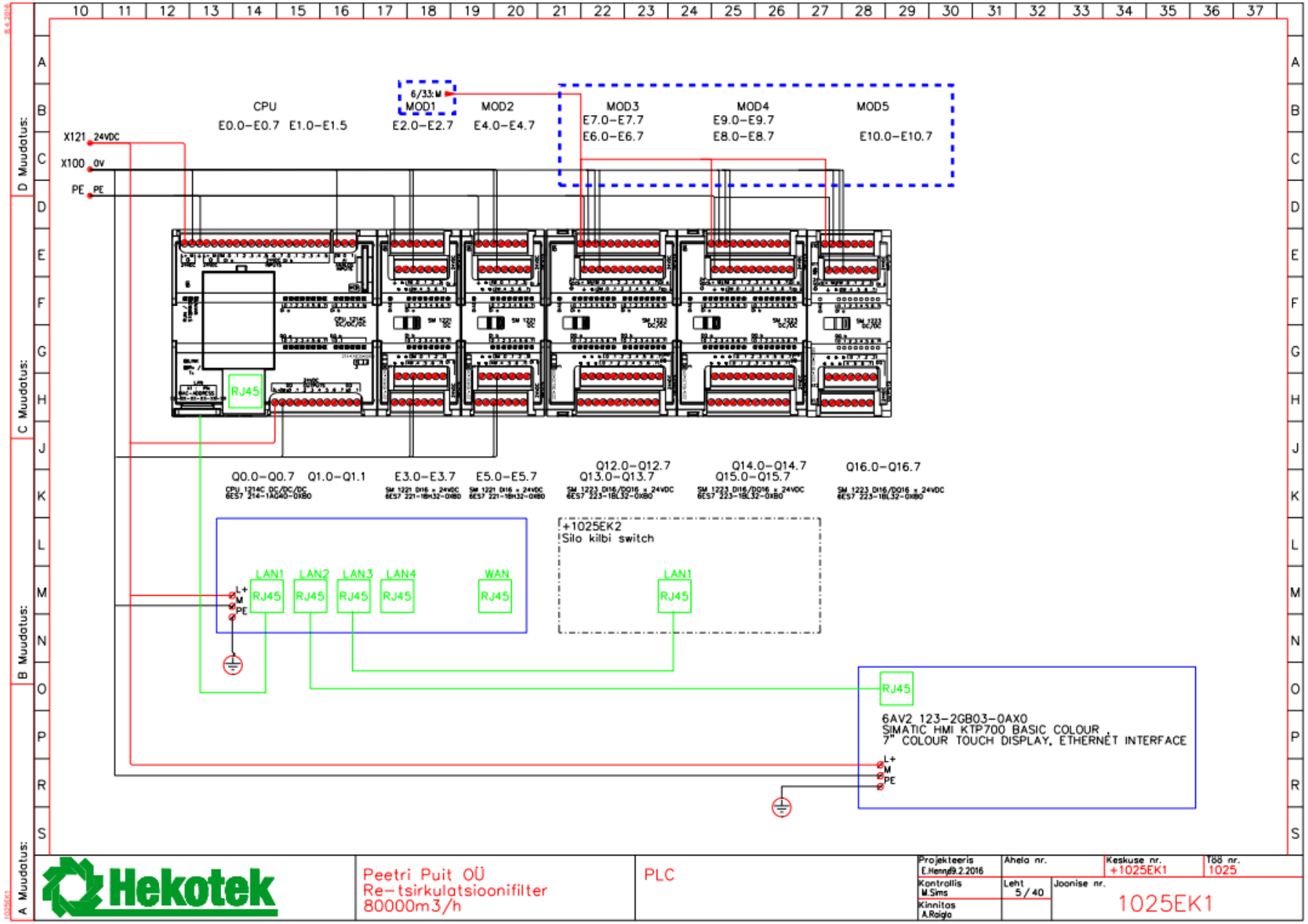
Joonise nr.
1025EK1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MOD2
E4.0–E4.7
MOD3
E7.0–E7.7
E6.0–E6.7
MOD4
E9.0–E9.7
E8.0–E8.7
MOD5
E10.0–E10.7
X121 24VDC
X100 0V
PE PE
RJ45
Q0.0–Q0.7 Q1.0–Q1.1
E3.0–E3.7 E5.0–E5.7
Q12.0–Q12.7
Q13.0–Q13.7
Q14.0–Q14.7
Q15.0–Q15.7
Q16.0–Q16.7
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Silo kilbi switch
LAN1 LAN2 LAN3 LAN4 WAN
L+
M
PE
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SIMATIC HMI KTP700 BASIC COLOUR
7" COLOUR TOUCH DISPLAY, ETHERNET INTERFACE
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C Muudatus:
B Muudatus:
A Muudatus:
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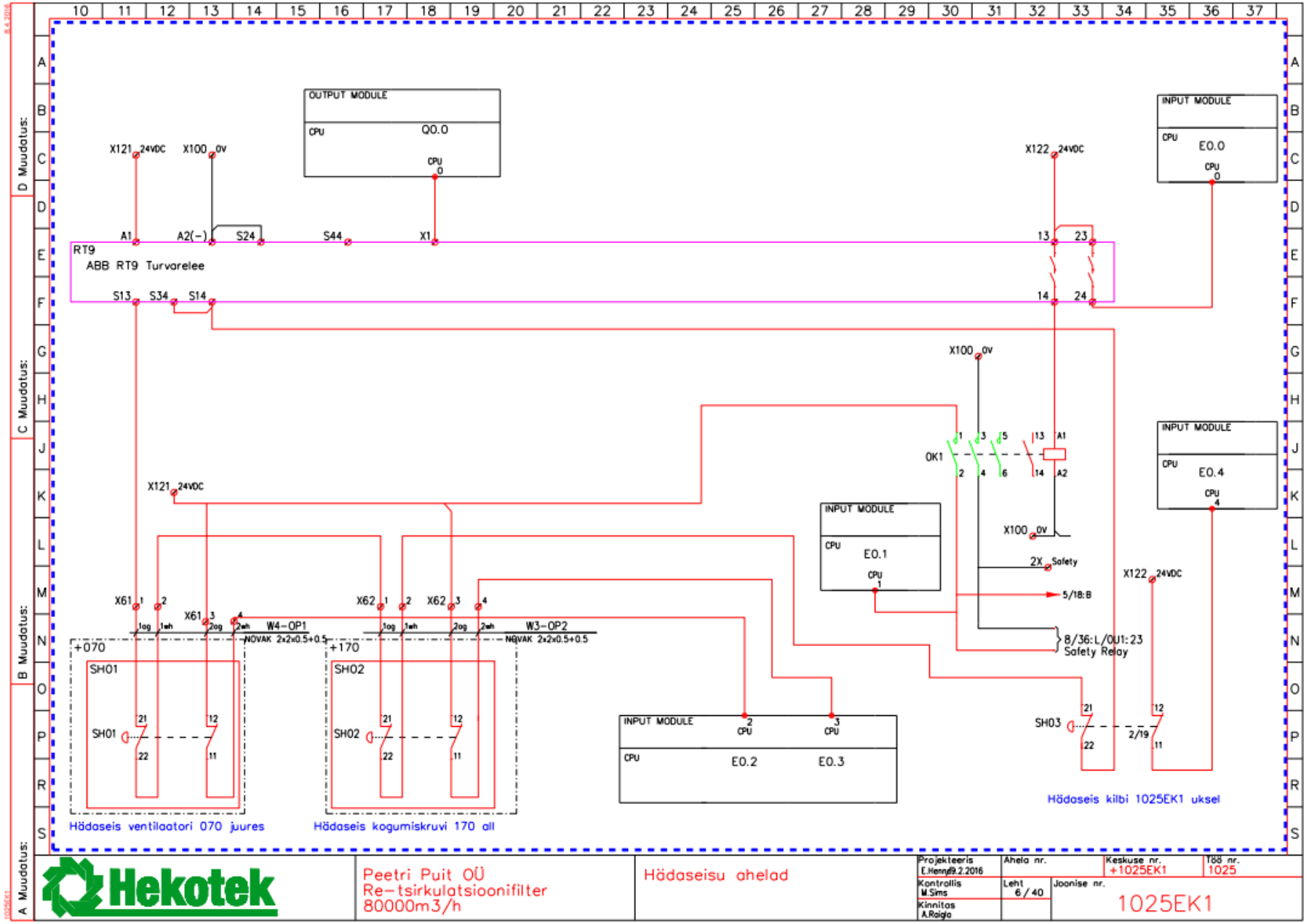
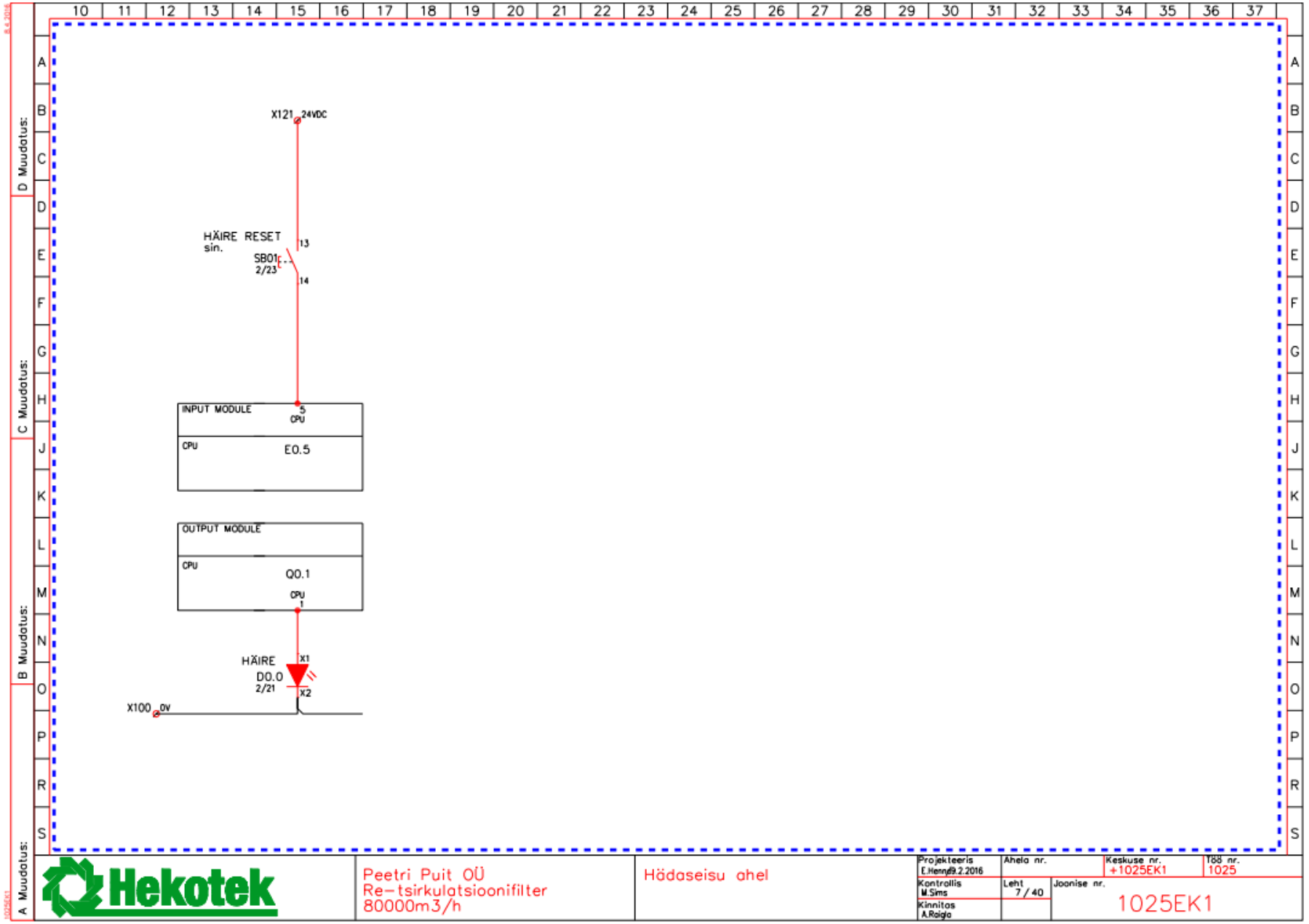
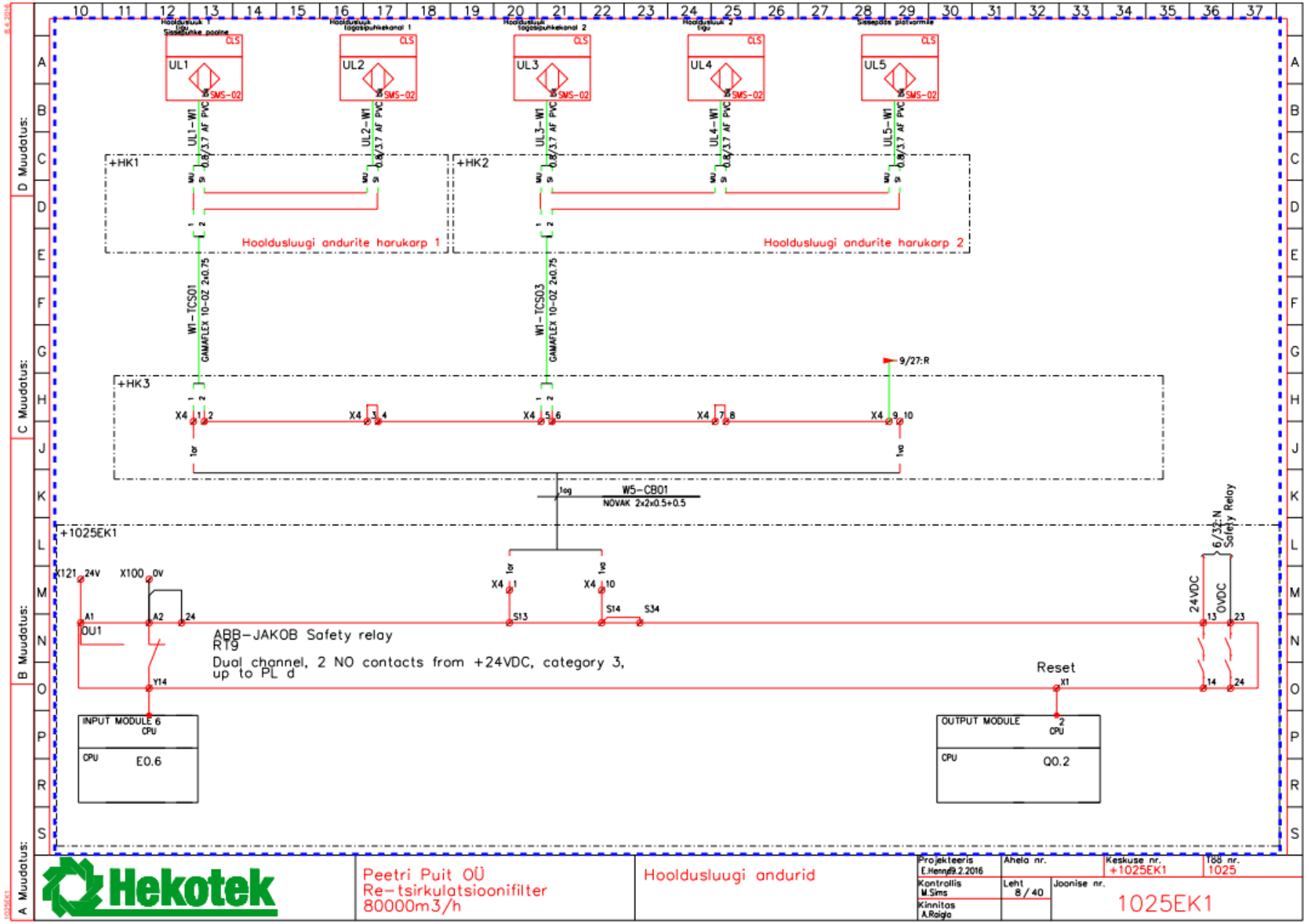
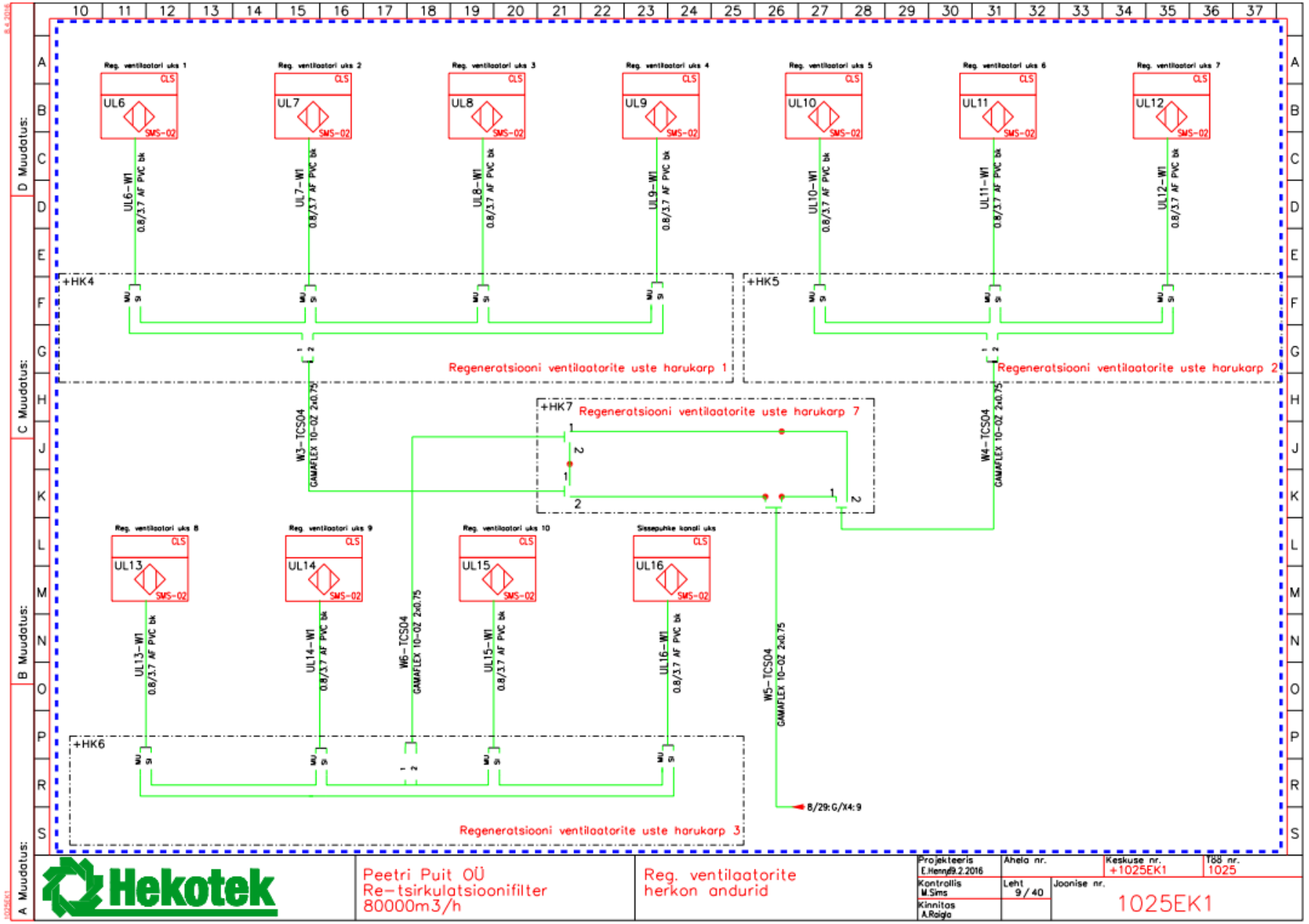
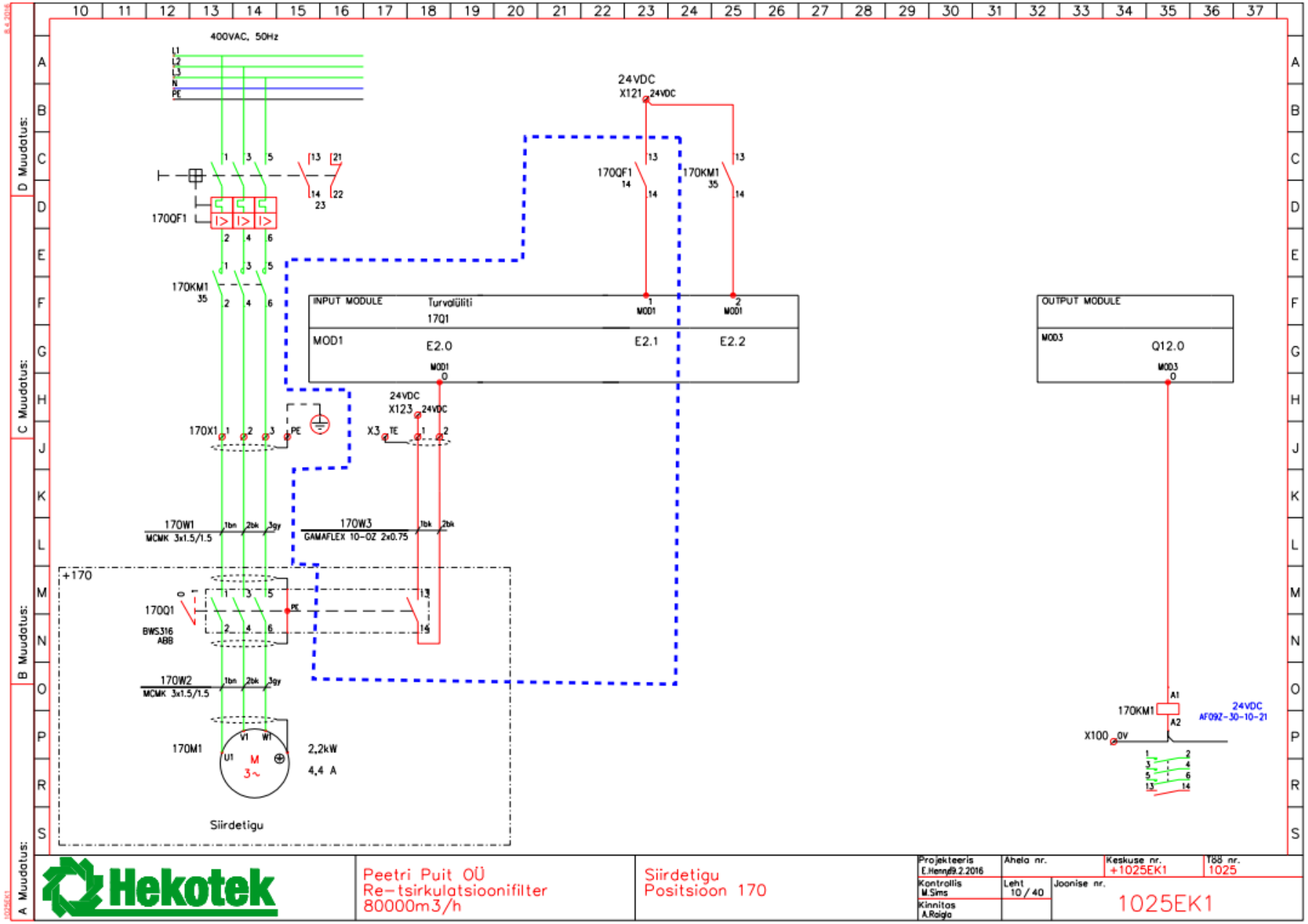
Joonise nr.
1025EK1

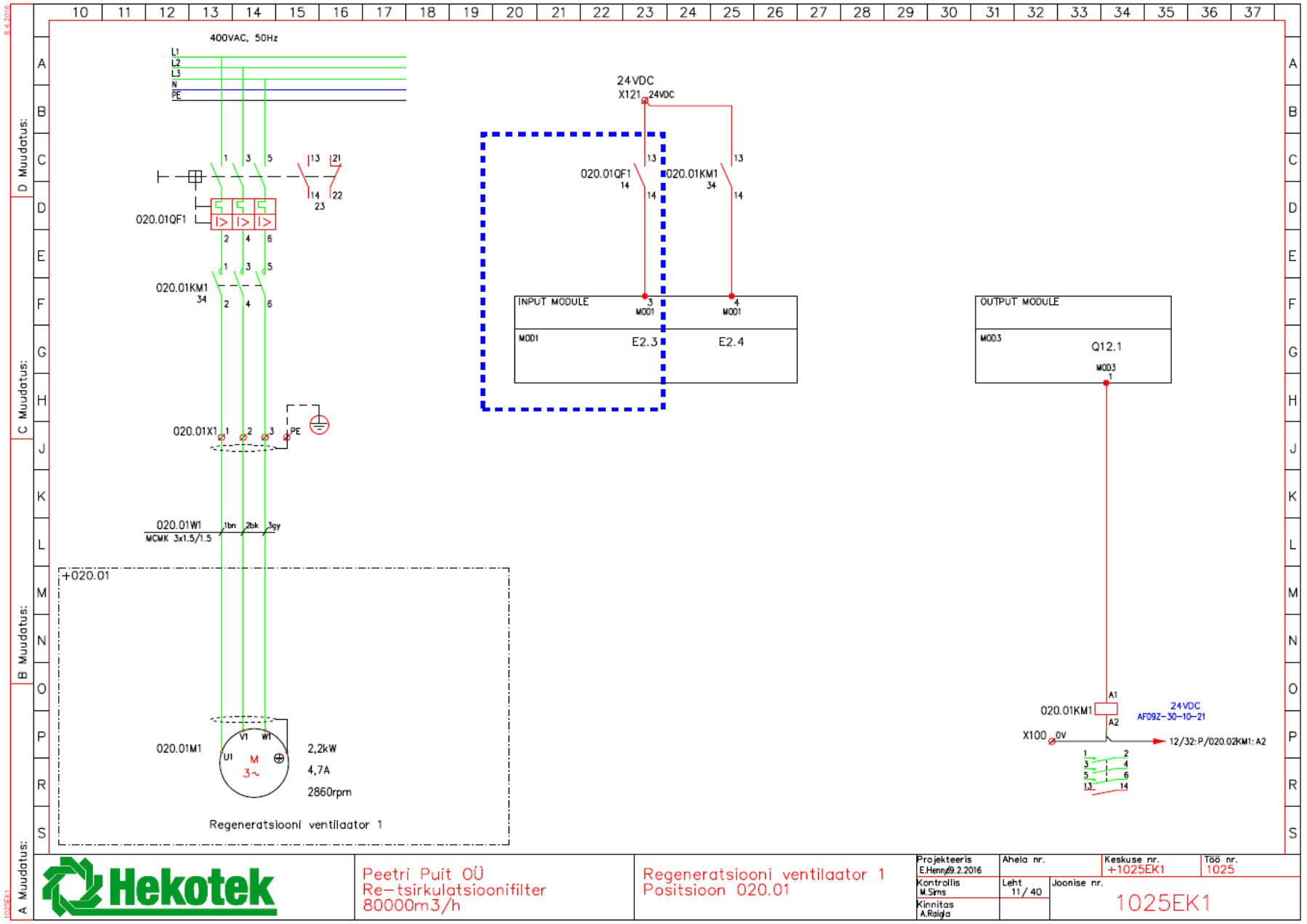

OUTPUT MODULE
CPU Q0.0
INPUT MODULE
CPU E0.0
INPUT MODULE
CPU E0.4
INPUT MODULE
CPU E0.1
INPUT MODULE
CPU E0.2 E0.3
X121 24VDC
X100 0V
X122 24VDC
A1
A2(-)
S24
S44
X1
13
23
14
24
RT9
ABB RT9 Turvarelee
S13
S34
S14
OK1
2X Safety
5/18:B
8/36:L/0U1:23
Safety Relay
X61
X62
W4-OP1
W3-OP2
NOVAK 2x2x0.5+0.5
+070
+170
SH01
SH02
SH03
2/19
Hädaseis ventilaatori 070 juures
Hädaseis kogumiskruvi 170 all
Hädaseis kilbi 1025EK1 uksel
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Hädaseisu ahelad
Projekteeris E.Henno 9.2.2016
Kontrollis M.Sims
Kinnitas A.Raigla
Leht 6 / 40
Keskuse nr. +1025EK1
Töö nr. 1025
Joonise nr. 1025EK1
A Muudatus:
B Muudatus:
C Muudatus:
D Muudatus:

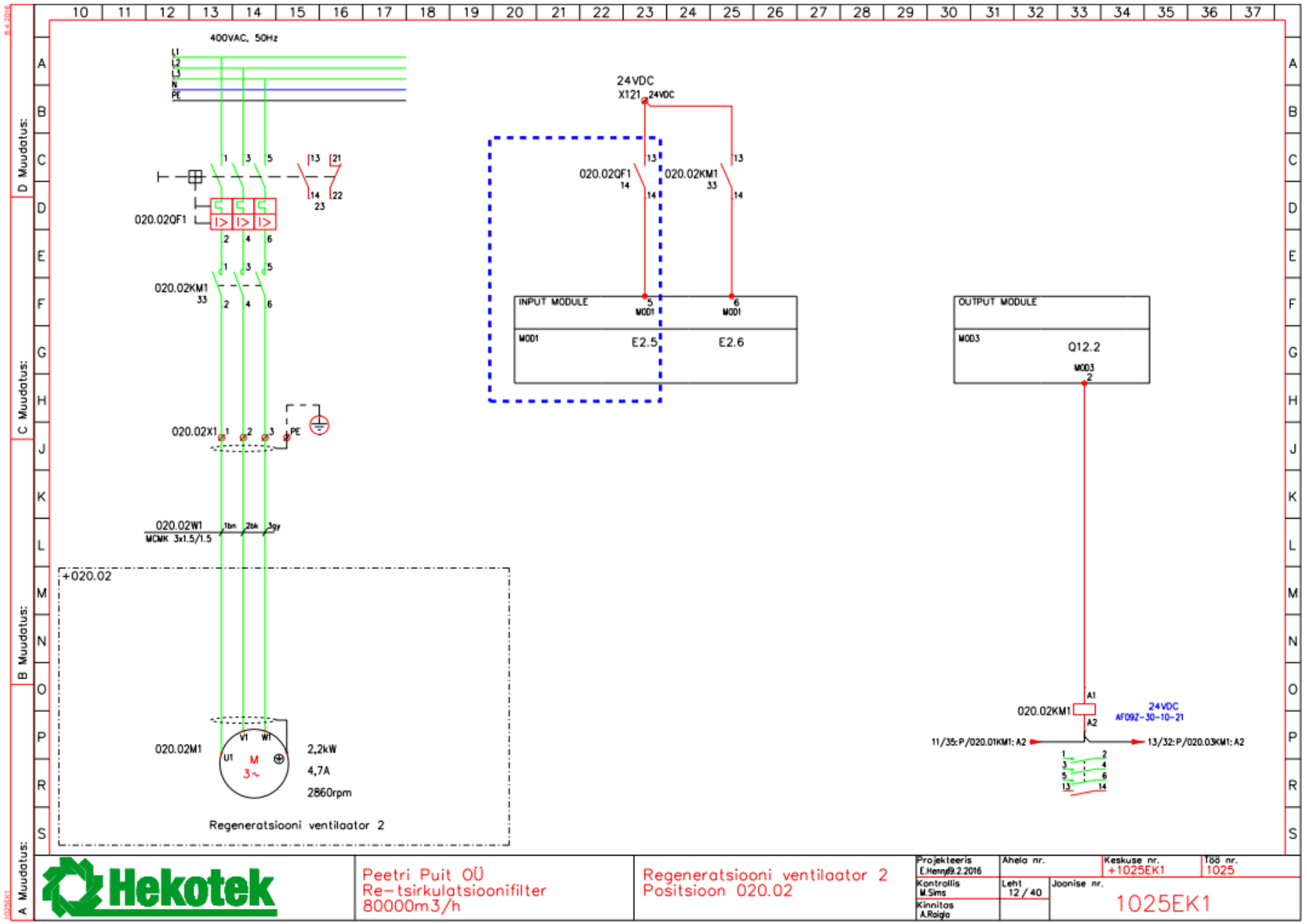

X121 24VDC
HÄIRE RESET
sin.
SB01
2/23
13
14
INPUT MODULE
5
CPU
CPU
E0.5
OUTPUT MODULE
CPU
Q0.1
CPU
1
HÄIRE
D0.0
2/21
X1
X2
X100 0V
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Hädaseisu ahel
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raiglo
Ahela nr.
Keskuse nr.
+1025EK1
Töö nr.
1025
Leht
7 / 40
Joonise nr.
1025EK1

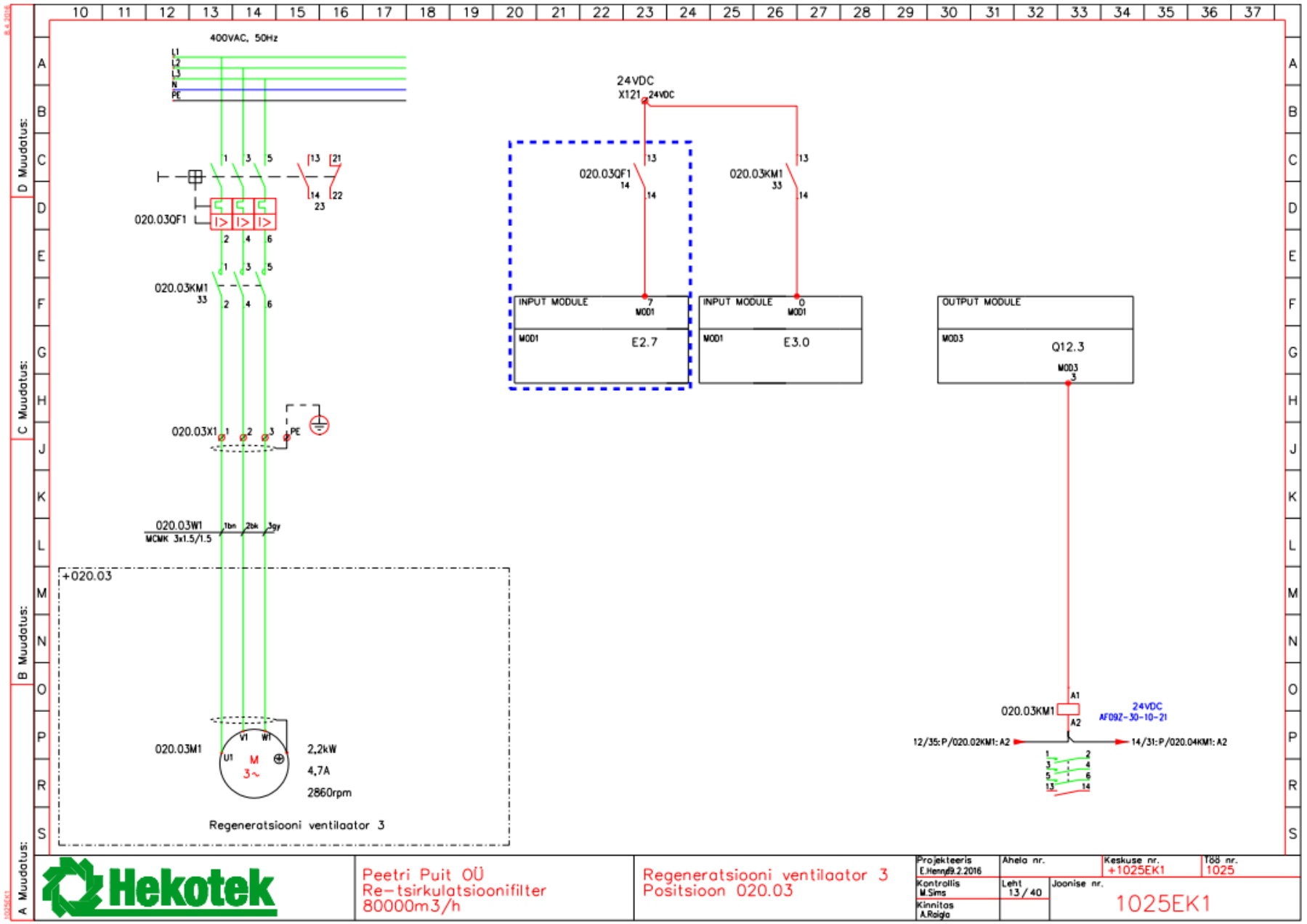

UL1
UL2
UL3
UL4
UL5
SMS-02
+HK1
+HK2
+HK3
Hooldusluugi andurite harukarp 1
Hooldusluugi andurite harukarp 2
W1-TCS01
W1-TCS03
GAMAFLEX 10-OZ 2x0.75
9/27:R
W5-CB01
NOVAK 2x2x0.5+0.5
+1025EK1
X121 24V
X100 0V
A1
A2
24
OU1
Y14
ABB-JAKOB Safety relay
RT9
Dual channel, 2 NO contacts from +24VDC, category 3,
up to PL d
S13
S14
S34
6/32:N
Safety Relay
24VDC
0VDC
13
23
14
24
Reset
X1
INPUT MODULE 6
CPU
E0.6
OUTPUT MODULE
2
Q0.2
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Hooldusluugi andurid
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
8 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

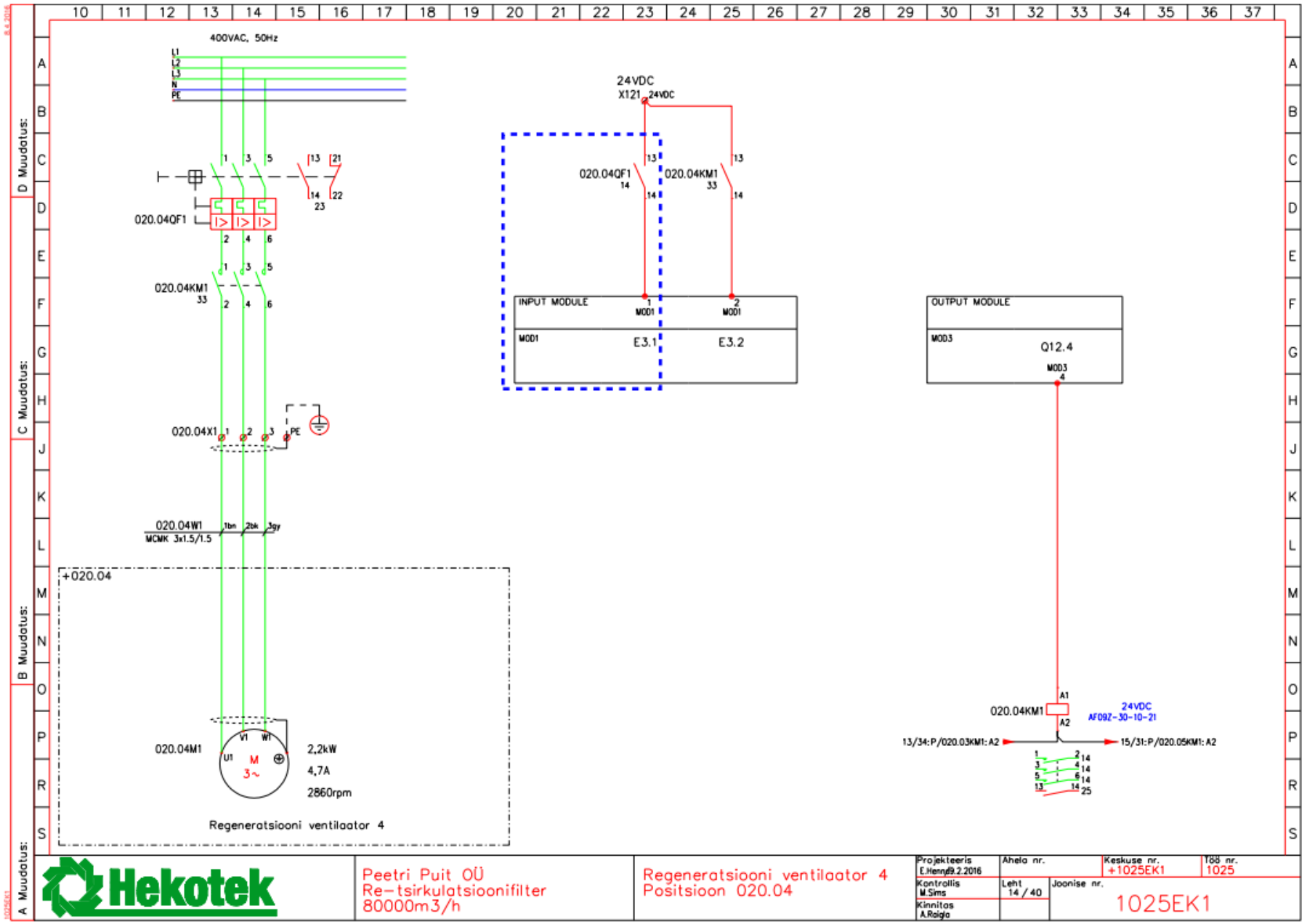

Reg. ventilaatori uks 1
Reg. ventilaatori uks 2
Reg. ventilaatori uks 3
Reg. ventilaatori uks 4
Reg. ventilaatori uks 5
Reg. ventilaatori uks 6
Reg. ventilaatori uks 7
UL6
UL7
UL8
UL9
UL10
UL11
UL12
SMS-02
UL6-W1 0.8/3.7 AF PVC bk
UL7-W1 0.8/3.7 AF PVC bk
UL8-W1 0.8/3.7 AF PVC bk
UL9-W1 0.8/3.7 AF PVC bk
UL10-W1 0.8/3.7 AF PVC bk
UL11-W1 0.8/3.7 AF PVC bk
UL12-W1 0.8/3.7 AF PVC bk
+HK4
+HK5
Regeneratsiooni ventilaatorite uste harukarp 1
Regeneratsiooni ventilaatorite uste harukarp 2
W3-TCS04 GAMAFLEX 10-02 2x0.75
W4-TCS04 GAMAFLEX 10-02 2x0.75
+HK7
Regeneratsiooni ventilaatorite uste harukarp 7
Reg. ventilaatori uks 8
Reg. ventilaatori uks 9
Reg. ventilaatori uks 10
Sissepuhke kanali uks
UL13
UL14
UL15
UL16
UL13-W1 0.8/3.7 AF PVC bk
UL14-W1 0.8/3.7 AF PVC bk
UL15-W1 0.8/3.7 AF PVC bk
UL16-W1 0.8/3.7 AF PVC bk
W6-TCS04 GAMAFLEX 10-02 2x0.75
W5-TCS04 GAMAFLEX 10-02 2x0.75
+HK6
Regeneratsiooni ventilaatorite uste harukarp 3
8/29:G/X4:9
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Reg. ventilaatorite herkon andurid
Projekteeris E.Henno 9.2.2016
Kontrollis M.Sims
Kinnitas A.Raigla
Ahela nr.
Leht 9 / 40
Keskuse nr. +1025EK1
Töö nr. 1025
Joonise nr. 1025EK1

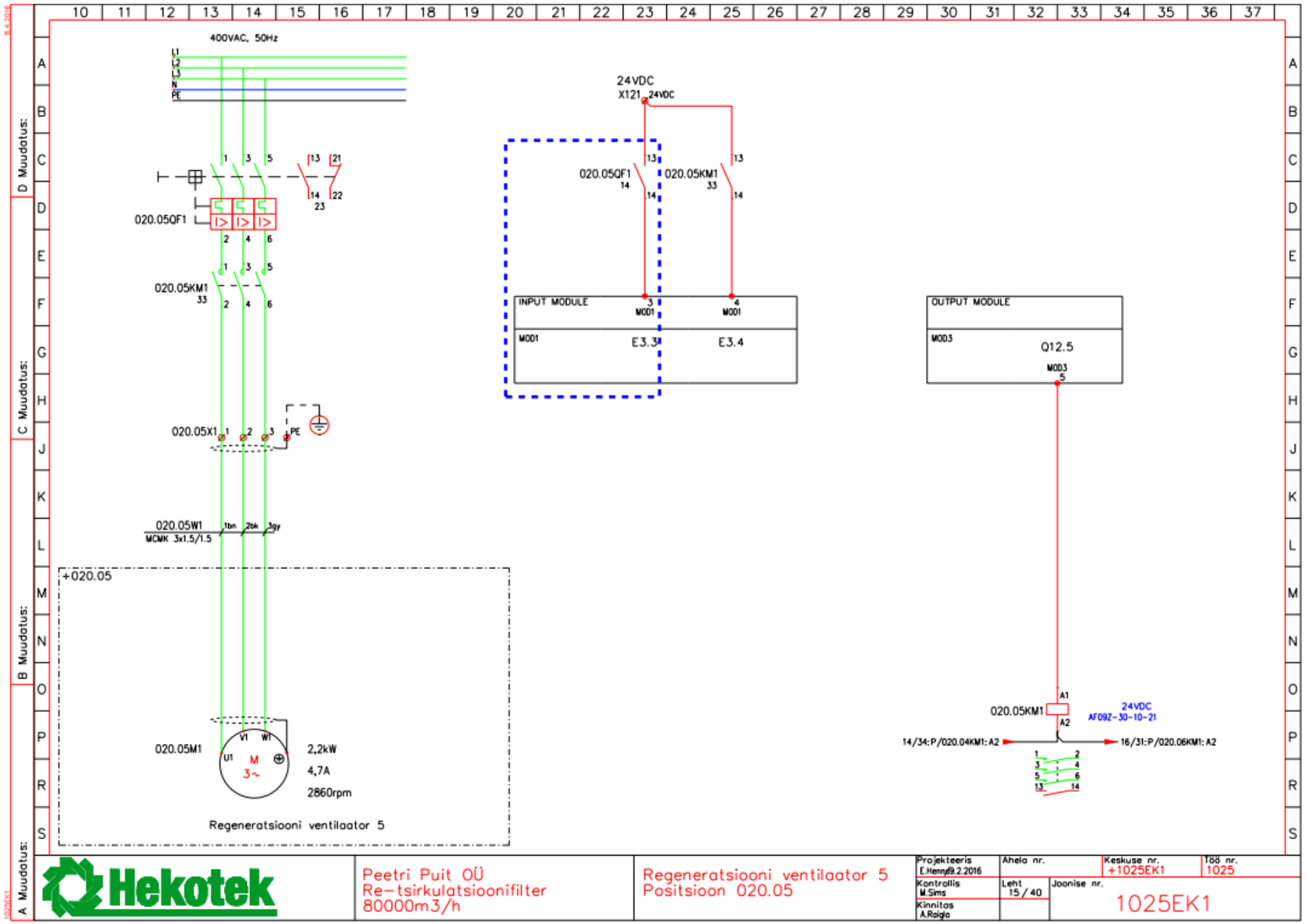

400VAC, 50Hz
L1
L2
L3
N
PE
24VDC
X121
24VDC
170QF1
170KM1
35
INPUT MODULE
Turvalüliti
17Q1
MOD1
E2.0
E2.1
E2.2
24VDC
X123
170X1
X3
170W1
MCMK 3x1.5/1.5
170W3
GAMAFLEX 10-OZ 2x0.75
+170
170Q1
BWS316
ABB
170W2
MCMK 3x1.5/1.5
170M1
2,2kW
4,4 A
Siirdetigu
OUTPUT MODULE
MOD3
Q12.0
170KM1
24VDC
AF09Z-30-10-21
X100
0V
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Siirdetigu
Positsioon 170
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
10 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

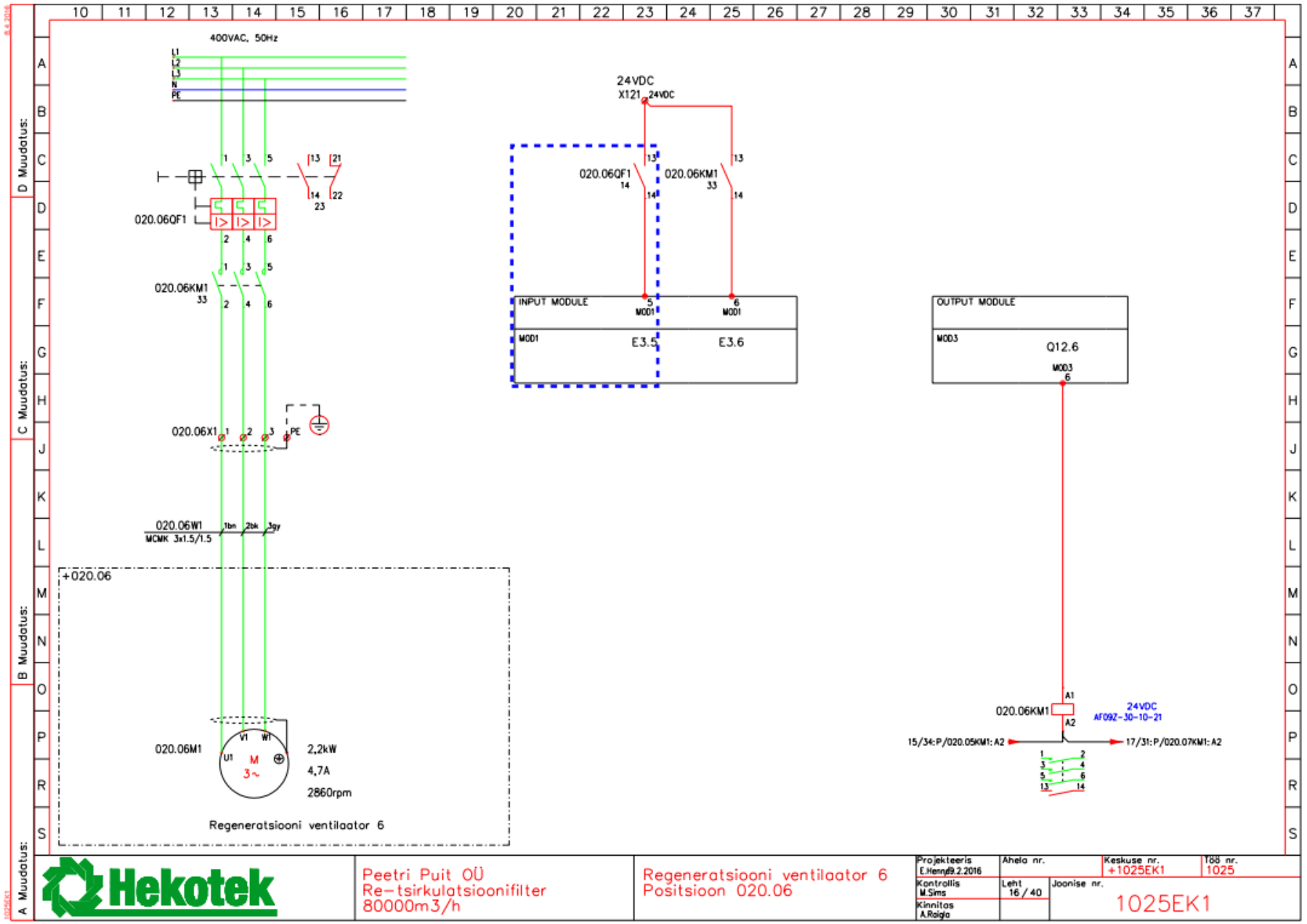

400VAC, 50Hz
L1
L2
L3
N
PE
020.01QF1
020.01KM1
34
020.01X1
PE
020.01W1
MCMK 3x1.5/1.5
1bn
2bk
3gy
+020.01
020.01M1
U1
V1
W1
M
3~
2,2kW
4,7A
2860rpm
Regeneratsiooni ventilaator 1
24VDC
X121
24VDC
020.01QF1
020.01KM1
INPUT MODULE
MOD1
E2.3
E2.4
OUTPUT MODULE
MOD3
Q12.1
020.01KM1
A1
A2
24VDC
AF09Z-30-10-21
X100
0V
12/32:P/020.02KM1:A2
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Regeneratsiooni ventilaator 1
Positsioon 020.01
Projekteeris
E.Henn 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raiga
Ahela nr.
Leht
11 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

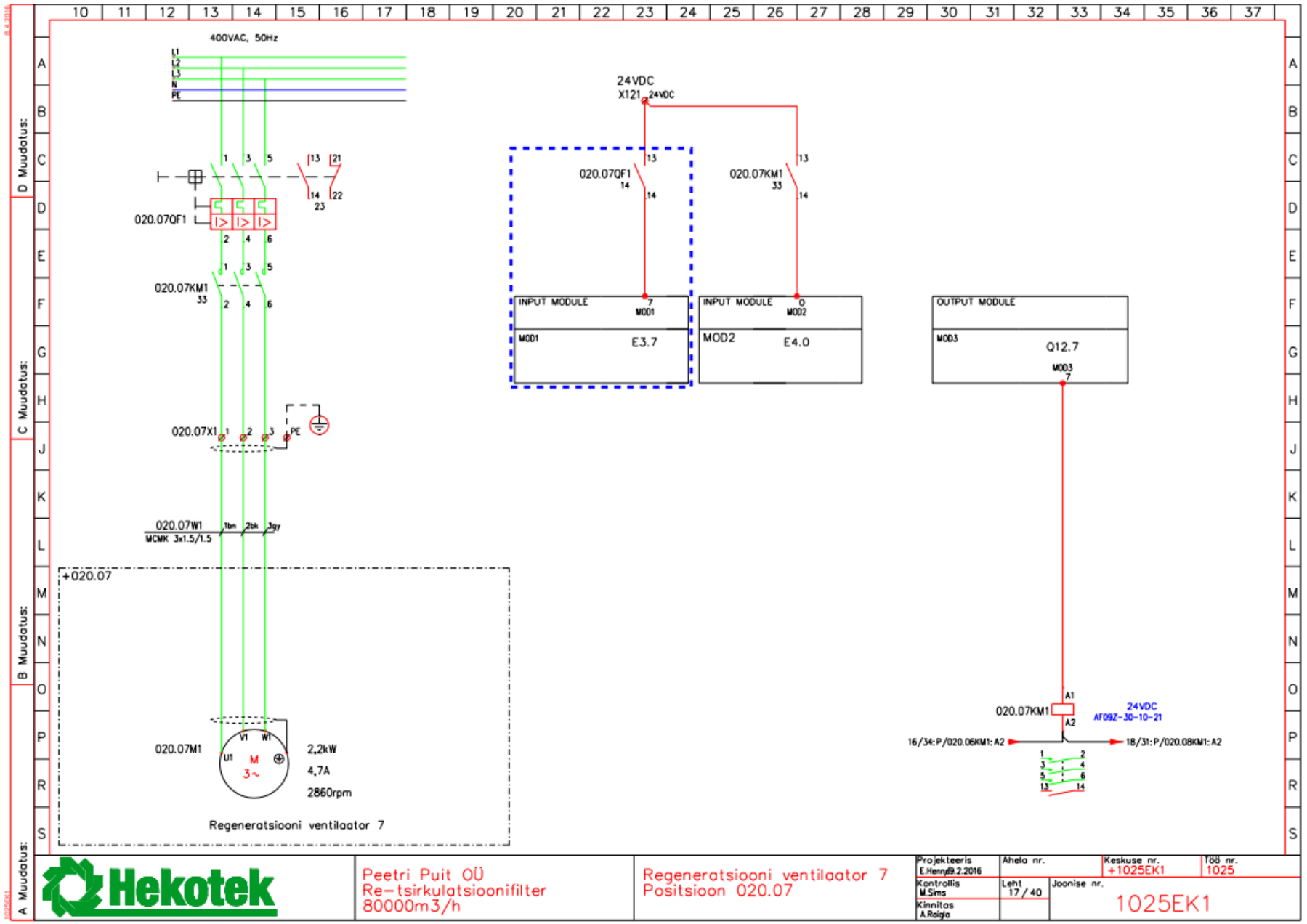

400VAC, 50Hz
L1
L2
L3
N
PE
020.02QF1
020.02KM1
33
020.02X1
PE
020.02W1
MCMK 3x1.5/1.5
1bn
2bk
3gy
+020.02
020.02M1
U1
V1
W1
M
3~
2,2kW
4,7A
2860rpm
Regeneratsiooni ventilaator 2
24VDC
X121
24VDC
020.02QF1
020.02KM1
INPUT MODULE
MOD1
E2.5
E2.6
OUTPUT MODULE
MOD3
Q12.2
020.02KM1
A1
A2
24VDC
AF09Z-30-10-21
11/35:P/020.01KM1:A2
13/32:P/020.03KM1:A2
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Regeneratsiooni ventilaator 2
Positsioon 020.02
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
12 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

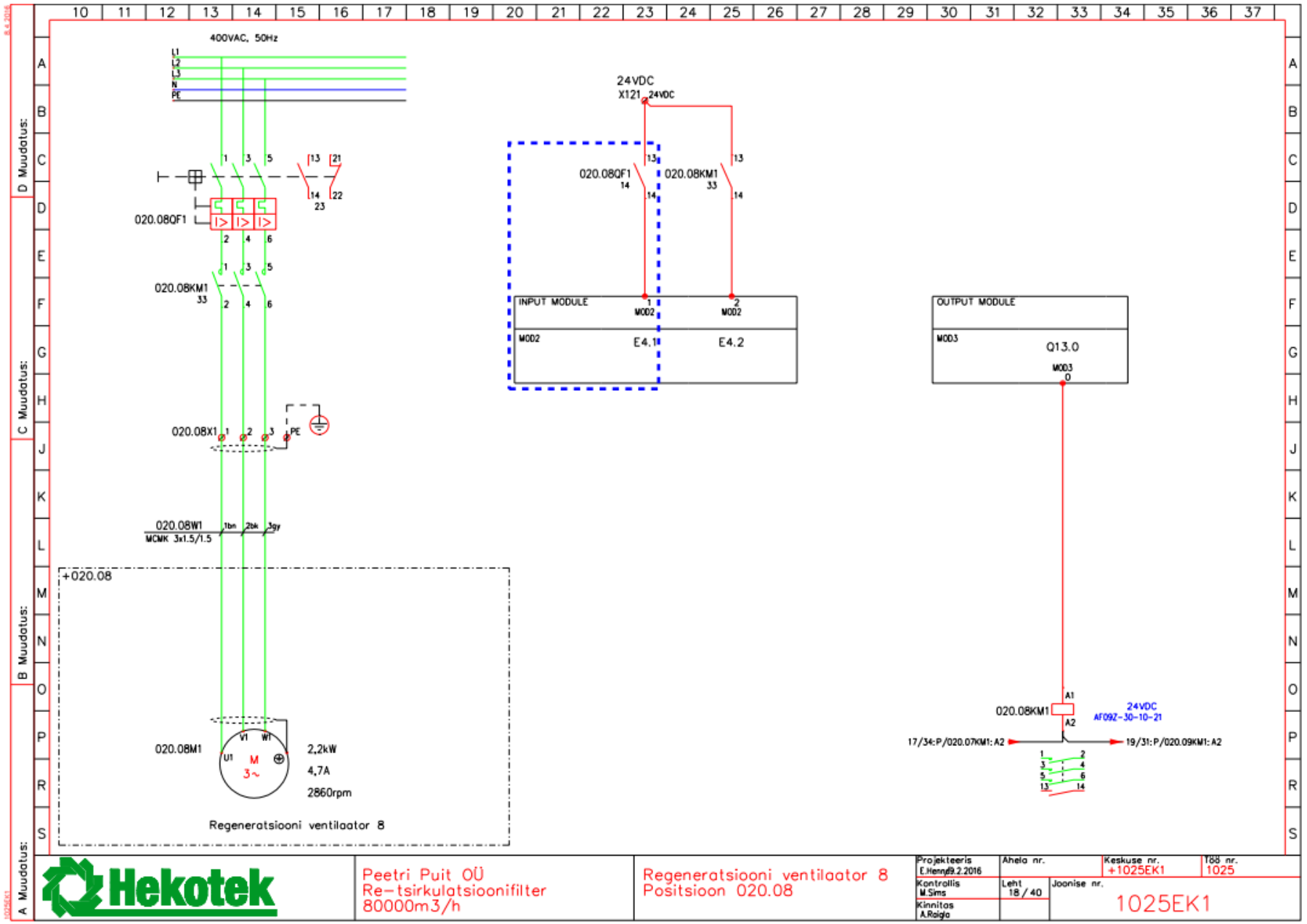

400VAC, 50Hz
L1
L2
L3
N
PE
020.03QF1
020.03KM1
33
020.03X1
020.03W1
MCMK 3x1.5/1.5
+020.03
020.03M1
2,2kW
4,7A
2860rpm
Regeneratsiooni ventilaator 3
24VDC
X121
24VDC
020.03QF1
020.03KM1
INPUT MODULE
MOD1
E2.7
INPUT MODULE
MOD1
E3.0
OUTPUT MODULE
MOD3
Q12.3
020.03KM1
24VDC
AF09Z-30-10-21
12/35:P/020.02KM1:A2
14/31:P/020.04KM1:A2
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Regeneratsiooni ventilaator 3
Positsioon 020.03
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
13 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

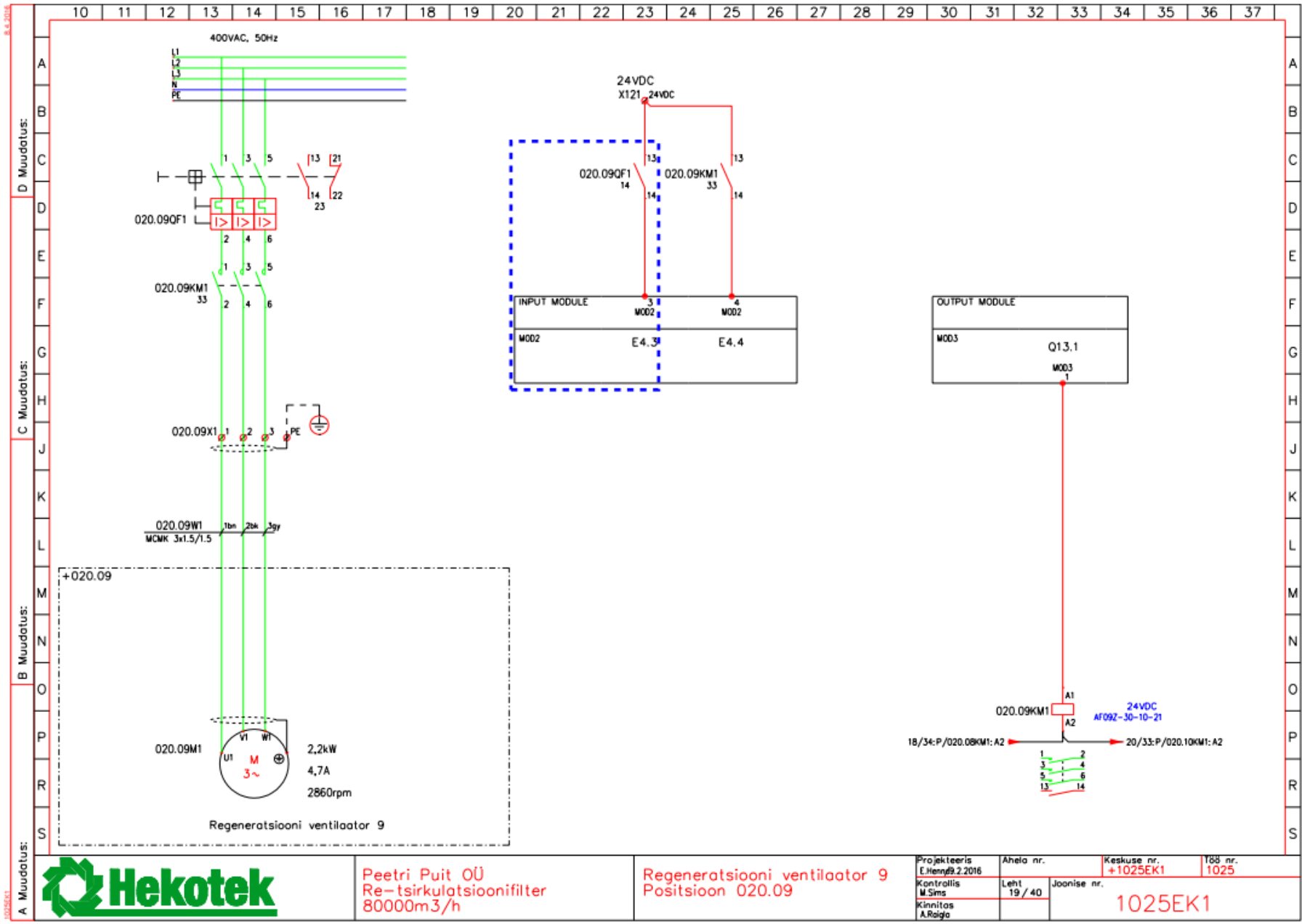

400VAC, 50Hz
L1
L2
L3
N
PE
020.04QF1
020.04KM1
33
020.04X1
PE
020.04W1
MCMK 3x1.5/1.5
1bn
2bk
3gy
+020.04
020.04M1
U1
V1
W1
M
3~
2,2kW
4,7A
2860rpm
Regeneratsiooni ventilaator 4
24VDC
X121
24VDC
020.04QF1
020.04KM1
INPUT MODULE
MOD1
E3.1
E3.2
OUTPUT MODULE
MOD3
Q12.4
020.04KM1
A1
A2
24VDC
AF09Z-30-10-21
13/34:P/020.03KM1:A2
15/31:P/020.05KM1:A2
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Regeneratsiooni ventilaator 4
Positsioon 020.04
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
14 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

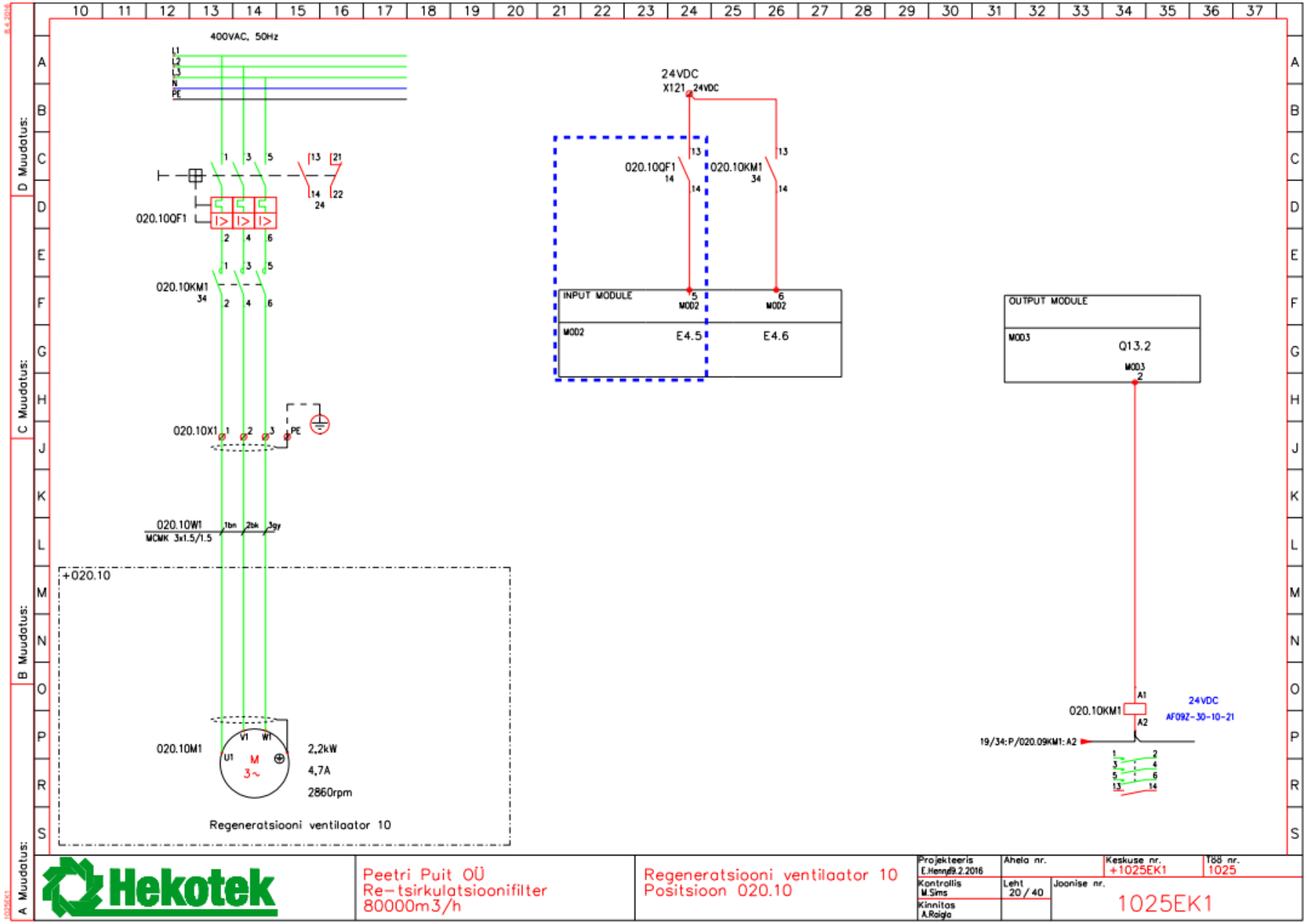

400VAC, 50Hz
L1
L2
L3
N
PE
020.05QF1
020.05KM1
33
020.05X1
020.05W1
MCMK 3x1.5/1.5
1bn
2bk
3gy
+020.05
020.05M1
U1
V1
W1
M
3~
2,2kW
4,7A
2860rpm
Regeneratsiooni ventilaator 5
24VDC
X121
24VDC
020.05QF1
020.05KM1
INPUT MODULE
MOD1
E3.3
E3.4
OUTPUT MODULE
MOD3
Q12.5
020.05KM1
A1
A2
24VDC
AF09Z-30-10-21
14/34:P/020.04KM1:A2
16/31:P/020.06KM1:A2
A Muudatus:
B Muudatus:
C Muudatus:
D Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Regeneratsiooni ventilaator 5
Positsioon 020.05
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
15 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

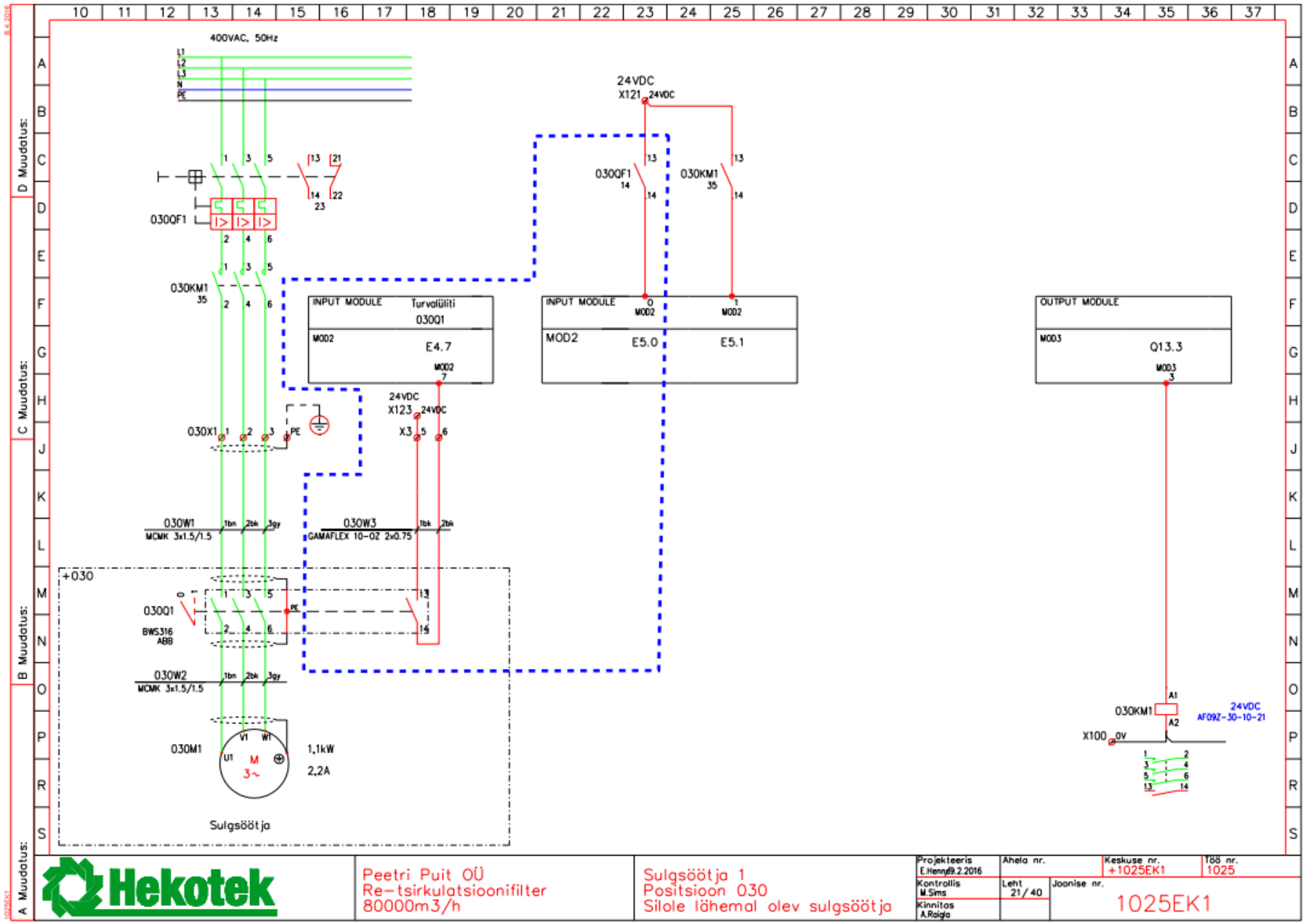

400VAC, 50Hz
L1
L2
L3
N
PE
020.06QF1
020.06KM1
33
020.06X1
PE
020.06W1
MCMK 3x1.5/1.5
1bn
2bk
3gy
+020.06
020.06M1
U1
V1
W1
M
3~
2,2kW
4,7A
2860rpm
Regeneratsiooni ventilaator 6
24VDC
X121
24VDC
020.06QF1
020.06KM1
INPUT MODULE
MOD1
E3.5
E3.6
OUTPUT MODULE
MOD3
Q12.6
020.06KM1
A1
A2
24VDC
AF09Z-30-10-21
15/34:P/020.05KM1: A2
17/31:P/020.07KM1: A2
A Muudatus:
B Muudatus:
C Muudatus:
D Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Regeneratsiooni ventilaator 6
Positsioon 020.06
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
16 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

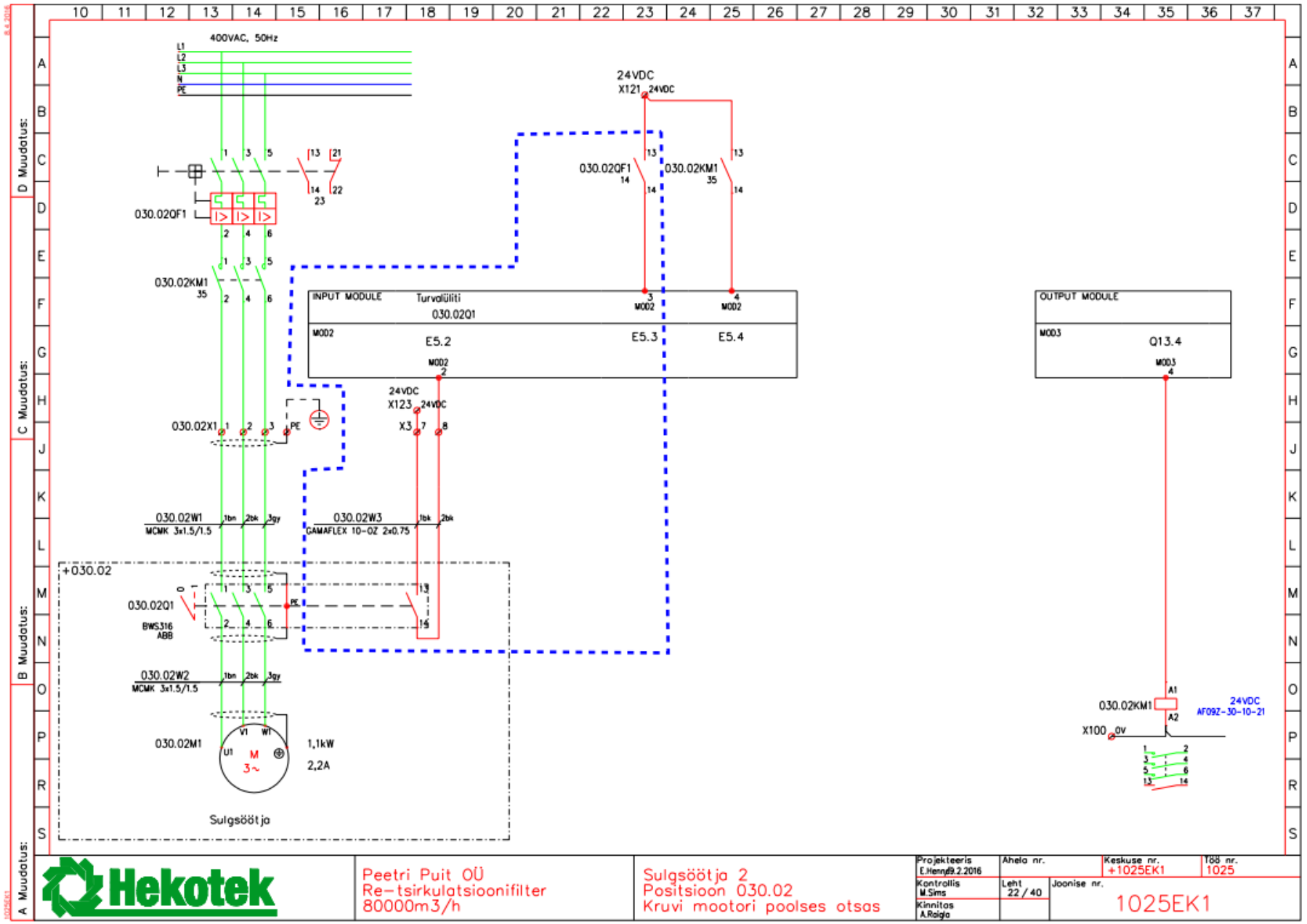

400VAC, 50Hz
L1
L2
L3
N
PE
020.07QF1
020.07KM1
33
020.07X1
PE
020.07W1
MCMK 3x1.5/1.5
1bn
2bk
3gy
+020.07
020.07M1
U1
V1
W1
M
3~
2,2kW
4,7A
2860rpm
Regeneratsiooni ventilaator 7
24VDC
X121
24VDC
020.07QF1
020.07KM1
INPUT MODULE
MOD1
E3.7
INPUT MODULE
MOD2
E4.0
OUTPUT MODULE
MOD3
Q12.7
020.07KM1
A1
A2
24VDC
AF09Z-30-10-21
16/34:P/020.06KM1: A2
18/31:P/020.08KM1: A2
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Regeneratsiooni ventilaator 7
Positsioon 020.07
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
17 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

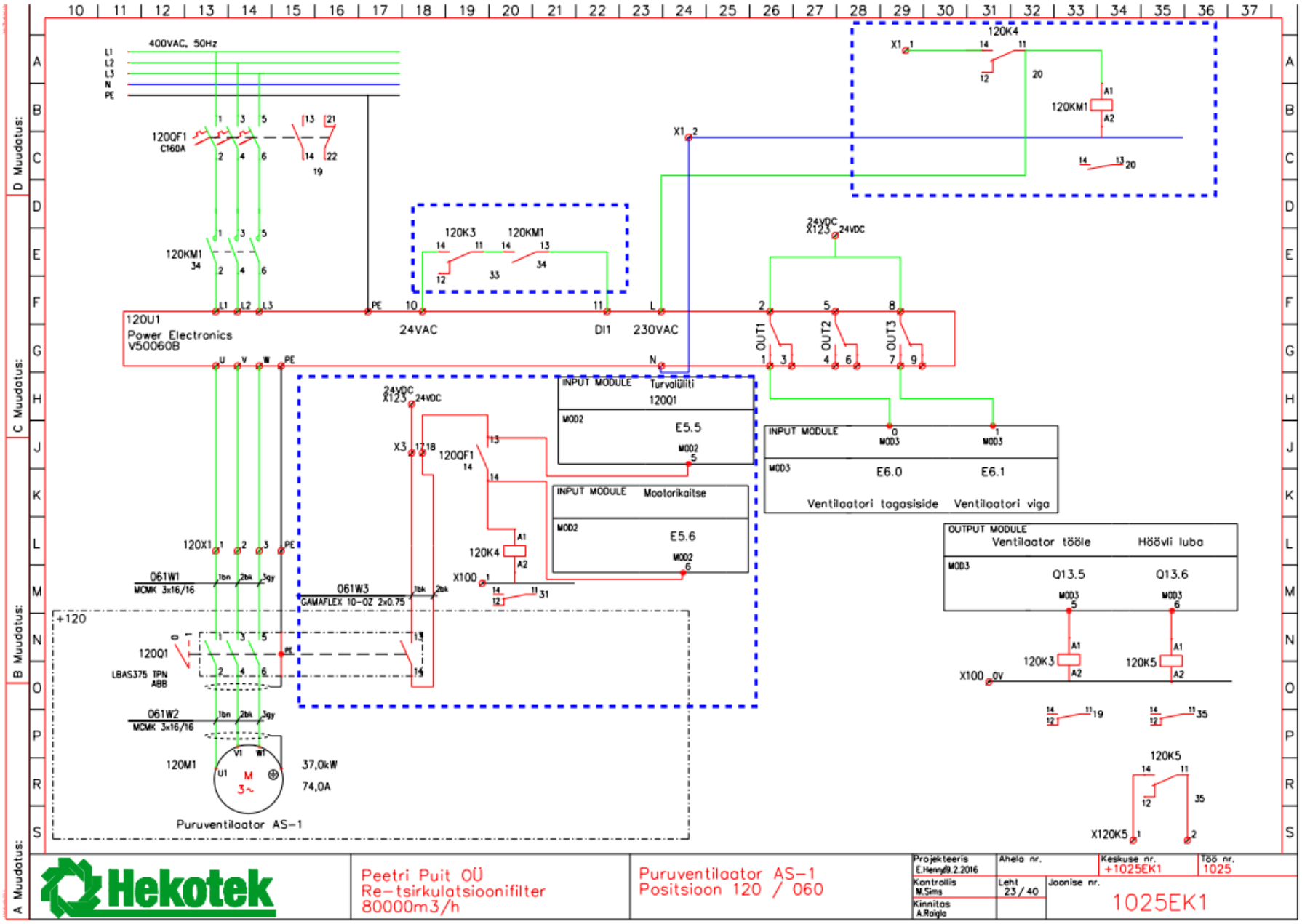

400VAC, 50Hz
L1
L2
L3
N
PE
020.08QF1
020.08KM1
33
020.08X1
020.08W1
MCMK 3x1.5/1.5
1bn
2bk
3gy
+020.08
020.08M1
U1
V1
W1
M
3~
2,2kW
4,7A
2860rpm
Regeneratsiooni ventilaator 8
24VDC
X121
24VDC
020.08QF1
020.08KM1
INPUT MODULE
MOD2
E4.1
E4.2
OUTPUT MODULE
MOD3
Q13.0
020.08KM1
A1
A2
24VDC
AF09Z-30-10-21
17/34:P/020.07KM1: A2
19/31:P/020.09KM1: A2
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Regeneratsiooni ventilaator 8
Positsioon 020.08
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
18 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

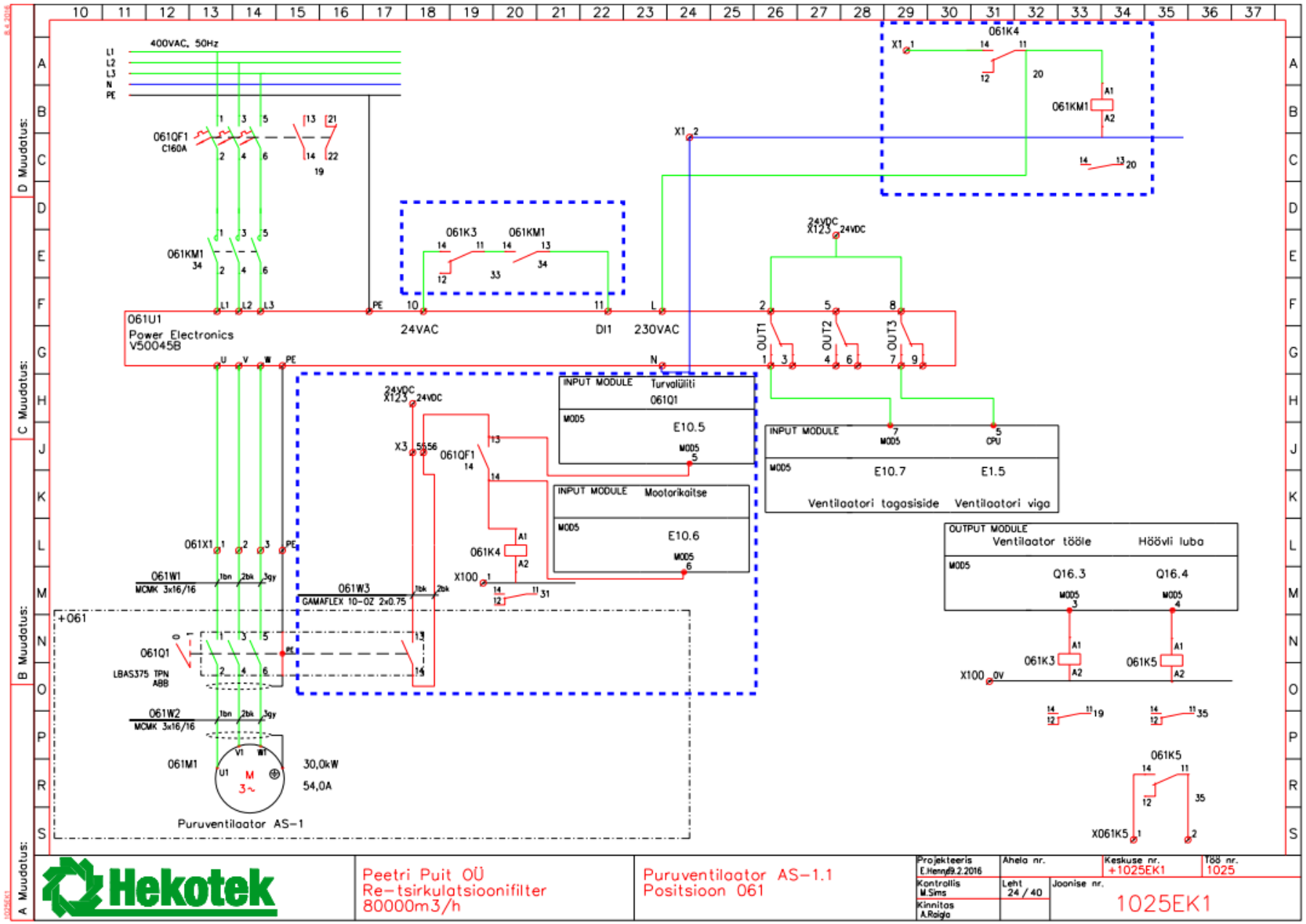

400VAC, 50Hz
L1
L2
L3
N
PE
020.09QF1
020.09KM1
33
020.09X1
PE
020.09W1
MCMK 3x1.5/1.5
1bn
2bk
3gy
+020.09
020.09M1
U1
V1
W1
M
3~
2,2kW
4,7A
2860rpm
Regeneratsiooni ventilaator 9
24VDC
X121
24VDC
020.09QF1
020.09KM1
INPUT MODULE
MOD2
E4.3
E4.4
OUTPUT MODULE
MOD3
Q1.3.1
020.09KM1
A1
A2
24VDC
AF09Z-30-10-21
18/34:P/020.08KM1:A2
20/33:P/020.10KM1:A2
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Regeneratsiooni ventilaator 9
Positsioon 020.09
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
19 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:


400VAC, 50Hz
L1
L2
L3
N
PE
020.10QF1
020.10KM1
34
020.10X1
PE
020.10W1
MCMK 3x1.5/1.5
1bn
2bk
3gy
+020.10
020.10M1
U1
V1
W1
M
3~
2,2kW
4,7A
2860rpm
Regeneratsiooni ventilaator 10
24VDC
X121 24VDC
020.10QF1
020.10KM1
INPUT MODULE
MOD2
E4.5
E4.6
OUTPUT MODULE
MOD3
Q13.2
A1
A2
24VDC
AF09Z-30-10-21
19/34:P/020.09KM1: A2
A Muudatus:
B Muudatus:
C Muudatus:
D Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Regeneratsiooni ventilaator 10
Positsioon 020.10
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
20 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

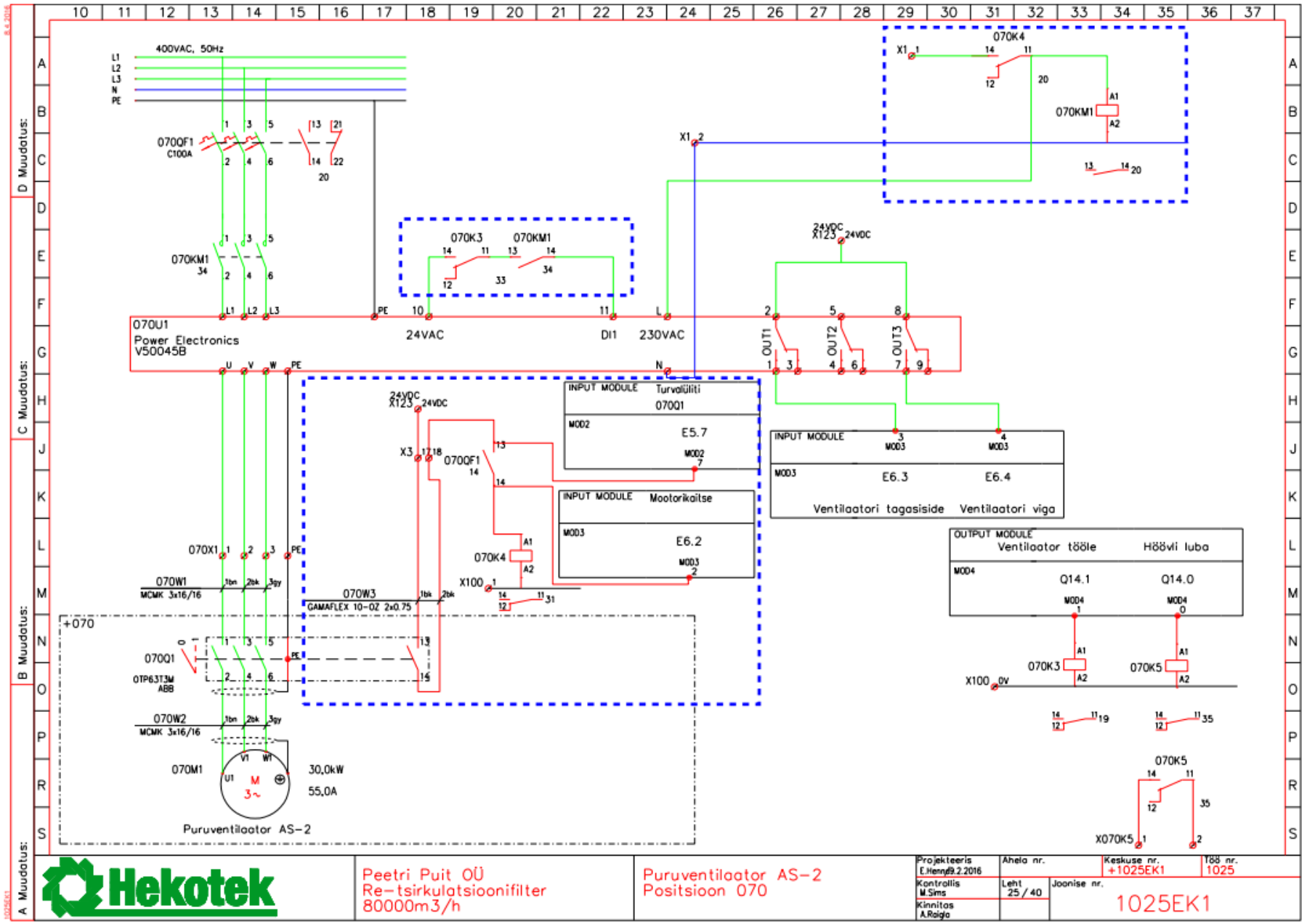

400VAC, 50Hz
L1
L2
L3
N
PE
24VDC
X121
24VDC
030QF1
030KM1
35
INPUT MODULE
Turvalüliti
030Q1
MOD2
E4.7
INPUT MODULE
MOD2
E5.0
E5.1
OUTPUT MODULE
MOD3
Q13.3
030X1
24VDC
X123
X3
030W1
MCMK 3x1.5/1.5
030W3
GAMAFLEX 10-02 2x0.75
+030
030Q1
BWS316
ABB
030W2
MCMK 3x1.5/1.5
030M1
1,1kW
2,2A
Sulgsöötja
030KM1
24VDC
AF09Z-30-10-21
X100
0V
A Muudatus:
B Muudatus:
C Muudatus:
D Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Sulgsöötja 1
Positsioon 030
Silole lähemal olev sulgsöötja
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
21/40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

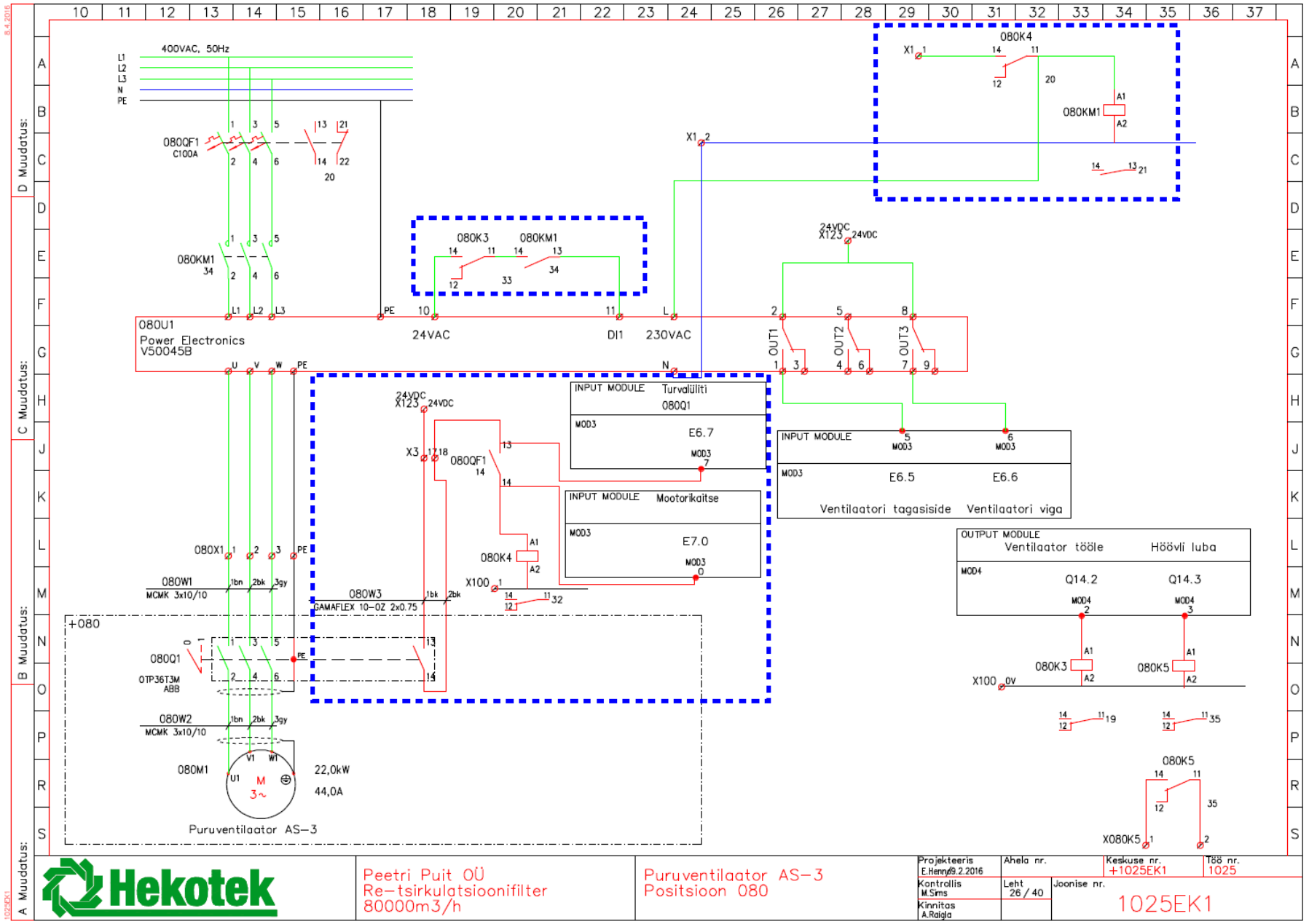

400VAC, 50Hz
L1
L2
L3
N
PE
24VDC
X121 24VDC
030.02QF1
030.02KM1
030.02X1
INPUT MODULE
Turvaliiliti
030.02Q1
MOD2
E5.2
E5.3
E5.4
24VDC
X123 24VDC
X3
OUTPUT MODULE
MOD3
Q13.4
030.02W1
MCMK 3x1.5/1.5
030.02W3
GAMAFLEX 10-OZ 2x0.75
+030.02
030.02Q1
BWS316
ABB
030.02W2
MCMK 3x1.5/1.5
030.02M1
1,1kW
2,2A
Sulgsöötja
030.02KM1
24VDC
AF09Z-30-10-21
X100 0V
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Sulgsöötja 2
Positsioon 030.02
Kruvi mootori poolses otsas
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
22 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1
A Muudatus:
B Muudatus:
C Muudatus:
D Muudatus:


400VAC, 50Hz
L1
L2
L3
N
PE
120QF1
C160A
120KM1
120K3
120K4
120U1
Power Electronics
V50060B
24VAC
DI1
230VAC
24VDC
OUT1
OUT2
OUT3
INPUT MODULE
Turvaliiliti
120Q1
E5.5
Mootorikaitse
E5.6
E6.0
E6.1
Ventilaatori tagasiside
Ventilaatori viga
OUTPUT MODULE
Ventilaator tööle
Höövli luba
Q13.5
Q13.6
120K5
061W1
MCMK 3x16/16
061W2
MCMK 3x16/16
061W3
GAMAFLEX 10-OZ 2x0.75
120X1
X100
X120K5
+120
120Q1
LBAS375 TPN
ABB
120M1
37,0kW
74,0A
Puruventilaator AS-1
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Puruventilaator AS-1
Positsioon 120 / 060
Projekteeris
E.Henry 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Keskuse nr.
+1025EK1
Töö nr.
1025
Leht
23 / 40
Joonise nr.
1025EK1


400VAC, 50Hz
L1
L2
L3
N
PE
061QF1
C160A
061KM1
061K3
061K4
061U1
Power Electronics
V50045B
24VAC
DI1
230VAC
24VDC
OUT1
OUT2
OUT3
INPUT MODULE Turvaliiliti
061Q1
E10.5
INPUT MODULE Mootorikaitse
E10.6
INPUT MODULE
E10.7
Ventilaatori tagasiside
E1.5
Ventilaatori viga
OUTPUT MODULE
Ventilaator tööle
Hõõvli luba
Q16.3
Q16.4
061W1
MCMK 3x16/16
061W2
MCMK 3x16/16
061W3
GAMAFLEX 10-OZ 2x0.75
061X1
X100
X123
X3
061K5
X061K5
061Q1
LBAS375 TPN
ABB
061M1
30,0kW
54,0A
Puruventilaator AS-1
+061
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Puruventilaator AS-1.1
Positsioon 061
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Leht
24 / 40
Joonise nr.
1025EK1
Keskuse nr.
+1025EK1
Töö nr.
1025

/ /


400VAC, 50Hz
L1
L2
L3
N
PE
070QF1
C100A
070KM1
070K3
070K4
070U1
Power Electronics
V50045B
24VAC
DI1
230VAC
24VDC
X123
OUT1
OUT2
OUT3
INPUT MODULE
Turvaliiliti
070Q1
E5.7
Mootorikaitse
E6.2
E6.3
E6.4
Ventilaatori tagasiside
Ventilaatori viga
OUTPUT MODULE
Ventilaator tööle
Hõõvli luba
Q14.1
Q14.0
070K5
070W1
MCMK 3x16/16
070W2
MCMK 3x16/16
070W3
GAMAFLEX 10-OZ 2x0.75
070X1
X100
X3
070Q1
OTP63T3M
ABB
070M1
30,0kW
55,0A
Puruventilaator AS-2
+070
X070K5
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Puruventilaator AS-2
Positsioon 070
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Leht
25 / 40
Joonise nr.
1025EK1

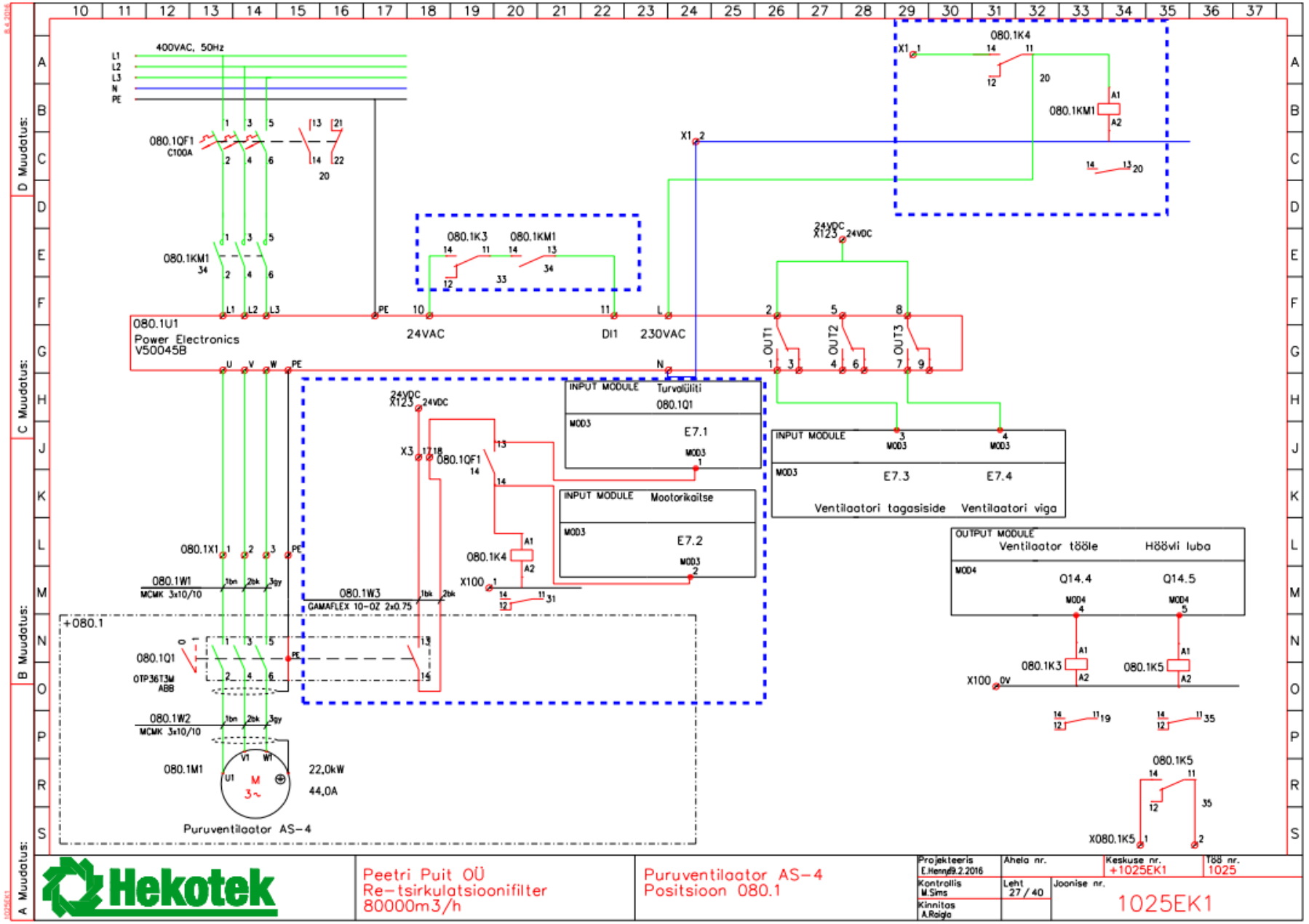


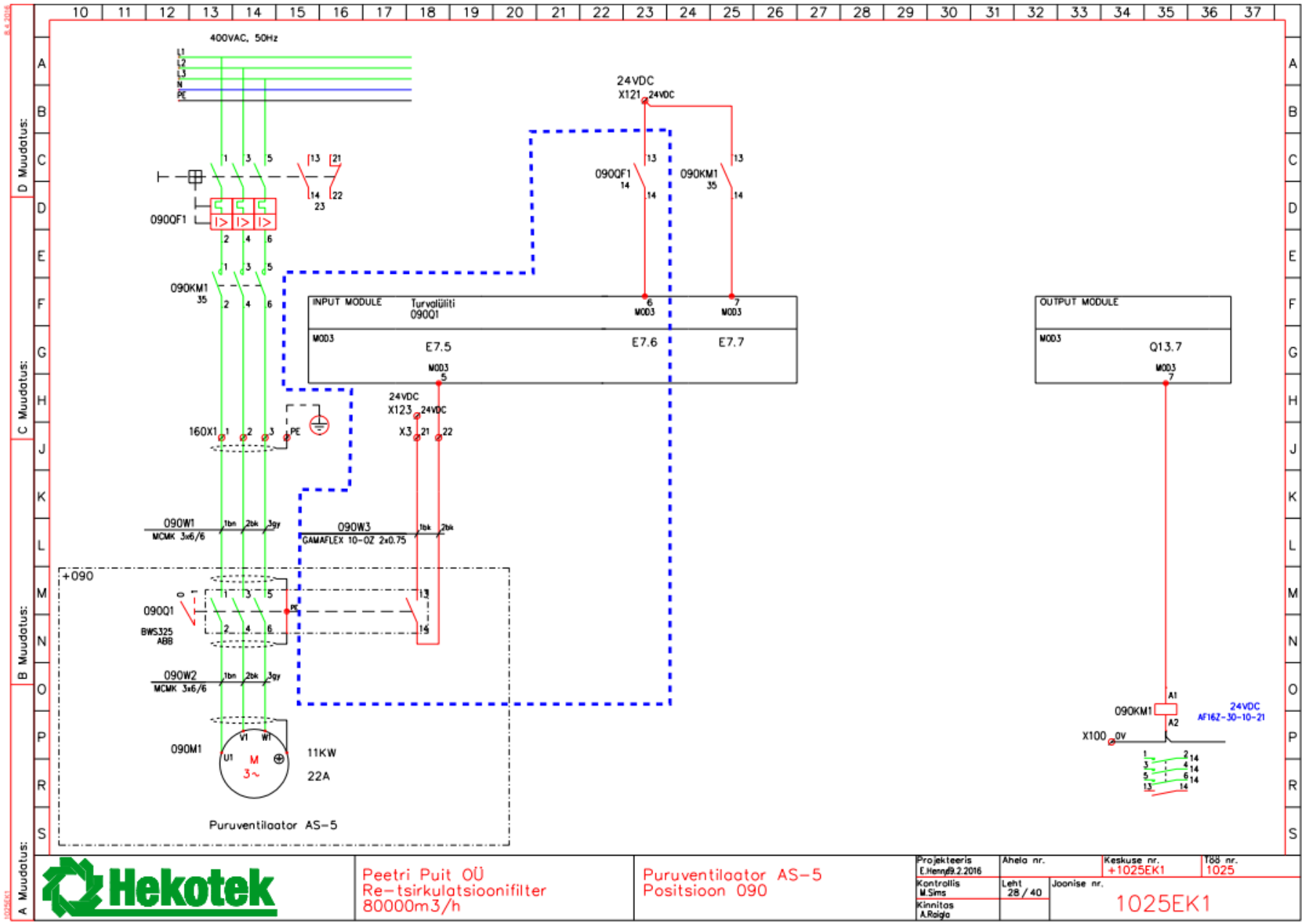
Hekotek

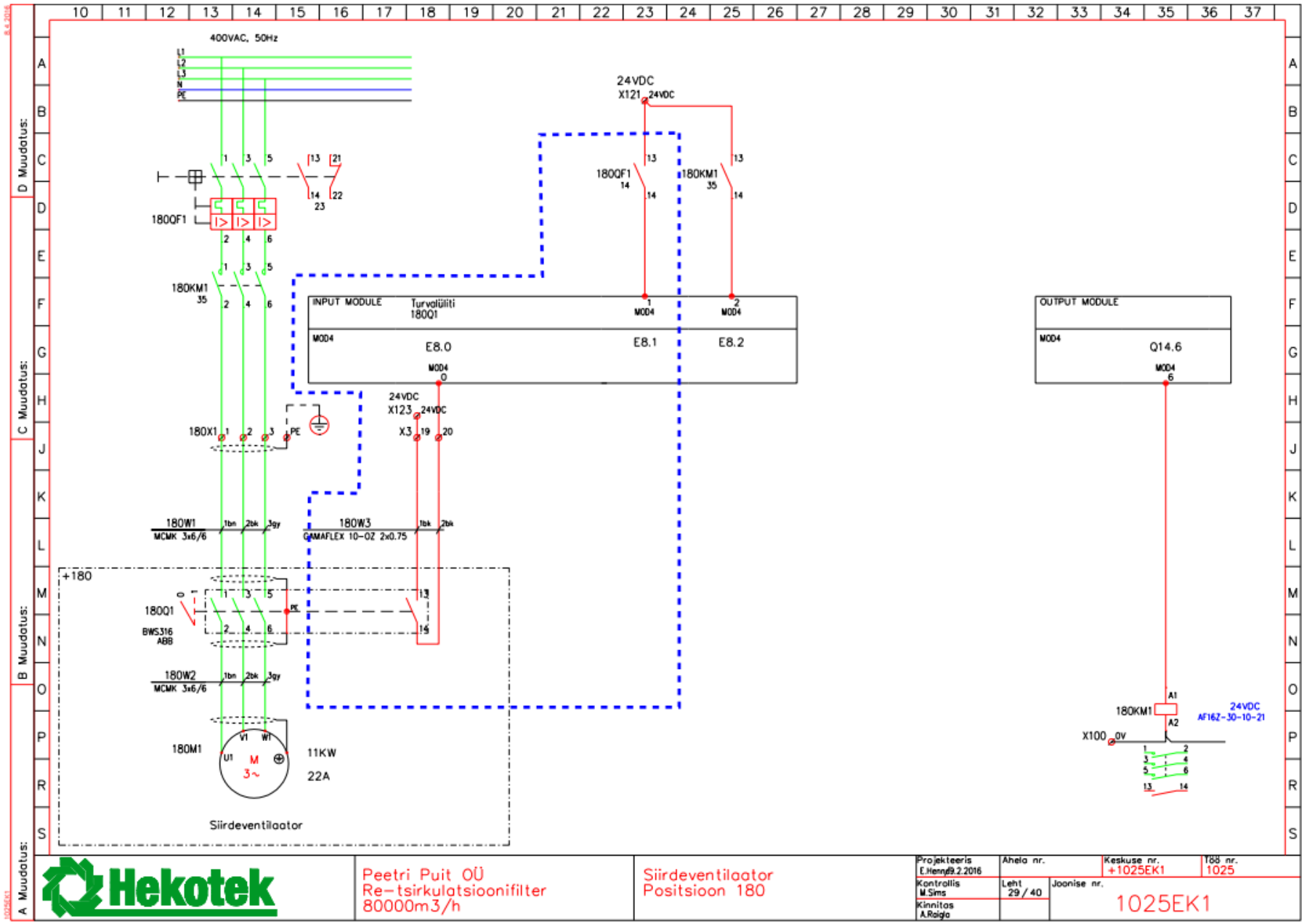
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h

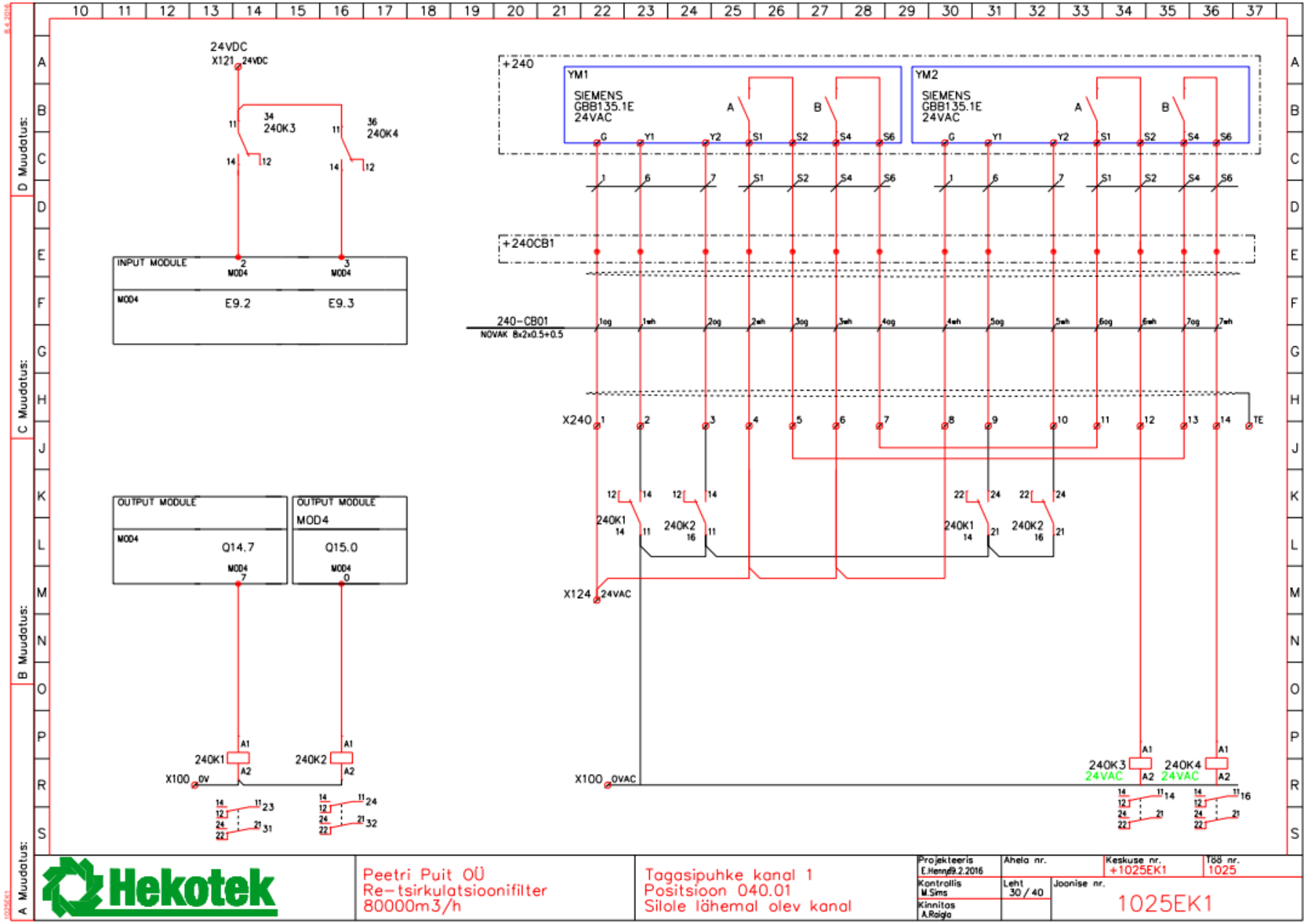
Puruventilaator AS-3
Positsioon 080

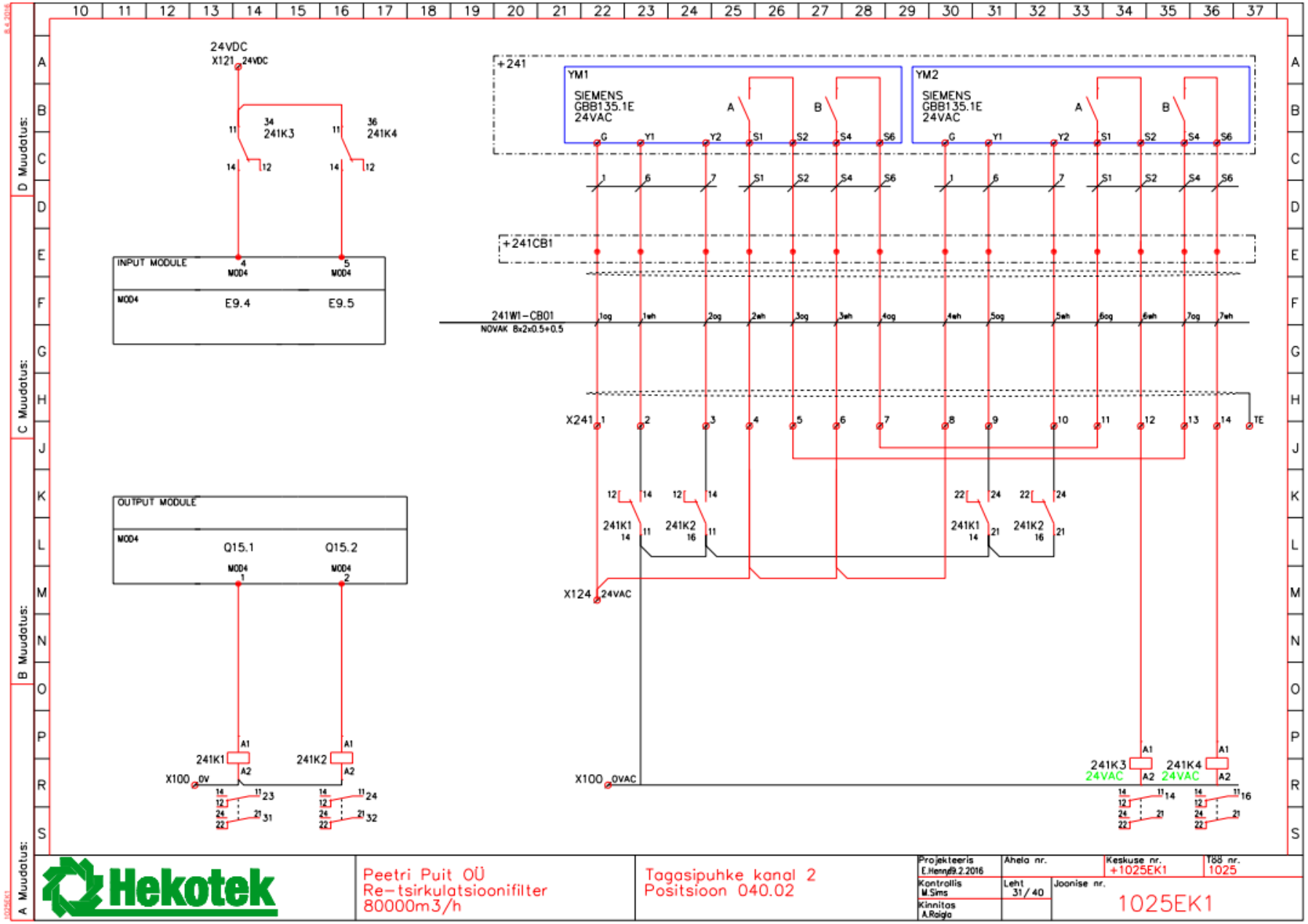
Projekteeris E.Henry 9.2.2016	Ahela nr.	Keskuse nr. +1025EK1	Töö nr. 1025
Kontrollis M.Sims	Leht 26 / 40	Joonise nr. 1025EK1	
Kinnitas A.Raigla			

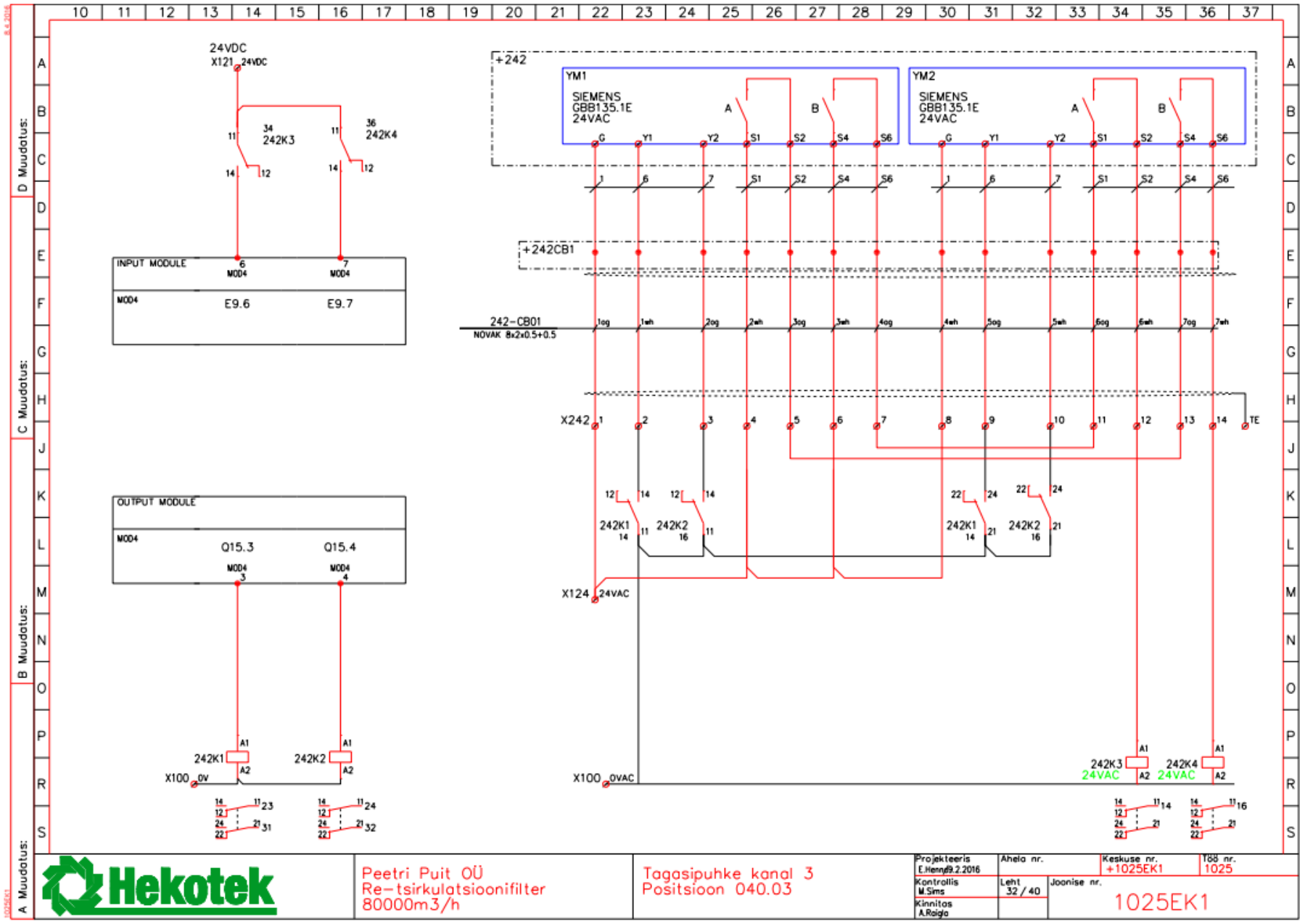

400VAC, 50Hz
L1
L2
L3
N
PE
080.1QF1
C100A
080.1KM1
080.1K3
080.1K4
080.1U1
Power Electronics
V50045B
24VAC
DI1
230VAC
OUT1
OUT2
OUT3
24VDC
X123
INPUT MODULE
Turvaliliti
080.1Q1
E7.1
Mootorikaitse
E7.2
E7.3
E7.4
Ventilaatori tagasiside
Ventilaatori viga
OUTPUT MODULE
Ventilaator tööle
Höövli luba
Q14.4
Q14.5
080.1K5
080.1X1
080.1W1
MCMK 3x10/10
080.1W3
GAMAFLEX 10-OZ 2x0.75
080.1W2
+080.1
080.1Q1
OTP36T3M
ABB
080.1M1
22,0kW
44,0A
Puruventilaator AS-4
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Puruventilaator AS-4
Positsioon 080.1
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
27 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:

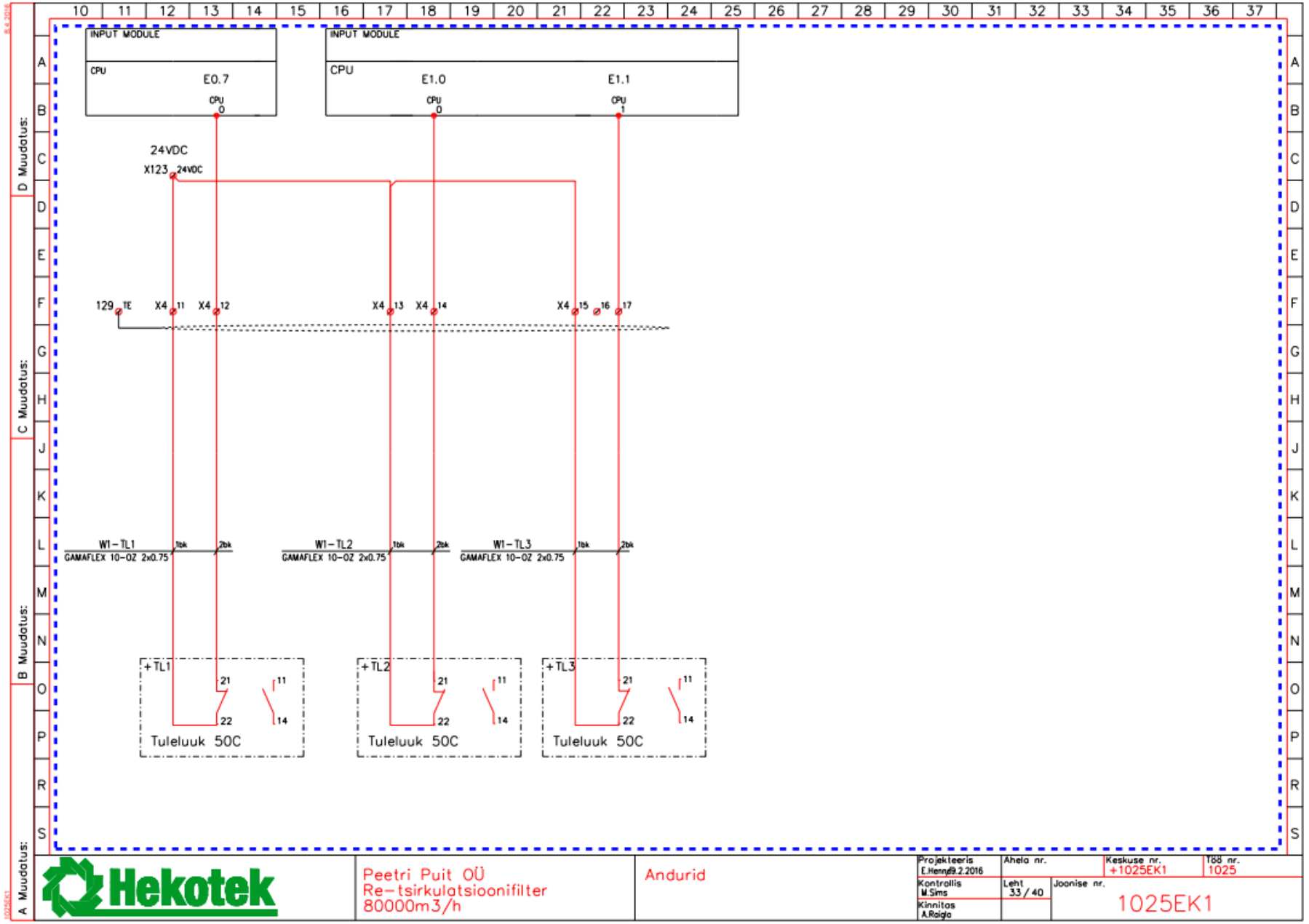

400VAC, 50Hz
L1
L2
L3
N
PE
24VDC
X121
24VDC
090QF1
090KM1
35
INPUT MODULE
Turvaliiliti
090Q1
MOD3
E7.5
E7.6
E7.7
OUTPUT MODULE
Q13.7
24VDC
X123
X3
160X1
090W1
MCMK 3x6/6
090W3
GAMAFLEX 10-OZ 2x0.75
+090
090Q1
BWS325
ABB
090W2
MCMK 3x6/6
090M1
11KW
22A
Puruventilaator AS-5
090KM1
AF16Z-30-10-21
X100
0V
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Puruventilaator AS-5
Positsioon 090
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
28 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:

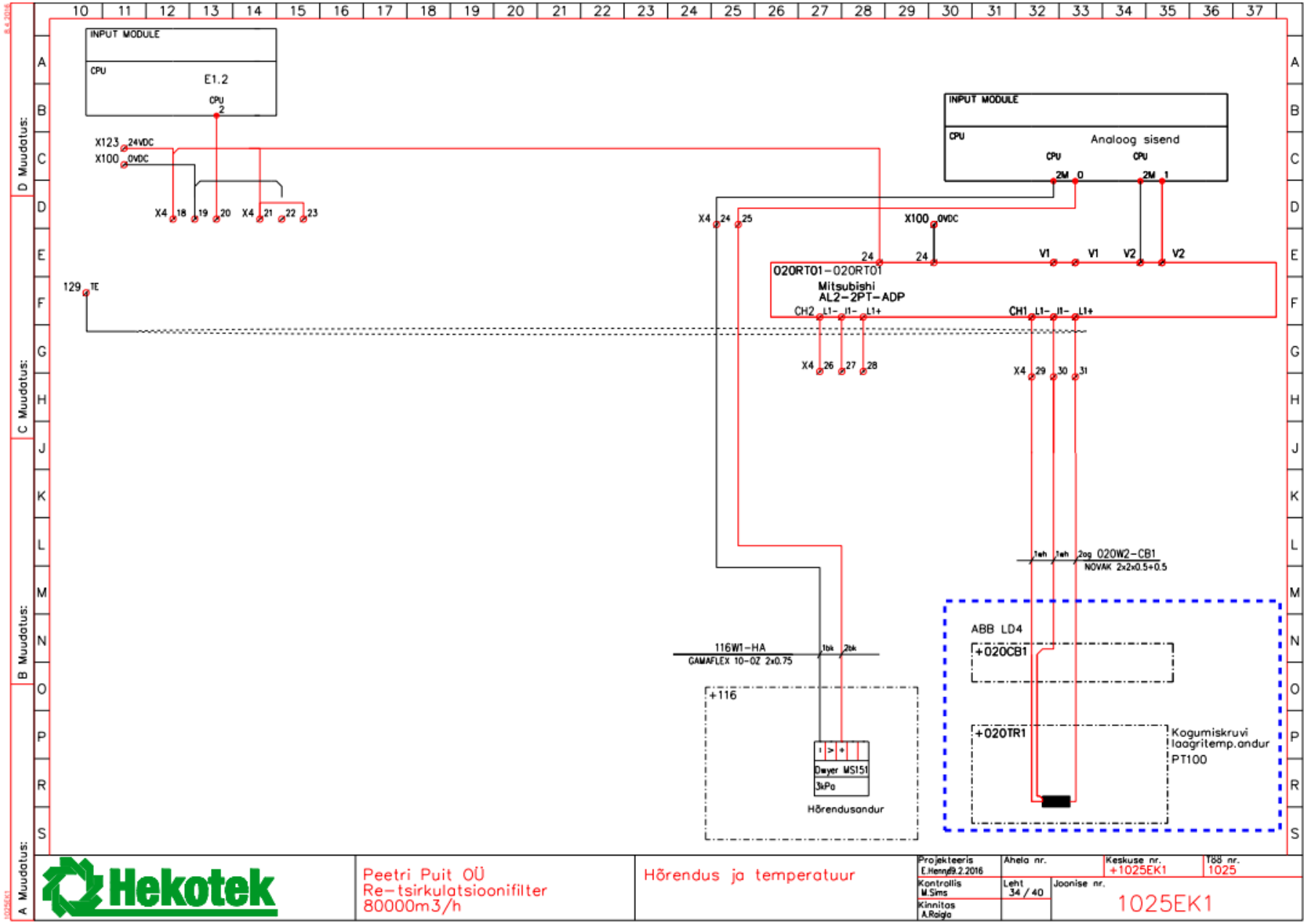

400VAC, 50Hz
L1
L2
L3
N
PE
24VDC
X121
24VDC
180QF1
180KM1
35
INPUT MODULE
Turvaliiliti
180Q1
MOD4
E8.0
E8.1
E8.2
24VDC
X123
24VDC
X3
19
20
180X1
PE
180W1
MCMK 3x6/6
180W3
GAMAFLEX 10-OZ 2x0.75
+180
180Q1
BWS316
ABB
180W2
MCMK 3x6/6
180M1
11KW
22A
Siirdeventilaator
OUTPUT MODULE
Q14.6
180KM1
24VDC
AF16Z-30-10-21
X100
0V
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Siirdeventilaator
Positsioon 180
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
29 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

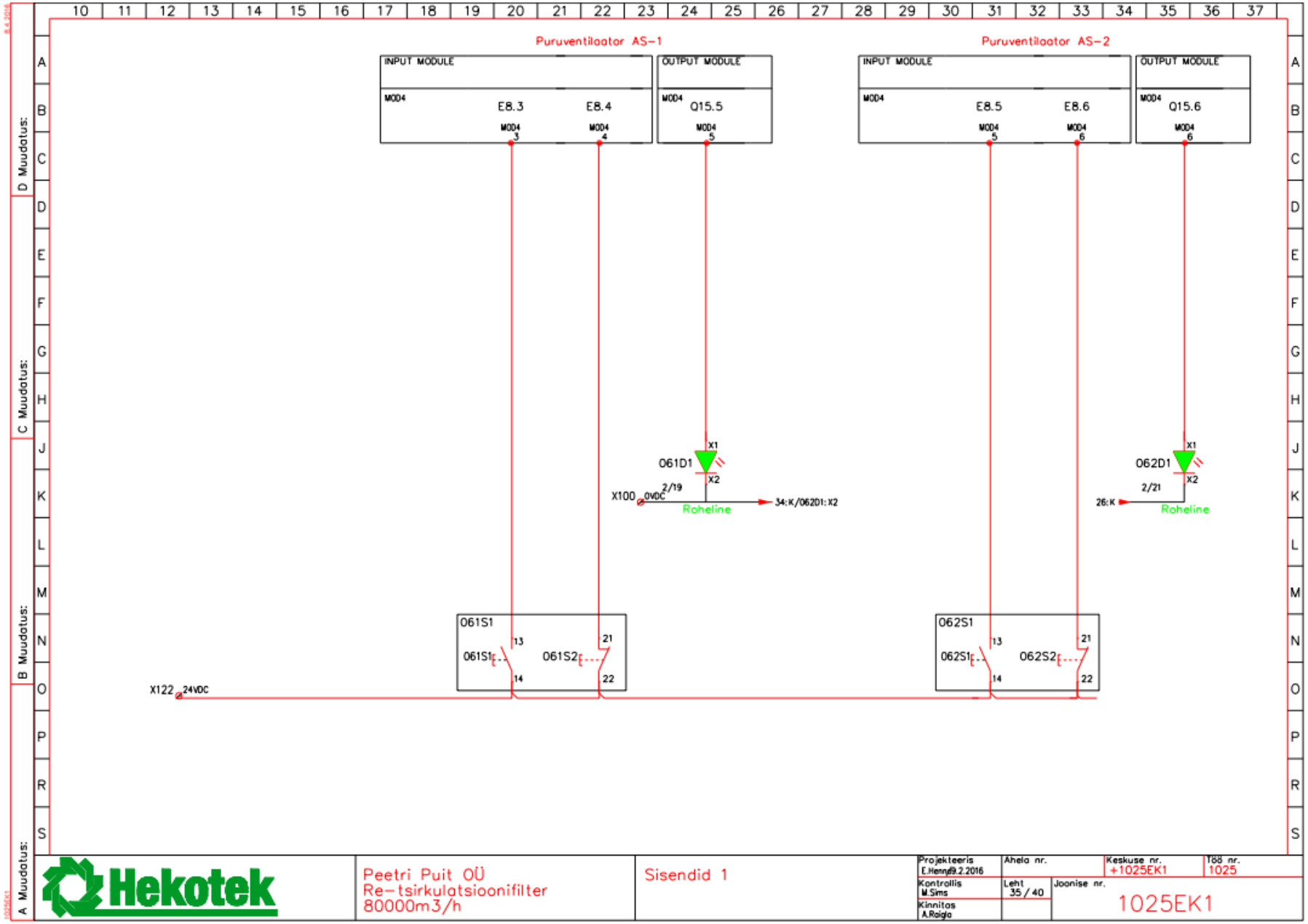

24VDC
X121 24VDC
34
240K3
36
240K4
INPUT MODULE
MOD4
E9.2
E9.3
OUTPUT MODULE
MOD4
Q14.7
Q15.0
240K1
240K2
X100 0V
+240
YM1
SIEMENS
GBB135.1E
24VAC
YM2
SIEMENS
GBB135.1E
24VAC
+240CB1
240-CB01
NOVAK 8x2x0.5+0.5
X240
X124 24VAC
X100 0VAC
240K3
240K4
24VAC
A Muudatus:
B Muudatus:
C Muudatus:
D Muudatus:
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Tagasipuhke kanal 1
Positsioon 040.01
Silole lähemal olev kanal
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raiglo
Ahela nr.
Leht
30 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

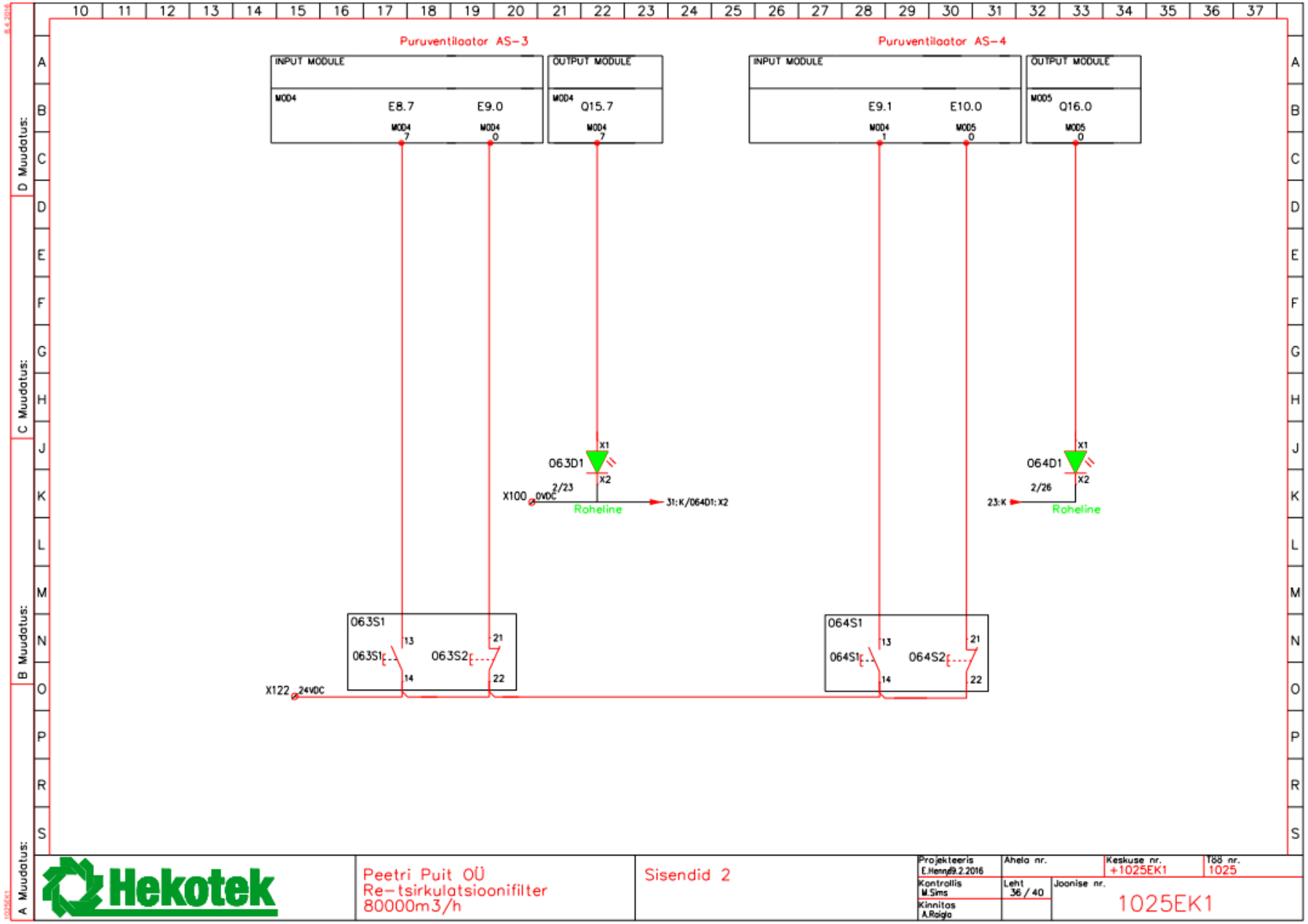

24VDC
X121 24VDC
34
241K3
36
241K4
INPUT MODULE
MOD4
E9.4
E9.5
OUTPUT MODULE
Q15.1
Q15.2
241K1
241K2
X100 0V
+241
YM1
SIEMENS
GBB135.1E
24VAC
YM2
SIEMENS
GBB135.1E
24VAC
+241CB1
241W1-CB01
NOVAK 8x2x0.5+0.5
X241
X124 24VAC
X100 0VAC
241K3
241K4
24VAC
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Tagasipuhke kanal 2
Positsioon 040.02
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raiglo
Ahela nr.
Leht
31 / 40
Keskuse nr.
+1025EK1
Joonise nr.
1025EK1
Töö nr.
1025
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:

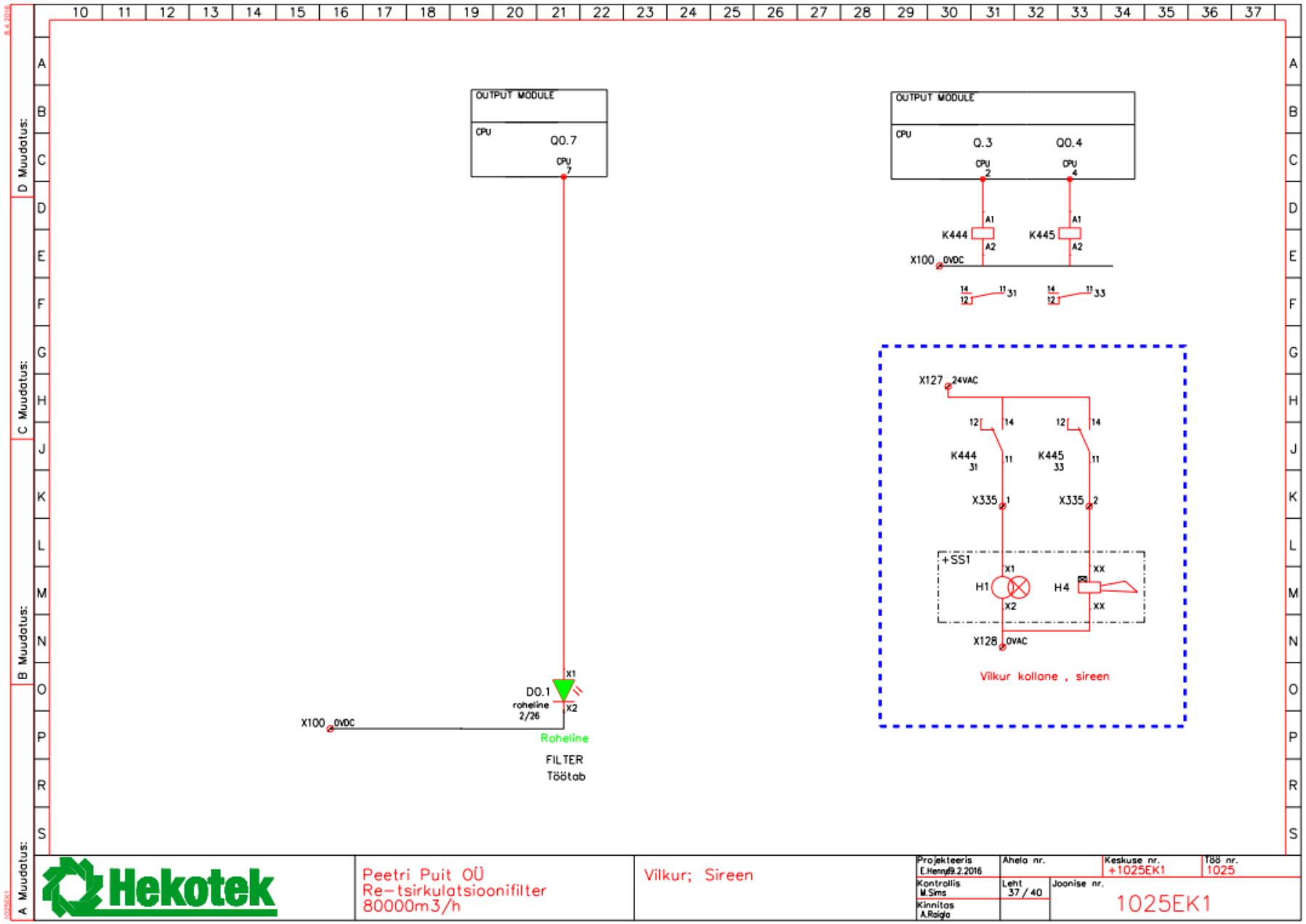

24VDC
X121 24VDC
34
242K3
36
242K4
INPUT MODULE
MOD4
E9.6
E9.7
OUTPUT MODULE
Q15.3
Q15.4
242K1
242K2
X100 0V
+242
YM1
SIEMENS
GBB135.1E
24VAC
YM2
SIEMENS
GBB135.1E
24VAC
+242CB1
242-CB01
NOVAK 8x2x0.5+0.5
X242
X124 24VAC
X100 0VAC
242K3
242K4
24VAC
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Tagasipuhke kanal 3
Positsioon 040.03
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raiglo
Ahela nr.
Leht
32 / 40
Keskuse nr.
+1025EK1
Joonise nr.
1025EK1
Töö nr.
1025
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:

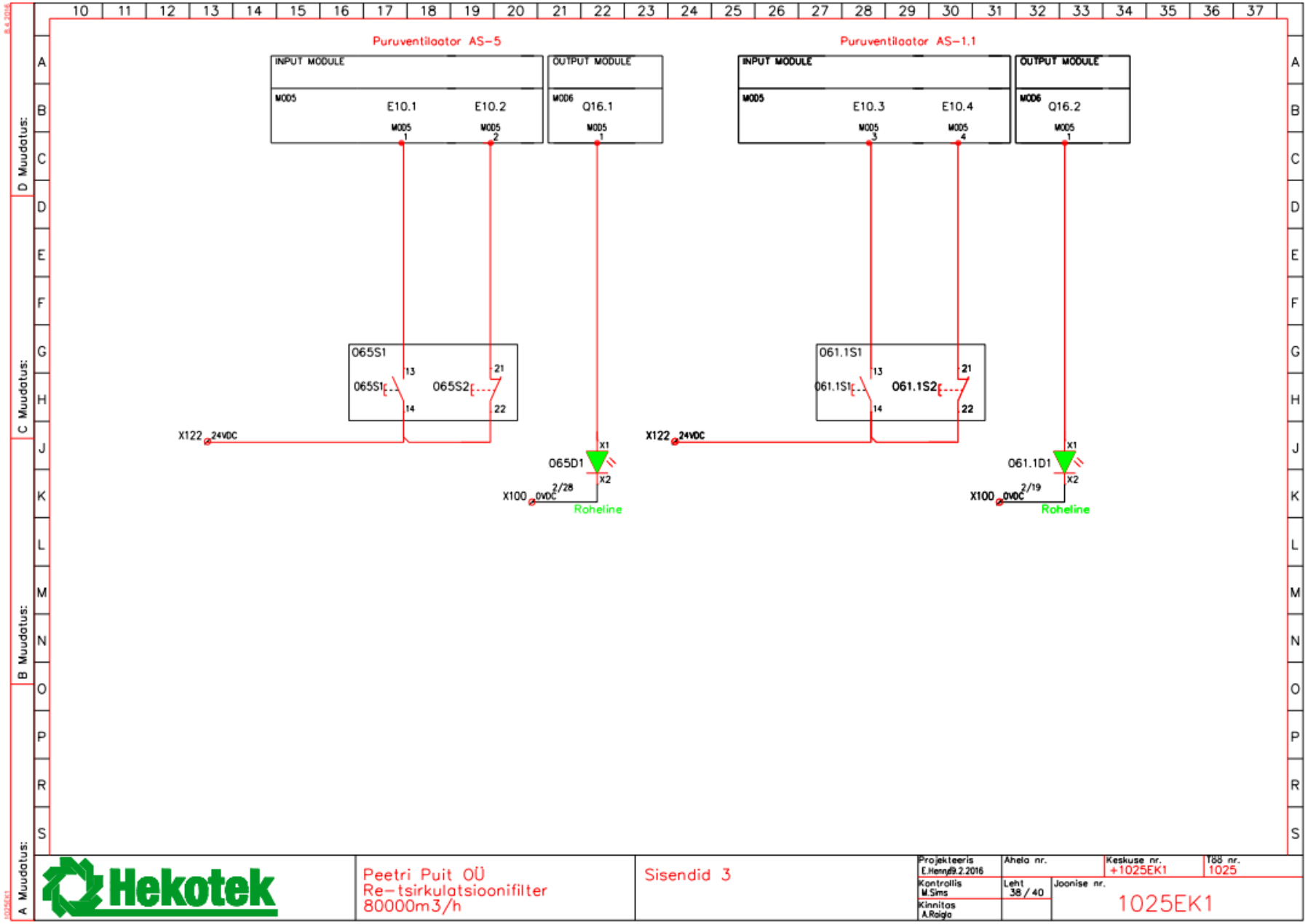

INPUT MODULE
CPU
E0.7
CPU 0
INPUT MODULE
CPU
E1.0
E1.1
CPU 0
CPU 1
24VDC
X123 24VDC
129 TE
X4 11
X4 12
X4 13
X4 14
X4 15
X4 16
X4 17
W1-TL1
GAMAFLEX 10-OZ 2x0.75
W1-TL2
GAMAFLEX 10-OZ 2x0.75
W1-TL3
GAMAFLEX 10-OZ 2x0.75
1bk
2bk
+TL1
+TL2
+TL3
21
22
11
14
Tuleluuk 50C
Tuleluuk 50C
Tuleluuk 50C
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Andurid
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raiglo
Ahela nr.
Leht
33 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

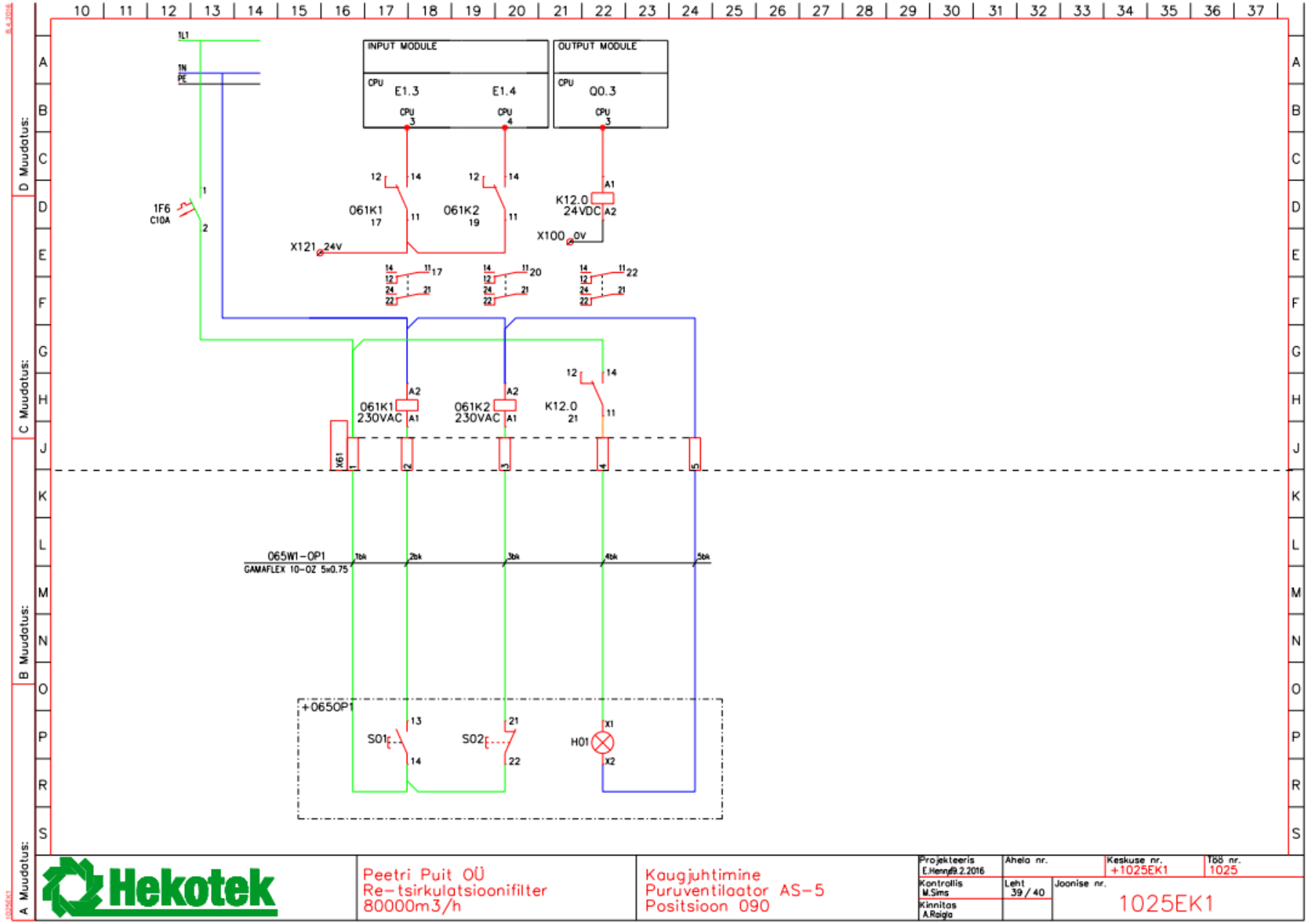

INPUT MODULE
CPU
E1.2
CPU
2
X123 24VDC
X100 0VDC
X4 18 19 20 X4 21 22 23
INPUT MODULE
CPU
Analoog sisend
CPU
CPU
2M 0
2M 1
X4 24 25
X100 0VDC
24
24
V1
V1
V2
V2
020RT01-020RT01
Mitsubishi
AL2-2PT-ADP
CH2 L1- I1- L1+
CH1 L1- I1- L1+
129 TE
X4 26 27 28
X4 29 30 31
1eh 1eh 2og 020W2-CB1
NOVAK 2x2x0.5+0.5
ABB LD4
+020CB1
+020TR1
Kogumiskruvi
laagritemp.andur
PT100
116W1-HA
GAMAFLEX 10-OZ 2x0.75
1bk 2bk
+116
Dwyer MS151
3kPa
Hõrendusandur
A Muudatus:
B Muudatus:
C Muudatus:
D Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Hõrendus ja temperatuur
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raiglo
Ahela nr.
Leht
34 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

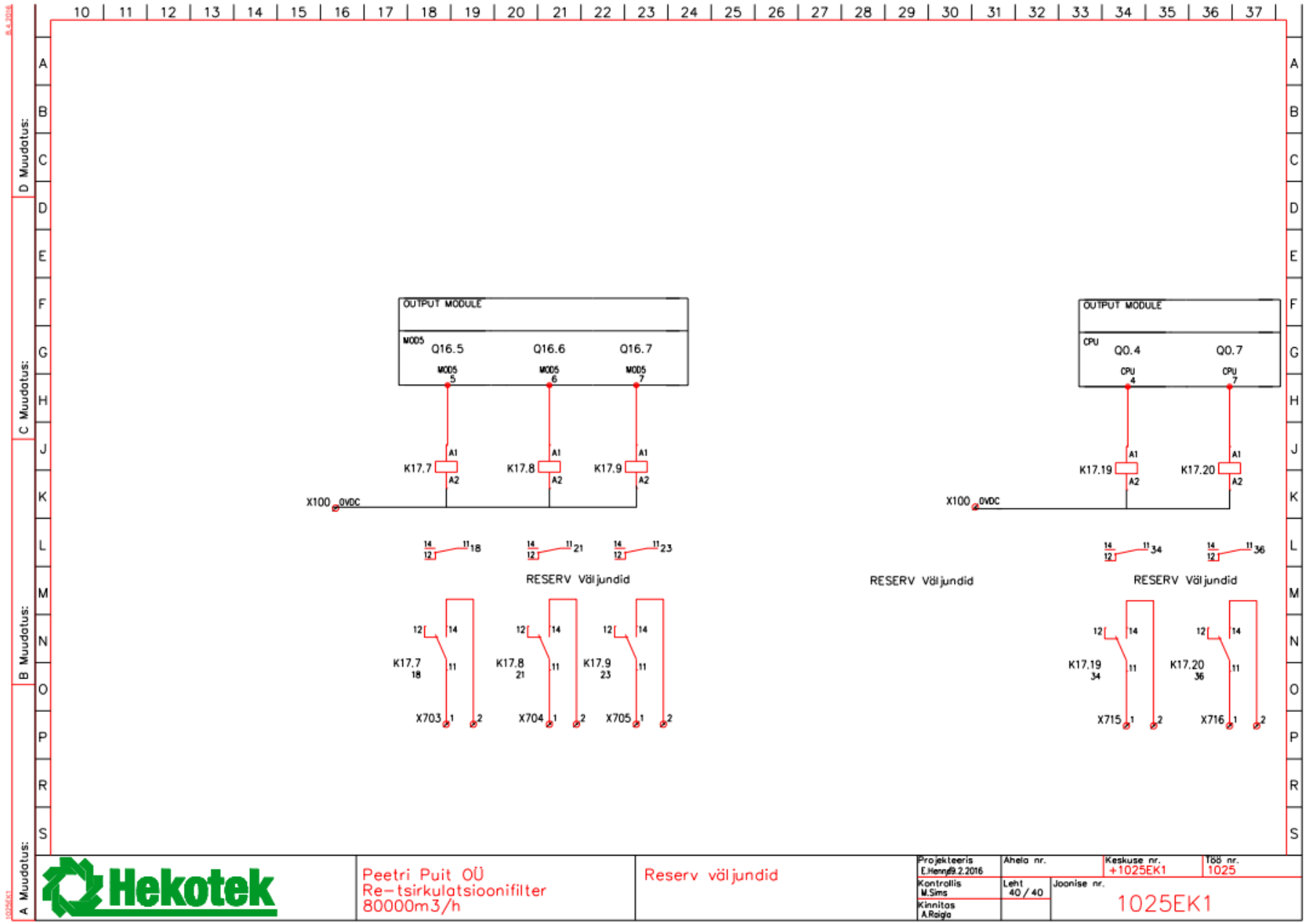

Puruventilaator AS-1
Puruventilaator AS-2
INPUT MODULE
OUTPUT MODULE
MOD4
E8.3
E8.4
Q15.5
E8.5
E8.6
Q15.6
061D1
062D1
X100 0VDC
2/19
Roheline
34:K/062D1:X2
2/21
26:K
061S1
062S1
061S2
062S2
X122 24VDC
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Sisendid 1
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
35 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1


Puruventilaator AS-3
INPUT MODULE
OUTPUT MODULE
MOD4
E8.7
E9.0
Q15.7
Puruventilaator AS-4
MOD5
E9.1
E10.0
Q16.0
063D1
064D1
X100 0VDC
2/23
31:K/064D1:X2
Roheline
2/26
23:K
063S1
063S2
064S1
064S2
X122 24VDC
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Sisendid 2
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Keskuse nr.
+1025EK1
Töö nr.
1025
Leht
36 / 40
Joonise nr.
1025EK1
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:


OUTPUT MODULE
CPU
Q0.7
CPU 7
X1
DO.1
roheline
2/26
X2
X100 0VDC
Roheline
FILTER
Töötab
OUTPUT MODULE
CPU
Q.3
Q0.4
CPU 2
CPU 4
A1
K444
A2
K445
X100 0VDC
14
12
11
31
33
X127 24VAC
K444 31
K445 33
X335 1
X335 2
+SS1
X1
H1
H4
X2
XX
X128 0VAC
Vilkur kollane , sireen
A Muudatus:
B Muudatus:
C Muudatus:
D Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Vilkur; Sireen
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
37 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1


Puruventilaator AS-5
INPUT MODULE
OUTPUT MODULE
MOD5
E10.1
E10.2
MOD6
Q16.1
065S1
065S2
X122 24VDC
065D1
X100 0VDC
2/28
Roheline
Puruventilaator AS-1.1
E10.3
E10.4
Q16.2
061.1S1
061.1S2
061.1D1
2/19
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Sisendid 3
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
38 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1


INPUT MODULE
OUTPUT MODULE
CPU
E1.3
E1.4
Q0.3
1L1
1N
PE
1F6
C10A
061K1
061K2
K12.0
24VDC
X121 24V
X100 0V
230VAC
065W1-OP1
GAMAFLEX 10-OZ 5x0.75
+065OP1
S01
S02
H01
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Kaugjuhtimine
Puruventilaator AS-5
Positsioon 090
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
39 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1


OUTPUT MODULE
MOD5
Q16.5
Q16.6
Q16.7
MOD5 5
MOD5 6
MOD5 7
K17.7
K17.8
K17.9
A1
A2
X100
0VDC
14
12
11
18
21
23
RESERV Väljundid
K17.7 18
K17.8 21
K17.9 23
X703
X704
X705
OUTPUT MODULE
CPU
Q0.4
Q0.7
CPU 4
CPU 7
K17.19
K17.20
X100
0VDC
RESERV Väljundid
34
36
RESERV Väljundid
K17.19 34
K17.20 36
X715
X716
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
Hekotek
Peetri Puit OÜ
Re-tsirkulatsioonifilter
80000m3/h
Reserv väljundid
Projekteeris
E.Henno 9.2.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
40 / 40
Keskuse nr.
+1025EK1
Töö nr.
1025
Joonise nr.
1025EK1

Appendix 2 Electrical Switchboard 1025EK2

1. Elektrotehnilised andmed
   - 1.1 Nimipinge — Un= 400/230V
   - 1.2 Nimivool — In= 63A
   - 1.3 Vastupidavus lühisele — Ik= 10 kA
   - 1.4 Arvutuslik võimsus — Pn= 32 kW (cos fii = 0.82)
   - 1.5 Juhistiku süsteem — TNS

2. Ehituslikud andmed
   - 2.1 Keskuse tüüp — Metallkilp
   - 2.2 Kaitseaste — IP 54
   - 2.3 Paigaldusviis — Seinale
   - 2.4 Kinnitusviis — Seinale
   - 2.5 Ukse lukustus — Lihtsa pöördlukuga
   - 2.6 Teenindusviis — 1–poolne
   - 2.7 Pinnakate — Pulbervärv RAL7032

3 Kaabliühenduste teostus
   - 3.1 Toide — Ülevalt
   - 3.2 Jõukaablid — Ülevalt
   - 3.3 Juhtimiskaablid — Ülevalt

4 Tähistus
   - 4.1 kilbisisesed juhtmed — Tähistada aparaadi klemmi põhiselt

5 Signaalaparatuur — Tavalised kilpides kasutatavad lambid

7 Tellija poolt tarnitavad seadmed

Kontroller, paneel ,lisamoodulid
Safety relay RT9 1tk

8 1025EK2 juurde kuuluvad joonised:

1025EK2

9 Seletused:

Aadress 3 numbrit 1025EK2/3/4
- 4 — kordinaat(joonise ülemine rida)
- /3 — lehe nr
- /1025EK2 — joonise nr

Aadress 2 numbrit 3/4
- 4 — kordinaat(joonise ülemine rida)
- /3 — lehe nr

Aadress 1 number 4
- 4 — kordinaat(joonise ülemine rida)

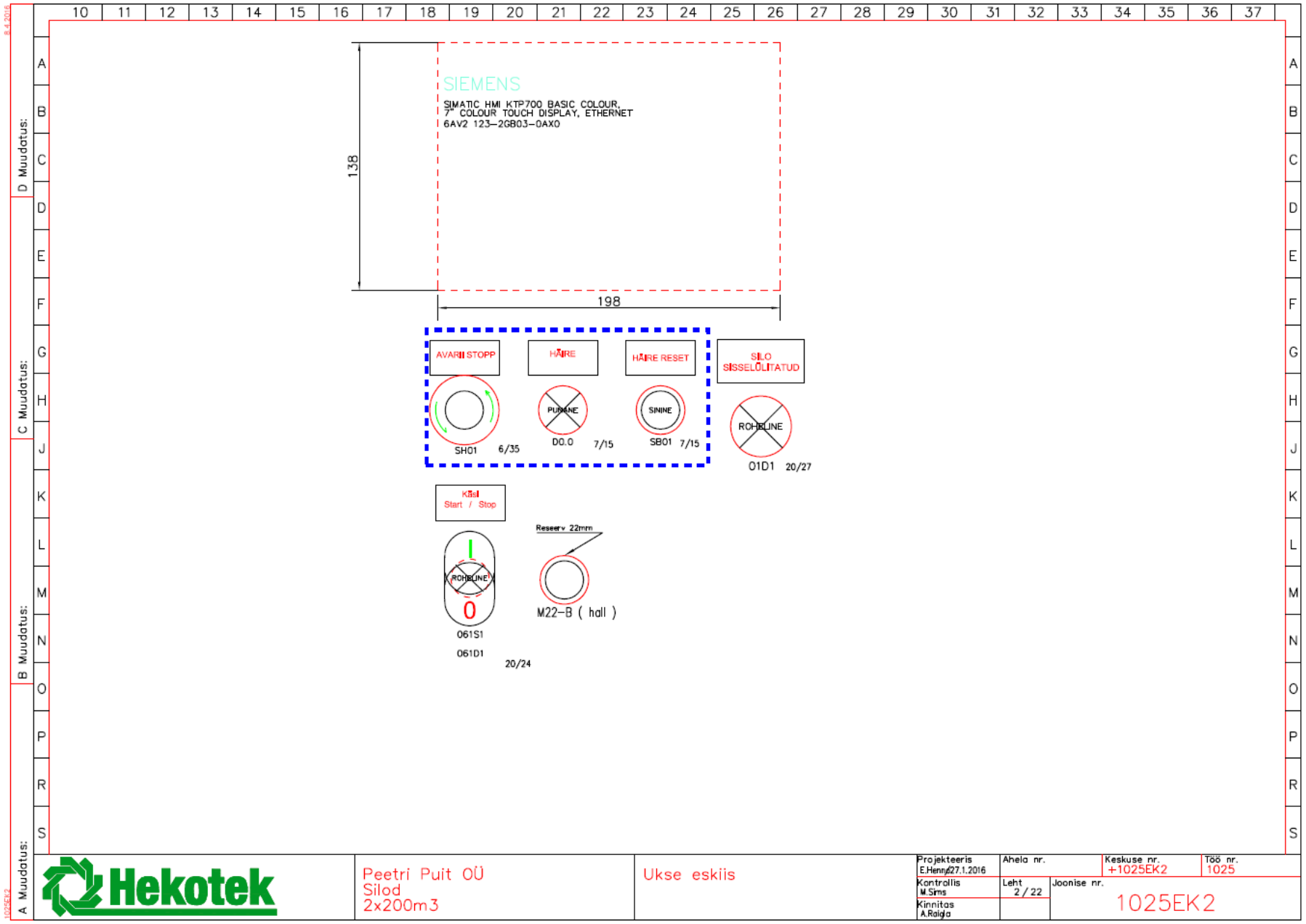
6 Märkused

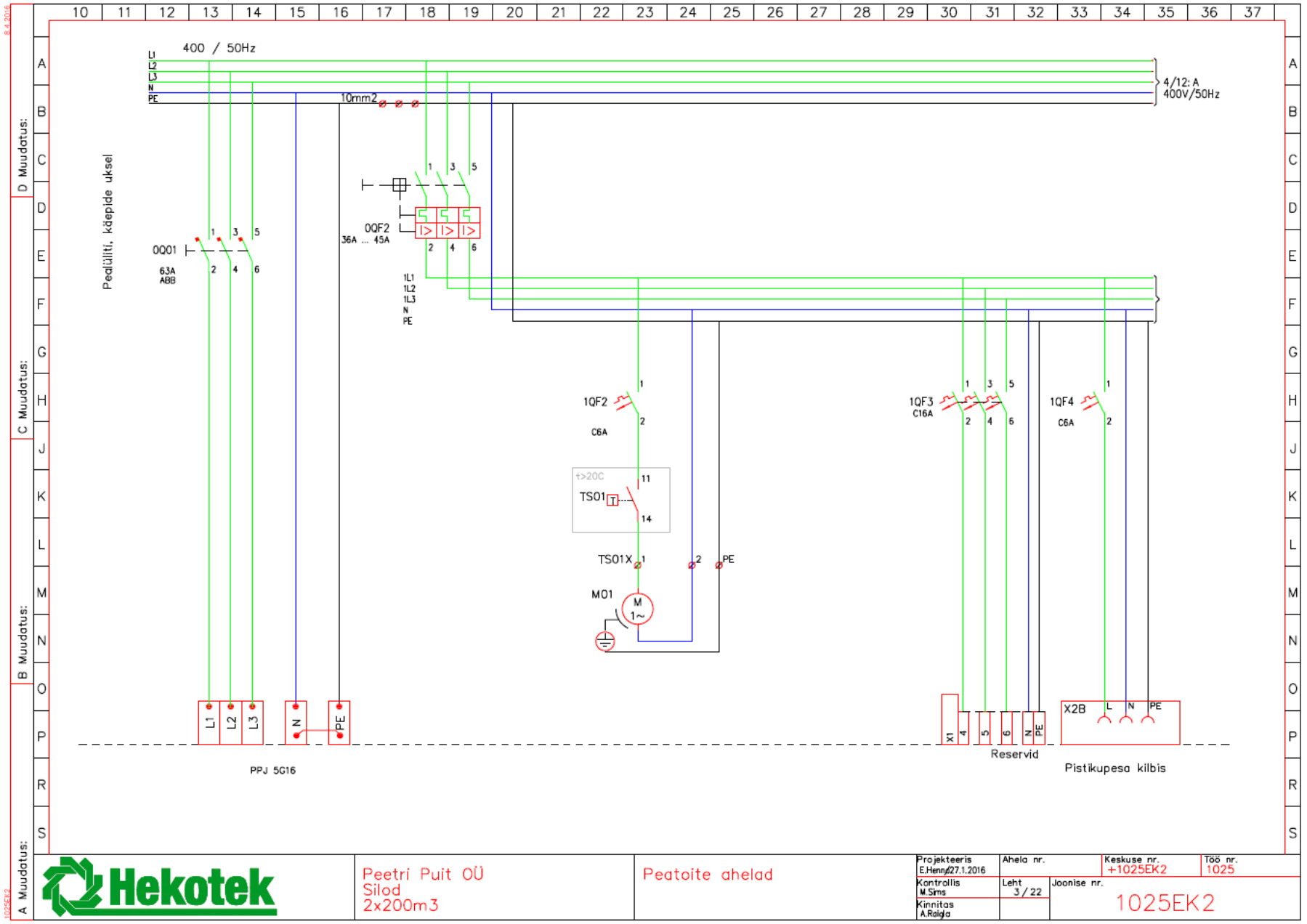
Kilbis jätta ruumi 20% ulatses iga aparatuuri tüübi väljal (releede, kaitseaparatuuri, kontaktorite jne väljal)
Iga klemmi rea lõppu jätta 20% vaba ruumi. Toite jaotuspunktis jätta samuti 20% vaba ruumi.
⏚ – selliselt tähistatud potensiaali punktis tuleb juhtmed paigaldada antud punkti ja joonisel näidatud järjekorras.
⏚ – võib valmistaja ise valida kuhu juhtmed paigaldada.
Kontaktoritele ja releedele arvestada kontakte mitte vähem kui joonisel näidatud (arvestada ka reserv kontaktid)
Paigaldada kaablikinnitus liist, kus on võimalik kasutada juhtmesidemeid.
Kõik klemmliistud tõsta alusplaadist kõrgemale vähemalt 40mm.
Klemmliistu tähised panna nii, et neid on võimalik kaablite montaazi käigus hõlpsasti näha.
Kõik klemmid ühe klemmliistu nr piirides, millelt minnakse välja ühe kaabliga, panna üksteise kõrvale ühte ritta(näit QX1 kaabel W1–xxx)
Samuti peaks ühe klemmliistu nr piires klemmid olema kas ühes reas või mitmes reas aga üksteisele võimalikult lähedal(näit JX1)
Kontrollerile jätta külje peale vähemalt 200mm ruumi lisamoodulite paigaldamiseks
Kilbi sisene võõrpinge >50V tuleb vedada eri värvi juhtmega ja märkida kilbi uksele sisse poole kollasel taustal kiri "VÕÕRPINGE *juhtme värv* JUHTMEGA"
Kõikidele 24VDC releedele panna vastudioodiga valgusdioodmoodulid

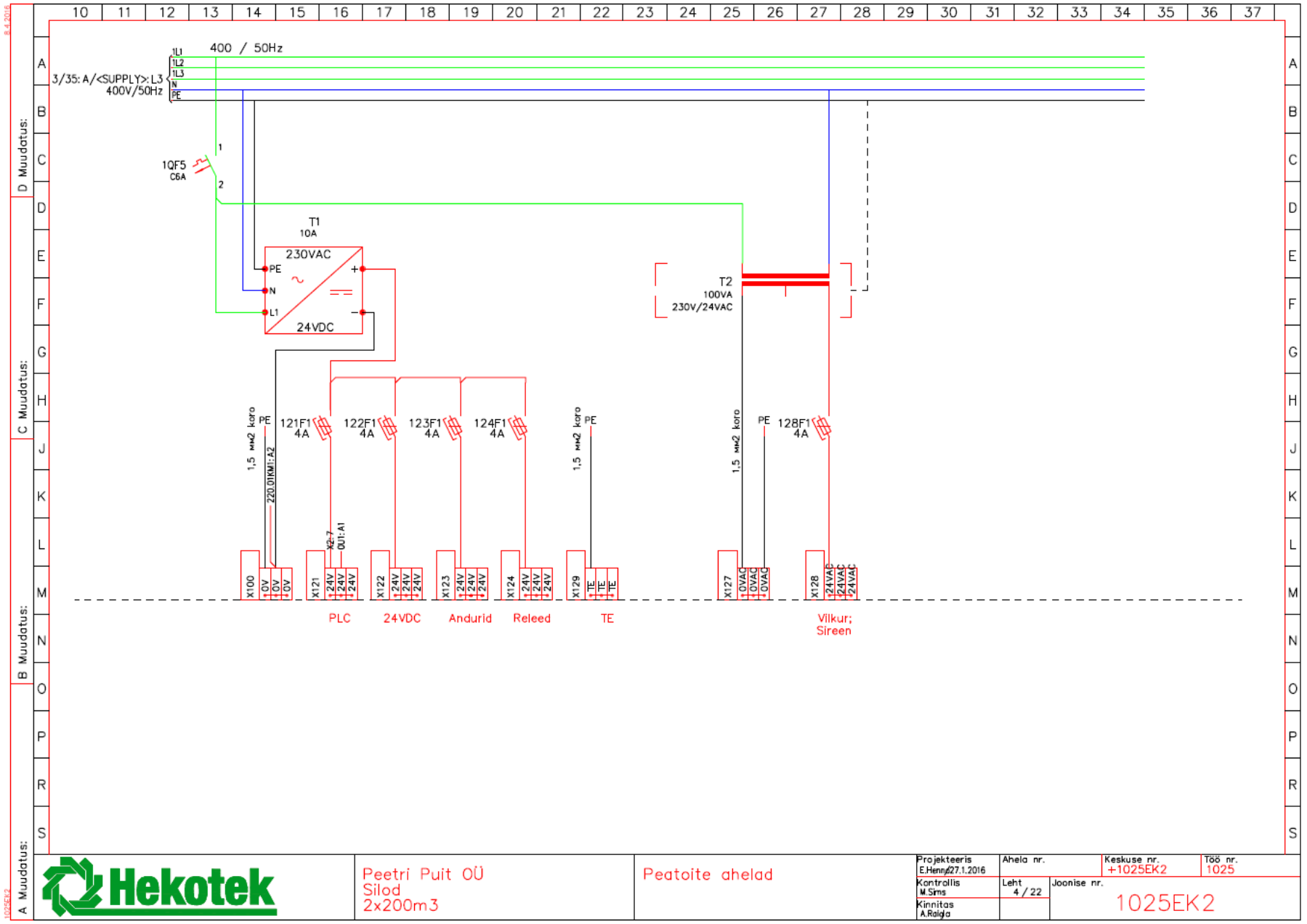
Hädaseis lüliti fikseeruv ja pöörates tagastuv
Juhtkeskuse korpuse konstruktsioonielemente ei tohi kasutada kaitsemaandus– ja varjestuse maandusjuhina

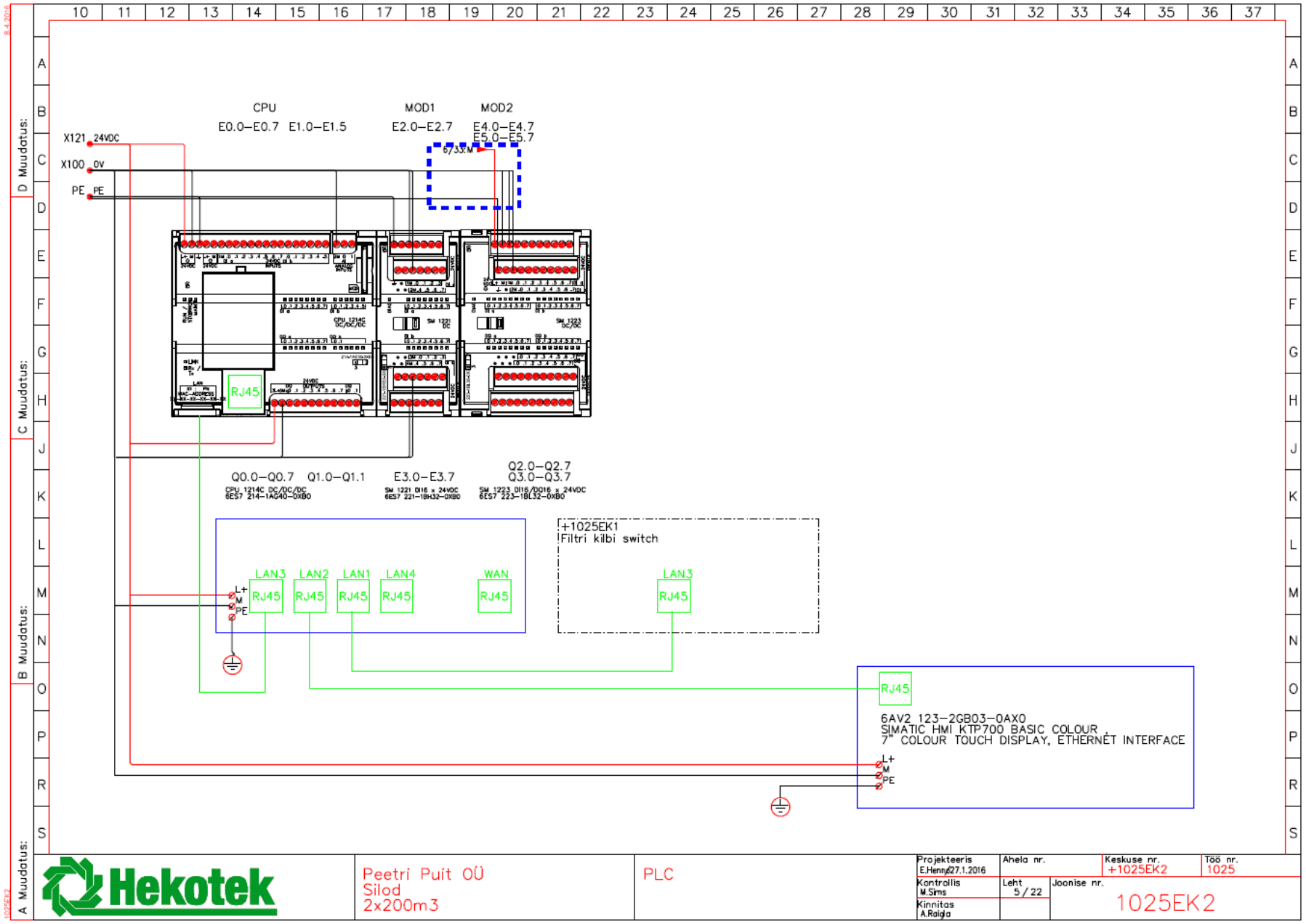
A Muudatus: 1025EK2
B Muudatus:
C Muudatus:
D Muudatus: 15.5.2016

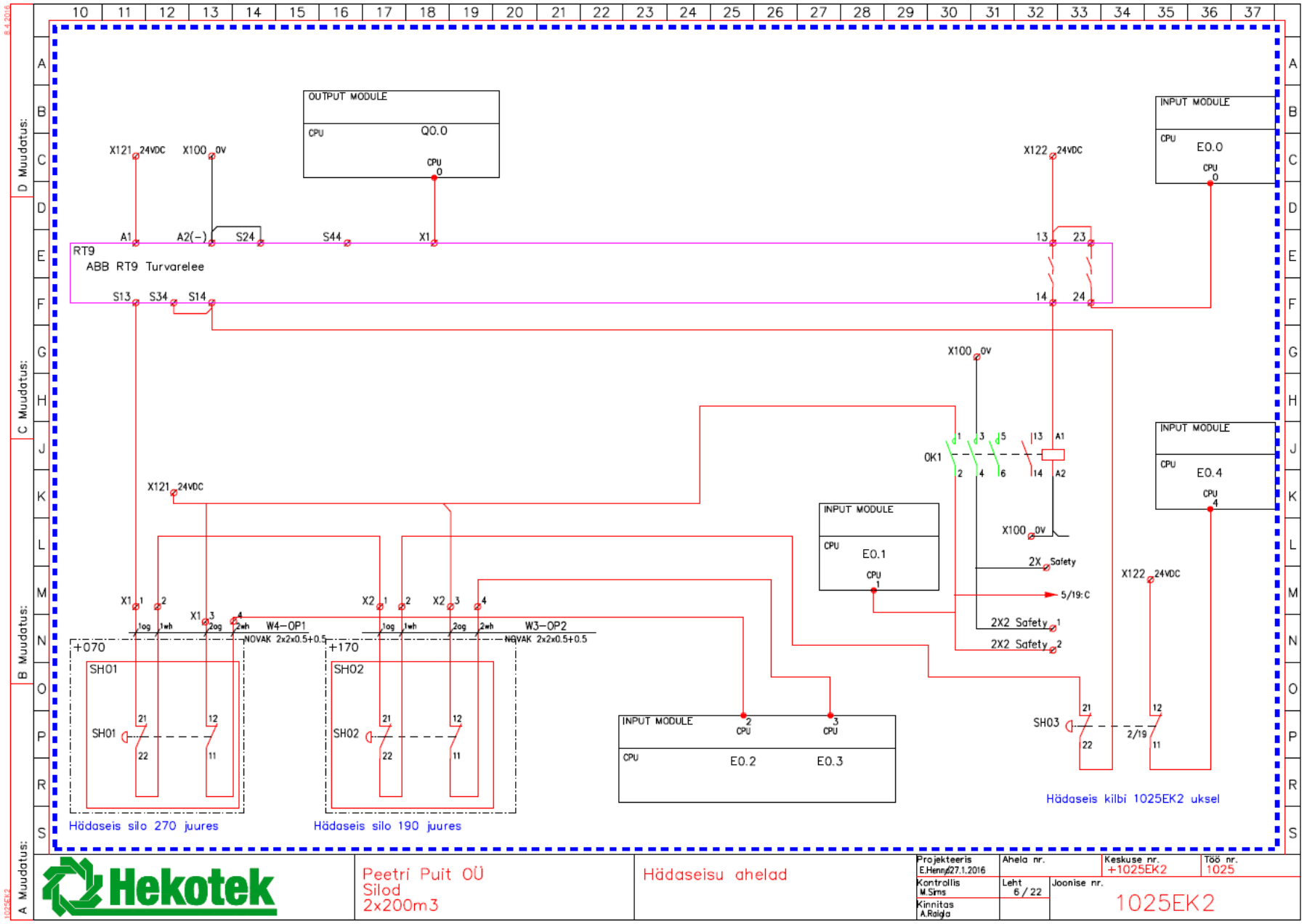
Hekotek	Peetri Puit OÜ Silod 2x200m3	Tehniline ülesanne	Projekteeris E.Henn 27.1.2016 Kontrollis M.Sims Kinnitas A.Raigla	Ahela nr. Leht 1 / 22	Keskuse nr. +1025EK2 Joonise nr. 1025EK2	Töö nr. 1025

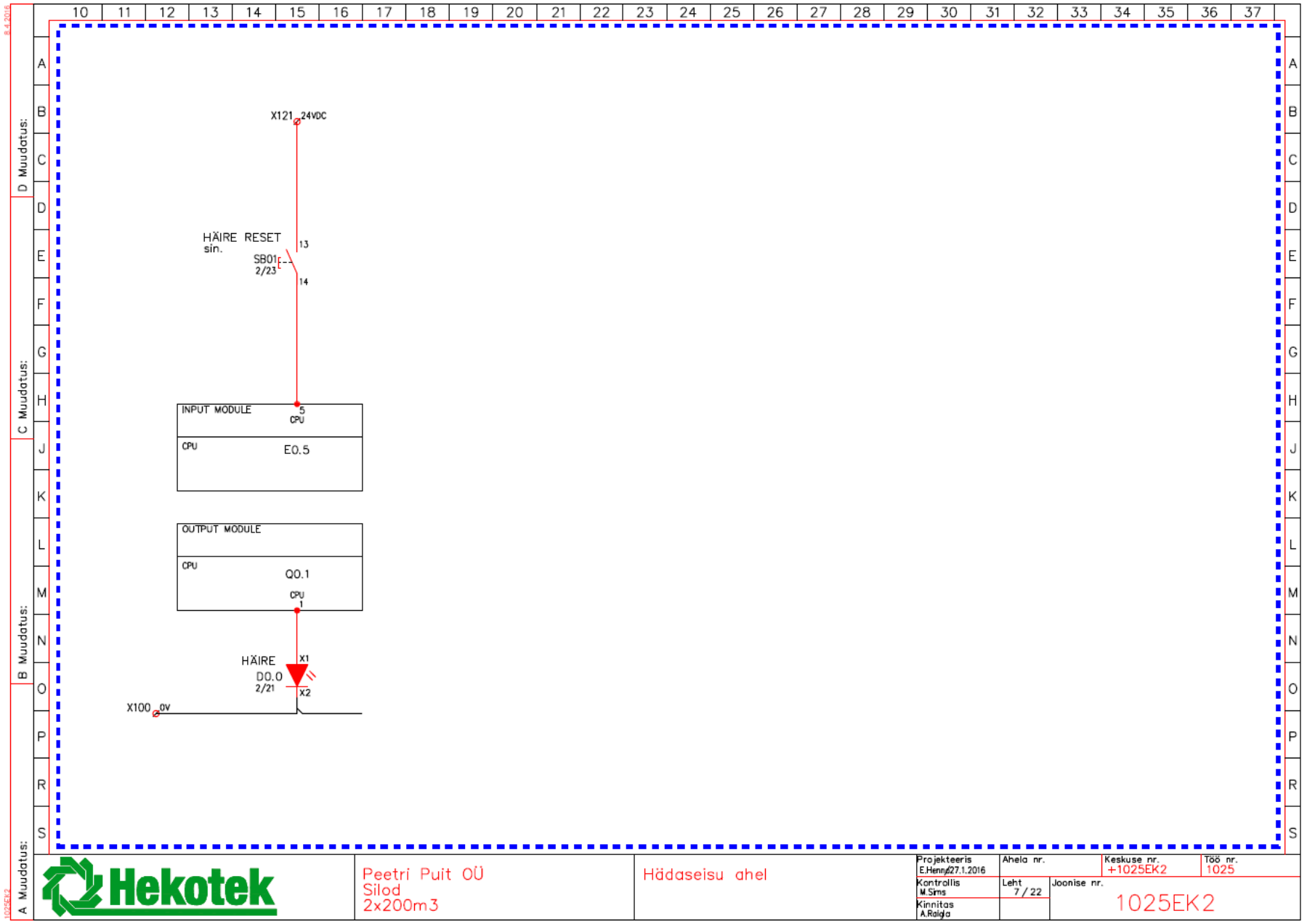

SIEMENS
SIMATIC HMI KTP700 BASIC COLOUR,
7" COLOUR TOUCH DISPLAY, ETHERNET
6AV2 123-2GB03-0AX0
138
198
AVARII STOPP
HÄIRE
HÄIRE RESET
SILO SISSELÜLITATUD
PUNANE
SININE
ROHELINE
SH01 6/35
D0.0 7/15
SB01 7/15
01D1 20/27
Käsi
Start / Stop
Reserv 22mm
ROHELINE
0
061S1
061D1
20/24
M22-B (hall)
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
8.4.2016
1025EK2
Hekotek
Peetri Puit OÜ
Silod
2x200m3
Ukse eskiis
Projekteeris E.Henn 27.1.2016
Kontrollis M.Sims
Kinnitas A.Raiga
Ahela nr.
Leht 2 / 22
Keskuse nr. +1025EK2
Töö nr. 1025
Joonise nr. 1025EK2

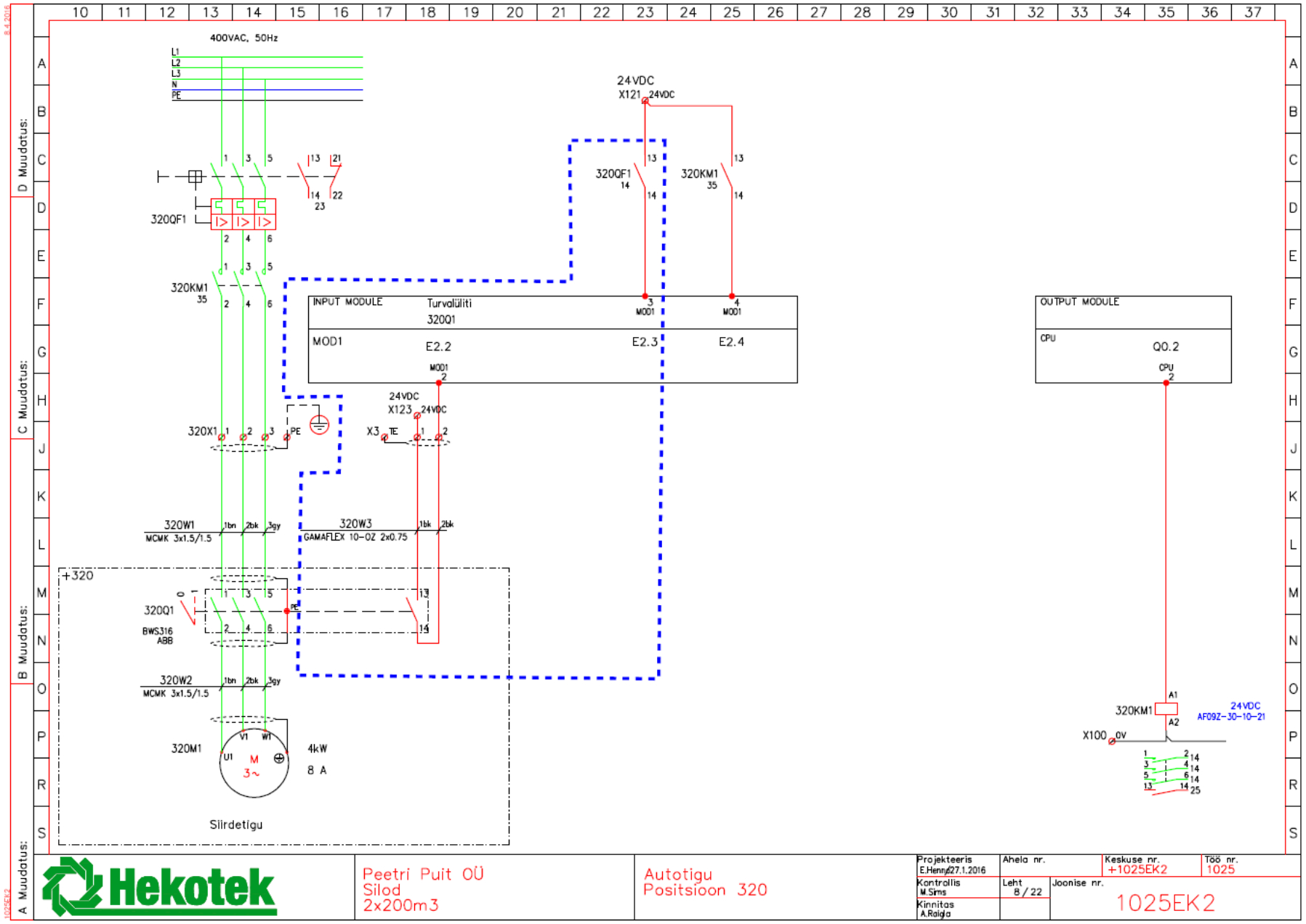

400 / 50Hz
L1
L2
L3
N
PE
10mm2
4/12: A
400V/50Hz
Pealüliti, käepide uksel
0QF2
36A ... 45A
0Q01
63A
ABB
1L1
1L2
1L3
N
PE
1QF2
C6A
t>20C
TS01
11
14
TS01X
1
2
PE
M01
M
1~
1QF3
C16A
1QF4
C6A
L1
L2
L3
N
PE
PPJ 5G16
X1
4
5
6
N
PE
Reservid
X2B
L
N
PE
Pistikupesa kilbis
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
8.4.2016
1025EK2
Hekotek
Peetri Puit OÜ
Silod
2x200m3
Peatoite ahelad
Projekteeris
E.Henn 27.1.2016
Kontrollis
M.Sims
Kinnitas
A.Raiga
Ahela nr.
Leht
3 / 22
Keskuse nr.
+1025EK2
Töö nr.
1025
Joonise nr.
1025EK2


400 / 50Hz
3/35: A/<SUPPLY>: L3
400V/50Hz
1L1
1L2
1L3
N
PE
1QF5
C6A
T1
10A
230VAC
24VDC
T2
100VA
230V/24VAC
121F1
4A
122F1
4A
123F1
4A
124F1
4A
128F1
4A
1,5 мм2 karo
220.01KM1:A2
X2:7
0U1:A1
X100
X121
X122
X123
X124
X129
X127
X128
PLC
24VDC
Andurid
Releed
TE
Vilkur;
Sireen
Hekotek
Peetri Puit OÜ
Silod
2x200m3
Peatoite ahelad
Projekteeris
E.Henn 27.1.2016
Kontrollis
M.Sims
Kinnitas
A.Raiga
Ahela nr.
Leht
4 / 22
Keskuse nr.
+1025EK2
Töö nr.
1025
Joonise nr.
1025EK2


CPU
E0.0–E0.7 E1.0–E1.5
MOD1
E2.0–E2.7
MOD2
E4.0–E4.7
E5.0–E5.7
X121 24VDC
X100 0V
PE PE
6ES7 214-1AG40-0XB0
Q0.0–Q0.7 Q1.0–Q1.1
E3.0–E3.7
Q2.0–Q2.7
Q3.0–Q3.7
LAN3 LAN2 LAN1 LAN4 WAN
RJ45
L+
M
PE
+1025EK1
Filtri kilbi switch
6AV2 123-2GB03-0AX0
SIMATIC HMI KTP700 BASIC COLOUR ,
7" COLOUR TOUCH DISPLAY, ETHERNET INTERFACE
Hekotek
Peetri Puit OÜ
Silod
2x200m3
PLC
Projekteeris
E.Henn 27.1.2016
Kontrollis
M.Sims
Kinnitas
A.Raiga
Ahela nr.
Leht
5 / 22
Keskuse nr.
+1025EK2
Töö nr.
1025
Joonise nr.
1025EK2


OUTPUT MODULE
CPU Q0.0
INPUT MODULE
CPU E0.0
INPUT MODULE
CPU E0.4
INPUT MODULE
CPU E0.1
INPUT MODULE
CPU E0.2 E0.3
X121 24VDC
X100 0V
X122 24VDC
A1
A2(-)
S24
S44
X1
13
23
14
24
RT9
ABB RT9 Turvarelee
S13
S34
S14
OK1
2X Safety
2X2 Safety
5/19:C
2/19
W4-OP1
W3-OP2
NOVAK 2x2x0.5+0.5
+070
+170
SH01
SH02
SH03
Hädaseis silo 270 juures
Hädaseis silo 190 juures
Hädaseis kilbi 1025EK2 uksel
Peetri Puit OÜ
Silod
2x200m3
Hädaseisu ahelad
Projekteeris E.Henn 27.1.2016
Kontrollis M.Sims
Kinnitas A.Raiga
Leht 6 / 22
Keskuse nr. +1025EK2
Töö nr. 1025
Joonise nr. 1025EK2

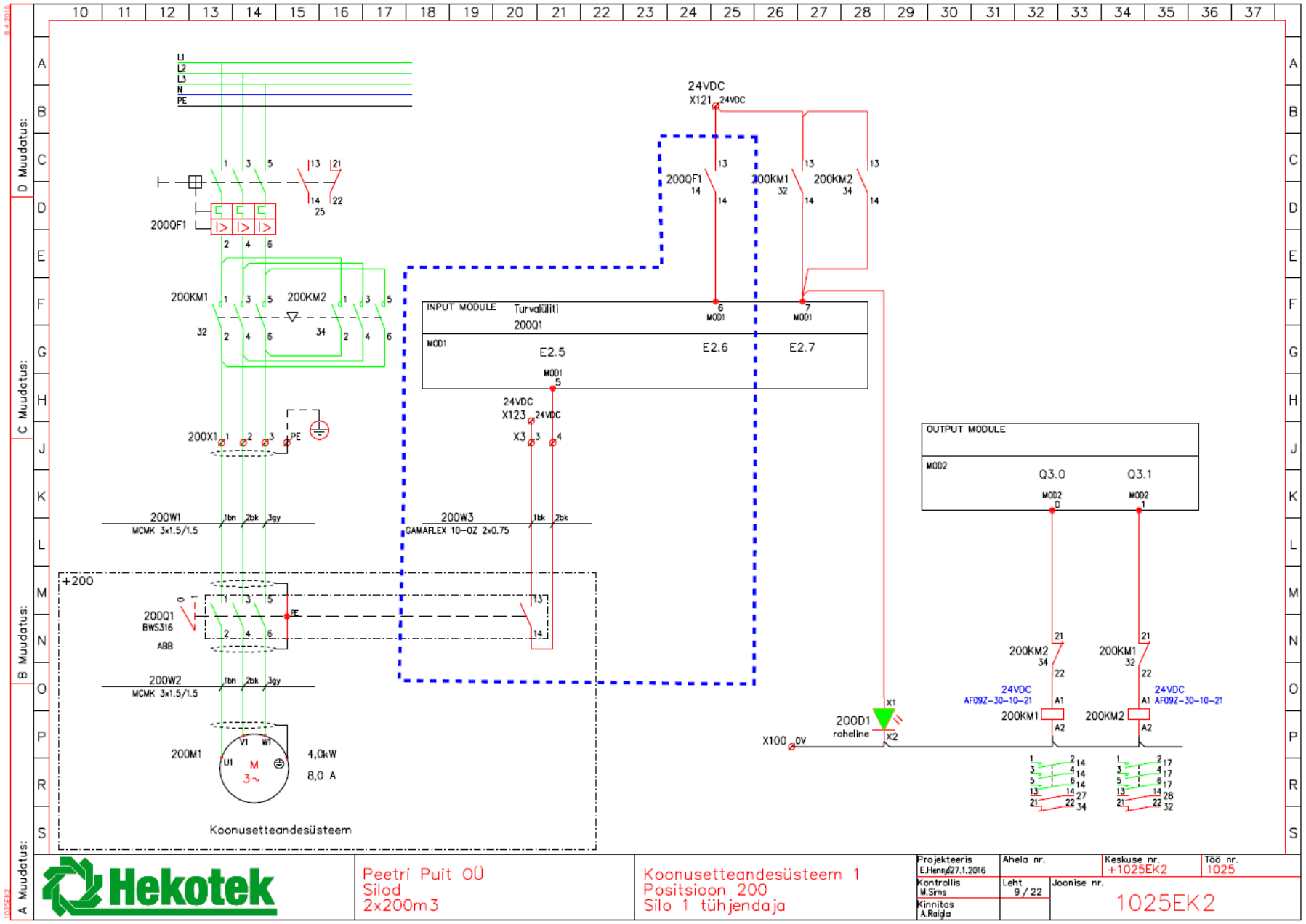

X121 24VDC
HÄIRE RESET
sin.
SB01
2/23
13
14
INPUT MODULE
5
CPU
CPU
E0.5
OUTPUT MODULE
CPU
Q0.1
CPU
1
HÄIRE
D0.0
2/21
X1
X2
X100 0V
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
Hekotek
Peetri Puit OÜ
Silod
2x200m3
Häädaseisu ahel
Projekteeris
E.Henn 27.1.2016
Kontrollis
M.Sims
Kinnitas
A.Raiga
Ahela nr.
Leht
7 / 22
Keskuse nr.
+1025EK2
Töö nr.
1025
Joonise nr.
1025EK2

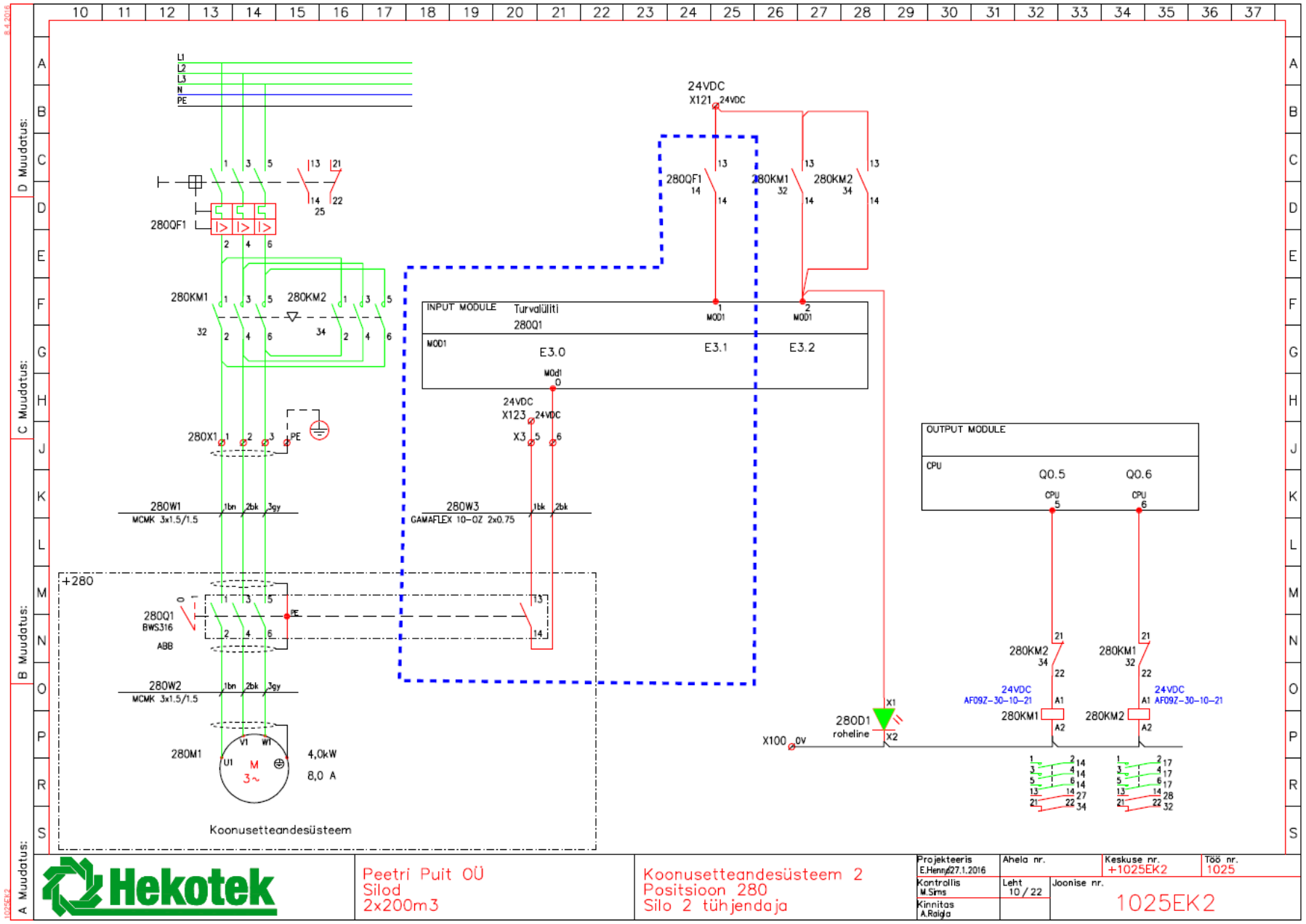


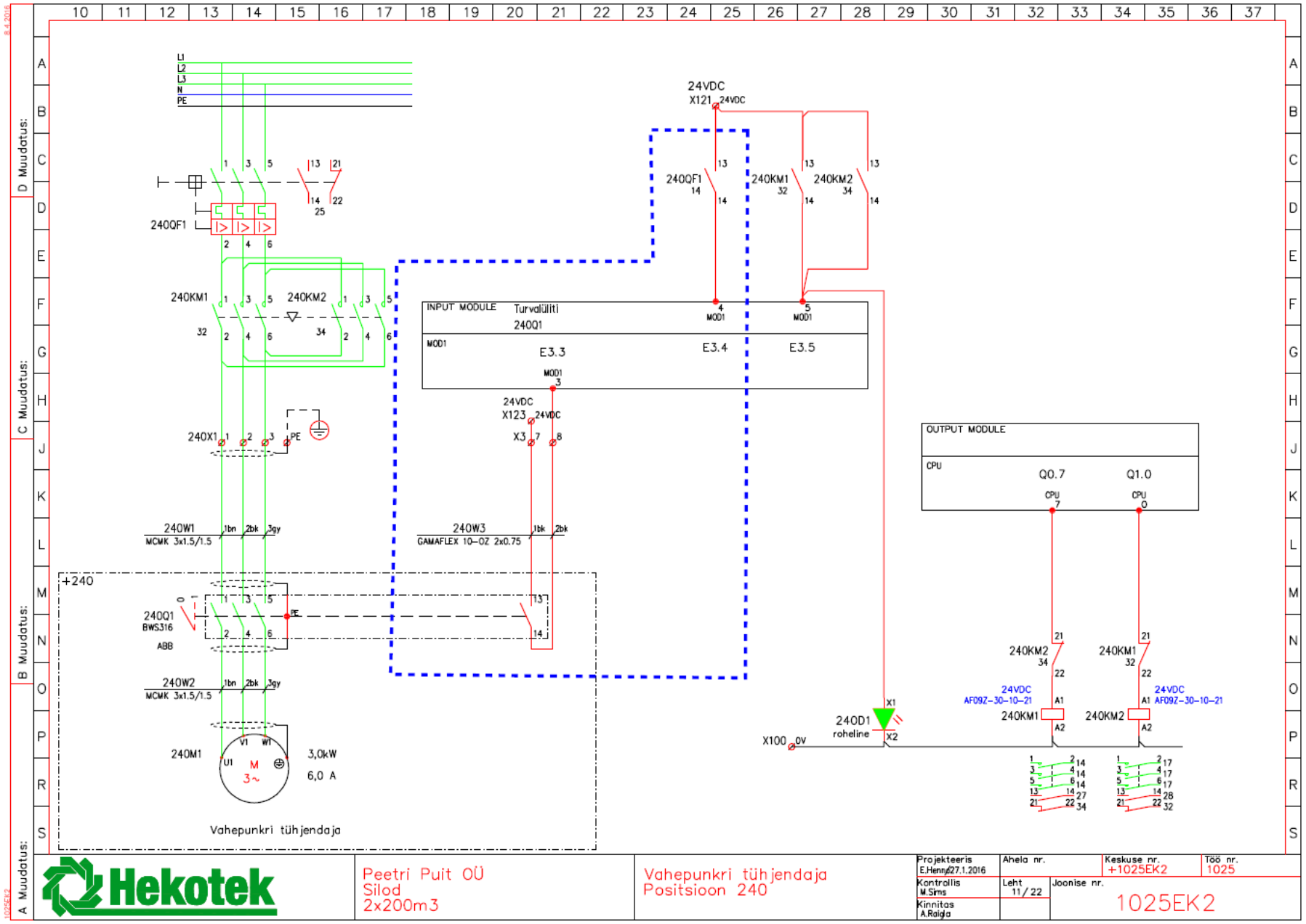
Peetri Puit OÜ
Silod
2x200m3

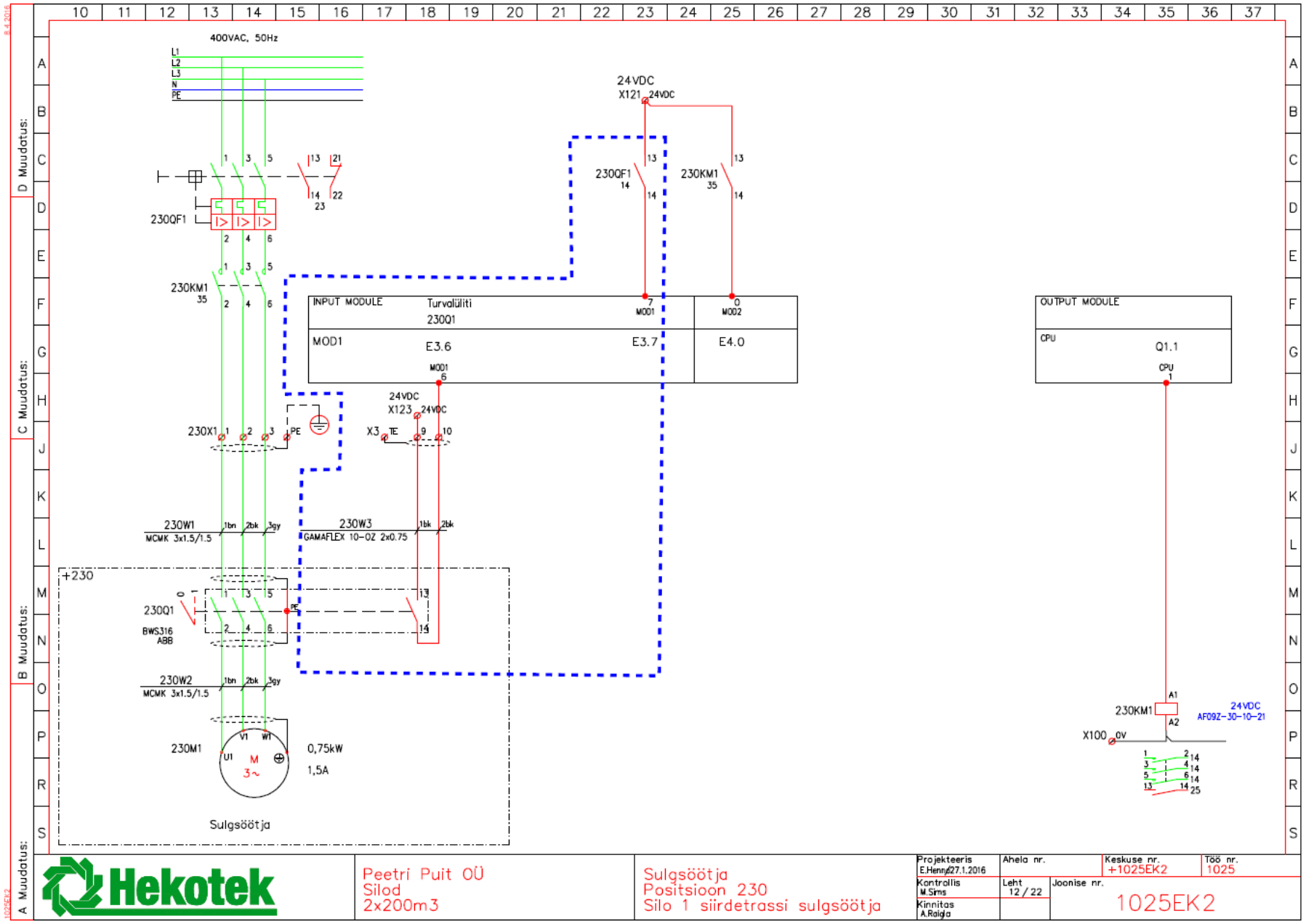
Autotigu
Positsioon 320

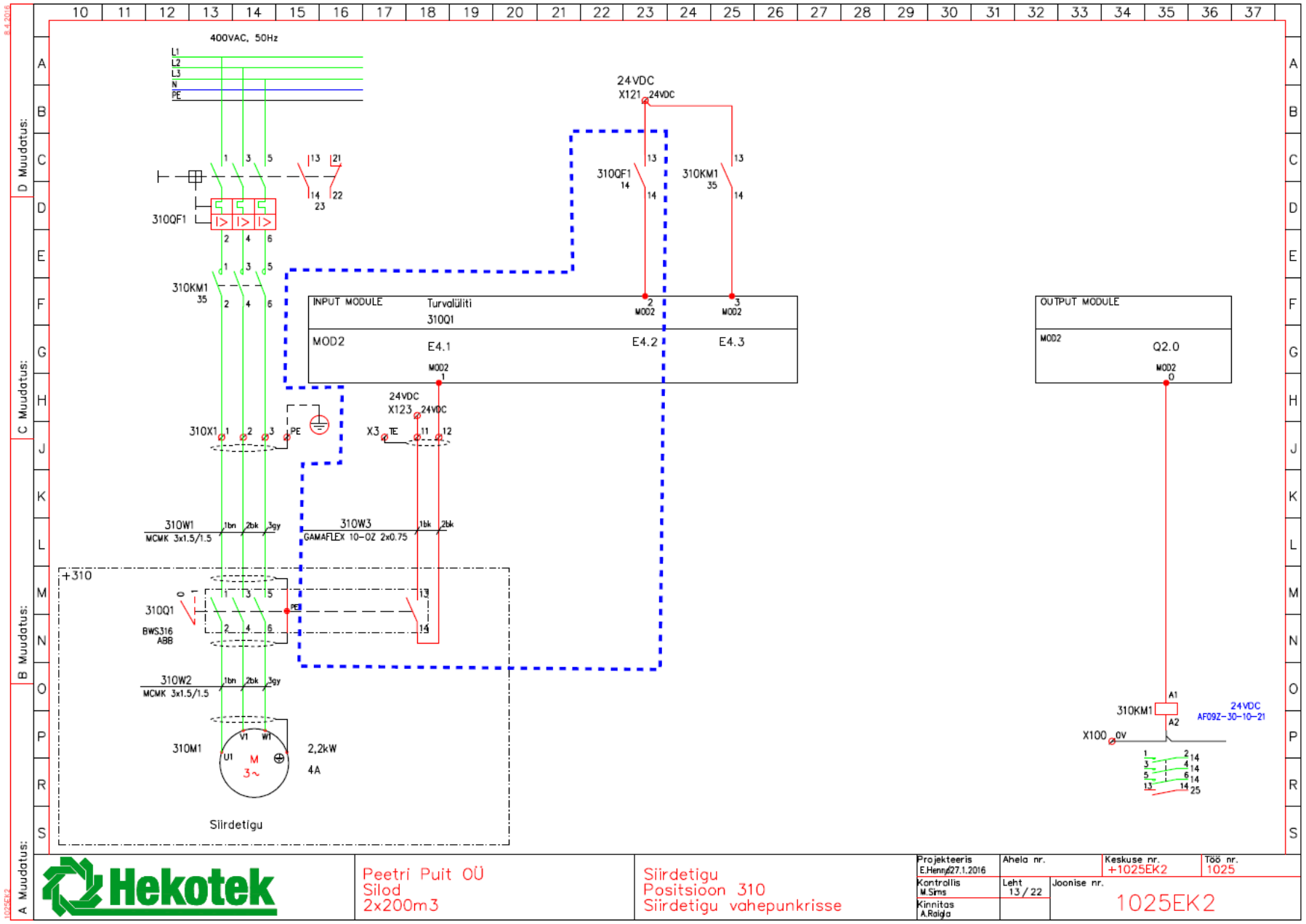
Projekteeris E.Henn 27.1.2016	Ahela nr.	Keskuse nr. +1025EK2	Töö nr. 1025
Kontrollis M.Sims	Leht 8 / 22	Joonise nr. 1025EK2	
Kinnitas A.Raiga			


L1
L2
L3
N
PE
200QF1
200KM1
200KM2
24VDC
X121
200QF1
200KM1
200KM2
INPUT MODULE
Turvalüliti
200Q1
MOD1
E2.5
E2.6
E2.7
24VDC
X123
X3
200X1
PE
200W1
MCMK 3x1.5/1.5
200W3
GAMAFLEX 10-OZ 2x0.75
+200
200Q1
BWS316
ABB
200W2
MCMK 3x1.5/1.5
200M1
4,0kW
8,0 A
Koonusetteandesüsteem
OUTPUT MODULE
MOD2
Q3.0
Q3.1
200KM2
200KM1
24VDC
AF09Z-30-10-21
200D1
roheline
X100
0V
Hekotek
Peetri Puit OÜ
Silod
2x200m3
Koonusetteandesüsteem 1
Positsioon 200
Silo 1 tühjendaja
Projekteeris
E.Henn 27.1.2016
Kontrollis
M.Sims
Kinnitas
A.Raiga
Ahela nr.
Leht
9 / 22
Keskuse nr.
+1025EK2
Töö nr.
1025
Joonise nr.
1025EK2


L1
L2
L3
N
PE
280QF1
280KM1
280KM2
24VDC
X121
24VDC
INPUT MODULE
Turvalüliti
280Q1
MOD1
E3.0
E3.1
E3.2
24VDC
X123
X3
280X1
PE
280W1
MCMK 3x1.5/1.5
280W3
GAMAFLEX 10-OZ 2x0.75
+280
280Q1
BWS316
ABB
280W2
MCMK 3x1.5/1.5
280M1
4,0kW
8,0 A
Koonusetteandesüsteem
OUTPUT MODULE
CPU
Q0.5
Q0.6
280OD1
roheline
X100
0V
24VDC
AF09Z-30-10-21
Hekotek
Peetri Puit OÜ
Silod
2x200m3
Koonusetteandesüsteem 2
Positsioon 280
Silo 2 tühjendaja
Projekteeris
E.Henn 27.1.2016
Kontrollis
M.Sims
Kinnitas
A.Raiga
Ahela nr.
Leht
10 / 22
Keskuse nr.
+1025EK2
Töö nr.
1025
Joonise nr.
1025EK2


L1
L2
L3
N
PE
24VDC
X121
240QF1
240KM1
240KM2
INPUT MODULE
Turvalüliti
240Q1
E3.3
E3.4
E3.5
24VDC
X123
X3
240X1
240W1
MCMK 3x1.5/1.5
240W3
GAMAFLEX 10-OZ 2x0.75
+240
240Q1
BWS316
ABB
240W2
MCMK 3x1.5/1.5
240M1
3,0kW
6,0 A
Vahepunkri tühjendaja
OUTPUT MODULE
CPU
Q0.7
Q1.0
240D1
roheline
X100
0V
24VDC
AF09Z-30-10-21
Peetri Puit OÜ
Silod
2x200m3
Vahepunkri tühjendaja
Positsioon 240
Projekteeris
E.Henn 27.1.2016
Kontrollis
M.Sims
Kinnitas
A.Raiga
Ahela nr.
Leht
11 / 22
Keskuse nr.
+1025EK2
Töö nr.
1025
Joonise nr.
1025EK2


400VAC, 50Hz
L1
L2
L3
N
PE
24VDC
X121
24VDC
230QF1
230KM1
35
INPUT MODULE
Turvalüliti
230Q1
MOD1
E3.6
E3.7
E4.0
MOD1
6
MOD1
7
MOD2
0
24VDC
X123
24VDC
X3
TE
9
10
230X1
PE
230W1
MCMK 3x1.5/1.5
1bn
2bk
3gy
230W3
GAMAFLEX 10-OZ 2x0.75
1bk
2bk
+230
230Q1
BWS316
ABB
230W2
MCMK 3x1.5/1.5
230M1
V1
W1
U1
M
3~
0,75kW
1,5A
Sulgsöötja
OUTPUT MODULE
CPU
Q1.1
CPU
1
230KM1
A1
A2
24VDC
AF09Z-30-10-21
X100
0V
Hekotek
Peetri Puit OÜ
Silod
2x200m3
Sulgsöötja
Positsioon 230
Silo 1 siirdetrassi sulgsöötja
Projekteeris
E.Henn 27.1.2016
Kontrollis
M.Sims
Kinnitas
A.Raiga
Ahela nr.
Leht
12 / 22
Keskuse nr.
+1025EK2
Töö nr.
1025
Joonise nr.
1025EK2
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
8.4.2016
1025EK2

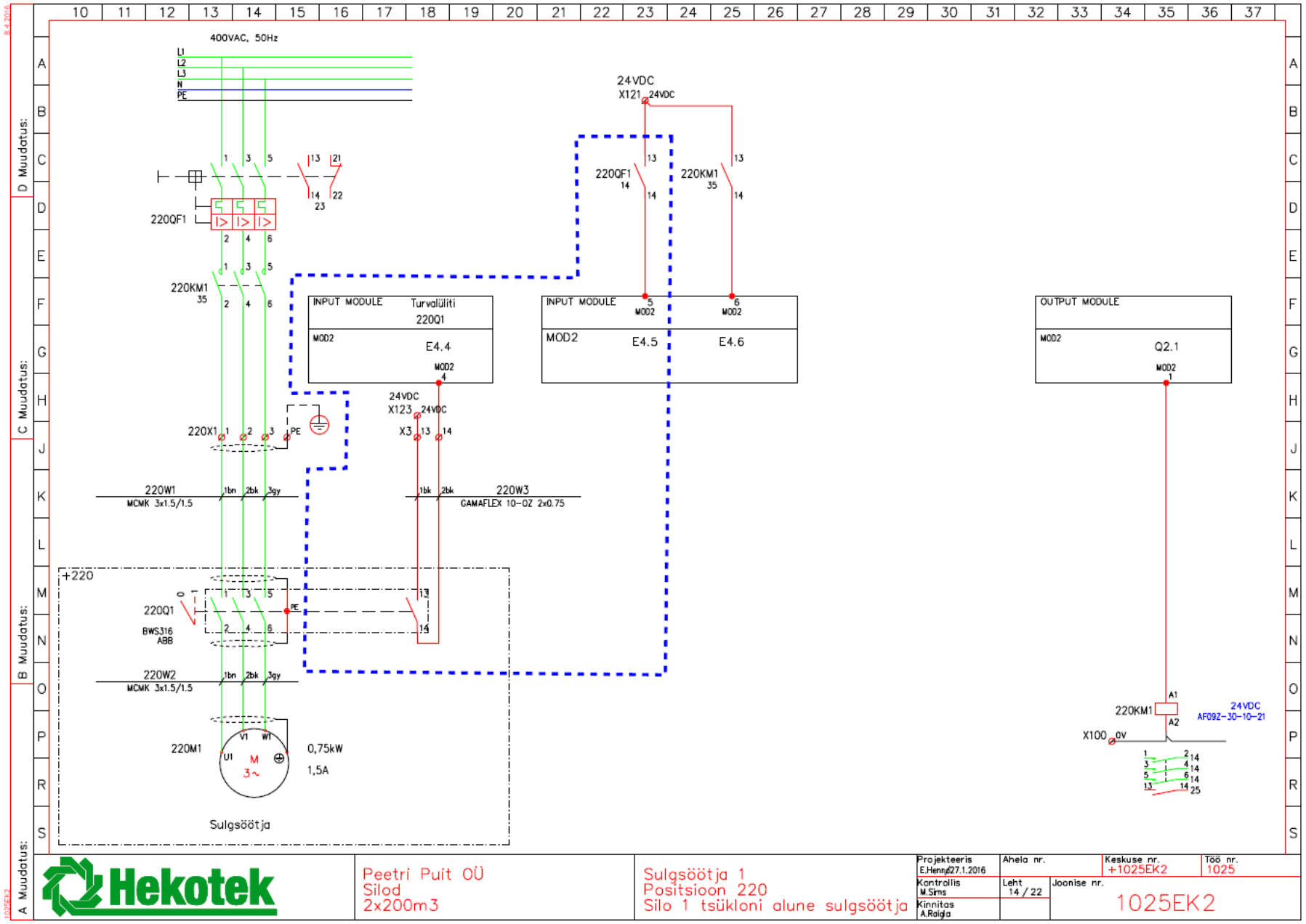


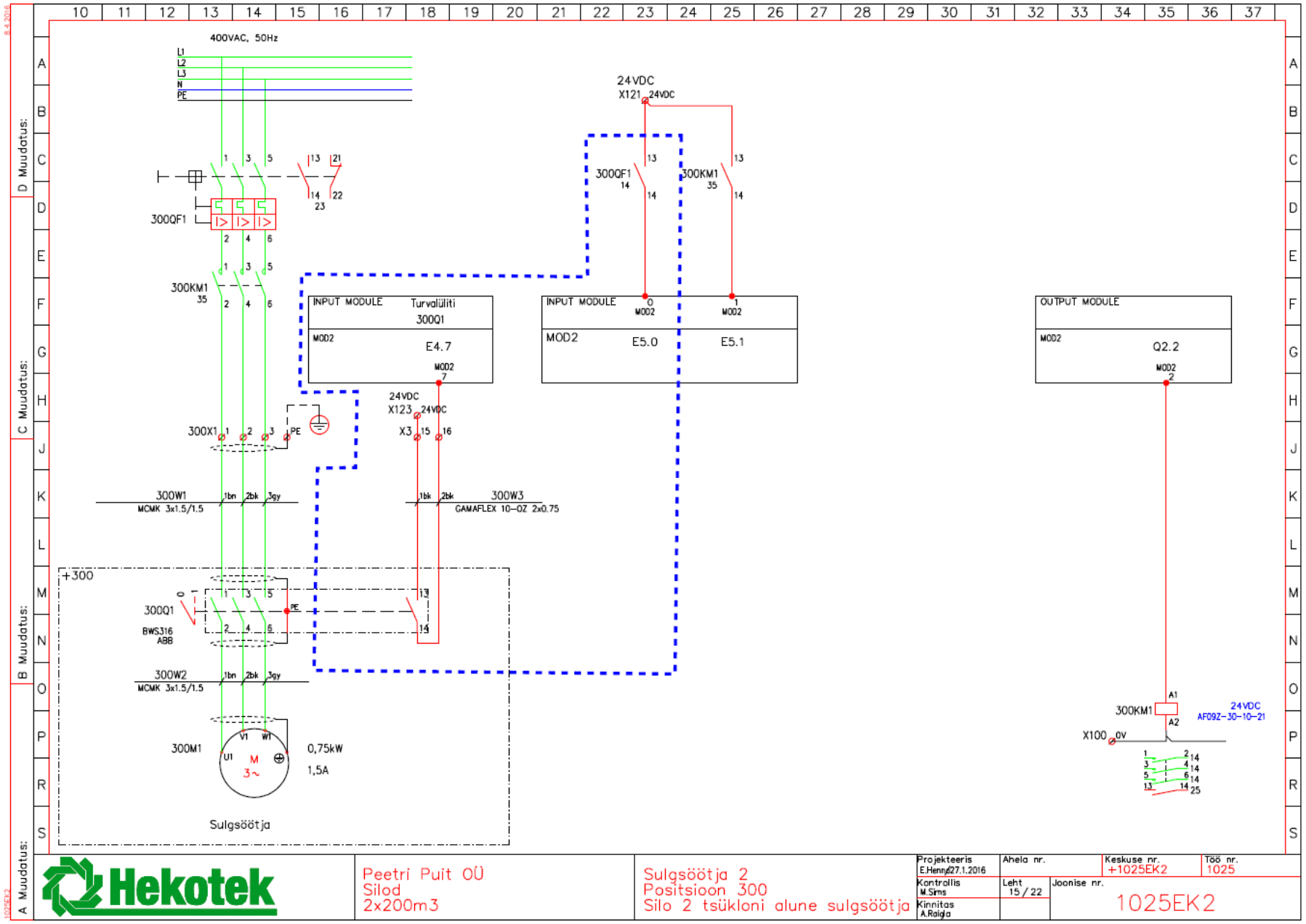
Hekotek

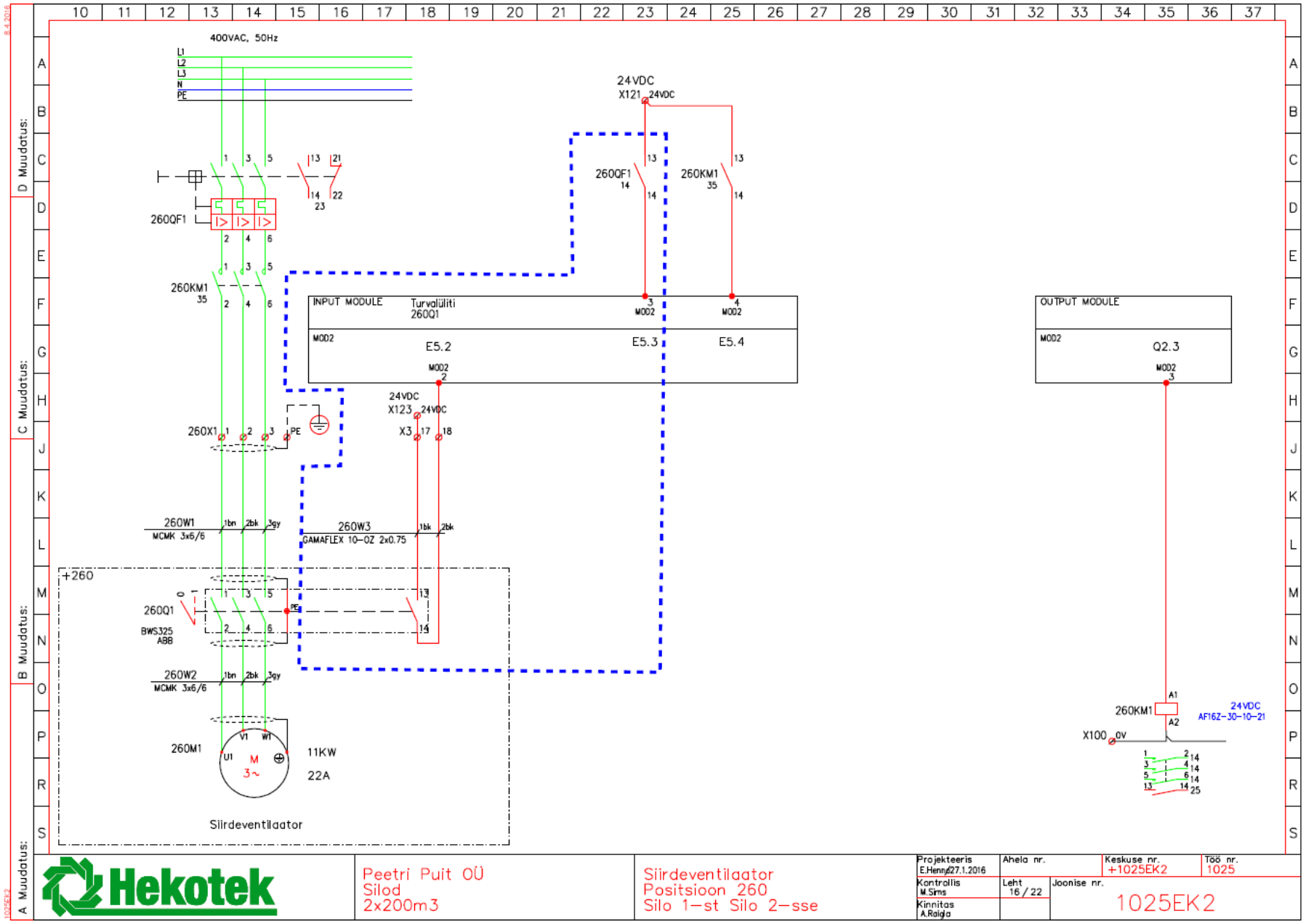
Peetri Puit OÜ
Silod
2x200m3

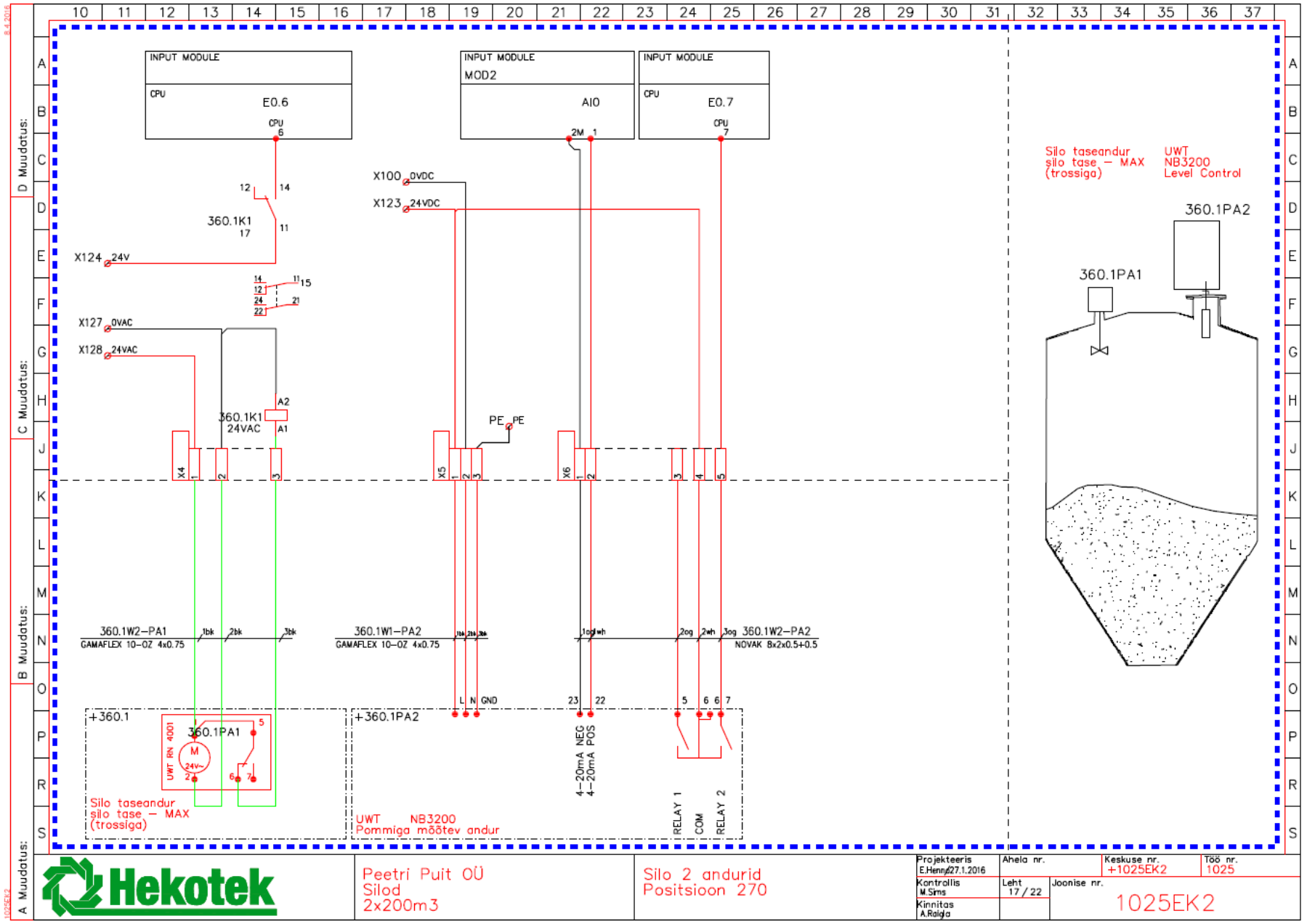
Siirdetigu
Positsioon 310
Siirdetigu vahepunkrisse

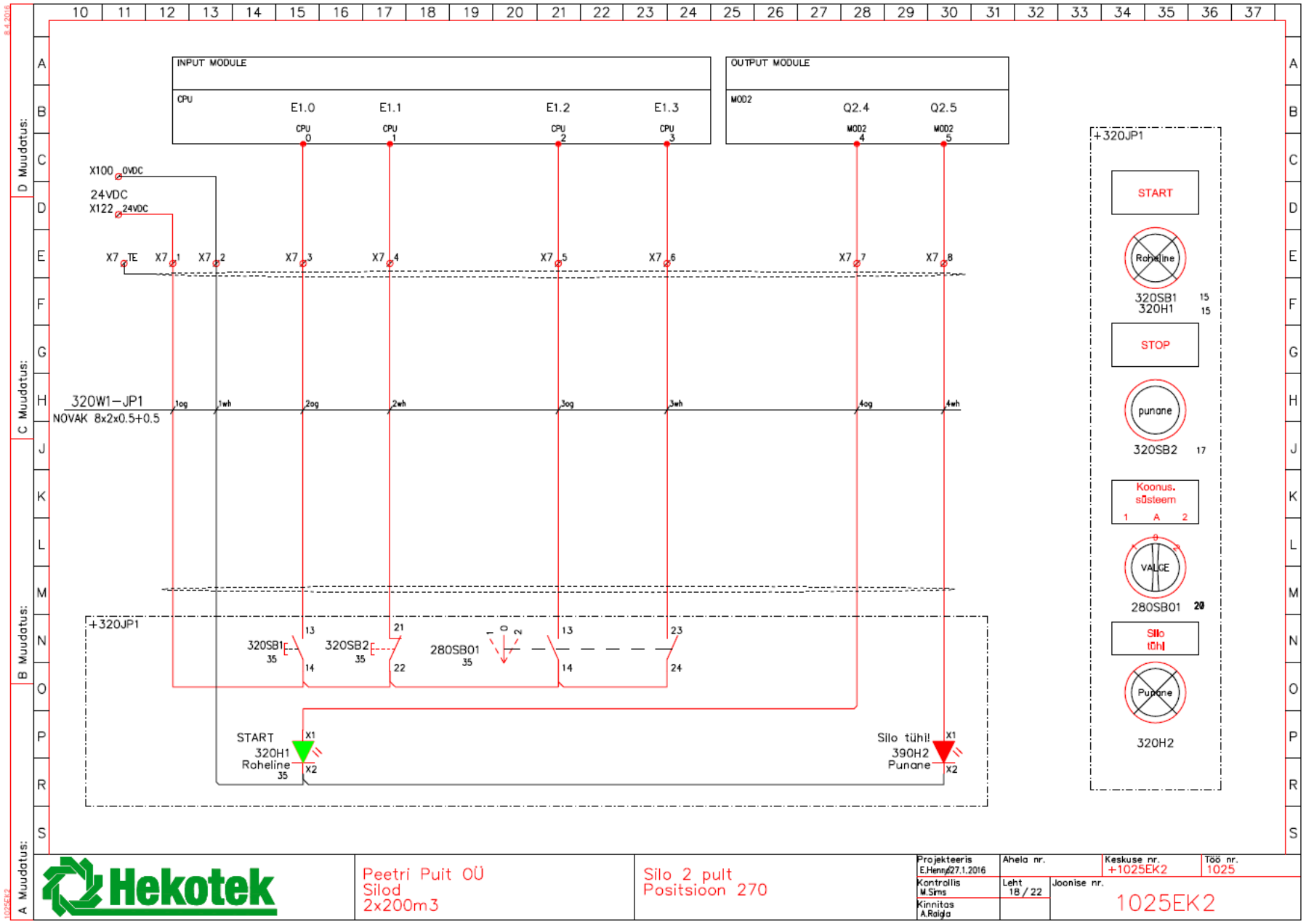
Projekteeris E.Henn 27.1.2016	Ahela nr.	Keskuse nr. +1025EK2	Töö nr. 1025
Kontrollis M.Sims	Leht 13 / 22	Joonise nr. 1025EK2	
Kinnitas A.Raiga			


400VAC, 50Hz
L1
L2
L3
N
PE
24VDC
X121
220QF1
220KM1
INPUT MODULE
Turvaliliti
220Q1
MOD2
E4.4
E4.5
E4.6
OUTPUT MODULE
Q2.1
24VDC
X123
X3
220X1
220W1
MCMK 3x1.5/1.5
220W3
GAMAFLEX 10-OZ 2x0.75
+220
220Q1
BWS316
ABB
220W2
MCMK 3x1.5/1.5
220M1
0,75kW
1,5A
Sulgsöötja
A1
A2
AF09Z-30-10-21
X100
0V
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
Hekotek
Peetri Puit OÜ
Silod
2x200m3
Sulgsöötja 1
Positsioon 220
Silo 1 tsükloni alune sulgsöötja
Projekteeris
E.Henn 27.1.2016
Kontrollis
M.Sims
Kinnitas
A.Raiga
Ahela nr.
Leht
14 / 22
Keskuse nr.
+1025EK2
Töö nr.
1025
Joonise nr.
1025EK2


400VAC, 50Hz
L1
L2
L3
N
PE
24VDC
X121
24VDC
300QF1
300KM1
35
INPUT MODULE
Turvaliliti
300Q1
MOD2
E4.7
INPUT MODULE
MOD2
E5.0
E5.1
OUTPUT MODULE
Q2.2
24VDC
X123
X3
300X1
300W1
MCMK 3x1.5/1.5
300W3
GAMAFLEX 10-OZ 2x0.75
+300
300Q1
BWS316
ABB
300W2
MCMK 3x1.5/1.5
300M1
0,75kW
1,5A
Sulgsöötja
300KM1
24VDC
AF09Z-30-10-21
X100
0V
Peetri Puit OÜ
Silod
2x200m3
Sulgsöötja 2
Positsioon 300
Silo 2 tsükloni alune sulgsöötja
Projekteeris
E.Henn 27.1.2016
Kontrollis
M.Sims
Kinnitas
A.Raiga
Ahela nr.
Leht
15 / 22
Keskuse nr.
+1025EK2
Töö nr.
1025
Joonise nr.
1025EK2


400VAC, 50Hz
L1
L2
L3
N
PE
24VDC
X121
24VDC
260QF1
260KM1
35
INPUT MODULE
Turvaliliti
260Q1
MOD2
E5.2
E5.3
E5.4
24VDC
X123
X3
260X1
260W1
MCMK 3x6/6
260W3
GAMAFLEX 10-OZ 2x0.75
+260
260Q1
BWS325
ABB
260W2
MCMK 3x6/6
260M1
11KW
22A
Siirdeventilaator
OUTPUT MODULE
Q2.3
260KM1
24VDC
AF16Z-30-10-21
X100
0V
Peetri Puit OÜ
Silod
2x200m3
Siirdeventilaator
Positsioon 260
Silo 1-st Silo 2-sse
Projekteeris
E.Henn 27.1.2016
Kontrollis
M.Sims
Kinnitas
A.Raiga
Ahela nr.
Leht
16 / 22
Keskuse nr.
+1025EK2
Töö nr.
1025
Joonise nr.
1025EK2
A Muudatus:
B Muudatus:
C Muudatus:
D Muudatus:


INPUT MODULE
CPU
E0.6
CPU 6
INPUT MODULE
MOD2
AI0
2M 1
INPUT MODULE
CPU
E0.7
CPU 7
X100 0VDC
X123 24VDC
X124 24V
360.1K1
17
12
14
11
X127 0VAC
X128 24VAC
360.1K1
24VAC
A2
A1
PE PE
X4
X5
X6
360.1W2–PA1
GAMAFLEX 10–OZ 4x0.75
1bk 2bk 3bk
360.1W1–PA2
GAMAFLEX 10–OZ 4x0.75
360.1W2–PA2
NOVAK 8x2x0.5+0.5
L N GND
23 22
5 6 6 7
+360.1
360.1PA1
UWT RN 4001
M
24V~
Silo taseandur
silo tase – MAX
(trossiga)
+360.1PA2
4–20mA NEG
4–20mA POS
RELAY 1
COM
RELAY 2
UWT NB3200
Pommiga mõõtev andur
Silo taseandur
silo tase – MAX
(trossiga)
UWT
NB3200
Level Control
360.1PA2
360.1PA1
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
Hekotek
Peetri Puit OÜ
Silod
2x200m3
Silo 2 andurid
Positsioon 270
Projekteeris E.Henn 27.1.2016
Kontrollis M.Sims
Kinnitas A.Raiga
Ahela nr.
Leht 17 / 22
Keskuse nr. +1025EK2
Töö nr. 1025
Joonise nr. 1025EK2

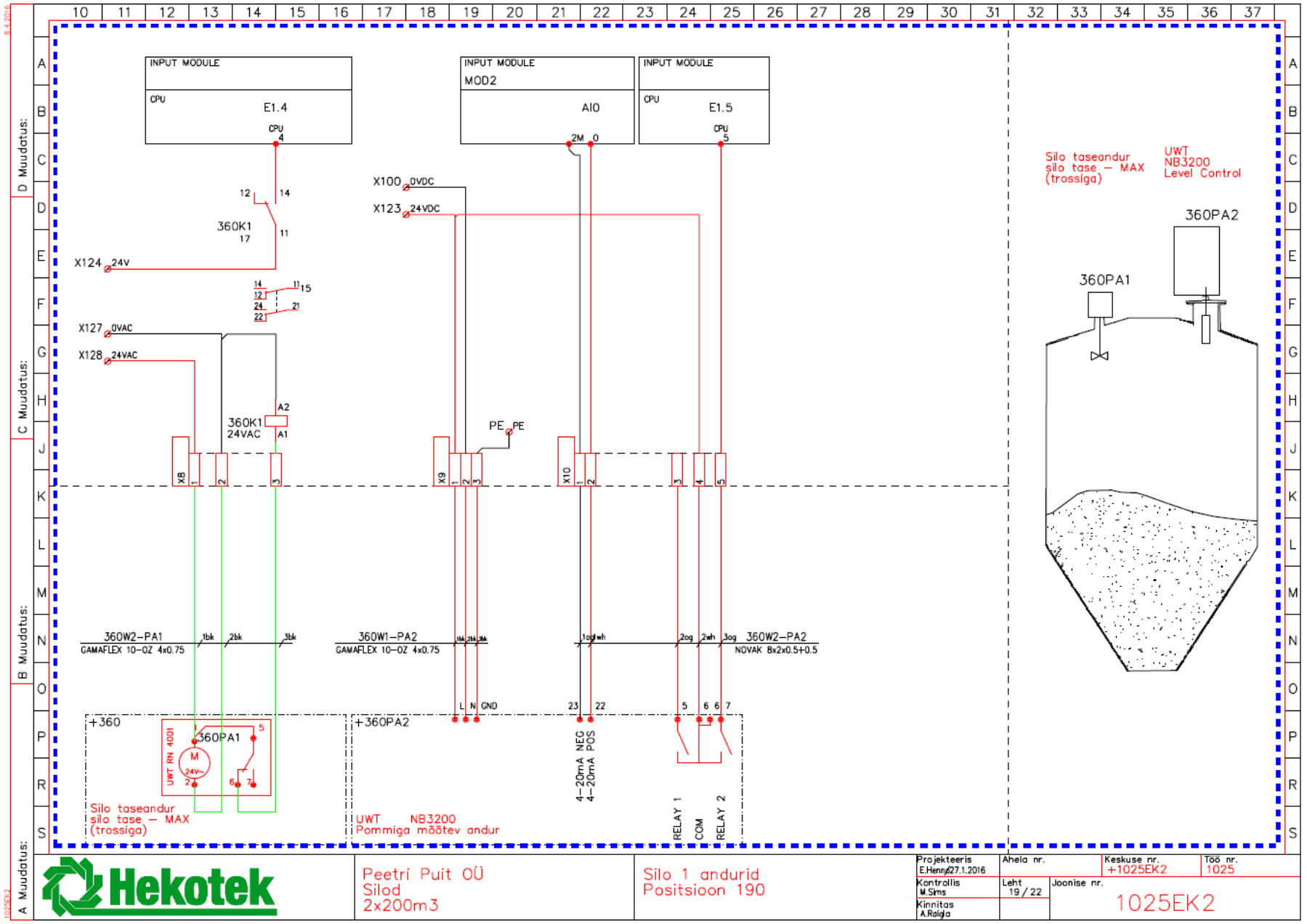


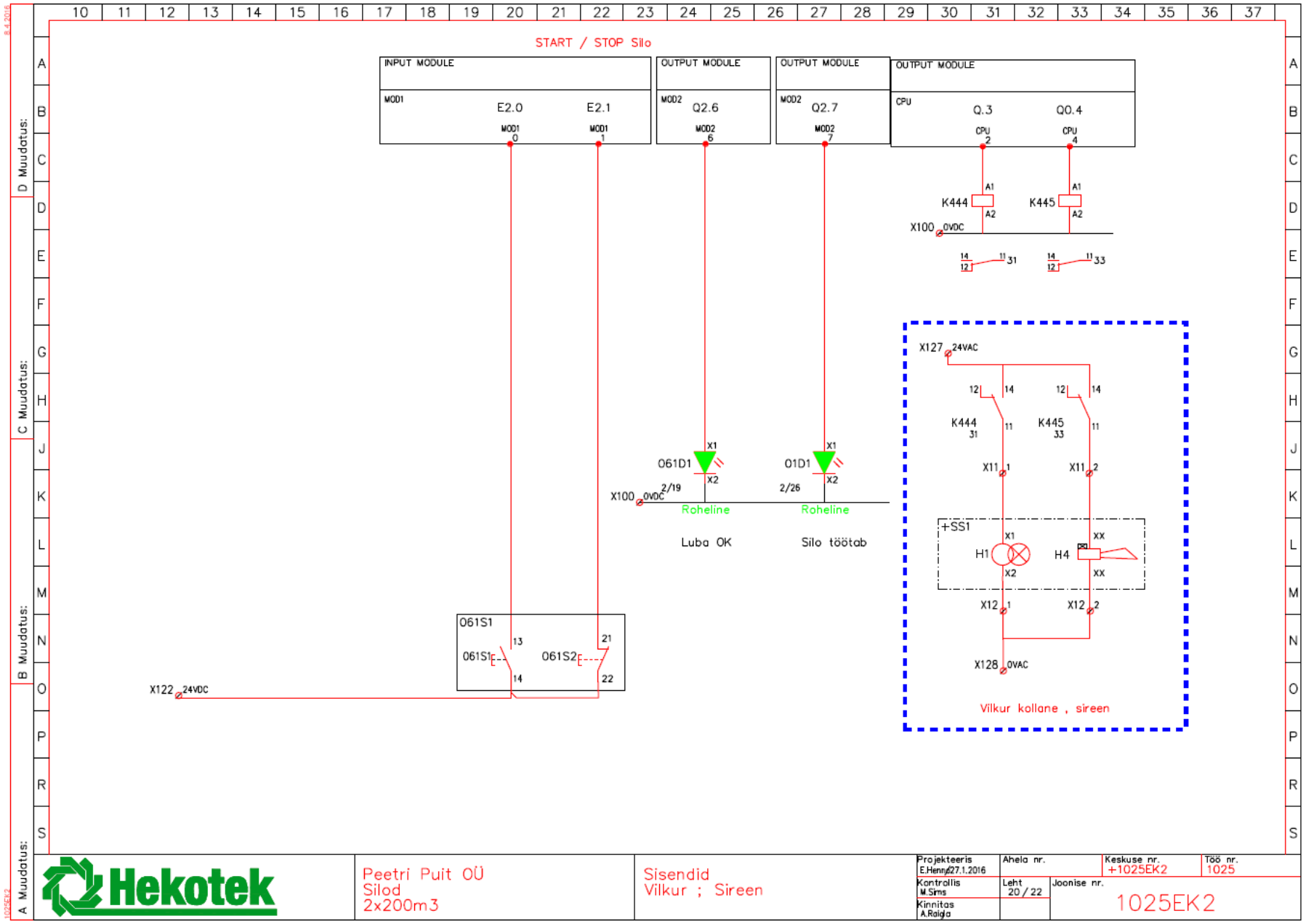
Hekotek

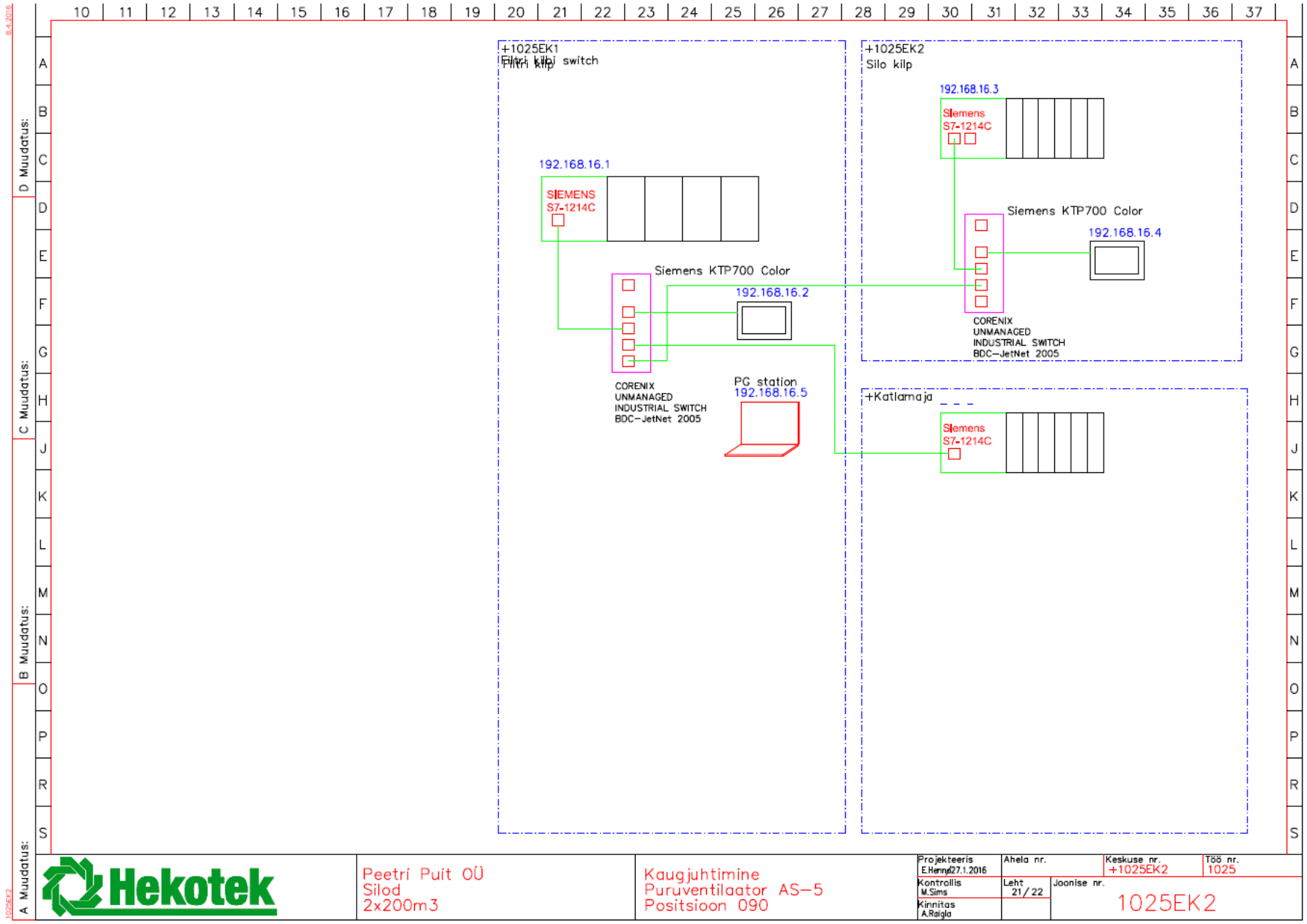
Peetri Puit OÜ
Silod
2x200m3

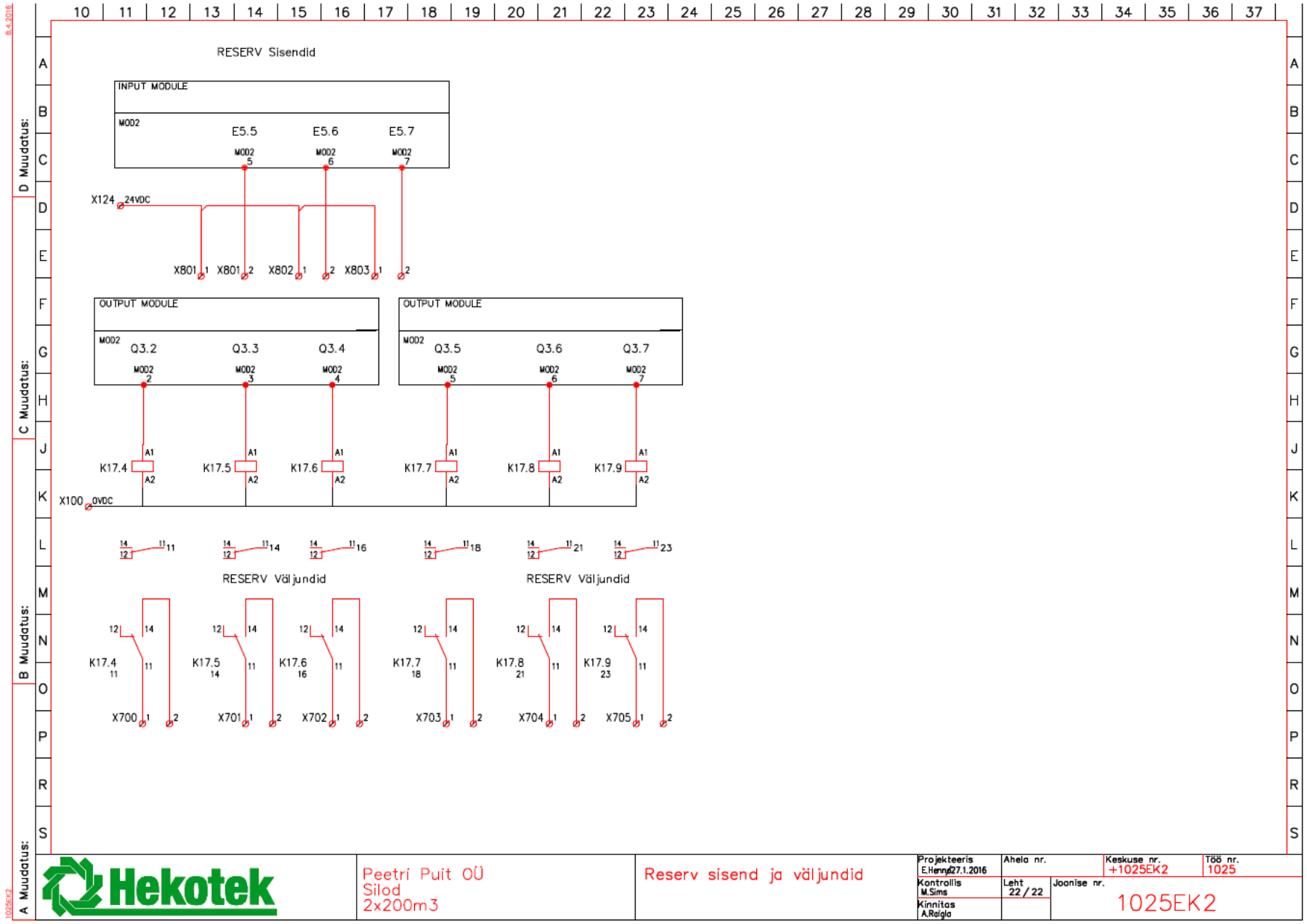
Silo 2 pult
Positsioon 270

Projekteeris E.Henn 27.1.2016	Ahela nr.	Keskuse nr. +1025EK2	Töö nr. 1025
Kontrollis M.Sims	Leht 18 / 22	Joonise nr. 1025EK2	
Kinnitas A.Ralga			


INPUT MODULE
CPU
E1.4
CPU 4
INPUT MODULE
MOD2
AI0
2M 0
INPUT MODULE
CPU
E1.5
CPU 5
X100 0VDC
X123 24VDC
X124 24V
360K1
17
12
14
11
X127 0VAC
X128 24VAC
360K1
24VAC
A2
A1
PE PE
X8
X9
X10
360W2-PA1
GAMAFLEX 10-0Z 4x0.75
1bk 2bk 3bk
360W1-PA2
GAMAFLEX 10-0Z 4x0.75
360W2-PA2
NOVAK 8x2x0.5+0.5
1og 2wh 2og 2wh 3og
L N GND
23 22
5 6 6 7
+360
360PA1
UWT RN 4001
M
24V~
+360PA2
4-20mA NEG
4-20mA POS
RELAY 1
COM
RELAY 2
Silo taseandur
silo tase – MAX
(trossiga)
UWT NB3200
Pommiga mõõtev andur
Silo taseandur
silo tase – MAX
(trossiga)
UWT
NB3200
Level Control
360PA2
360PA1
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
1025EK2
Hekotek
Peetri Puit OÜ
Silod
2x200m3
Silo 1 andurid
Positsioon 190
Projekteeris E.Henn 27.1.2016
Kontrollis M.Sims
Kinnitas A.Raiga
Ahela nr.
Leht 19 / 22
Keskuse nr. +1025EK2
Töö nr. 1025
Joonise nr.
1025EK2


START / STOP Silo
INPUT MODULE
MOD1
E2.0
E2.1
OUTPUT MODULE
MOD2
Q2.6
OUTPUT MODULE
MOD2
Q2.7
OUTPUT MODULE
CPU
Q.3
Q0.4
K444
K445
X100 0VDC
061D1
01D1
Roheline
Roheline
Luba OK
Silo töötab
061S1
061S2
X122 24VDC
X127 24VAC
+SS1
H1
H4
X128 0VAC
Vilkur kollane , sireen
Hekotek
Peetri Puit OÜ
Silod
2x200m3
Sisendid
Vilkur ; Sireen
Projekteeris
E.Henn 27.1.2016
Kontrollis
M.Sims
Kinnitas
A.Raiga
Ahela nr.
Leht
20 / 22
Keskuse nr.
+1025EK2
Töö nr.
1025
Joonise nr.
1025EK2


+1025EK1
Filtri kilbi switch
192.168.16.1
SIEMENS
S7-1214C
Siemens KTP700 Color
192.168.16.2
CORENIX
UNMANAGED
INDUSTRIAL SWITCH
BDC-JetNet 2005
PG station
192.168.16.5
+1025EK2
Silo kilp
192.168.16.3
Siemens
S7-1214C
Siemens KTP700 Color
192.168.16.4
CORENIX
UNMANAGED
INDUSTRIAL SWITCH
BDC-JetNet 2005
+Katlamaja
Siemens
S7-1214C
D Muudatus:
C Muudatus:
B Muudatus:
A Muudatus:
Hekotek
Peetri Puit OÜ
Silod
2x200m3
Kaugjuhtimine
Puruventilaator AS-5
Positsioon 090
Projekteeris
E.Henry 27.1.2016
Kontrollis
M.Sims
Kinnitas
A.Raigla
Ahela nr.
Leht
21 / 22
Keskuse nr.
+1025EK2
Töö nr.
1025
Joonise nr.
1025EK2

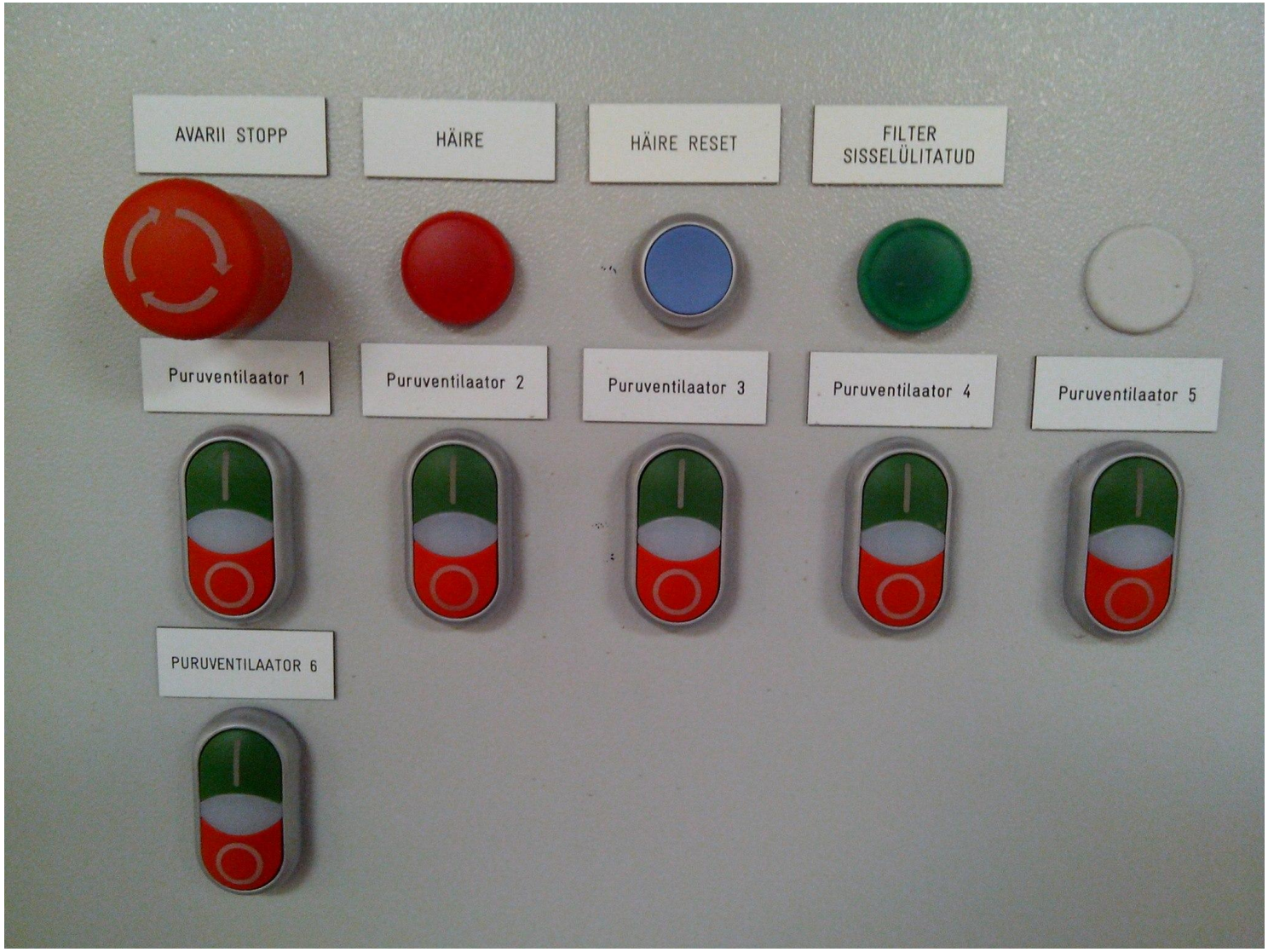

RESERV Sisendid
INPUT MODULE
MOD2
E5.5
E5.6
E5.7
X124 24VDC
X801 1
X801 2
X802 1
X802 2
X803 1
X803 2
OUTPUT MODULE
OUTPUT MODULE
Q3.2
Q3.3
Q3.4
Q3.5
Q3.6
Q3.7
K17.4
K17.5
K17.6
K17.7
K17.8
K17.9
X100 0VDC
RESERV Väljundid
RESERV Väljundid
X700
X701
X702
X703
X704
X705
Hekotek
Peetri Puit OÜ
Silod
2x200m3
Reserv sisend ja väljundid
Projekteeris E.Henry 27.1.2016
Kontrollis M.Sims
Kinnitas A.Raigla
Aheld nr.
Leht 22 / 22
Keskuse nr. +1025EK2
Töö nr. 1025
Joonise nr. 1025EK2

Appendix 3. PLC Program

PLC Program is presented on Compact Disc.

Appendix 4. Electrical switchboard

Appendix 5. Controls on switchboard door



Appendix 6. Filter after installation