



Equipment section Medium Voltage Switchgears

PINE MV - FS / WS

Pine

An **Ingeteam** brand



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Pine MV-FS/WS

Introduction

Pine MV-FS/WS a range of **medium voltage switchgears developed by Pine Equipos Eléctricos up to 36kV, 4000A, 50kA produced in both fixed and withdrawable units.**

Each Pine MV-FS/WS panel has been specifically designed in order to meet the **highest quality standards**, resulting in a product of exceptional mechanical and electrical performance. Approved to be used for special applications such as **marine or seismic and type tested for IEC and ANSI standards.**



Combined-cycle Power Plant

**SINCE 1995 PINE
PANELS HAVE BEEN
PRODUCED AND
INSTALLED IN OVER 30
COUNTRIES
WORLDWIDE**

Characteristics

Range

- Up to 12-17,5 kV, ...4000 A, ...50 kA
- Up to 24 kV, ...3150 A, ...31,5 kA
- Up to 36 kV
- IEC / ANSI Standards
- Highly customized versions

Safety

- Fitted with safety interlocks
- Internal arc classification IAC AFLR
- Classified LSC1, LSC2A, LSC2B
- CB racking with closed door

Flexibility

- Wide range of applications
- Vacuum and SF6 circuit-breaker
- Vacuum contactor and SF6 circuit-breaker
- Switch-disconnector
- Traditional Ti/TT and sensors

Quality

- ISO 9001 / ISO 14001 / OHSAS 18001
- Extensive references list
- Installed in over 30 countries

Features

- Protection and control
- Earthing switch

Applications

Energy

- Power generation stations
- Substations
- Main and auxiliary switchgear

Industry

- Pulp and Paper
- Cement, textile and food
- Quarrying
- Petrochemical
- Oil and gas
- Metallurgy
- Rolling mills
- Mines

Marine

- Drilling platforms
- Off-shore oil rigs
- Cruise, container and tankers ships
- Ferries

Transport

- Airports
- Ports
- Railways
- Underground

Infrastructures

- Shopping malls
- Hospitals
- Large infrastructure and civil works



Industrial unit in Pine Zamudio (Spain)

Pine MV-FS

The fixed solution

Pine MV-FS is a medium voltage switchgear with a metal enclosure, suitable for indoor installations. **Appropriate for medium current levels for substations or high currents** for direct electrical connections of high power generators.

These panels are guaranteed arc proof in accordance with the **IEC 62271-200 Standards, class A accessibility, criteria 1 to 5.**

All the installation, operation and maintenance operations can be carried out from the front of the unit. The switchgear and the earthing switches are operated from the front, with the door closed.

Normal operational conditions *

The rated characteristics of the switchgear are guaranteed under the following ambient conditions:

- Minimum ambient temperature: -5 °C
- Maximum ambient temperature: +40 °C
- Ambient humidity
- The normal operational altitude is up to 1.000 m. a. s. l. *
- Presence of normal, non-corrosive and uncontaminated atmosphere

Switchgear's configuration

- Mechanical structure made of 3 mm rolled sections
- 2,5 mm section lateral panels
- Busbars according to the rated current with optional tin-coating or silver-coating at connexion points
- Flaps on the top for the gas exit

Apparatus

The range of apparatus available for Pine MV-FS switchgear, which is the most complete in the market, includes:

- Withdrawable vacuum circuit-breakers with mechanical or magnetic actuator
- Fixed gas circuit-breakers
- Fixed vacuum contactors with fuses
- Fixed switch-disconnectors
- Instrument transformers
- Current and voltage measurement sensors

** Other values can be supplied, in this case please contact your Pine sales representative.*

** Other altitudes can be supplied, please contact your Pine sale representative*



Pine MV-FS Fixed version

Standards

The switchgear and corresponding main apparatus comply with the following Standards:

- **IEC 62271-1** for general purposes
- **IEC 62271-200** for the switchgear
- **IEC 62271-102** for the earthing switch
- **IEC 62271-100** for the circuit-breakers
- **IEC 60071-2** for the insulation coordination
- **IEC 60470** for the contactors
- **IEC 60265-1** for the switch-disconnectors
- **IEC 60529** for degree of protection
- **IEC 60044** for measurement and protection transformers
- **IEC 60168** for supporting insulator

Colour of the external surfaces

RAL7035 - light grey (front doors and side sheets).
Paint system C1/C2/C3 - C5I/C5M/C4.

** Other colours available on request.*

Protection degrees

The switchgear degree of protection conforms with IEC 60529 Standards. Pine MV-FS switchgear is normally supplied with the following standard degrees of protection:

- IP42 for the enclosure
- IP2X for the partition between compartments

On request, the external housing can be supplied with a higher protection degree. In this case please contact your Pine sales representative.

The electrical characteristics of the switchboard may vary as a result of ambient conditions other than those described in the previous section and also if a higher degree of protection is used.

Pine MV-FS electrical characteristics

Rated voltage (kV)	7,2	12	17,5	24	36
Rated insulation voltage (kV)	7,2	12	17,5	24	36
Rated power frequency withstand voltage (kV) 1min	20	28	38	50	70
Rated lightning impulse withstand voltage (kV)	60	75	95	125	170
Rated frequency (Hz)	50/60	50/60	50/60	50/60	50/60
Rated short time withstand current (kA 3s)	...50	...50	...50	...50	...50
Peak current (kA)	...125	...125	...125	...125	...125
Internal arc withstand current (kA 1s)	40	40	40	40	40
Internal arc withstand current (kA 0,64s)	50	50	50	50	50
Main busbar rated current (A)	...4000	...4000	...4000	...4000	...4000
Circuit-breaker rated current (A)	630	630	630	630	630
	1250	1250	1250	1250	1250
	1600	1600	1600	1600	1600
	2000	2000	2000	2000	2000
	2500	2500	2500	-	-
	3150	3150	3150	2500	2500
	3600	3600	3600	-	-
Circuit-breaker rated current especial for the power generator solution (A)	1250	1250	1250	-	1250
	2500	2500	2500	2500	2500
	3150	3150	3150	3150	3150
	4000	4000	4000	4000	-

For panel with contactor the rated current value is 400 A.

Pine MV-WS (IEC)

The withdrawable feature

Pine MV-WS (IEC) is medium voltage switchgear with a metal enclosure, suitable for indoor installations. **Metal partitions segregate the compartments from each other and the live parts are air-insulated.**

Since the switchgear is highly modular, this consists of a simple selection of components required by any application. **The functional units of the switchgear are guaranteed arc proof in accordance with the IEC 62271-200 Standards, appendix AA, class A accessibility, criteria 1 to 5.**

All the installation, operation and maintenance operations can be carried out from the front of the unit. The switchgear and the earthing switches are operated from the front, with the door closed.

Apparatus

The range of apparatus available for Pine MV-WS (IEC) switchgear is the most complete in the market, including:

- Withdrawable vacuum circuit-breakers

- Withdrawable gas circuit-breakers SF6
- Withdrawable vacuum contactors with fuses
- Withdrawable SF6 gas contactors with fuses

This makes it possible to offer a single switchgear-user interface, with the same operational and maintenance procedures.

The switchgear can be fitted with instrument transformers or sensors for current and voltage measurement and protection and any type of additional protection and control unit.

Normal operation conditions

The rated characteristics of the switchgear are guaranteed under the following ambient conditions:

- Minimum ambient temperature: - 5 °C
- Maximum ambient temperature: + 40 °C
- Ambient humidity
- The normal operational altitude is up to 1.000 m. a. s. l. * (Other altitudes can be supplied, please contact your Pine sales representative)
- Presence of normal, non-corrosive and uncontaminated atmosphere.



Pine MV-WS (IEC) Withdrawable switchgears

Standards

The switchgear and corresponding main apparatus comply with the following Standards.

- IEC 62271-1 for general purposes
- IEC 62271-200 for the switchgear
- IEC 62271-102 for the earthing switch
- IEC 62271-100 for the circuit-breakers
- IEC 60071-2 for the insulation coordination
- IEC 60470 for the contactors
- IEC 60265-1 for the switch-disconnectors
- IEC 60529 for degree of protections
- IEC 60044 for measurement and protection transformers
- IEC 60168 for supporting insulator

Colour of the external surfaces

RAL7035 - light grey (front doors and side sheets).
Paint system C1/C2/C3/C5M.

* Other colours available on request.

Protection degrees

The switchgears degree of protection conforms with IEC 60529 Standards. Pine MV-WS switchgear is normally supplied with the following standard degrees of protection:

- IP42 for the enclosure
- IP2X for the partition between compartments

On request, the external housing can be supplied with a higher protection degree. In this case please contact your Pine sales representative.

The electrical characteristics of the switchboard may vary as a result of ambient conditions other than those described in the previous section and also if a higher degree of protection is used.

Pine MV-WS (IEC) electrical characteristics

Rated voltage (kV)	7,2	12	17,5	24	36
Rated insulation voltage (kV)	7,2	12	17,5	24	36
Rated power frequency withstand voltage (kV) 1min	20	28	38	50	70
Rated lightning impulse withstand voltage (kV)	60	75	95	125	170
Rated frequency (Hz)	50/60	50/60	50/60	50/60	50/60
Rated short time withstand current (kA 3s)	...50	...50	...50	...40	...31,5
Peak current (kA)	...125	...125	...125	...80	...80
Internal arc withstand current (kA 1s)	-	-	-	...25	-
Internal arc withstand current (kA 0,5s)	...50	...50	...50	-	-
Main busbar rated current (A)	...4000	...4000	...4000	...4000	-
Circuit-breaker rated current (A)	630	630	630	630	-
	1250	1250	1250	1250	1250
	1600	1600	1600	1600	1600
	2000	2000	2000	2000	2000
	2500	2500	2500	-	-
	3150	3150	-	-	-
Circuit-breaker rated current with forced ventilation (A)	3600	3600	-	2500	-
	4000	4000	-	2500	-

For panel with contactor the rated current value is 400 A.

Pine MV-WS (ANSI)

Description

Pine MV-WS (ANSI) is the solution developed by Pine Equipos Eléctricos to **comply with the American National Standards Institute, Inc.**

Metal partitions segregate the compartments from each other and the live parts are air-insulated. The switchgear design allows the double exit configuration via column with low voltage compartment.

The functional units of the switchgear are guaranteed arc proof in accordance with ANSI/IEEE C37.20.7. Standards.

For these designs we include an upper duct to permit gas exit from the electrical cabinets.

Apparatus

The range of apparatus available for Pine MV-WS (ANSI) switchgear, which is the most complete in the market, includes:

- Earthing track
- Withdrawable vacuum circuit-breakers

The switchgear can be fitted with instrument transformers or sensors for current and voltage measurement and protection and any type of protection and control unit.

Switchgear and busbar configuration

The highly skilled technical level employed during the design process of the medium voltage panels, under the IEC standard, has been the starting point for the development of Pine MV-WS (ANSI) panels. The stringent quality control procedures applied to the design have led to equipment with:

- Two-floor configuration
- Unique low voltage compartment

The use of these particular units allows extremely efficient use of space.



Pine MV-WS (ANSI) Withdrawable switchgears

Normal operation conditions

The rated characteristics of the switchgear are guaranteed under the following ambient conditions:

- Minimum ambient temperature – 5 °C
- Maximum ambient temperature: + 40 °C **For other temperature ranges, please contact your Pine sales representative*
- Ambient humidity
- The normal operational altitude is up to 1.000 m. a. s. l. **For higher altitude applications, please contact your Pine sales representative*
- Presence of normal, non-corrosive and uncontaminated atmosphere.

Colour of the external surfaces

RAL7035 - light grey (front doors and side sheets). Other colours available on request.

Standards

The switchgear and corresponding apparatus comply with the following Standards:

- **ANSI/IEEE C37.20.2** for general purposes
- **ANSI C37.55** for the switchgear
- **ANSI C37.58** for the earthing switch
- **ANSI C37.09/10/11/12** for the circuit-breakers
- **ANSI C57.13** for the 4 instrument transformers and protection
- **ANSI C29.1** for the insulators
- **Nema 250** for degree of protections

Degrees of protection

The degrees of protection of the switchgear conform with **Nema 250:2008 Standards**. The switchgear is normally supplied with the following standard degrees of protection Nema type 1 for the external structure.

Pine MV-WS (ANSI) electrical characteristics

Rated voltage (kV)	4,76	8,25	15
Rated insulation voltage (kV)	4,76	8,25	15
Rated power frequency withstand voltage (kV) 1min	19	36	36
Rated lightning impulse withstand voltage (kV)	60	95	95
Rated frequency (Hz)	60	60	60
Rated short time withstand current 40 kA (kA 2s)	...50	...40	...50
Peak current (kA)	130	130	130
Internal arc withstand current (kA)	50	50	50
Main busbar rated current (A)	4000	4000	4000
Circuit-breaker rated current (A)	1200	1200	1200
	2000	2000	2000
	3000	3000	3000
	4000	4000	4000 (FV)

*(FV) Forced ventilation

Pine MV-FS/WS

IEC Standard

Loss of service continuity

The various LSC categories describe the possibility of maintaining other compartments and/or panels energized while a compartment in the main circuit is opened. The defined categories are:

- **LSC-1:** The whole switchgear shall be put out of service for opening a main circuit compartment for normal operation and/or normal maintenance or for gaining access to any switchgear components.
- **LSC-2A:** The same as LSC-1 with the exception that the main busbars and the functional units adjacent to the one under maintenance can remain energized.
- **LSC-2B:** The same as LSC-2A with the exception that the cable compartment can remain energized.

As the busbar, circuit-breaker and cable compartments are not physically and electrically segregated the Pine MV-FS is classified as LSC-2A.

This category defines the possibility of accessing the circuit-breaker compartment with the busbars and cables energized.

In the case of using the fixed version of the switch-disconnector, the panel is defined LSC-2A since the cable and apparatus compartments are not physically segregated.

As the busbar, circuit-breaker and cable compartments are physically and electrically segregated the Pine MV-WS is classified as LSC-2B.

This category defines the possibility of accessing the circuit-breaker compartment with the busbars and cables energized.

Partition Metallic - PM

With regard to the type of partitions or shutters between live parts and an open compartment, a distinction is made between two partition classes:

- Class PM
(Partition made of Metal)
- Class PI
(Partition made of Insulating material)

Pine MV-FS switchgear is defined as PM partition class taking into account the segregation between compartments, made of metallic sheets/shutters.

Pine MV-WS switchgear is defined as PI partition class.

Interlock-controlled accessible compartment

The front side of Pine MV-WS is classified interlock-controlled because access to the compartments containing high voltage parts, intended to be opened for normal operation and/or normal maintenance, is controlled by the integral design of the switchgear.

Tool-based accessible compartment

The rear part of the Pine MV-WS is classified tool-based as it is only possible to open the compartment containing high-voltage parts using a tool.

On petition, a key interlock can be included in the rear part of the MV-WS switchgear.

Pine MV-WS switchgear is internal arc classified IAC AFLR.



Cabinas de media tensión en contenedor

Functional units

Compartments

Each switchgear unit consists of three **power compartments**:

- **Circuit-breaker [A]**,
- **Busbars [B]**
- **Cables [C]** (figure 1)

Each unit is fitted with a **low voltage compartment [D]**, where all the auxiliary instruments are housed.

Arc-proof switchgear is provided with valves for evacuation of the gases produced by an arc.

Wide variety of gas ducts are available. **All of the compartments are accessible from the front and maintenance operations can correctly carried out with the switchgear installed up against a wall.**

Main busbars

The busbar compartment contains the main busbar system connected to the upper isolating contacts of the circuitbreaker by means of branch connections.

The main busbars are **flat bars and made of electrolytic copper** thus facilitating the modification and maintenance operations. On request, busbars connexions can be supplied tin-coated or silver-coated.

The busbars are **covered with insulating material**, configurable according to thermic requirements.

Electro-dynamic effort calculations are carried out for the support insulators installation.

Cable connections

The cable incoming compartment **contains the feeder for connection of the power cables** to the lower contacts of the circuit-breaker.

The feeder connections are made of electrolytic copper flat busbars and they are covered with insulating material. The distances are variable depending on the connection requirements (number of cables in each phase, cables section, etc.)

Earthing switch

Cable compartment can be fitted with an earthing switch for cable earthing. **The same device can also be used to earth the busbar system.**

Earthing switch can also be installed directly on the main busbar system in a dedicated compartment.

The earthing switch has short-circuit making capacity. Control of the earthing switch is from the front of the switchgear with manual operation, and can also be motor operated. The position of the earthing switch can be seen from the front of the switchgear by means of a mechanical coupled indicator.

Earthing busbar

The earthing busbar is made of electrolytic copper and runs longitudinally throughout the switchgear, thereby guaranteeing maximum personnel and installation safety.

Insulators, busbars and shutters

The insulators are made of epoxy resin and designed for the numerous insulation voltage levels. The busbars are made with fibre plates from 4mm to 5mm.

The shutters are metallic and are activated automatically during movement of the circuit-breaker from the racked-out position to the operation position and vice versa.

Cables

The Pine MV switchgear has copper feeder connections appropriate to the incoming cable number and section.

Gas exhaust valves

The gas exhaust valves are located above the switchgear. Each power compartment is fitted with a valve. The pressure generated by the fault activates the valve, allowing the hot gases and incandescent particles produced by the internal arc be evacuated.

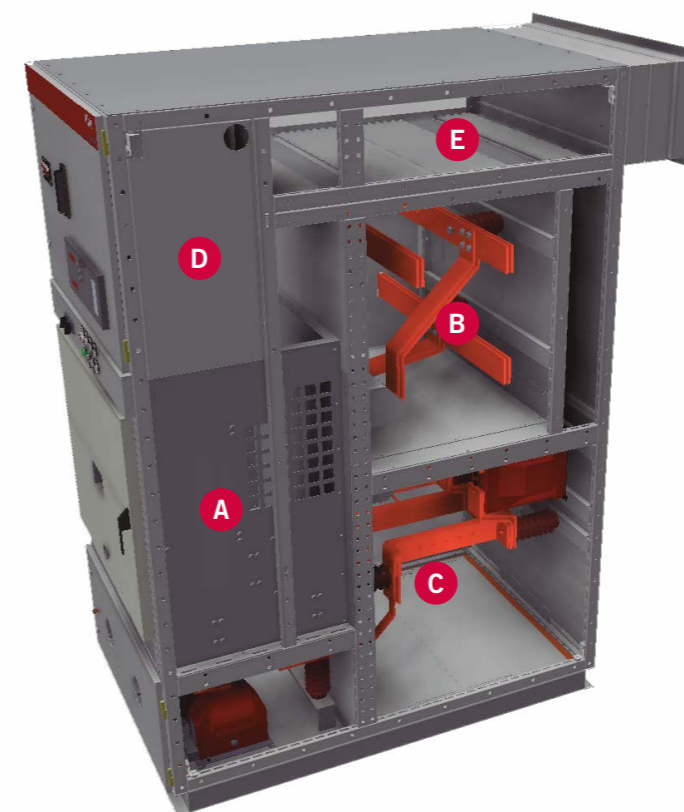
Pine Equipos Eléctricos designs evacuation ducts to transport gases outside of the room in cases where the installation does not allow the evacuation to the gases inside. Please contact your Pine sales representative for dedicated solutions.

Instrument Transformers and bushings

The cable incoming compartment is used in current transformers, power (fixed unit version) auto-valves and earthing switch.

In the case of withdrawable power transformers, our design **allows the replacement of fuses with the switchgear in service.**

The fibre screens remain closed thanks to the extracted TT, blocking access to the tension parts.



Unit compartments

- [A]. Circuit-breaker compartment
- [B]. Busbar compartment
- [C]. Cable compartment
- [D]. Low voltage compartment
- [E]. Gas duct valves

Pine MV-FS/WS

Fully type-tested IEC/ANSI

The Pine MV-FS/WS switchgears have undergone the complete range of tests required by the international IEC/ ANSI Standards. In addition, **the tests required by the main shipping registers (LR, DNV, RINA, BV and GL) have been carried out** for use of the switchgear in marine installations.

Each switchgear unit is subjected to routine tests in the factory before delivery. These tests are intended to provide a functional check of the switchgear based on the specific characteristics of each installation.

IEC/ANSI type tests

- Short-time and peak withstand current
- Temperature rise
- Internal arc capability
- Dielectric test
- Making and breaking capacity of circuit-breaker and contactors
- Earthing switch making capacity
- Mechanical operations of circuit-breaker and earthing switch
- IP protection degree

These tests were carried out according to IEC 62271-200 Standards for the Pine MV-FS and Pine MV-WS (IEC) switchgears and according to IEEE C37.20.2 / IEEE C37.20.7 for Pine MV-WS (ANSI) switchgears.

IEC routine factory tests

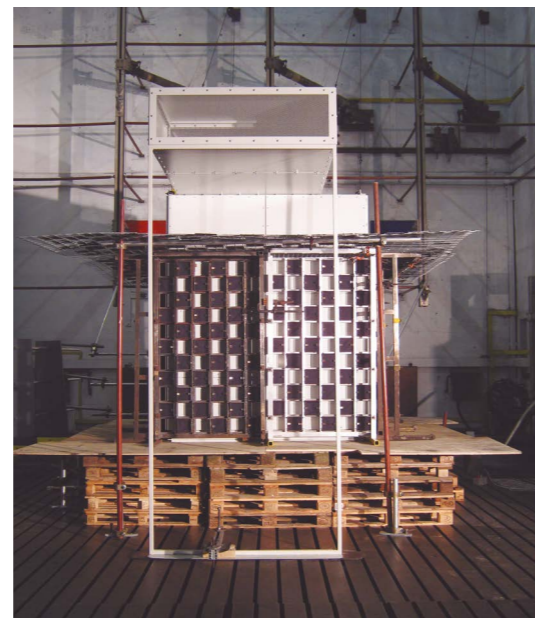
- Visual inspection and check
- Mechanical sequence operations
- Cabling check
- Electrical sequence operations
- Power frequency withstand voltage
- Measurement of the resistance of the main circuits
- Secondary insulation test

Seismic test

Pine MV switchgears has undergone seismic tests according to Uniform Building Code 1997 UBC1997, Zone 4 and EN 60.068-3-3:1993 European standard.



During Pine MV switchgear seismic test



Switchgear during internal arc test

Pine MV-FS/WS

Safety

This objective is pursued from two points of view, the effects derived from an internal fault or inadequate training of the personnel in charge of the installation, breakage or tampering of the safety interlocks respectively.

Internal arc

An internal arc is a highly unlikely fault, although it can theoretically be caused by various factors, such as:

- Insulation defects due to deterioration in the quality of the components. The reasons can be adverse environmental conditions and highly polluted atmospheres or environments.
- Overvoltages of atmospheric origin or generated by the operation of a component.
- Overheating of the contact area, due to the presence of corrosive agents or when the connections are not sufficiently tightened.
- Entry of small animals into the switchgear (i.e. via cable entrance).
- Material left behind, inside the switchgear during maintenance activities

The energy produced by the internal arc causes an **increase in the internal pressure and temperature, mechanical stresses on the switchgear structure, melting, decomposition and evaporation of materials.**

Unless suitably protected by the metal housing, these phenomena may have very serious consequences for the personnel in the vicinity of the switchgear.

The internal arc test verifies that the compartment doors remain closed and that no components are ejected from the switchgear, and that no flames or incandescent gases exit, thereby ensuring safety of the personnel near the switchgear.

THE SAFETY OF PERSONNEL IS THE FIRST REQUERIMENT AND PRIORITY OF PINE MV-FS/WS SWITCHGEAR DESIGN

The test ensures that no perforations are produced in external accessible parts of the housing, and that all the connections to the earthing circuit remain intact, hence guaranteeing the safety of personnel who may access the switchgear after the fault.

The IEC 62271-200 and IEEE C37.20.7 standard describes the methods to be used for carrying out the test and the criteria which the switchgear must conform to. The Pine MV-FS/WS switchgear fully conforms to all criteria indicated by the IEC and IEEE standards for Pine MV-WS(ANSI) switchgears. The tests certifies Pine MV-FS/WS as **IAC-A-FLR according to IEC-62271-200 standard.**

tecnalia

DNV·GL

KEMA Laboratories

In addition to the metallic structure of the switchgear and with the objective of preventing the internal arc, some measures can be implemented. They respond in two ways:

- Through optic sensors detecting the light beam of the internal arc
- Detecting the increase in current as a consequence of the internal arc

Pine has a wide range of experience in the setting of this type of element in the Pine MV-FS/WS switchgears, which thanks to the immediate intervention (ms), prevents the internal damage derived from the fault.

Operation safety

Locking system

The locking system may vary according to the type of installation and the aim is to allow the **maintenance and operation personnel** to access the internal parts while guaranteeing the absence of any voltage.

Electromechanical coils

These devices permit automatic locking systems without the need for human intervention.


The circuit-breaker racking-in/out and the earthing switch closing/opening operations can be interlocked. Magnets can also be applied to the earthing switch of busbar applications. They operate with active logics and therefore the lack of auxiliary voltage leaves the interlocking system active in a position of safety.




Key interlocking logics by electric equipment key

Safety interlocking logics (manufacturer's own circuit breaker)


Lock

- 
1. Apparatus racking-in/out
 2. Apparatus closing
 3. Earthing switch closing
 4. Apparatus racking-in
 5. Apparatus compartment door opening
 6. Apparatus racking-in
 7. Feeder compartment door opening
 8. Earthing switch opening

Keys

- 
9. Apparatus racking-in lock
 10. Earthing switch closing lock
 11. Earthing switch opening lock
 12. Insertion of the apparatus racking-in/out crank lever
 13. Insertion of the earthing switch operating lever
 14. Incoming cable door opening
 15. Independent switch opening / closing

Electromagnets

- 
16. Apparatus racking-in/out
 17. Earthing switch ON/OFF
 18. Apparatus compartment door opening
 19. Cable compartment door opening
 20. Independent switch opening and closing

Accessory devices (from switch manufacturer)

- | | |
|---|--|
| Shutter fail-safe: | The device locks the shutters when the apparatus is removed from the compartment. The operator cannot open the shutters manually. The shutters can only be operated by the apparatus truck or the service trucks. |
| Circuit-breaker mechanical operating mechanism: | The apparatus compartment is equipped with a mechanical device that enables circuit-breaker closing and/or opening directly by means of the front operating mechanism pushbuttons, while holding the door closed. The controls can be operated with the circuit-breakers in the operation and racked-out position. |

Note: Other lock options available on request

Pine MV-FS/WS

Components

Pine MV-FS/WS switchgears include components from the best brands in the market for the following:

- SF6 circuit breakers or vacuum circuit-breakers
- SF6 or vacuum contactors
- Switch-disconnectors
- Earthing switches
- Protection relays
- Instrument and protection transformers

Depending on the client's requirements and meeting the specifications for each project, our technical team decide on the best components for each switchgear.

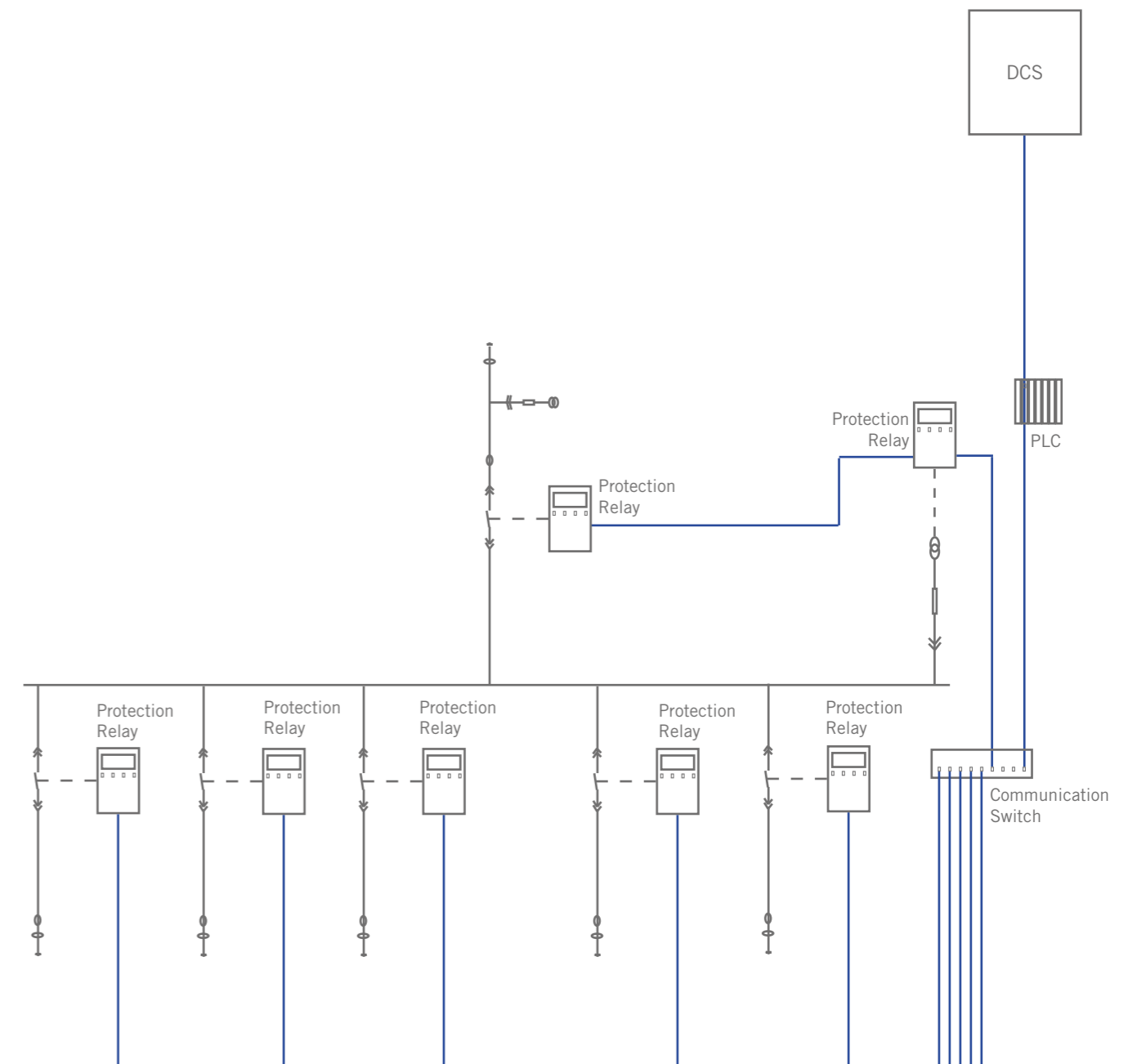
Pine MV-FS/WS switchgears are designed ad-hoc for each product, thus allowing to our clients include any constructive requirement.

All kind of communication procedure such as protection relays (modbus, profibus, etc.), auto-transfer system, electric parameters management through automatons are detailed by our engineers in order to make Pine MV-FS/WS switchgears a flexible and high quality product.



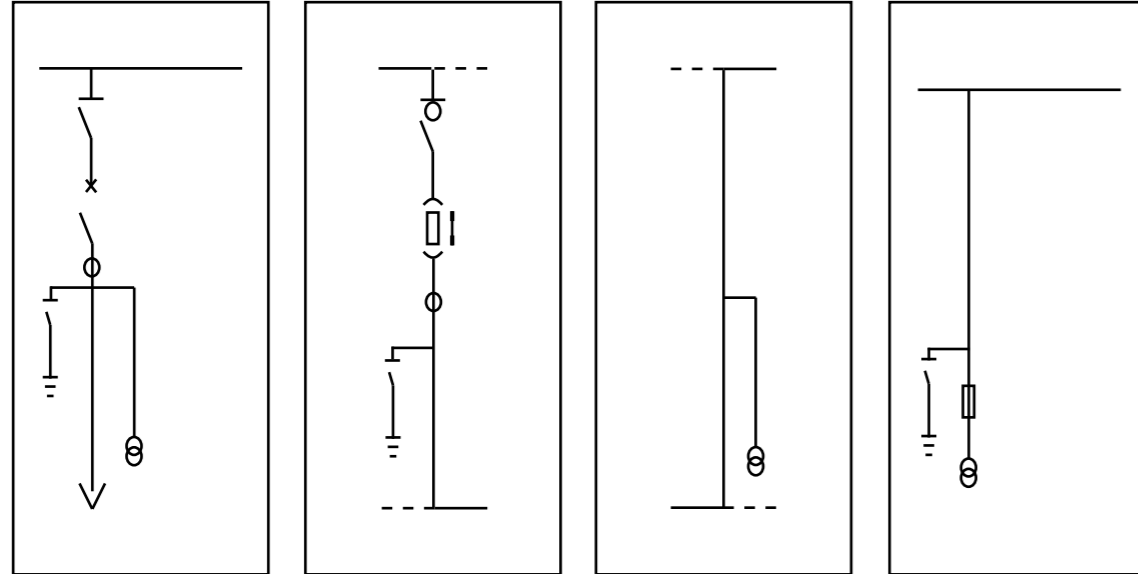
Pine MV-FS

Electric scheme and communications



Pine MV-FS

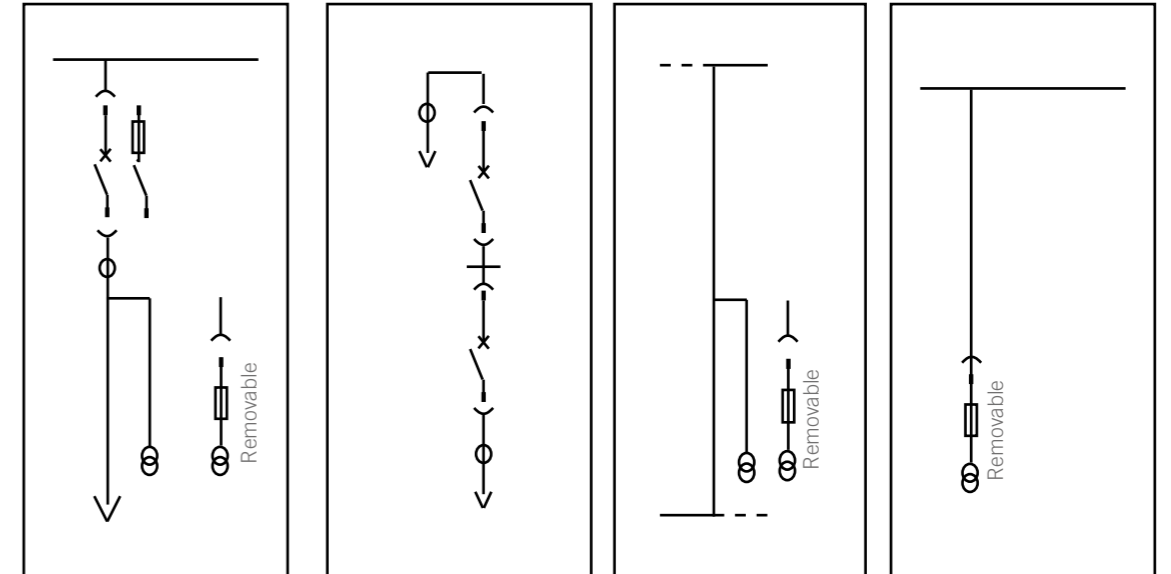
Type of units single line diagram



Incoming/outgoing feeder Auxiliary Services feeder Riser Measurement and busbar earthing

Pine MV-WS (ANSI)

Types of units single line diagram

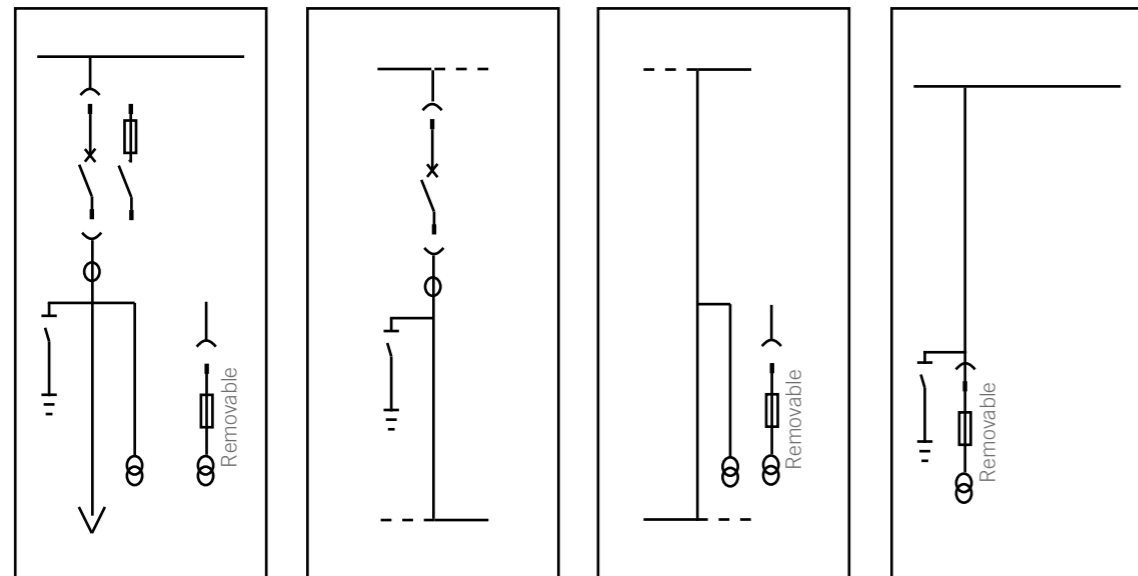


Incoming/outgoing feeder Double feeder Riser Measurement

Please contact with your Pine sales representative for other configurations.

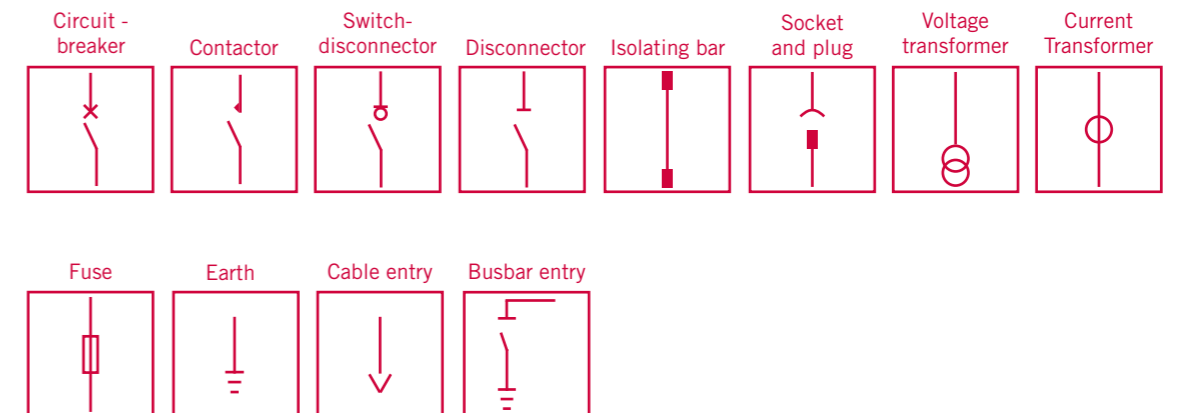
Pine MV-WS (IEC)

Type of units single line diagram



Incoming/outgoing feeder Bus-tie Riser Measurement and busbar earthing

Graphical symbols



Pine MV-WS
Dimensiones

...12kV y 17,5kV

Rated current (A)	400	630	1250	1600	2000	2500	3150	3600	4000
Width (mm)	750	750	750	900	900	1100	1100	1100	1100
Height (mm)	2400	2400	2400	2400	2400	2400	2400	2400	2400
Depth (mm)	1800	1800	1800	1800	1800	1800	1800	1800	1800

24kV

Rated current (A)	630	1250	1600	2000	2000	2500
Width (mm)	1000	1200	1200	1200	1200	1200
Height (mm)	2600	2600	2600	2600	2600	2600
Depth (mm)	2000	2000	2000	2000	2000	2000

36kV

Please contact your Pine Sales Representative for each project.

4,76-8,25-15kV ANSI

Rated Current (A)	400	630	1250	1600	2000	2500	3150	3600	4000
Width (mm)			1050		1050		1050	1050	
Height (mm)			(1)		(1)		(1)	(2)	
Depth (mm)			2200		2200		2200	2500	

(1) 2700 the switchgear + 500 the gas evacuation compartment
 (2) 3000 the switchgear + 500 the gas evacuation compartment

Note: Panel lengths could vary depending on the number of elements to be installed in the low voltage compartment.

Pine MV-FS could vary their dimensions according to main characteristics of each Project. Therefore, please contact your Pine sales representative.

Pine MV-FS/WS
Marine applications

Since it was founded in 1969, Pine Equipos Eléctricos has dedicated a significant part of its development and design to switchgears within the marine sector, where the range of temperatures, vibrations and space limitations make Pine MV-WS an **adaptable and functional solution**. Our references in marine applications in a wide range of shipyards worldwide guarantee a high quality and reliable product.

Our ample experience manufacturing low voltage switchgears **under the main classification societies (DNV, LR, GL, AB, BV) standards**, are the basis for the adaptation of the Pine MV-WS switchgear to the naval sector.



Simon Stevin vessel

Pine MV-FS/WS

Marine applications

Characteristics

Protection degree

The required protection degree for marine applications is IP42 (protection from foreign bodies with 1mm diameter and from water penetration, with a maximum tilt of 15°). Pine possesses the IP42 test certification.

Escape duct for gases

Depending on the characteristics of the engine control room, Pine MV medium voltage panels can be found in two possible configurations. In the case of sufficient existing space under IEC Standard, it maintains the standard valves for gases evacuation. If not, there is an option of adding an escape duct for evacuating gases from the electric room.

Handrails

The front and rear switchgear is always supplied with handrails. In addition, all doors (low voltage compartment, apparatus and line) are fitted with an appropriate lock in open position.



Switchgear designed for marine application

Pine MV-WS for marine applications

Types of units



Offshore platform

Compartments

Each panel consists of three power compartments: circuit-breaker [A], busbars [B], and cable's entry [C] (see figure 1). Each unit is fitted with a low voltage compartment [D], where all the subsidiary instruments are located.

The arc-proof switchgear is normally provided with valves for the evacuation of the gases produced by an electrical arc.

Different types of gas ducts are available. All the compartments are accessible from the front and maintenance operations can be correctly carried out with the switchgear installed up against a wall.

Main busbars

The busbar compartment contains the main busbar system connected to the upper isolating contacts of the circuitbreaker by means of branch connections.

The main busbars are flat and made of electrolytic copper facilitating any maintenance and replacement operation. On request the busbar connections can be supplied zinc coated or plated.

The busbars are covered with configurable insulation material and according to the thermic requirements.

For the support insulators placing, the required electrodynamic efforts calculations are made.

Pine MV-WS for marine applications

Types of units

Cable connections

The cable incoming compartment contains the feeder for connection of the power cables to the lower contacts of the circuit-breaker.

The feeder connections are made of electrolytic copper flat busbars and are covered with insulating material. The distances are variable depending on the connection requirements (number of cables in each phase, cables section, etc.)

Earthing switch

Cable compartment can be fitted with an earthing switch for cable earthing. The same device can also be used to earth the busbar system (measurement and bus-tie units).

The earthing switch can also be installed directly on the main busbar system in a dedicated compartment (busbar applications).

The earthing switch has short-circuit making capacity. Control of the earthing switch is from the front of the switchgear with manual operation, and can also be motor operated. The position of the earthing switch can be seen from the front of the switchgear by means of a mechanical coupled indicator.

Earthing busbar

The earthing busbar is made of electrolytic copper and runs longitudinally throughout the switchgear, thereby guaranteeing maximum personnel and installation safety.

Insulators, busbars and shutters

The insulators are made of epoxy resin and designed for the numerous insulation voltage levels. The busbars are made with fibre plates from 4mm to 5mm.

The shutters are metallic and are activated automatically during movement of the circuit-breaker from the racked-out position to the operation position and vice versa.

Cables entrance

The Pine MV switchgear has copper feeder connections appropriate to the incoming cable number and section.

Gas exhaust valves

The gas exhaust valves are located above the switchgear. Each power compartment is fitted with a corresponding valve. The pressure generated by the fault opens the valve, allowing the hot gases and incandescent particles produced by the internal arc to be evacuated.

Pine Equipos Eléctricos designs evacuation ducts to the outside of the room in cases where the installation do not allow evacuation of the gases from inside. *Please contact your Pine sales representative for dedicated solutions.*

Instrument Transformers and bushings

The cable incoming compartment is used in current transformers, power (fixed unit version) auto-valves and earthing switch.

In case of power transformers in withdrawable version, our design allows the replacement of fuses with the switchgear in service.

Pine MV-WS for marine applications

Dimensions

...12kV

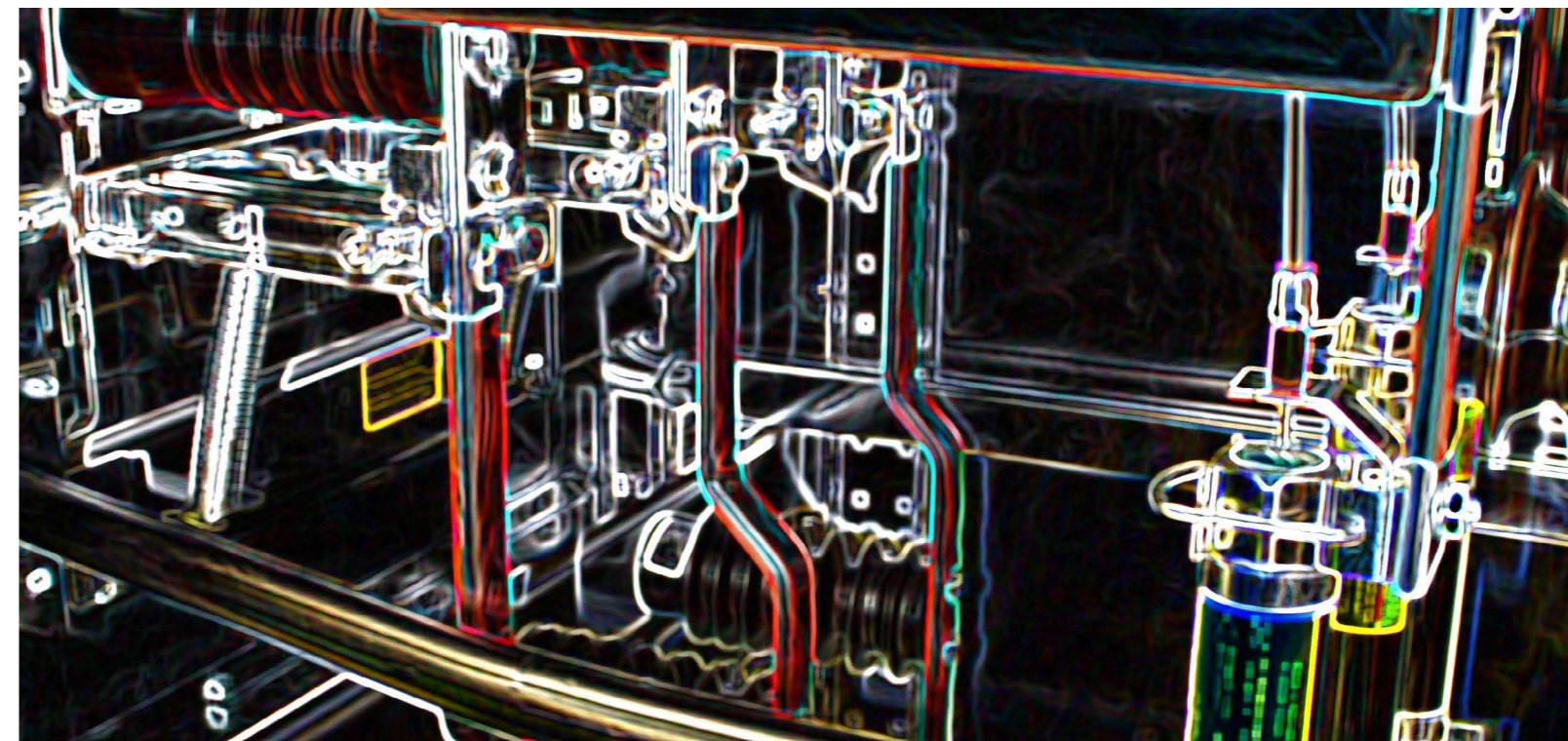
Rated current (A)	630	1250	1600	2000	2500	3150
Width (mm)	477	677	677	827	827	1077
Height (mm)	477	2500	2500	2500	2500	2500
Depth (mm)	477	1700	1700	1700	1700	1700
Rated current (A)						

Thermographic inspection

The crucial points to monitor from temperature perspective are the cable power connections to the busbar cabins and the main busbar spot.

The possibility of a fault in the main busbars is highly unlikely due to the fact that Pine Equipos Eléctricos applies a seal after tightening all busbar screws with a torque wrench.

Pine installs windows for infrared thermography for a variety of models depending on the construction requirements in order to permit monitoring of the hot spots.



Notes



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Pine

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