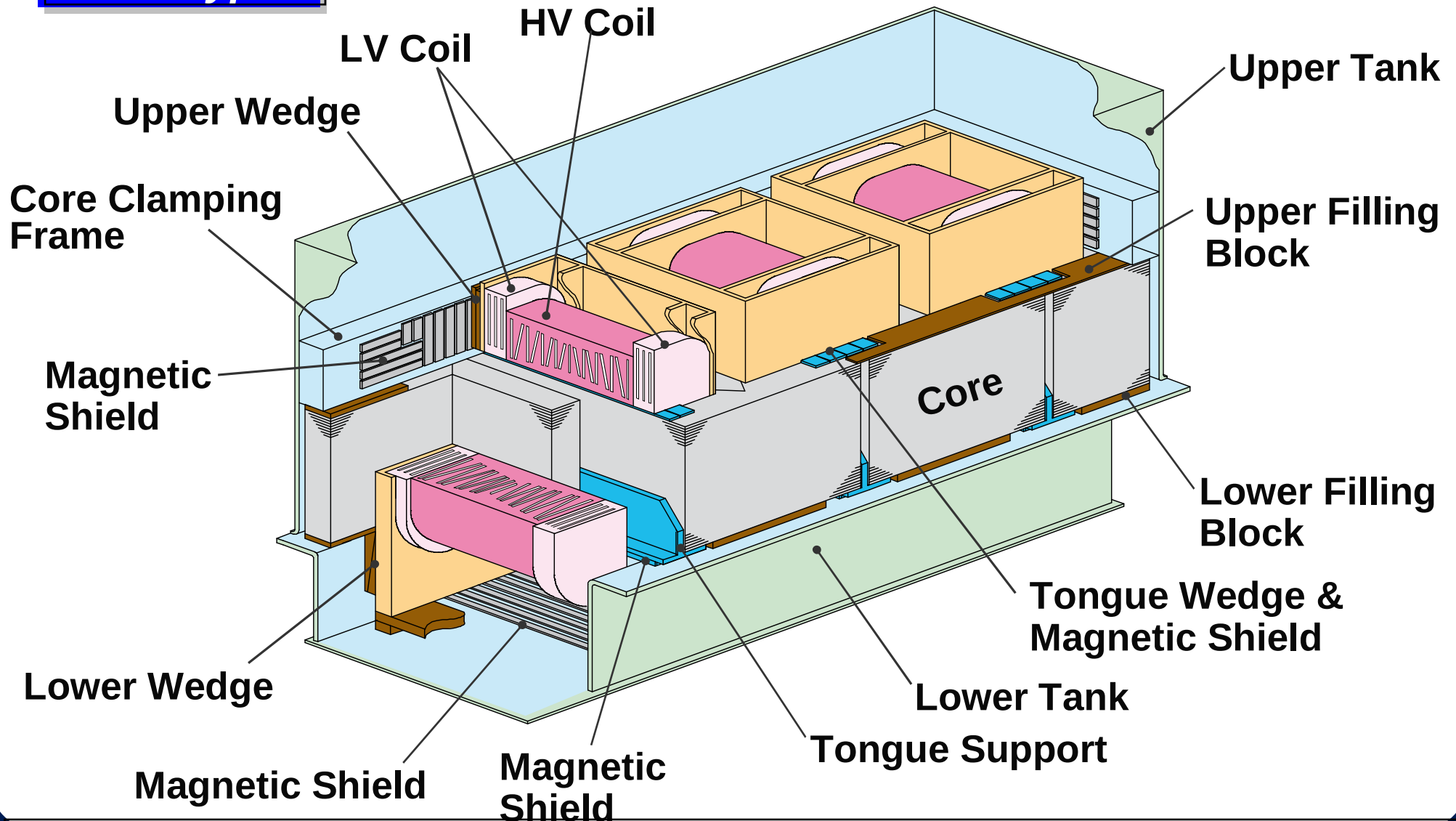


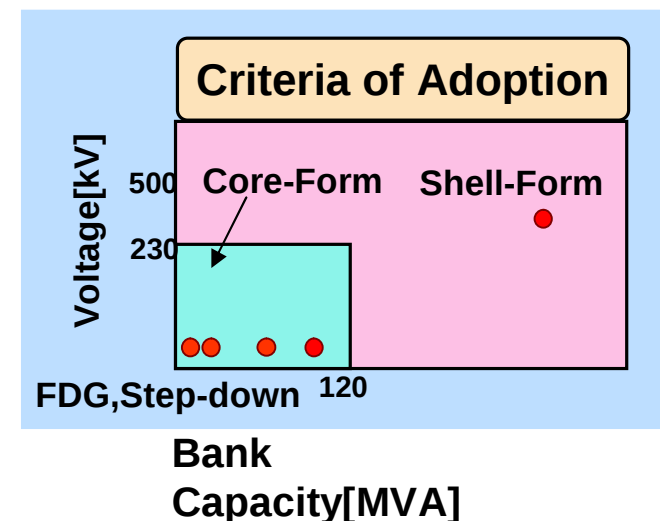
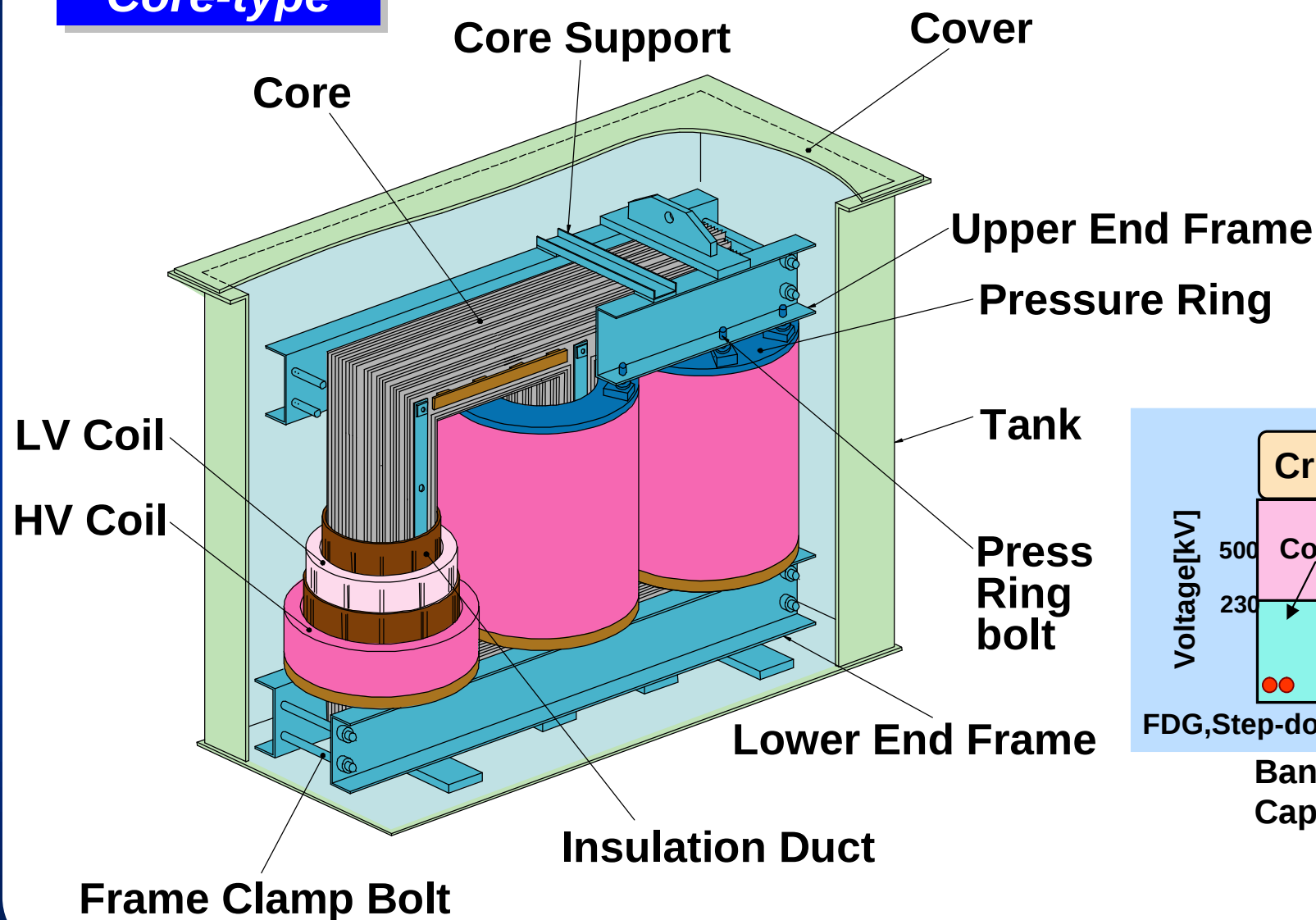
Typical Construction of Transformers

Shell-type

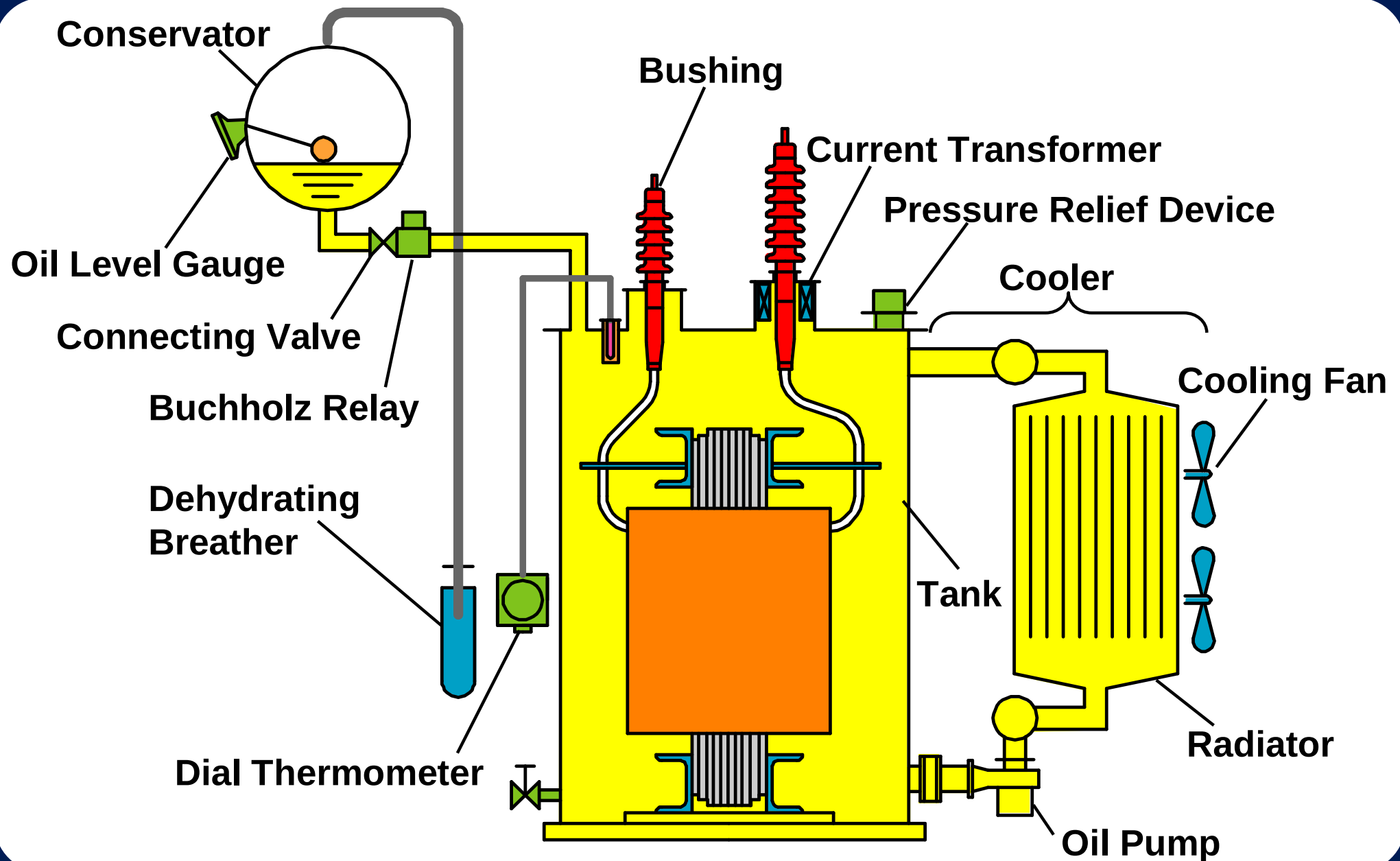


Typical Construction of Transformers

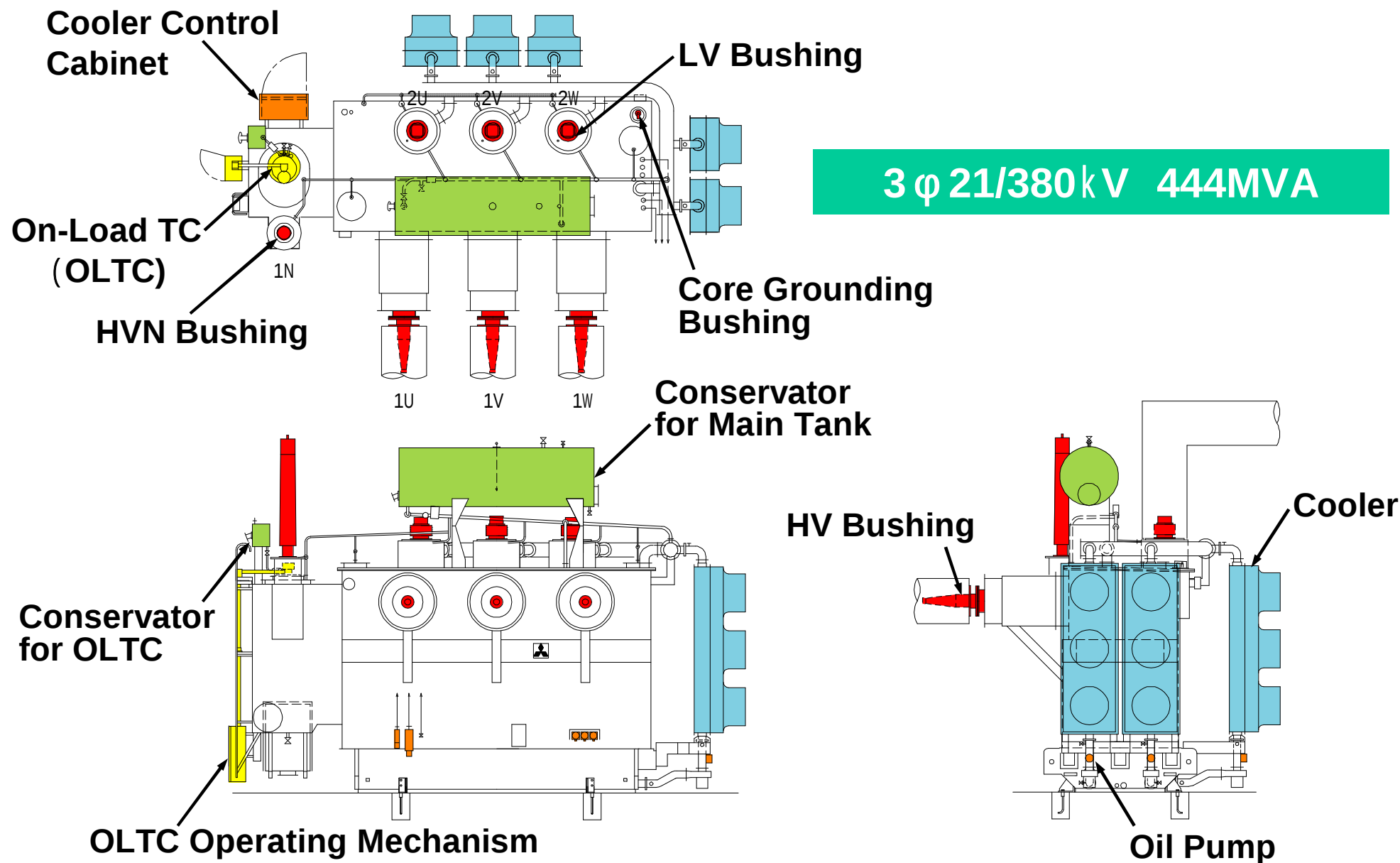
Core-type



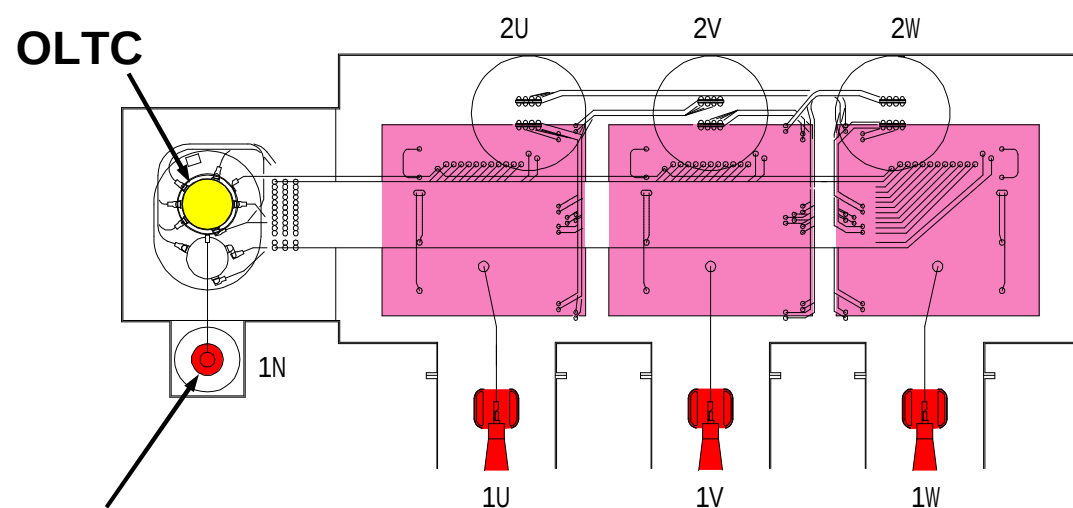
Typical Construction : Oil Filled Transformer



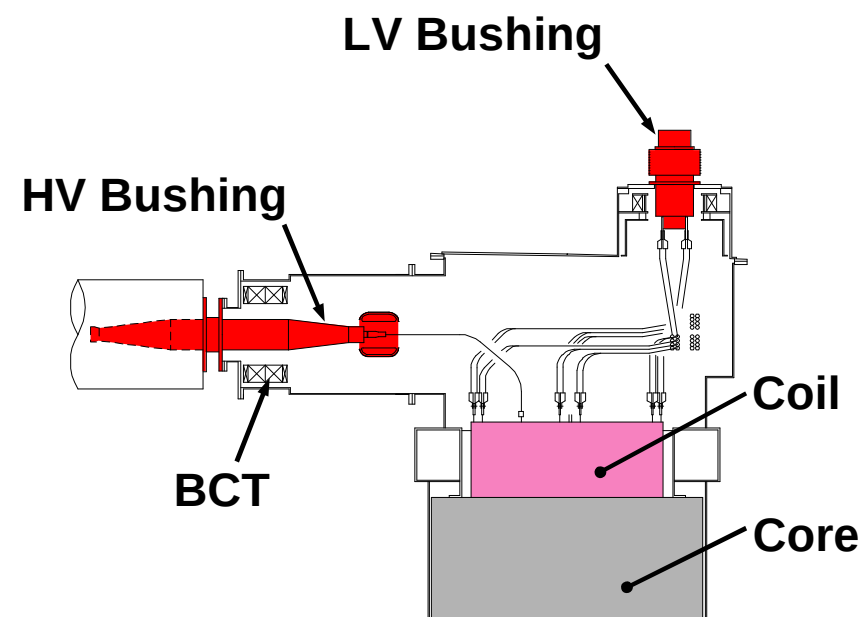
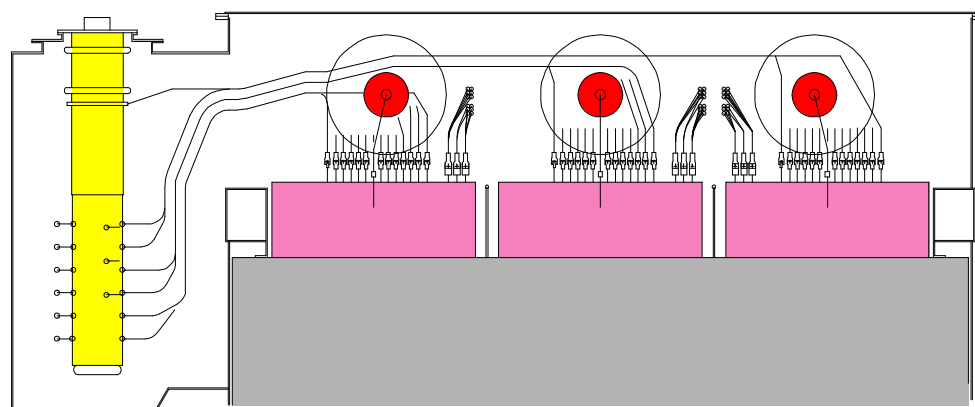
General Arrangement of Gen. Step-up TR



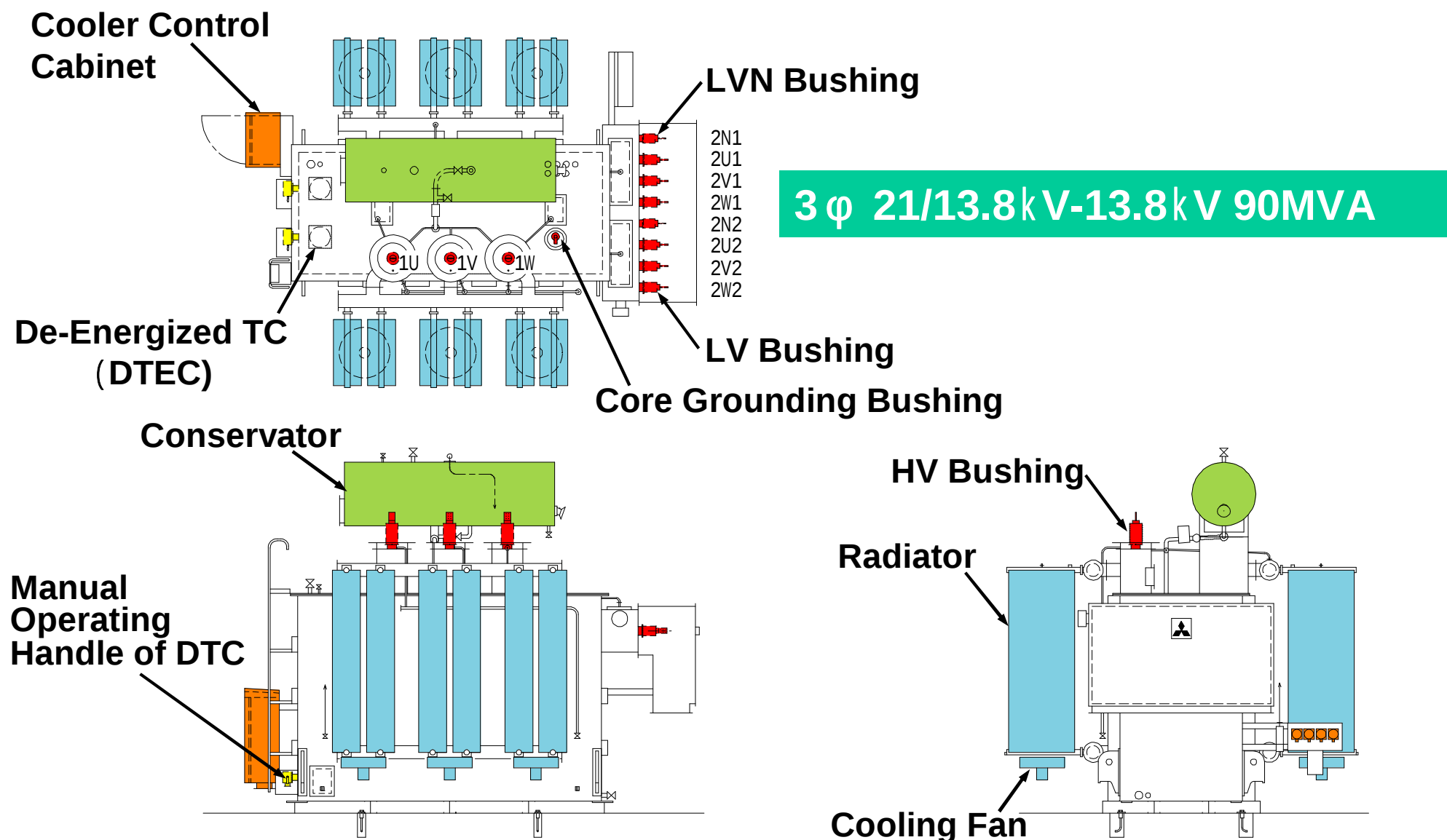
Internal Arrangement of Gen. Step-up TR



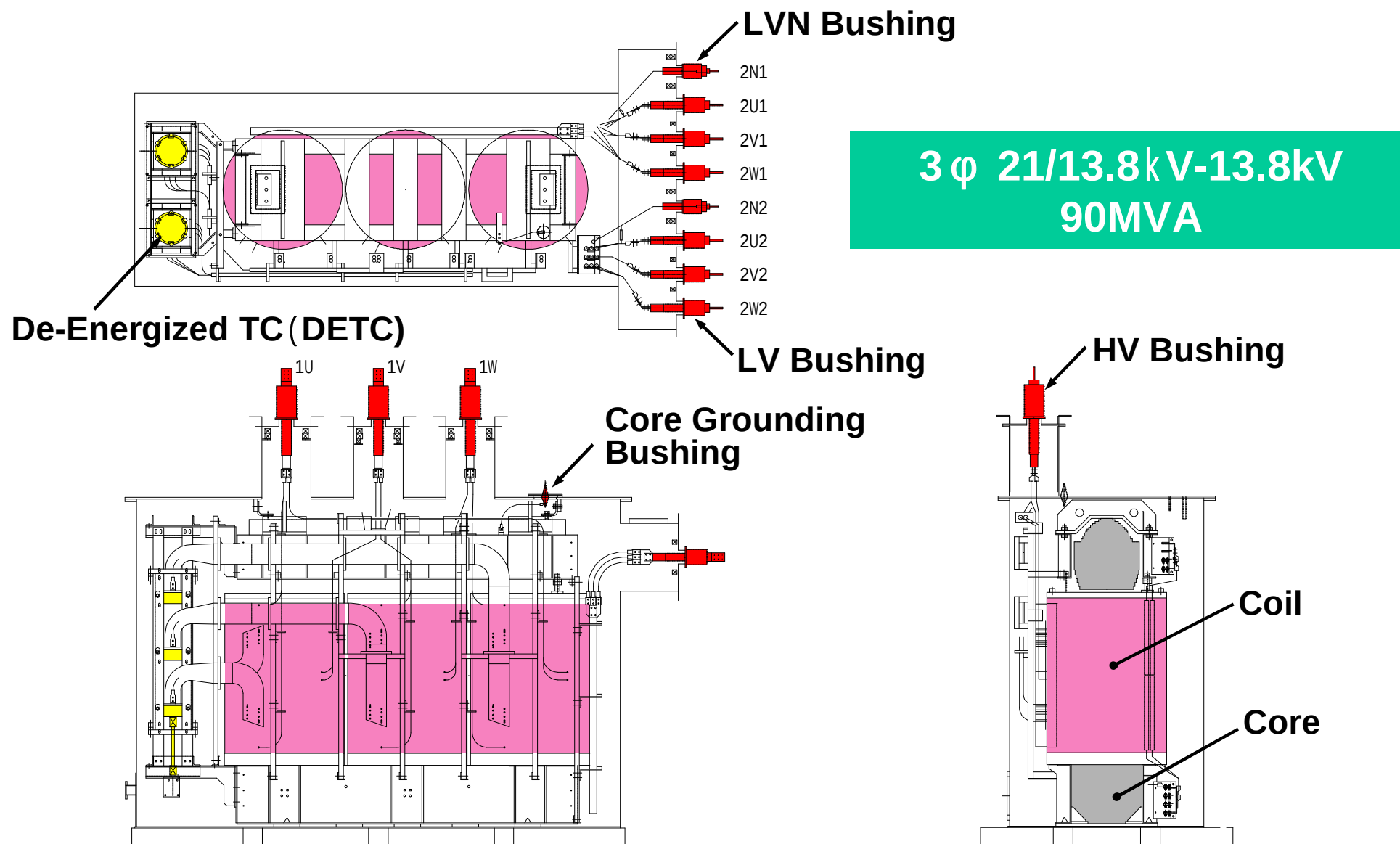
3 ϕ 21/380kV 444MVA



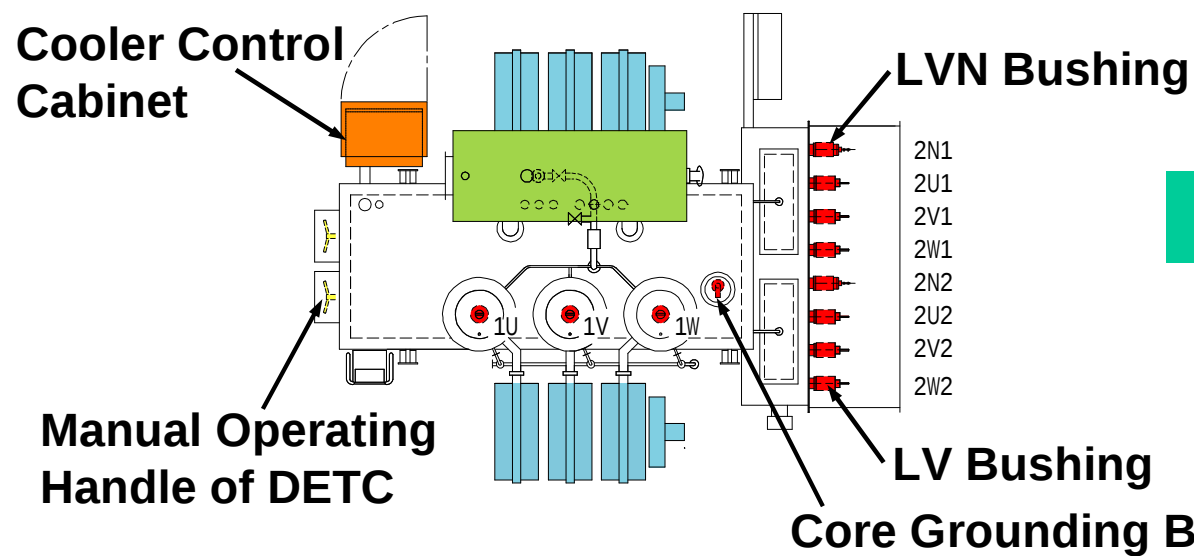
General Arrangement of Power Plant Aux. TR



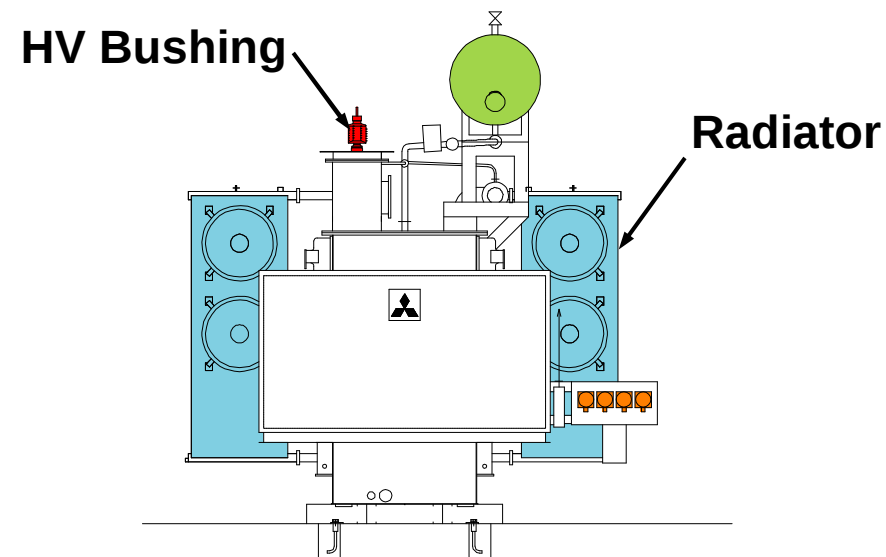
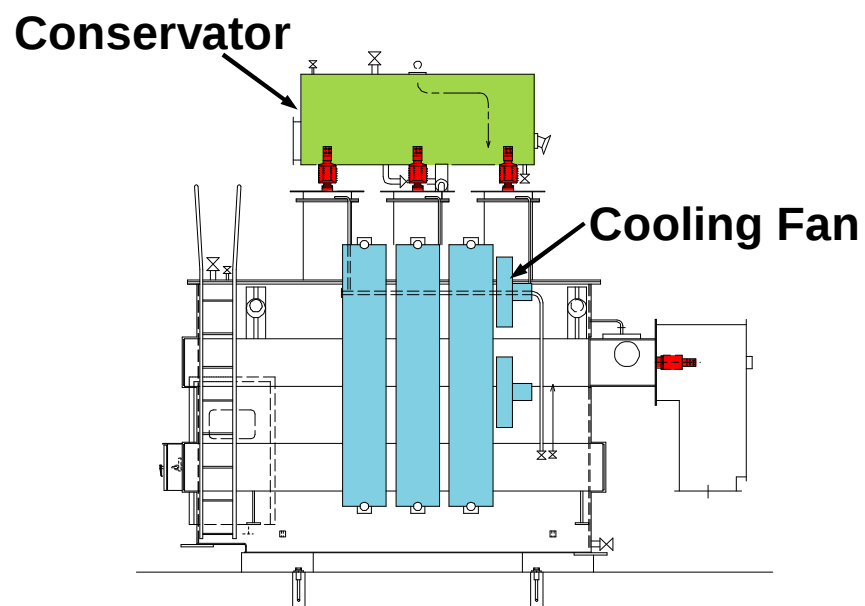
Internal Arrangement of Power Plant Aux. TR



General Arrangement of RO Plant Aux. TR



3 ϕ 21/13.8-13.8kV 41MVA



Internal Arrangement of RO Plant Aux. TR

De-Energized TC(DETC)

Manual Operating
Handle of DETC

LVN Bushing

2N1

2U1

2V1

2W1

2N2

2U2

2V2

2W2

LV Bushing

1U

1V

1W

3 ϕ 21/13.8-13.8kV 41MVA

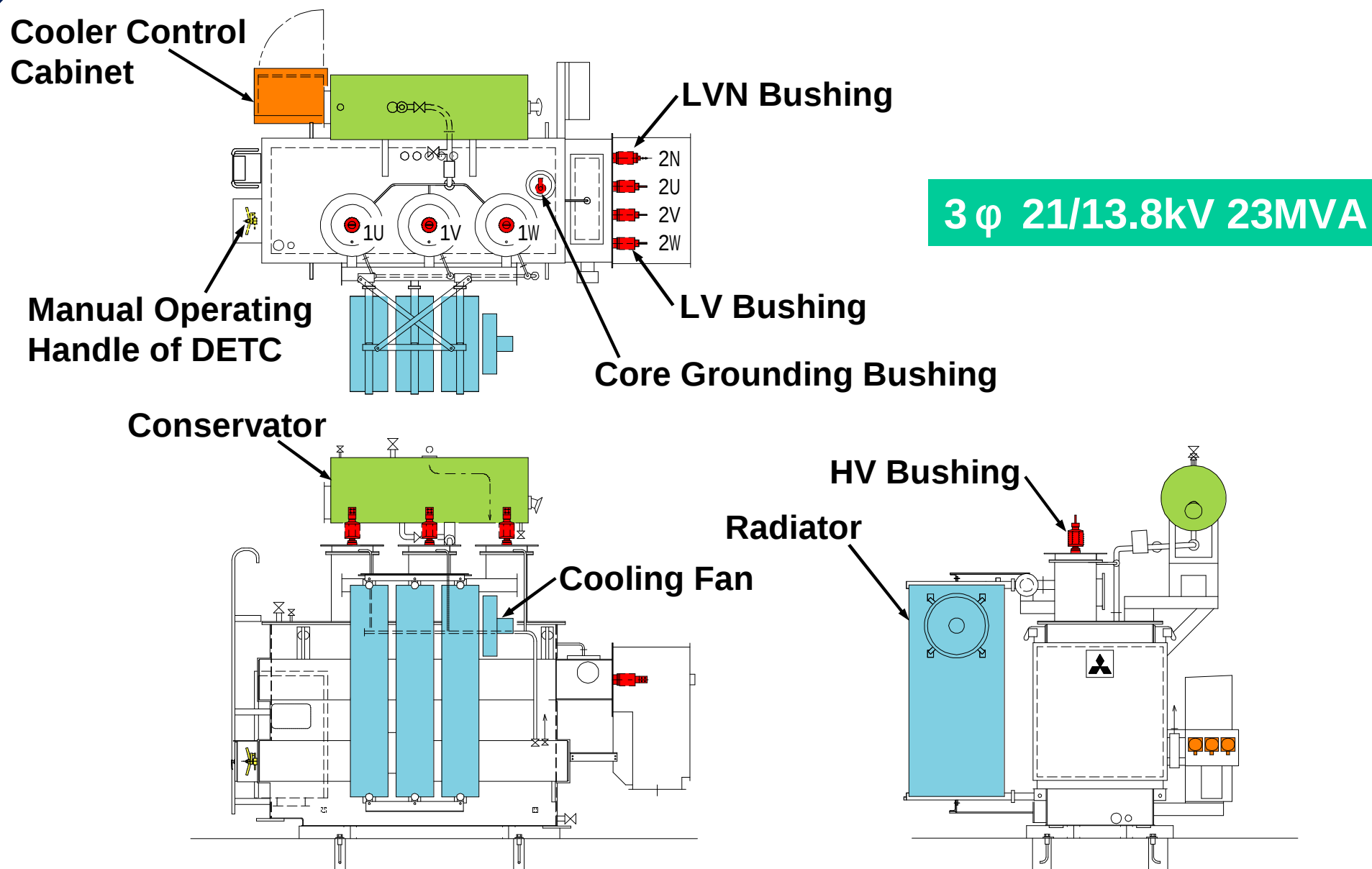
HV Bushing

BCT

Coil

Core

General Arrangement of Sea Water Intake Aux. TR



Internal Arrangement of Sea Water Intake Aux. TR

De-Energized TC(DETC)

LVN Bushing

2N

2U

2V

2W

3 ϕ 21/13.8kV 23MVA

Manual Operating
Handle of DETC

LV Bushing

1U

1V

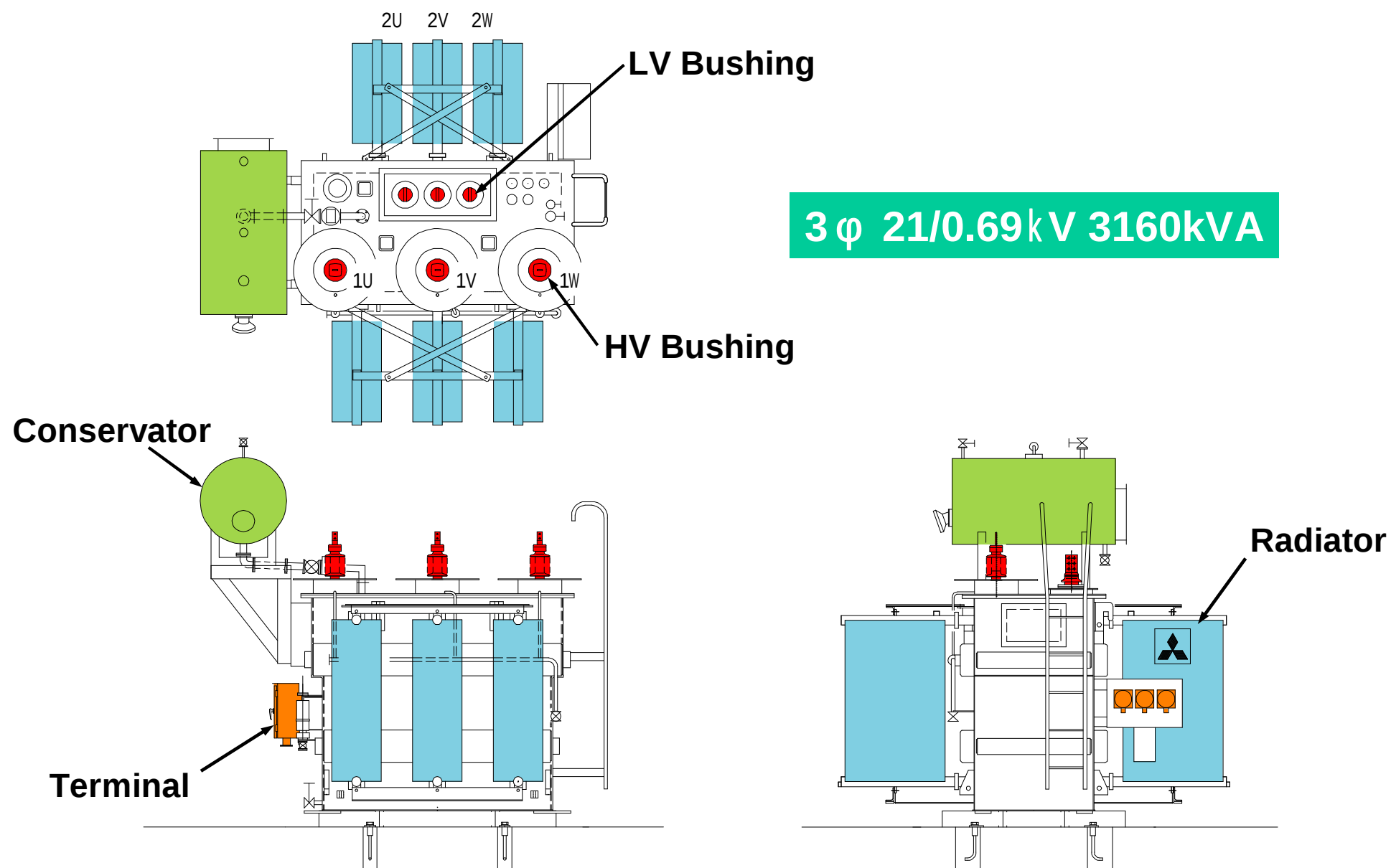
1W

HV Bushing

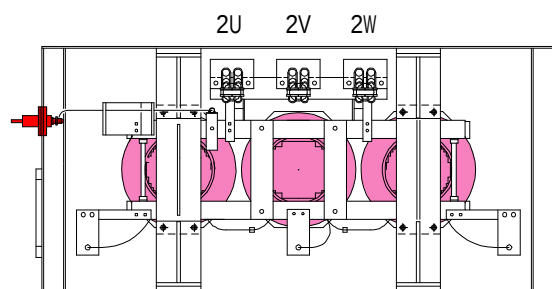
Coil

Core

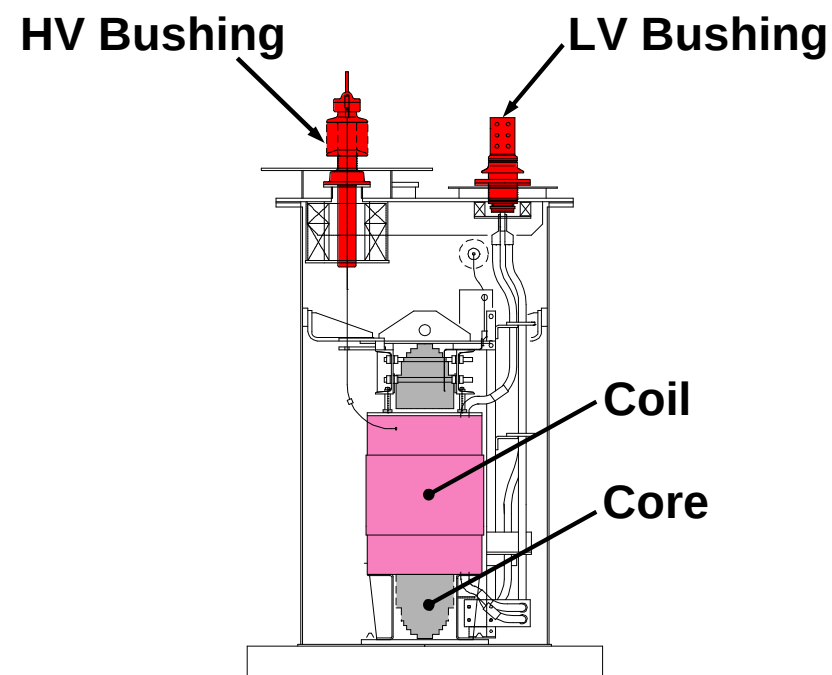
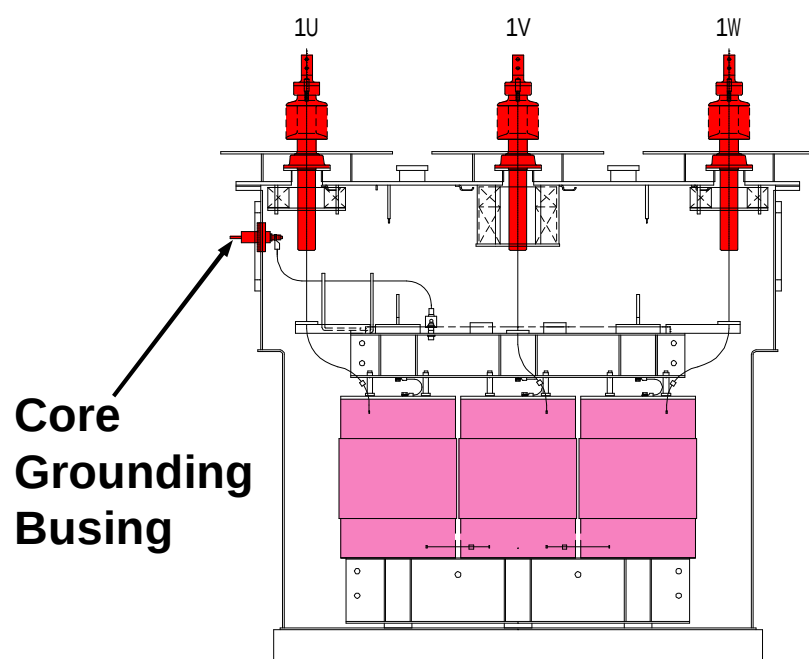
General Arrangement of Gen. Excitation TR



Internal Arrangement of Gen. Excitation TR



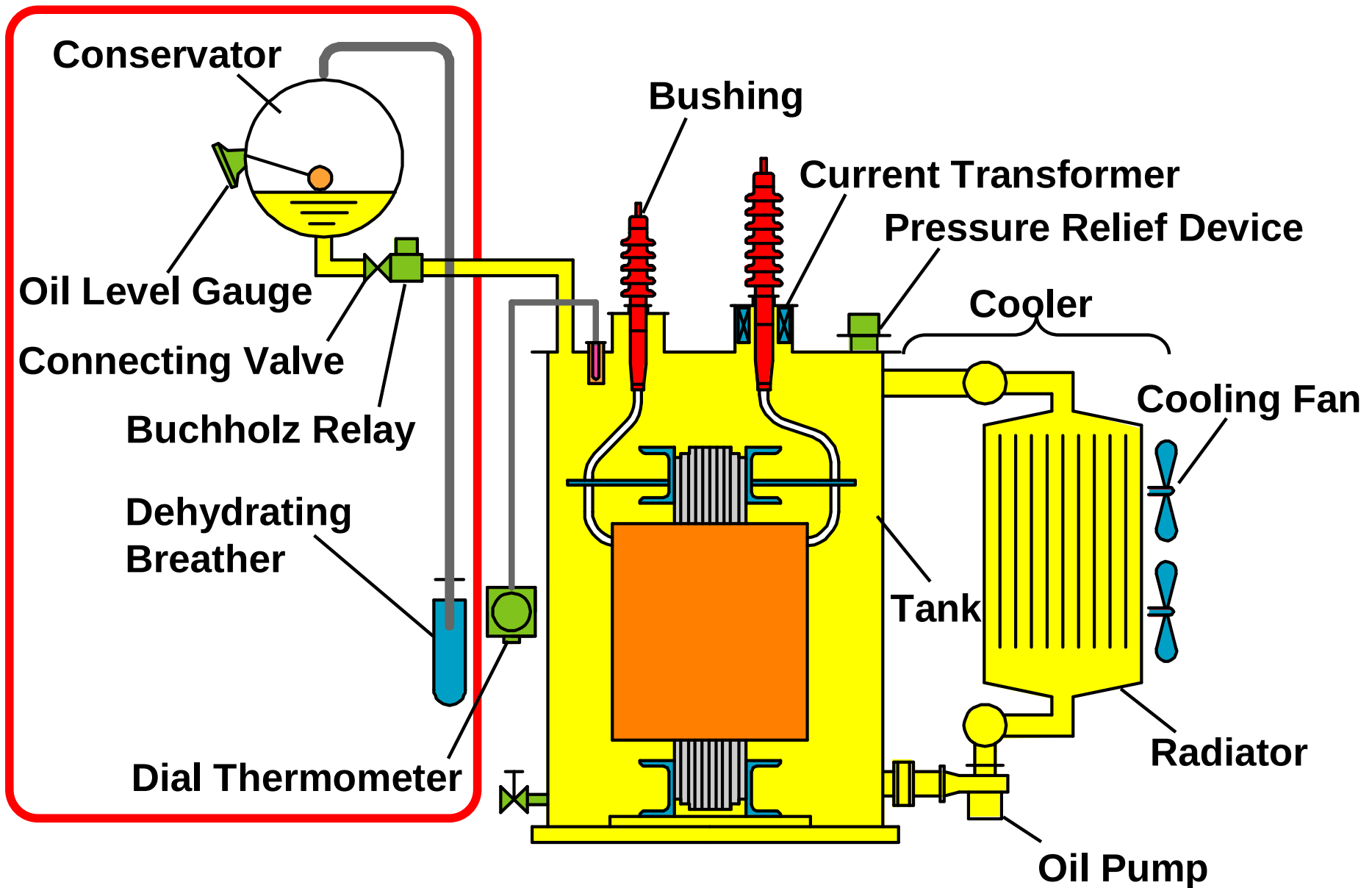
3 ϕ 21/0.69kV 3160kVA



Agenda

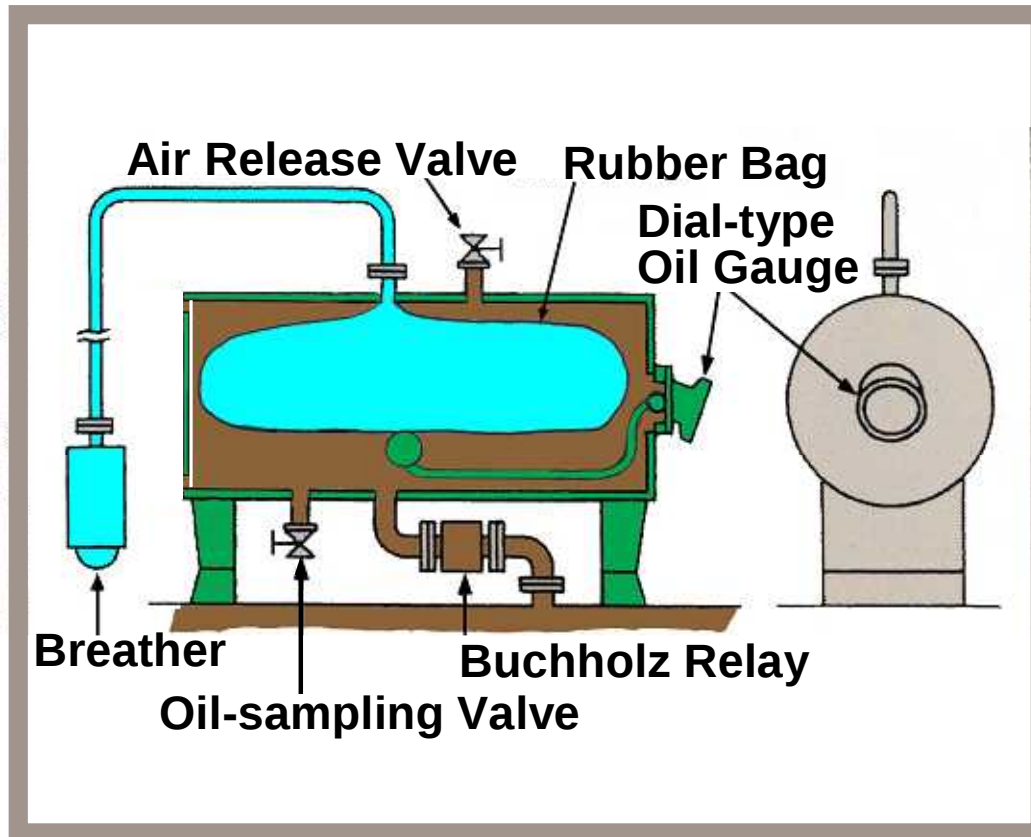
- General Explanation of Power Transformers
- Construction of Transformers
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 - Troubleshooting

Typical External Construction : Oil Filled Transformer



Oil Preservation System (Typical) : (Conservator)

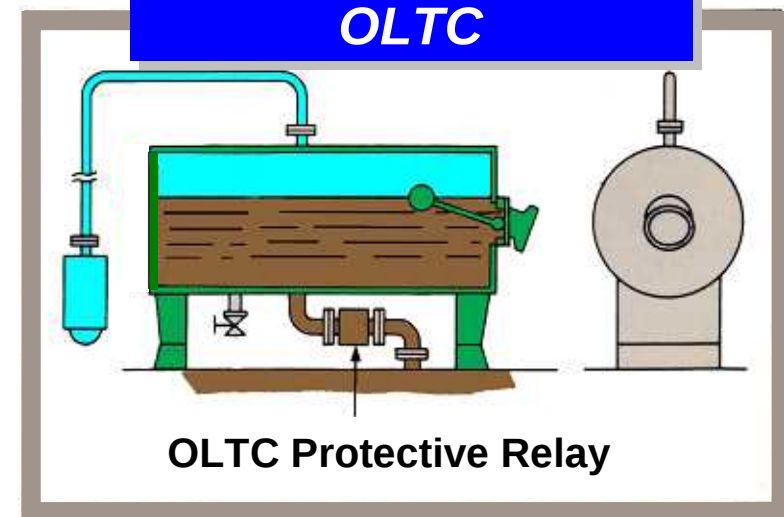
Conservator For Transformer Tank



To prevent deterioration of oil from moisture & oxygen.

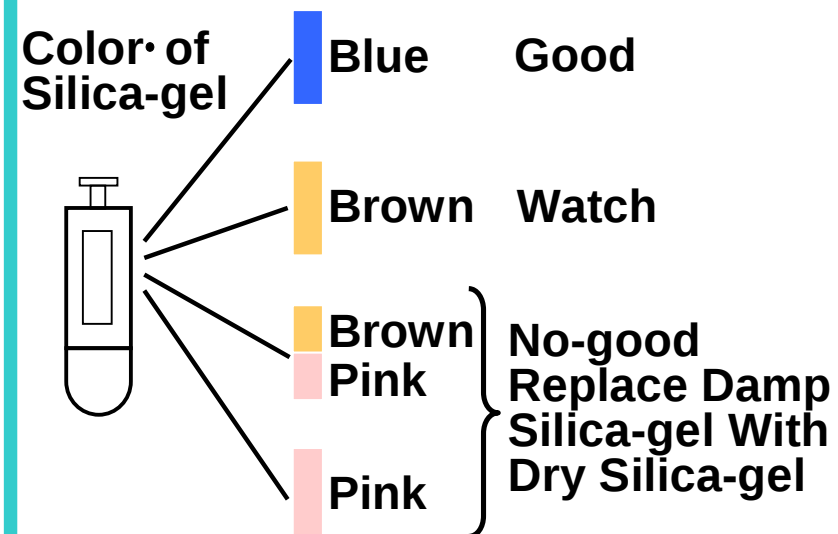
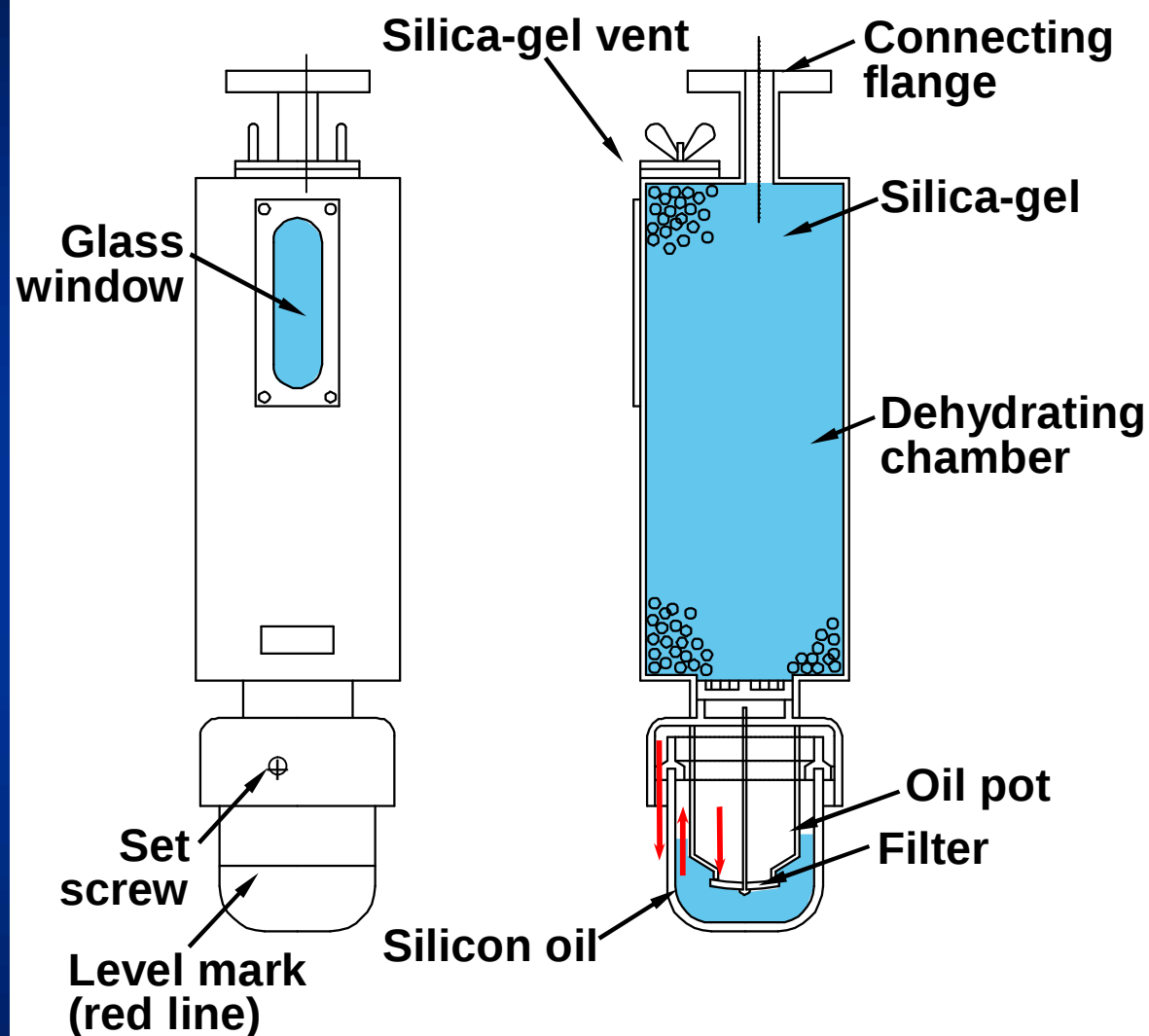
To absorb expansion of oil volume due to change of oil temp.

Conservator For OLTC

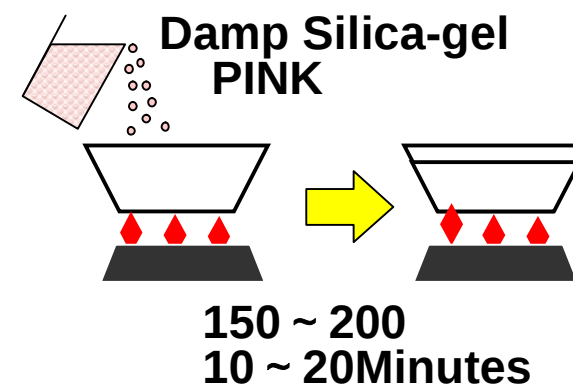


Rubber Cell Type Conservator
No-moisture
No-oxidation

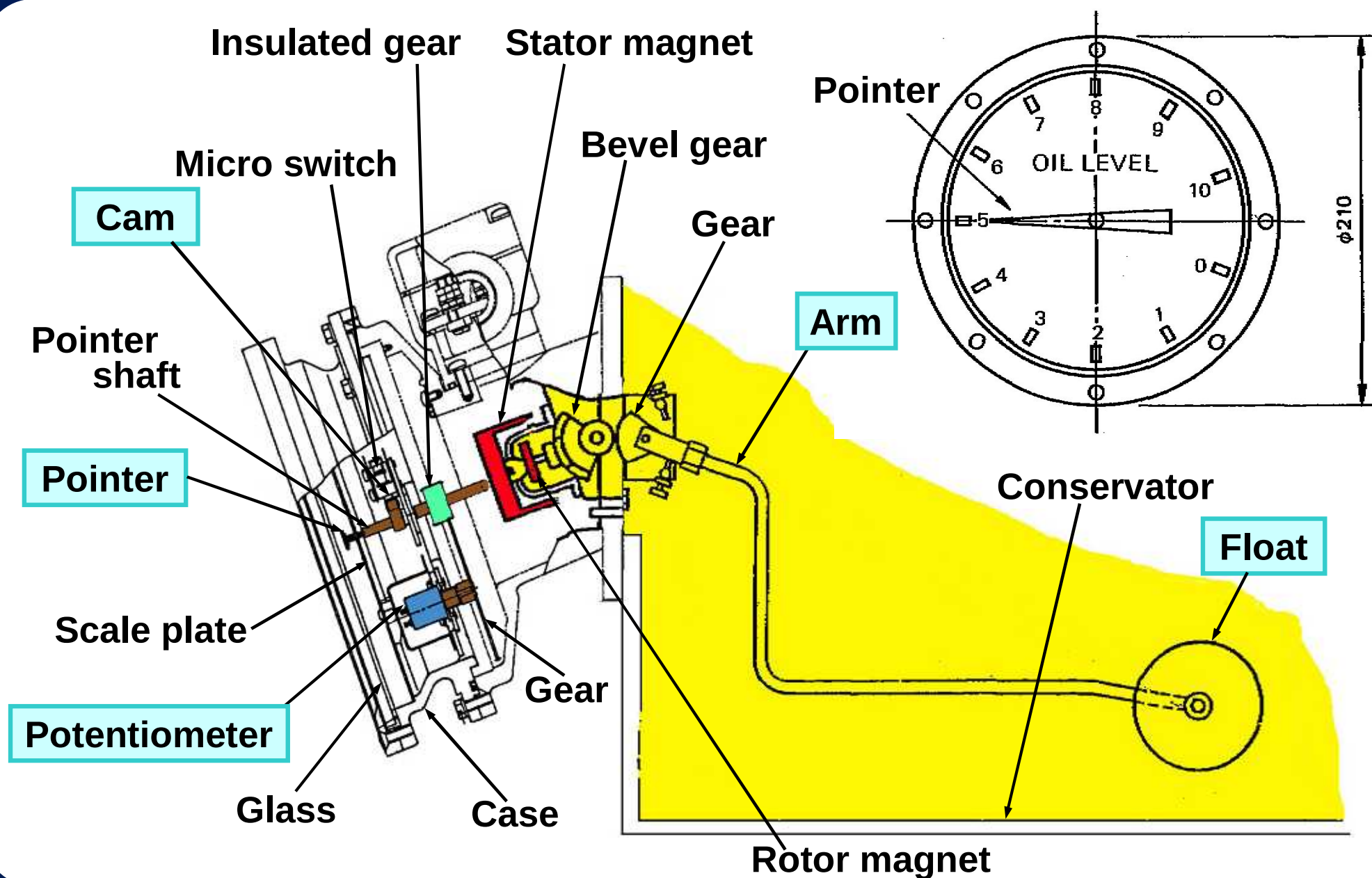
Filter Breather



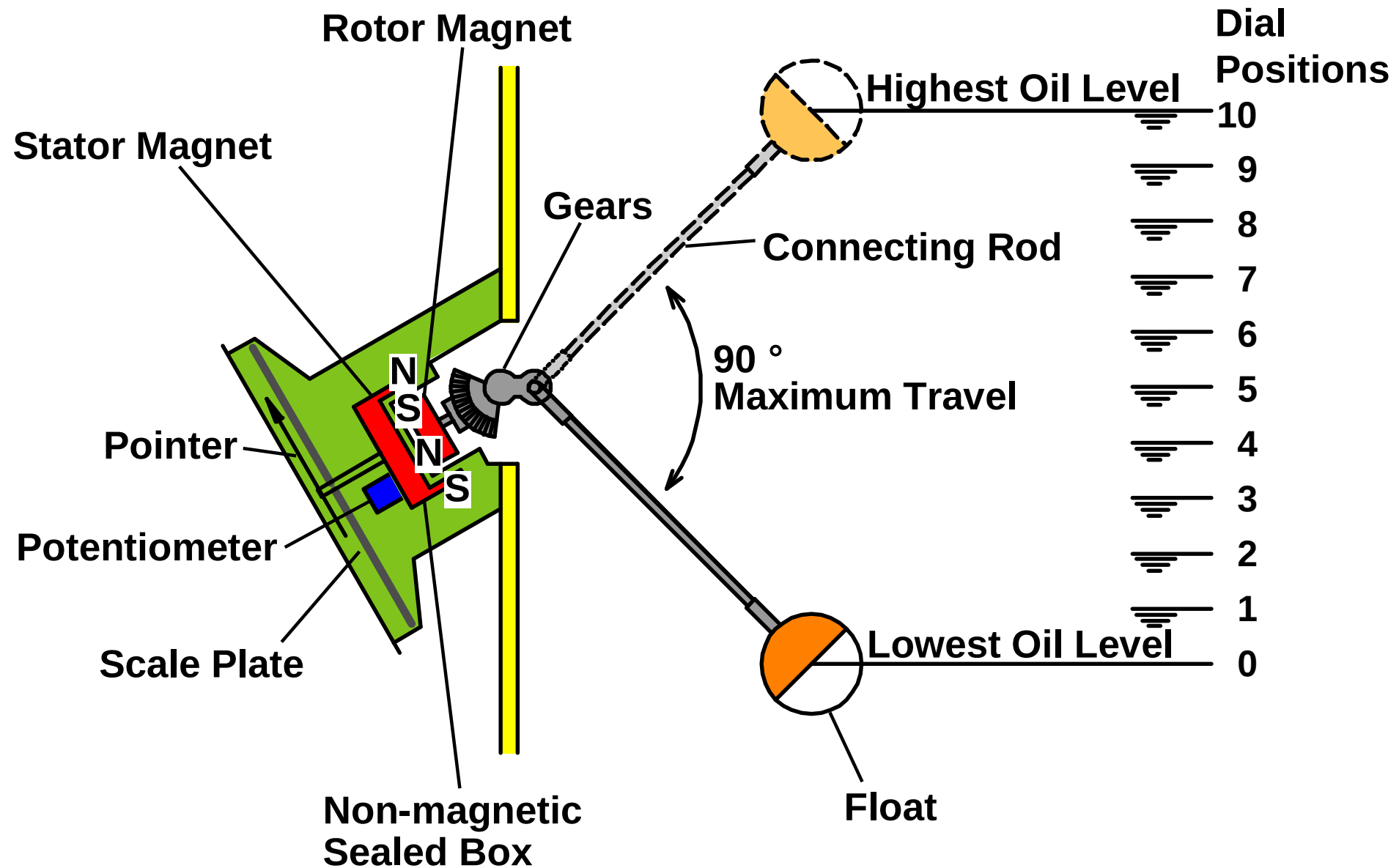
How To Re-use Damp Silica-gel



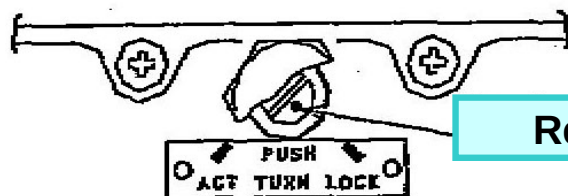
Oil level gauge (1/2)



Oil level gauge (2/2)

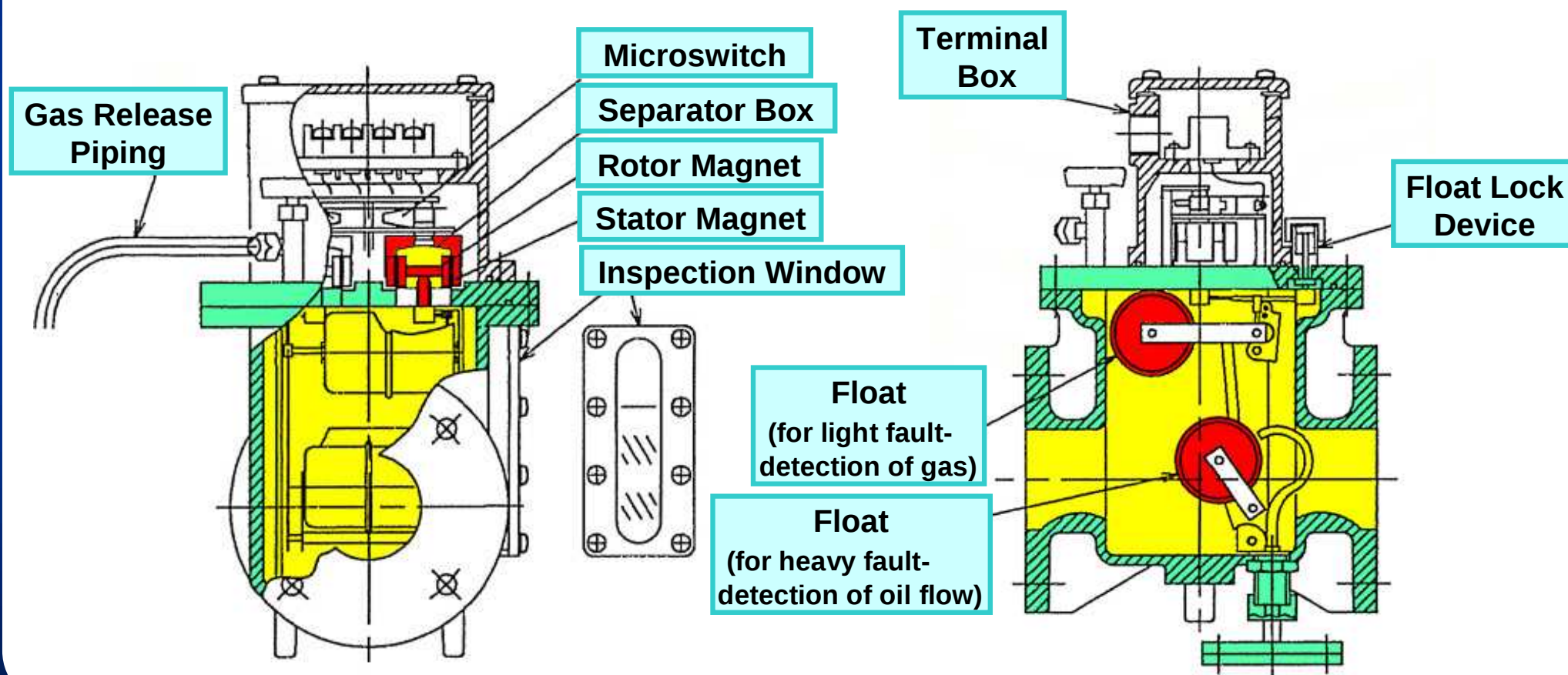


Buchholz Relay

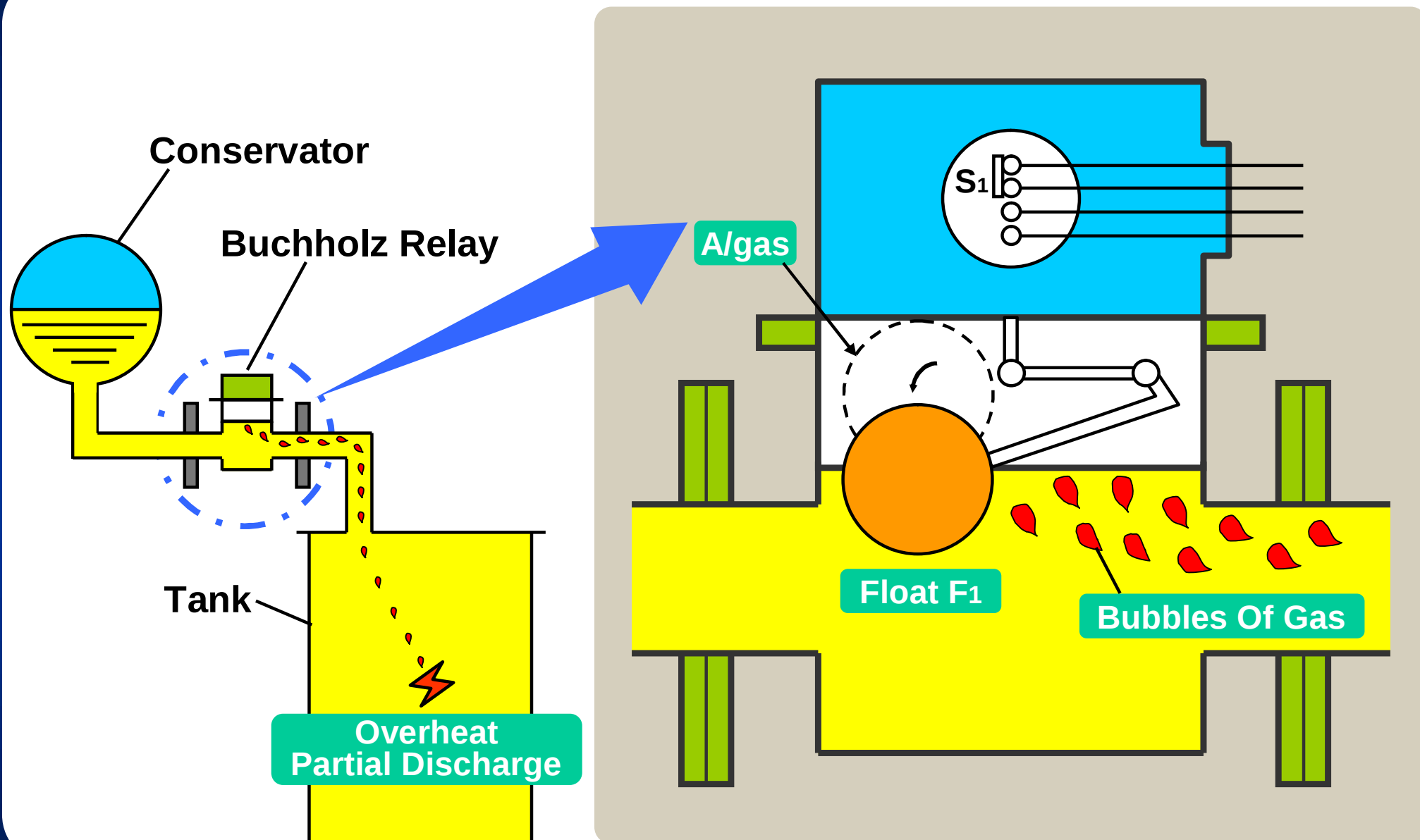


Red marked up point

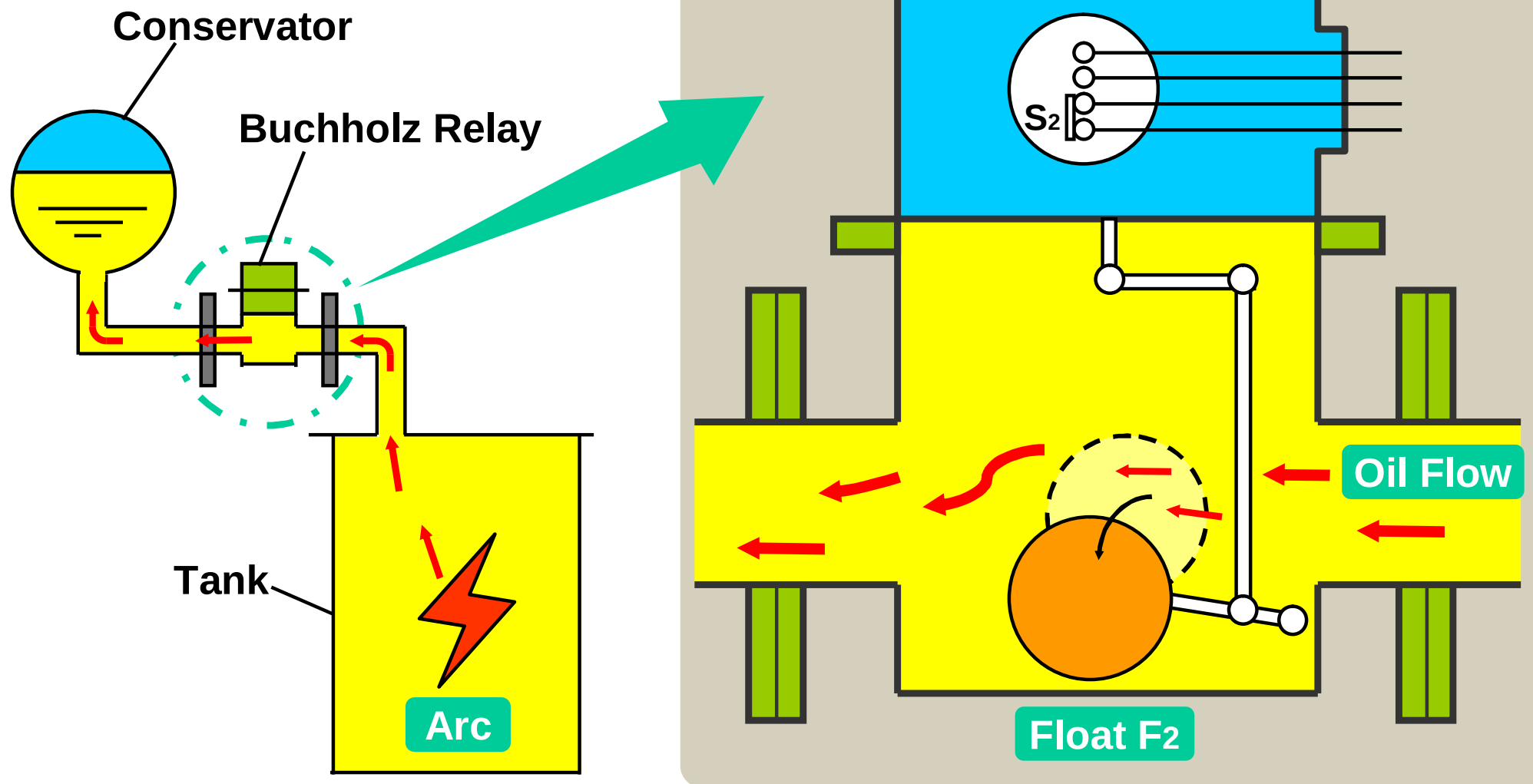
Float lock device detail



Buchholz Relay (alarm)



Buchholz Relay(trip)

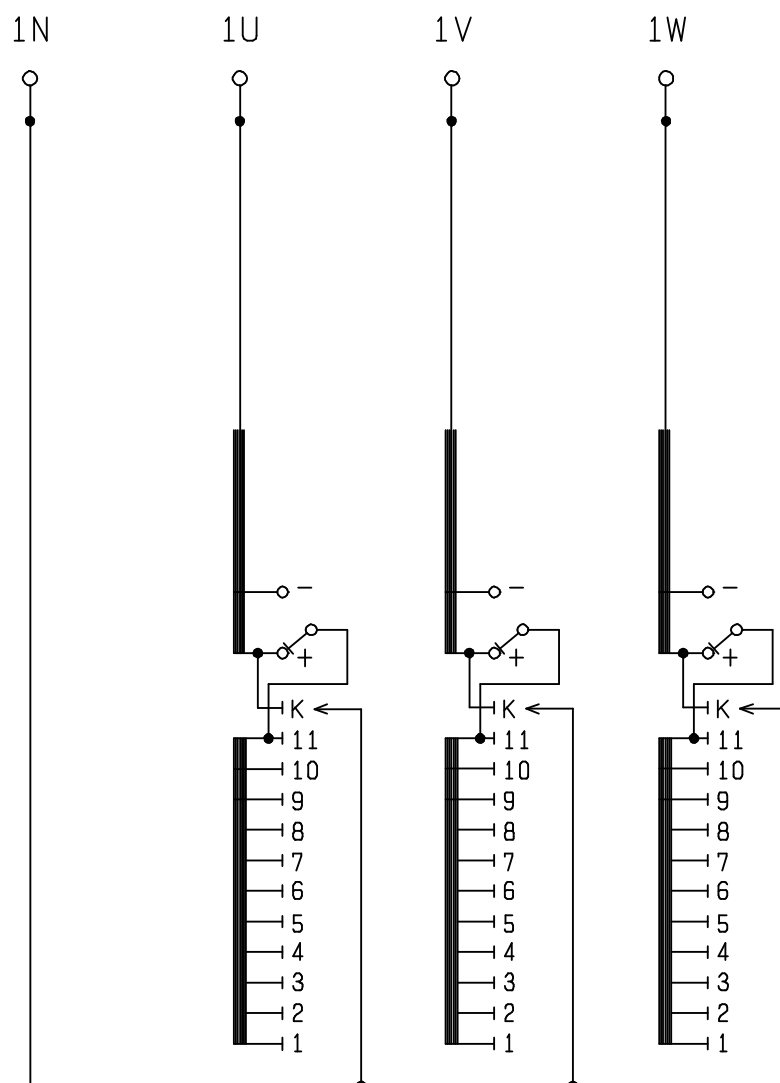


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- General Explanation of Power Transformers
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OLTC Connection Diagram of HV Winding

【 Gen. Step-up TR 】

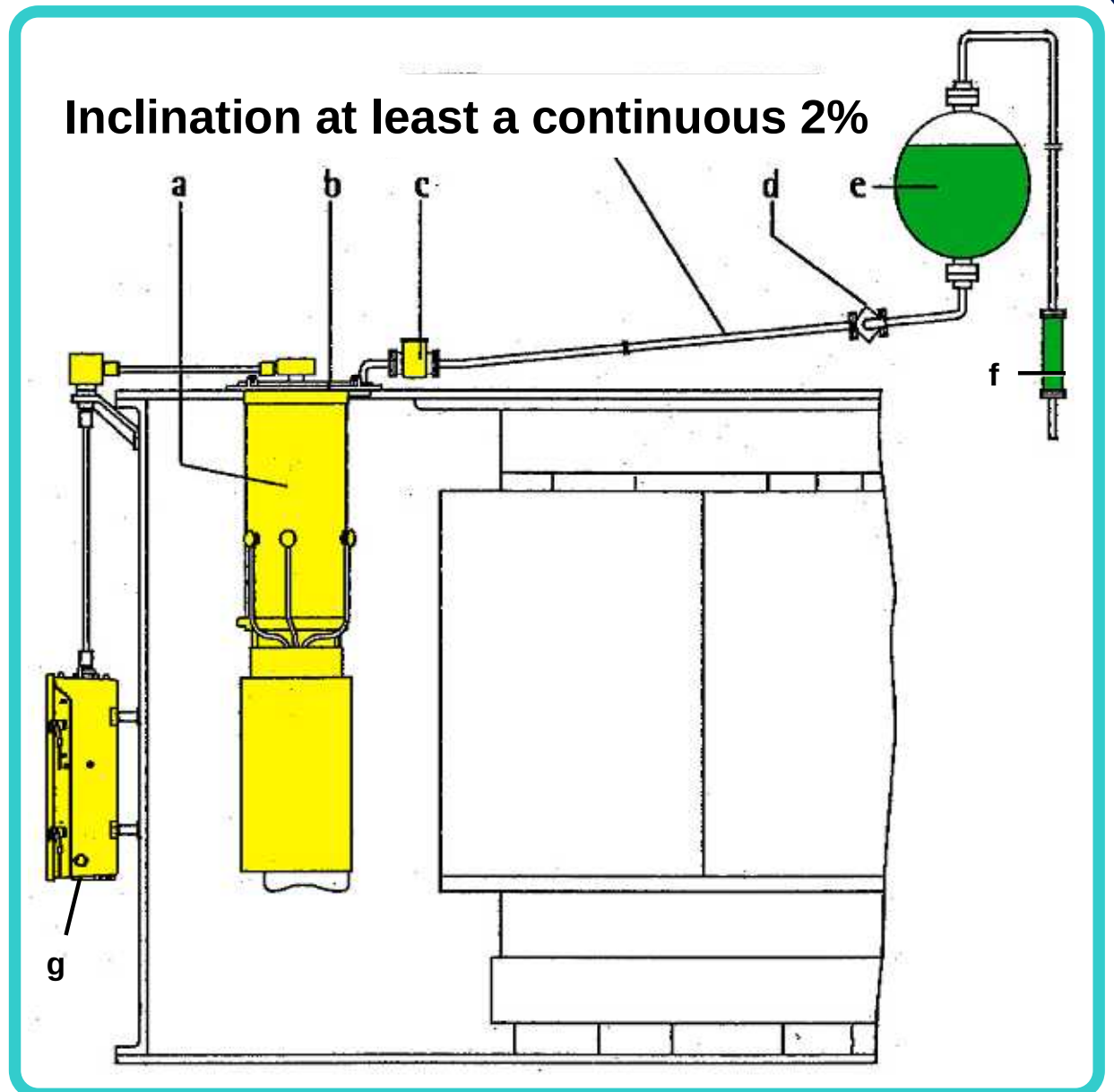


Voltage Table & Tap Connection.

	VOLT	AMP	POSITION	CONNECTION	
				TAP SELECTOR	TRANSFER SWITCH
HV	427500	600	1	1	+
	422750	606	2	2	
	418000	613	3	3	
	413250	620	4	4	
	408500	628	5	5	
	403750	635	6	6	
	399000	642	7	7	
	394250	650	8	8	
	389500	658	9	9	
	384750	666	10	10	
	380000	675	11A	11	-
			11B	K	
			11C	1	
	375250	683	12	2	
	370500	692	13	3	
	365750	701	14	4	
	361000	710	15	5	
	356250	720	16	6	
	351500	729	17	7	
	346750	739	18	8	
	342000	750	19	9	
	337250	760	20	10	
	332500	771	21	11	

Typical Tap Changer System (OLTC)

- a - On-load tap-changer oil compartment
- b - On-load tap-changer head
- c - Protective relay RS 2001
- d - Stop valve
- e - Oil conservator
- f - Filter Breather
- g - Motor drive



a,d : Main arcing contact

b,c : Resistor contact

(a) In service on odd-NO

(b) Current carrying contact off.
b contact on.

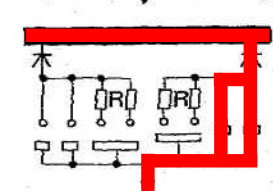
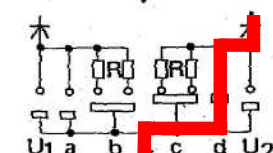
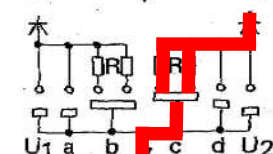
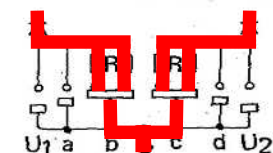
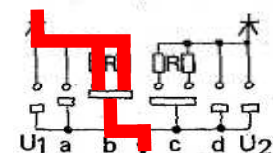
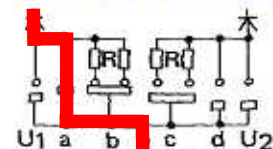
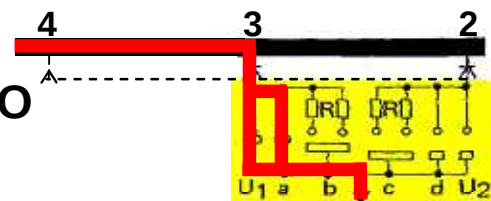
(c) a contact off.

(d) c contact on

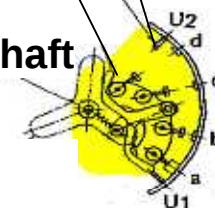
(e) b contact off

(f) d contact on

(g) In service on even-NO

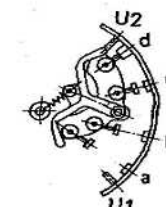
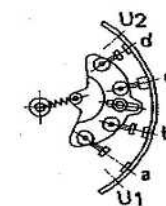
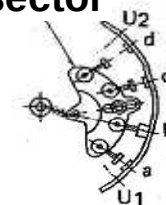


Even-NO side

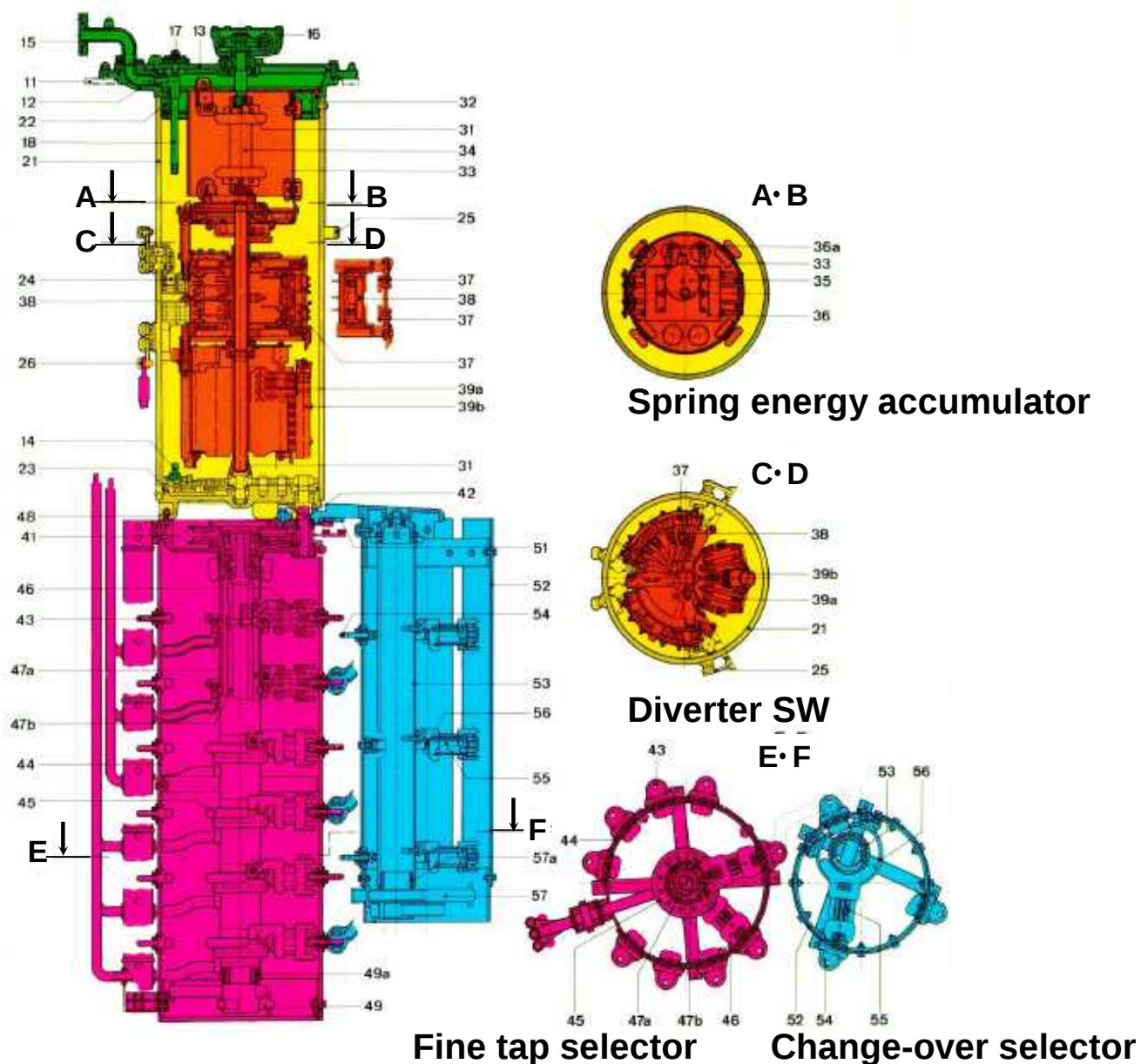


Odd-NO side

Insulation sector



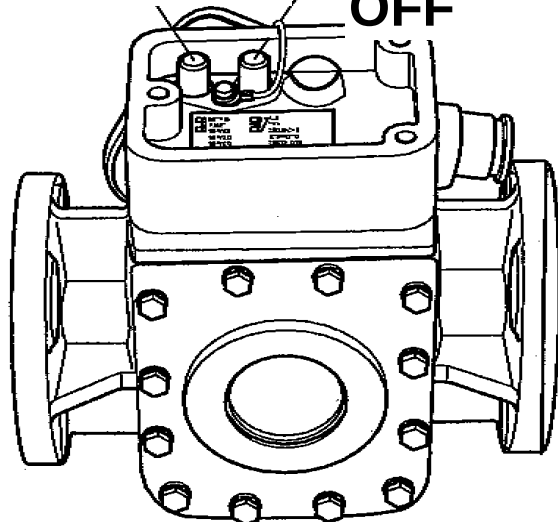
Tap Changer System (R -1200) – Typical For Gen. Step-up TR



Tap Changer System (RS2001)

Test button
IN SERVICE

Test button
OFF

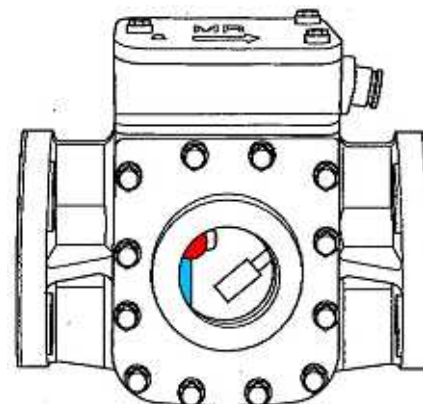
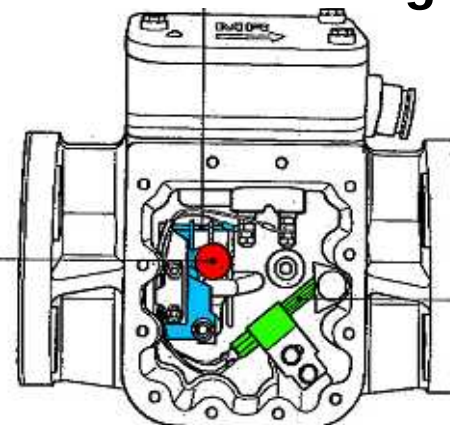


Cover open

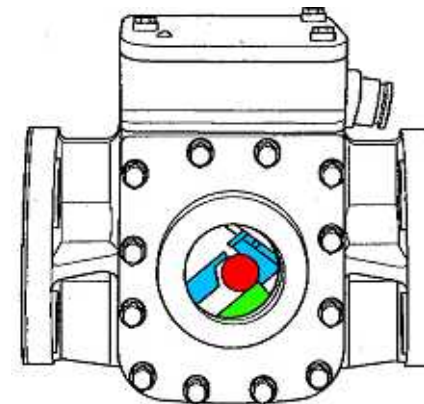
Permanent magnet

Flap valve

Reed switch



Position "IN
SERVICE"

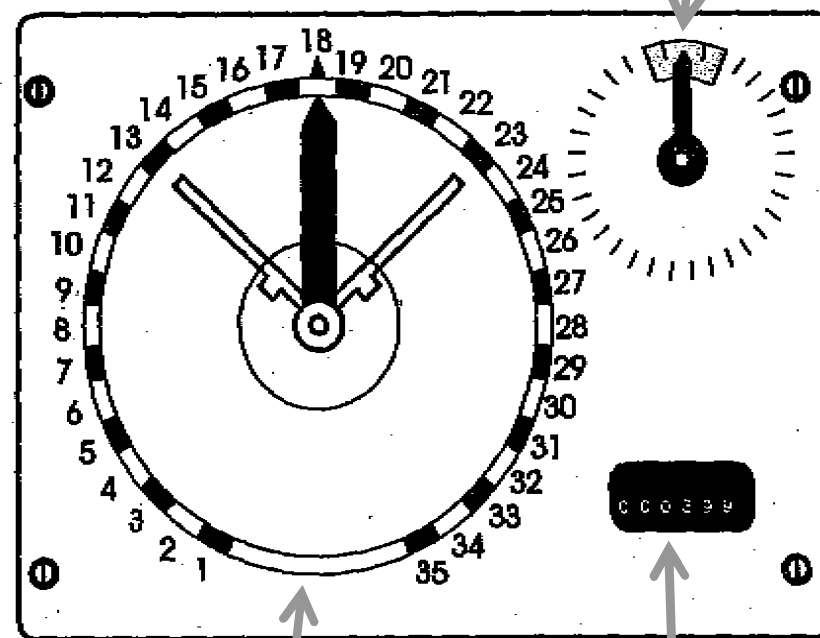


Position
"OFF"

Tap Changer System (Motor Drive Unit ED) - Typical



Tap Change indication

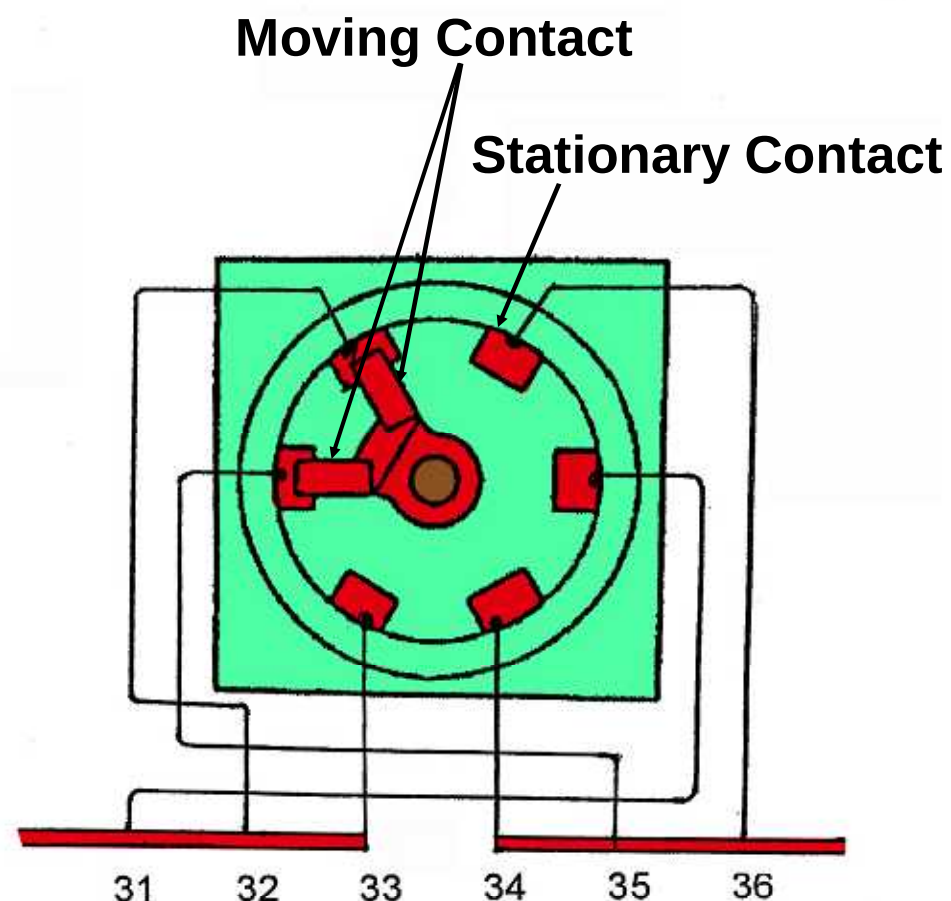
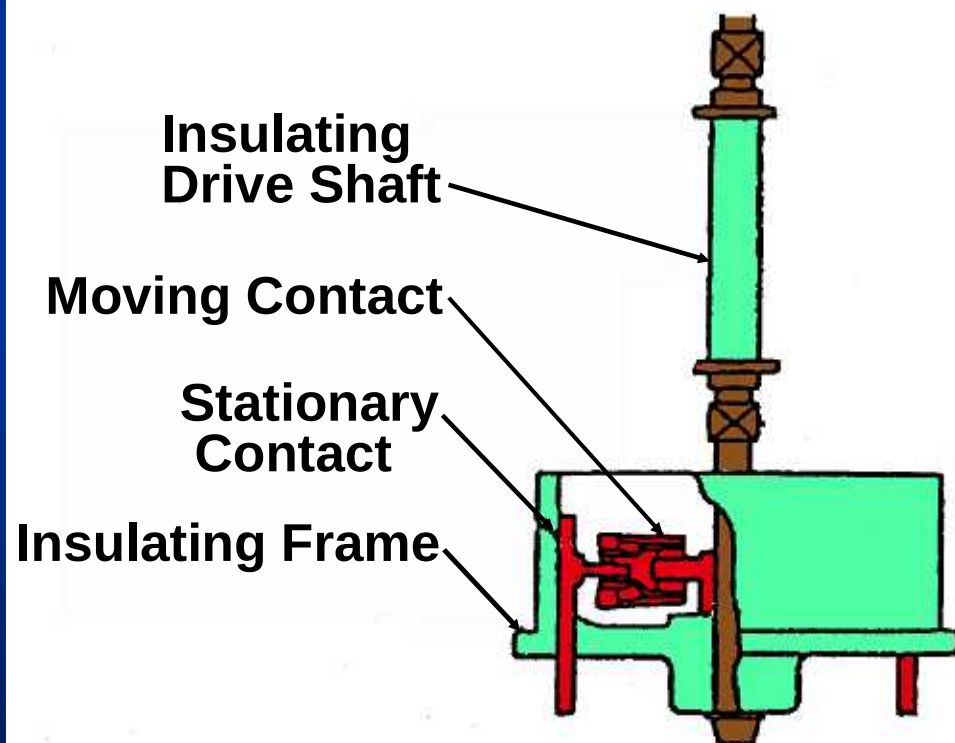


Position indicator

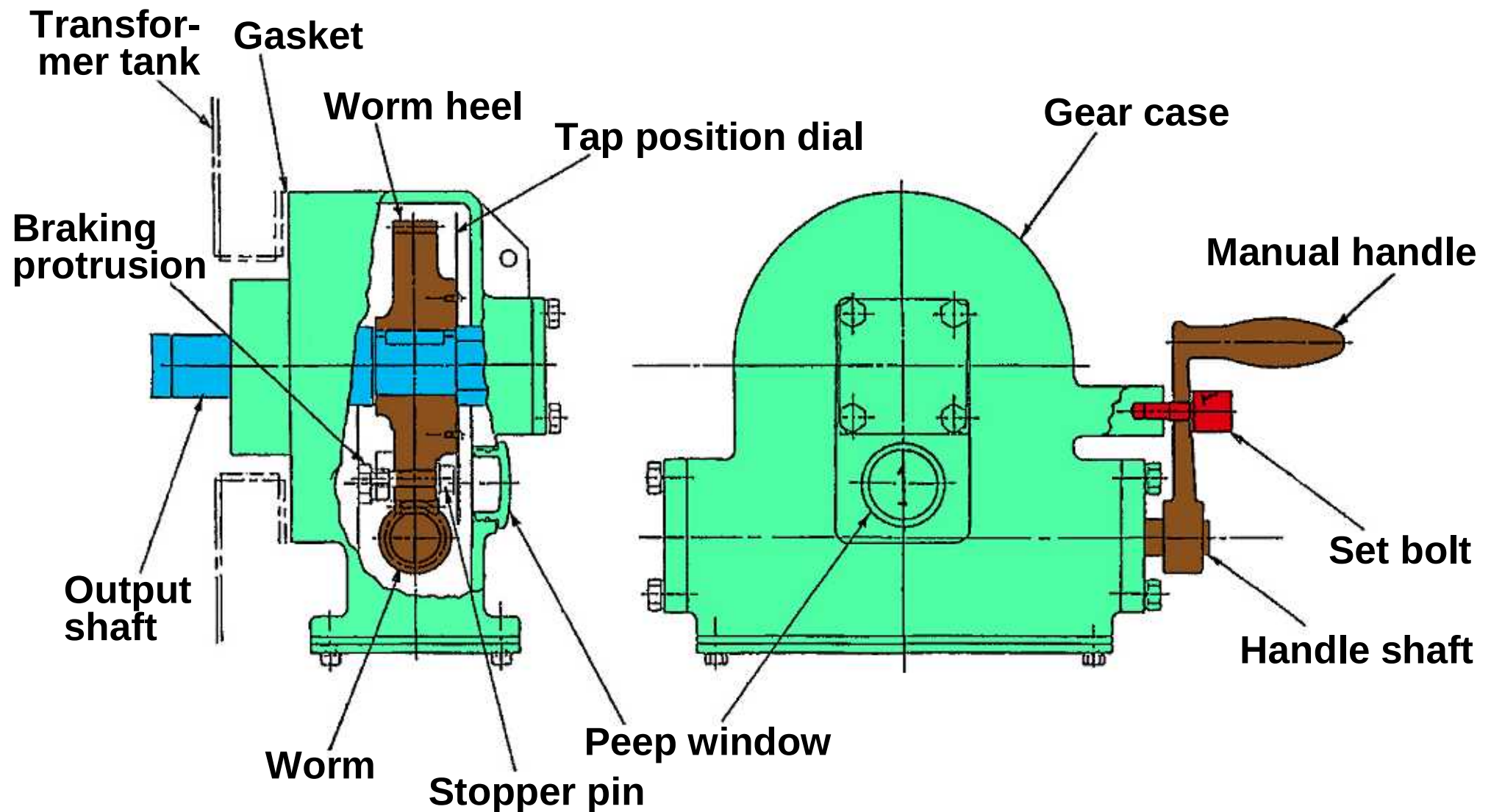
Operation counter

De-Energized Tap-Changer (Power Plant Aux. TR)

	V O L T	AMP		POSITION	CONNECTIONS
		ONAN	ONAF		
HV	F22050	1650	2357	1	13-14 • 23-24 • 33-34
	F21530	1689	2413	2	13-15 • 23-25 • 33-35
	R21000	1732	2474	3	12-15 • 22-25 • 32-35
	F20480	1776	2537	4	12-16 • 22-26 • 32-36
	F19950	1823	2605	5	11-16 • 21-26 • 31-36



Manual handle for DETC (Power Plant Aux. TR)



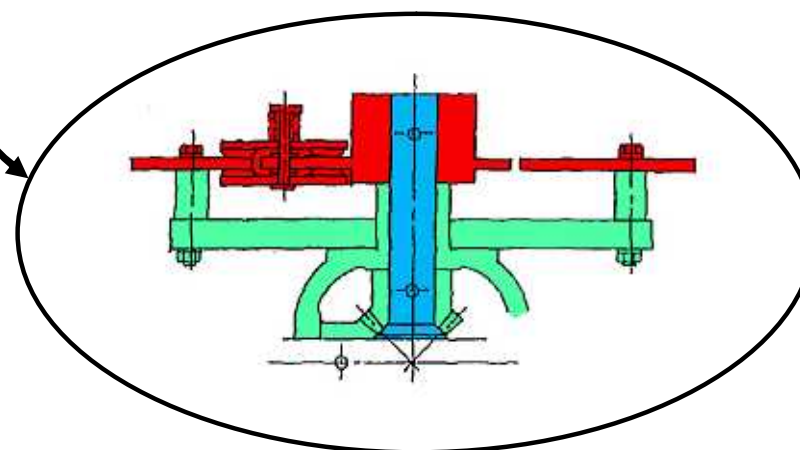
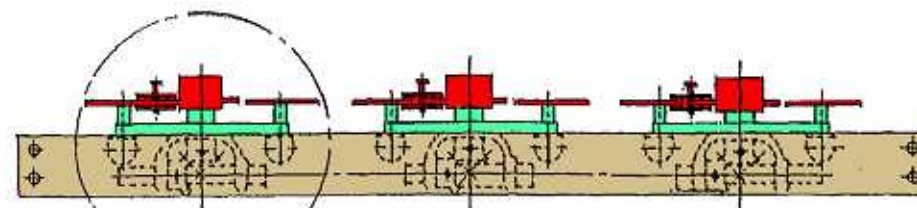
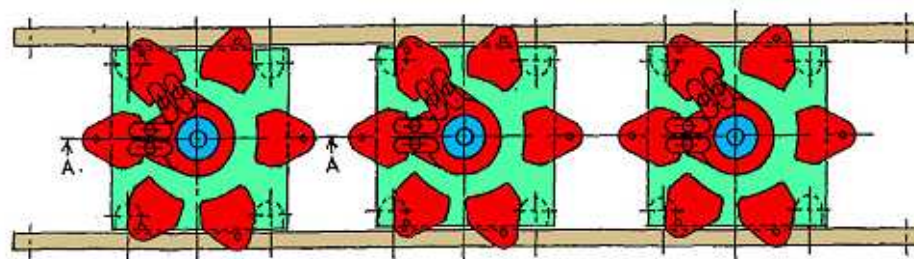
Voltage Table & Tap Connection

【 RO Plant Aux. TR 】

	V O L T	A M P		P O S I T I O N	C O N N E C T I O N S
		ONAN	ONAF		
H V	F22050	759	1074	1	13-14 • 23-24 • 33-34
	F21530	778	1099	2	13-15 • 23-25 • 33-35
	R21000	797	1127	3	12-15 • 22-25 • 32-35
	F20480	818	1156	4	12-16 • 22-26 • 32-36
	F19950	839	1187	5	11-16 • 21-26 • 31-36

【 Sea Water Intake Aux. TR 】

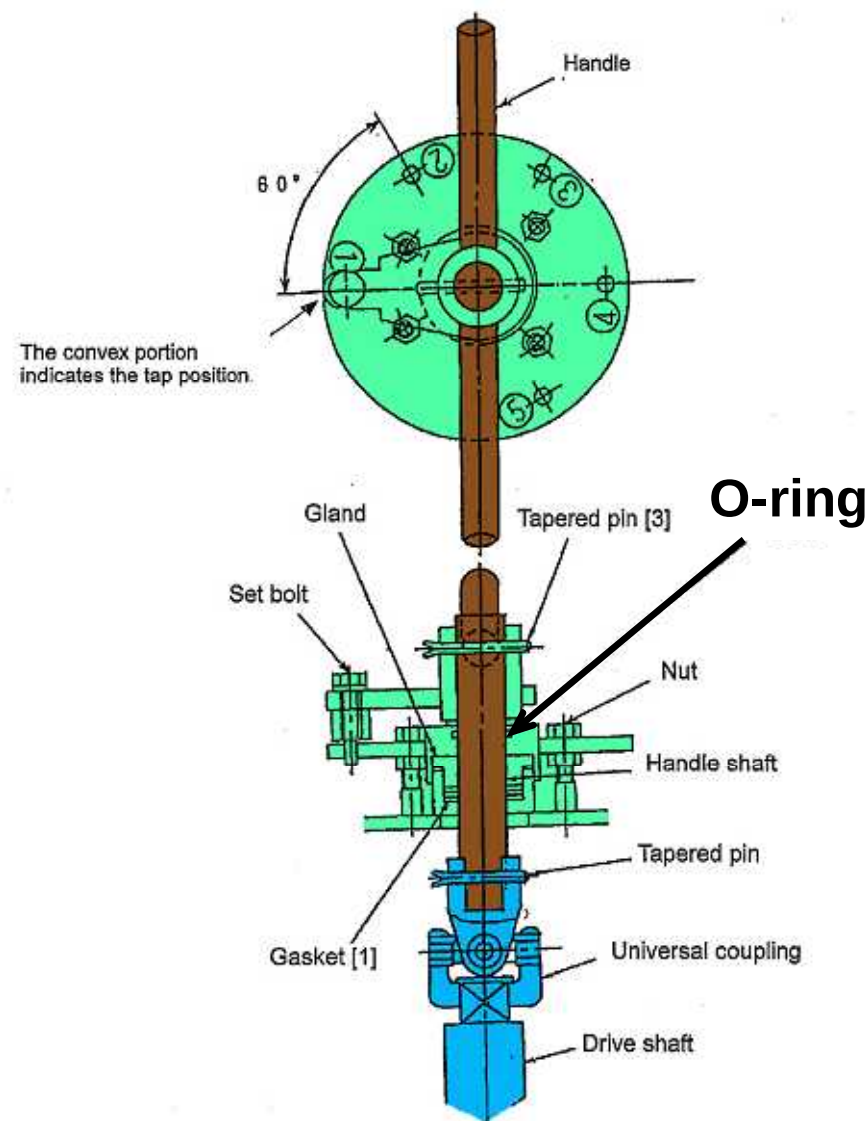
	V O L T	A M P		P O S I T I O N	C O N N E C T I O N S
		ONAN	ONAF		
H V	F22050	419	602	1	13-14 • 23-24 • 33-34
	F21530	429	617	2	13-15 • 23-25 • 33-35
	R21000	440	632	3	12-15 • 22-25 • 32-35
	F20480	451	648	4	12-16 • 22-26 • 32-36
	F19950	463	666	5	11-16 • 21-26 • 31-36



Manual handle for DETC

【 Sea Water Intake Aux. TR 】

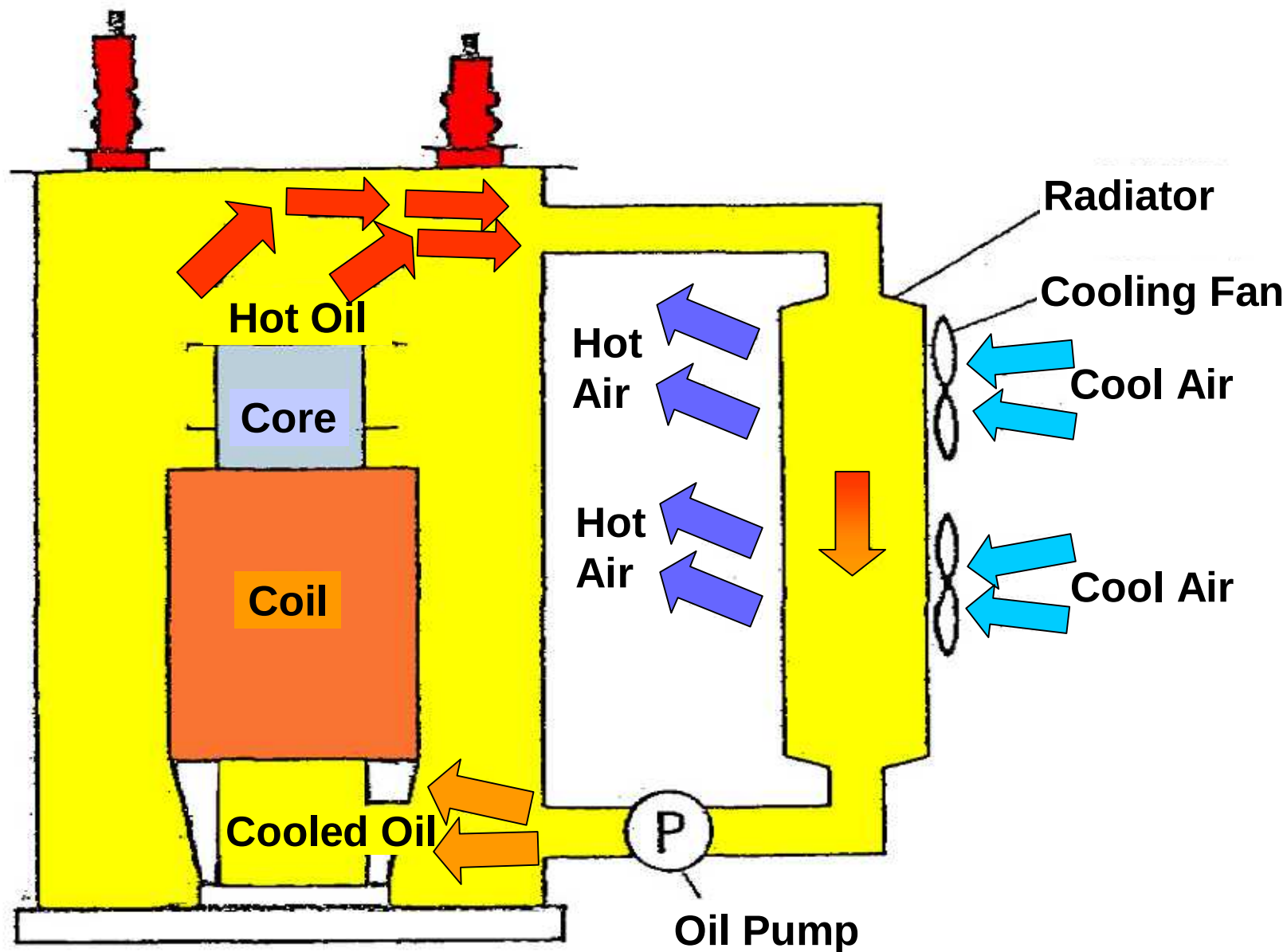
【 RO Plant Aux. TR 】



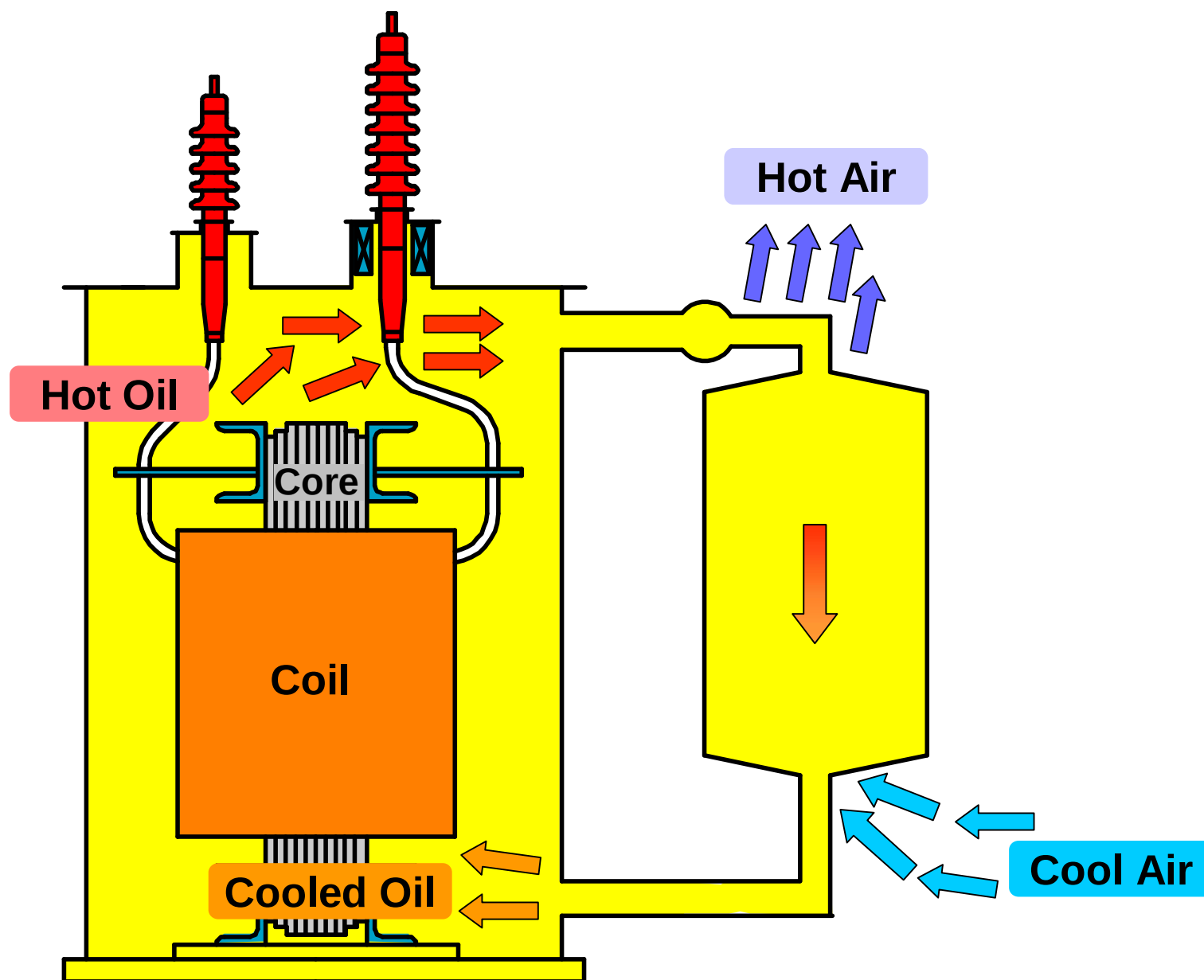
Agenda

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Cooling System (Forced Oil Forced Air Cooling)

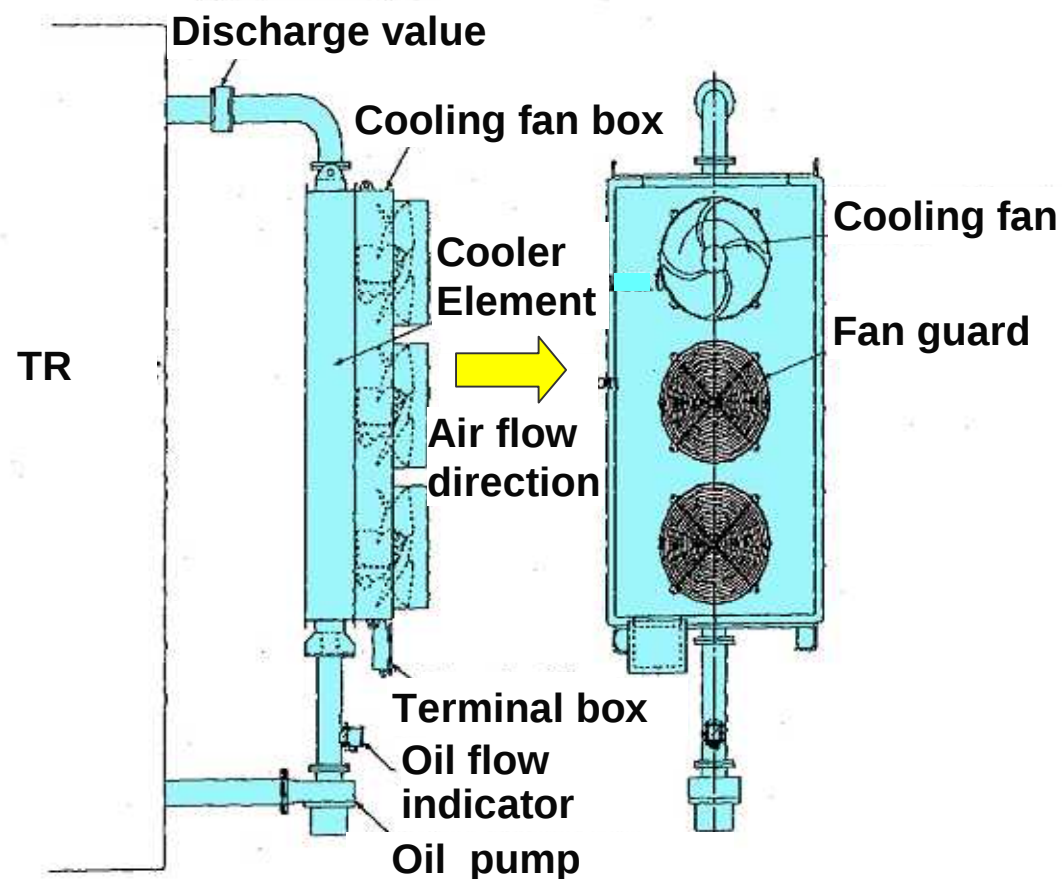


Cooling System : Oil Filled Natural Cooling

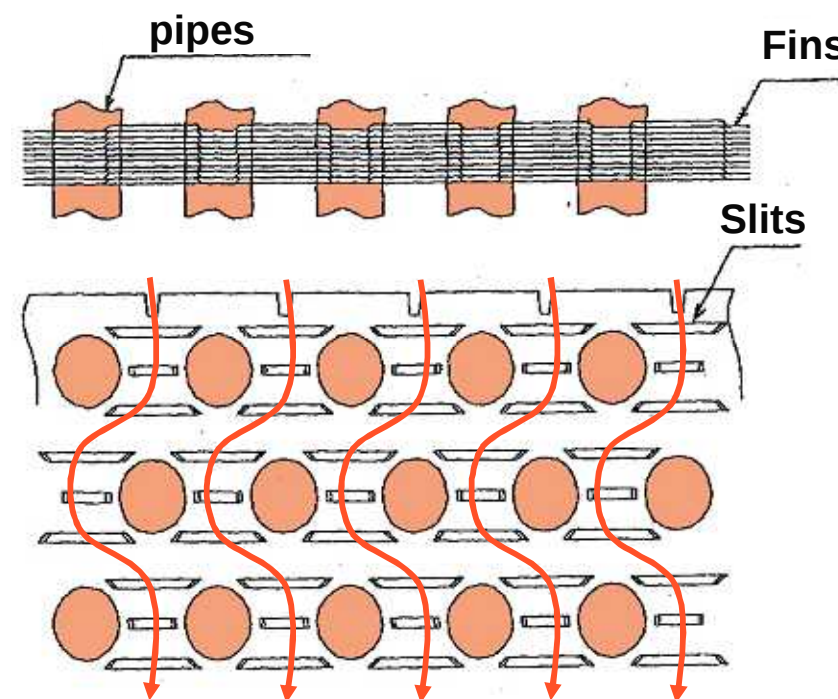


Cooling System

AEF-Type Cooler for ODAF

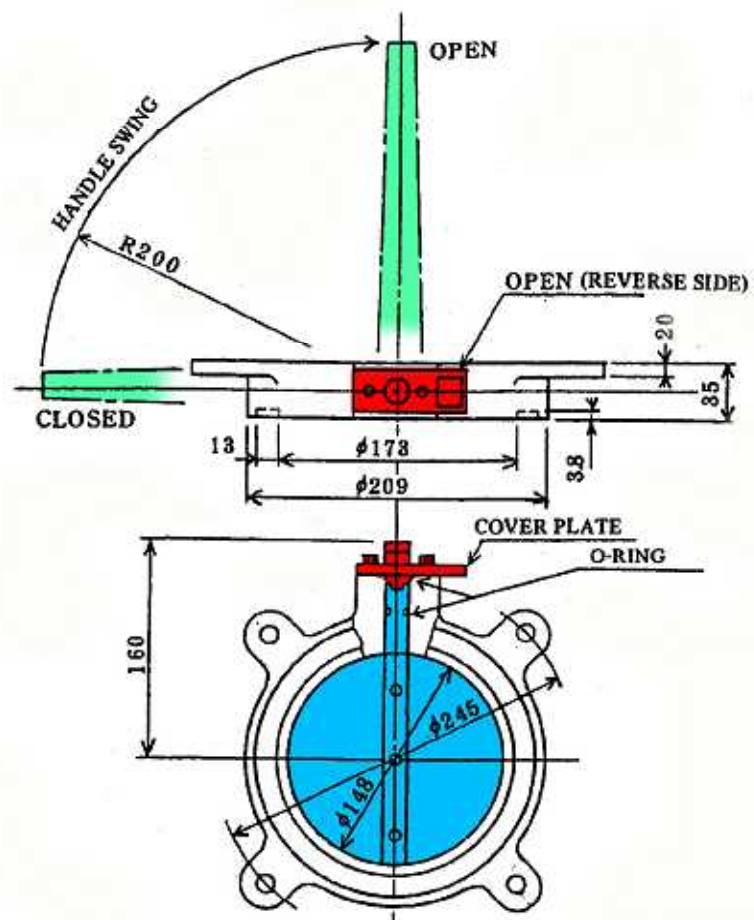


Slit Fin - Cooling Pipes Structural Drawing

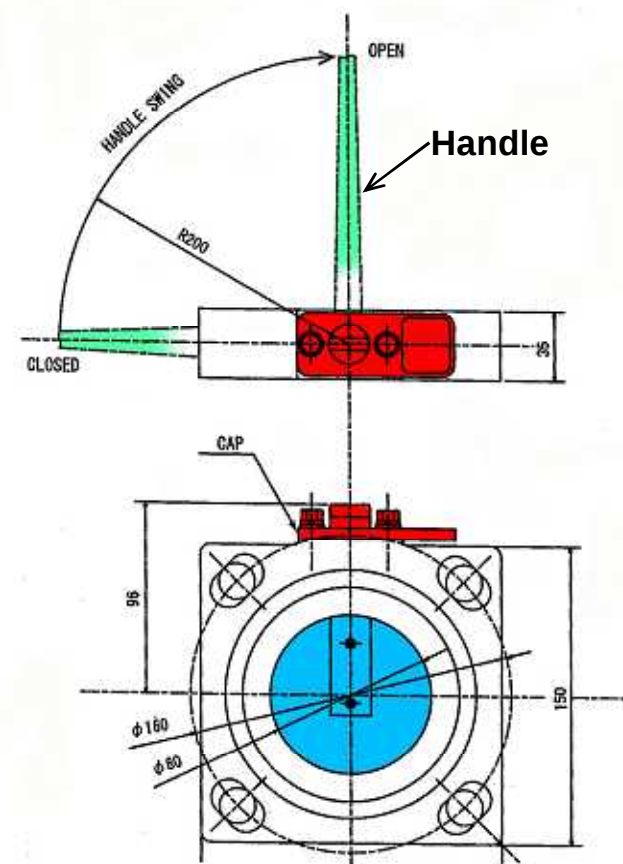


Radiator Valve

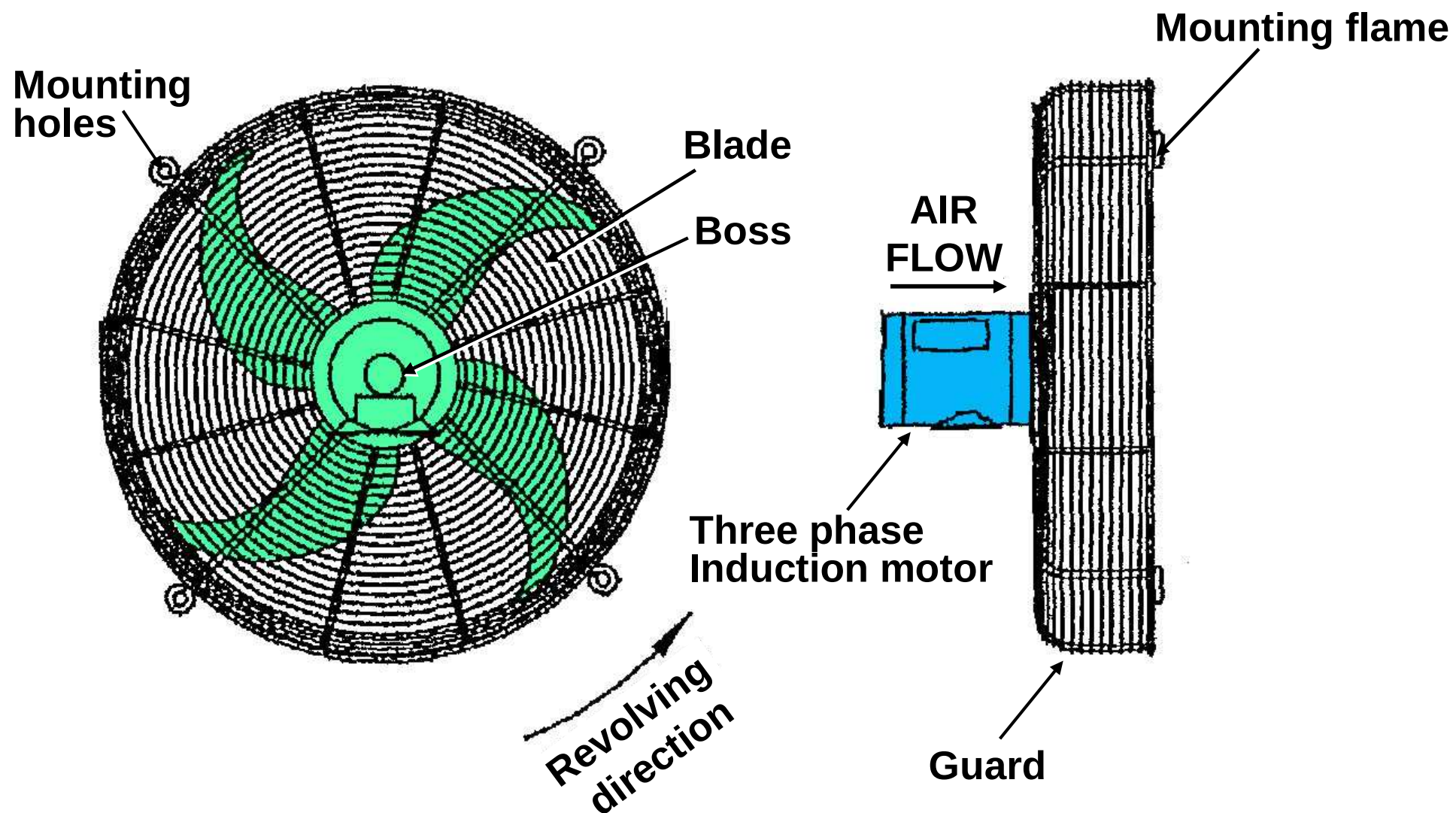
Type BMI-160



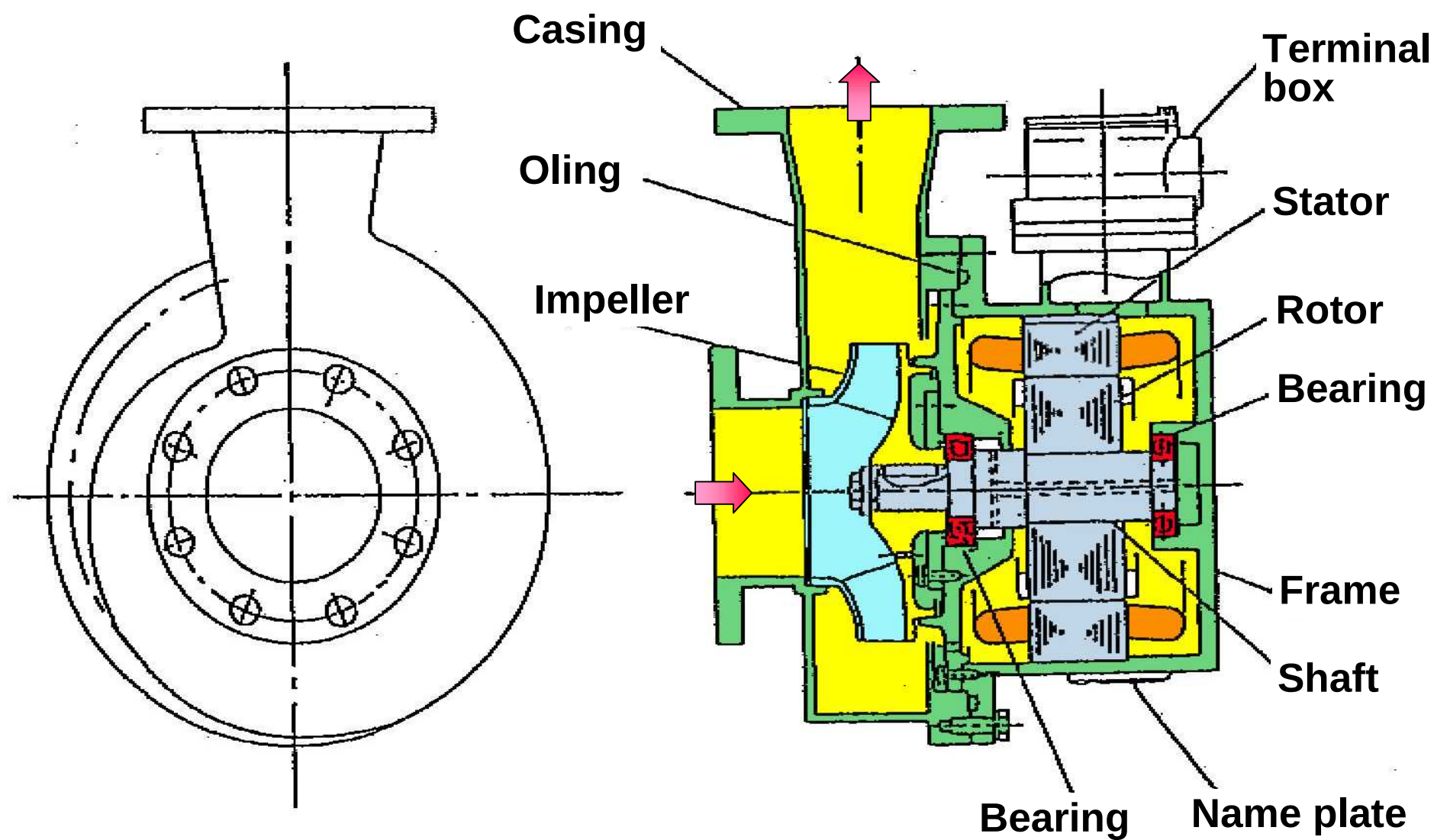
Type BM-80



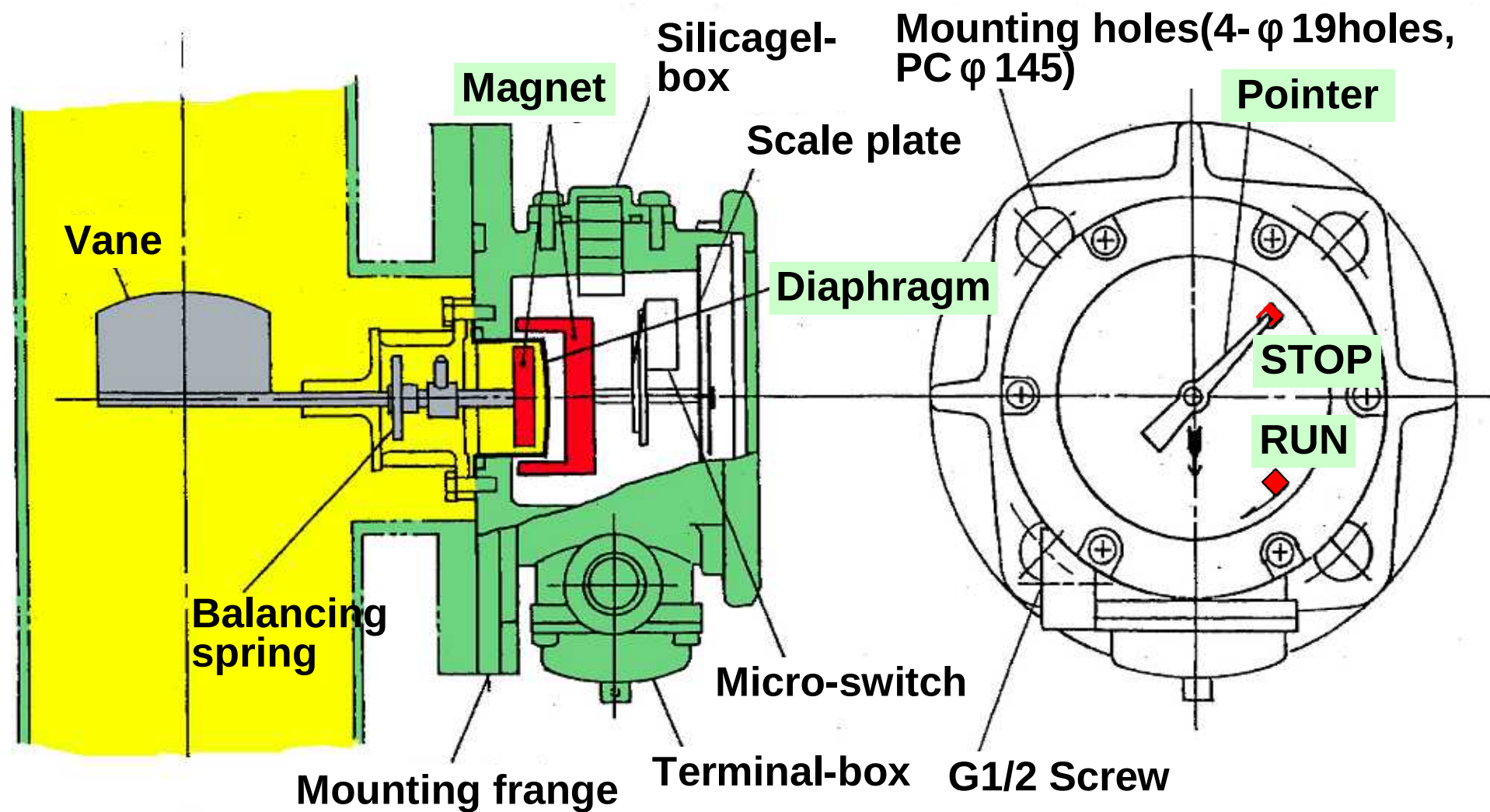
Cooling Fan (Outline)



Oil Pump



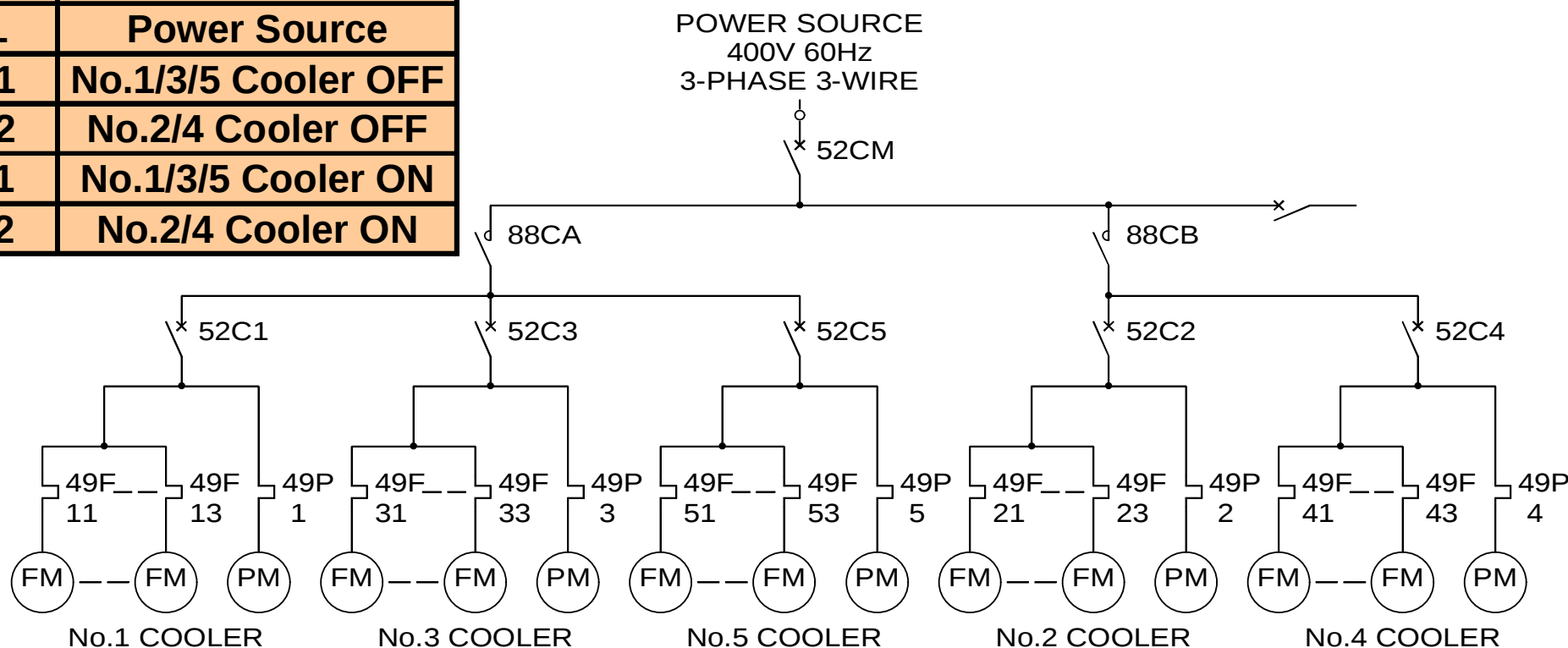
Oil Flow Indicator



Cooler Control (Gen. Step-Up TR)

Control SW		Operation of Unit Coolers
43C	"MANU"	No. 1/3/5 Coolers are controlled by control SW 3-88CA. No. 2/4 Coolers are controlled by control SW 3-88CB.
	"AUTO"	No. 1/3/5 Coolers are started when transformer is energized. No. 2/4 Coolers are started when winding temperature reached to 65 °C or oil temperature reached to 55 °C.

Lamp	Description
WL	Power Source
GL1	No.1/3/5 Cooler OFF
GL2	No.2/4 Cooler OFF
RL1	No.1/3/5 Cooler ON
RL2	No.2/4 Cooler ON

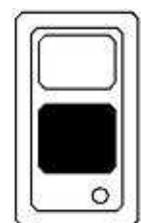


Cooler Control (Gen. Step-Up TR)

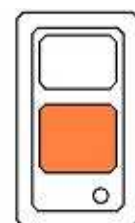
Arrangement of Control Devices

Fault Indicators: Total 20

- Buchholz relay
- Oil/Winding temp.
- Pressure relief device
- Cooler abnormal etc.



Normal



Faulty

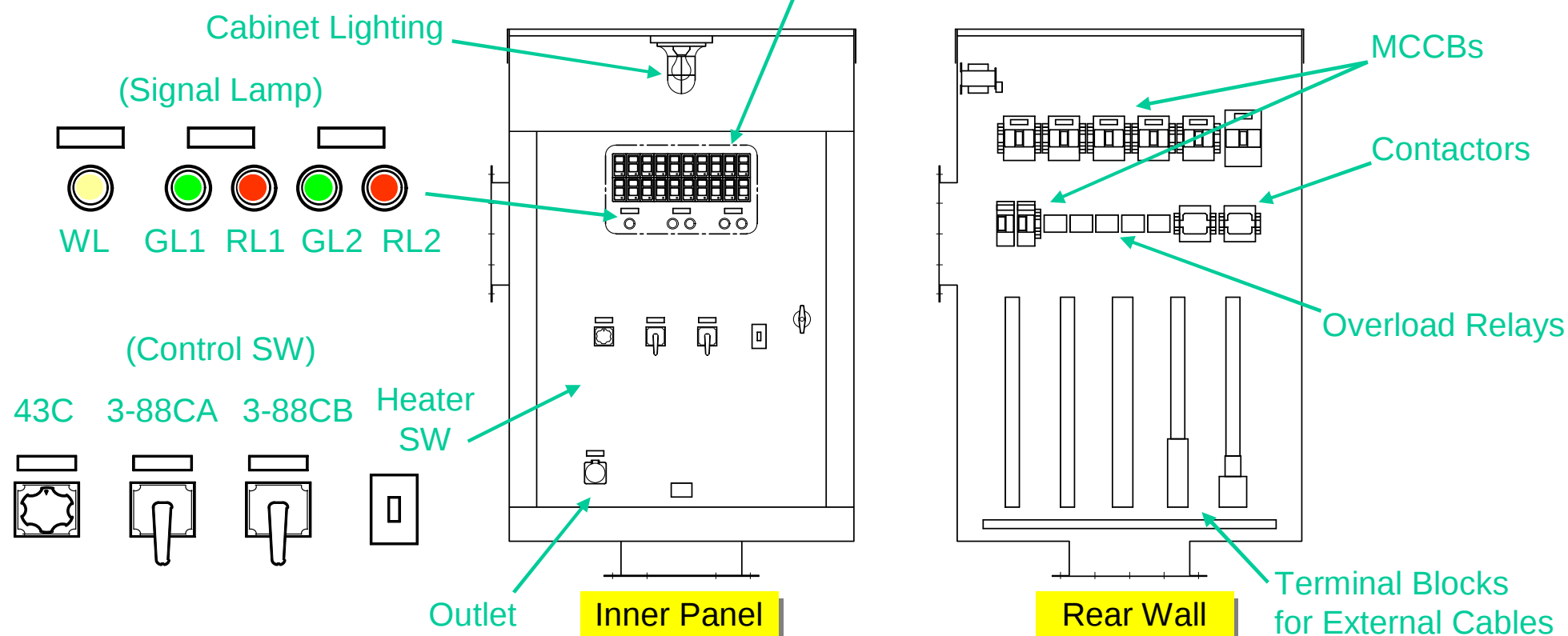


Continual Faulty

Card Holder

Display Panel

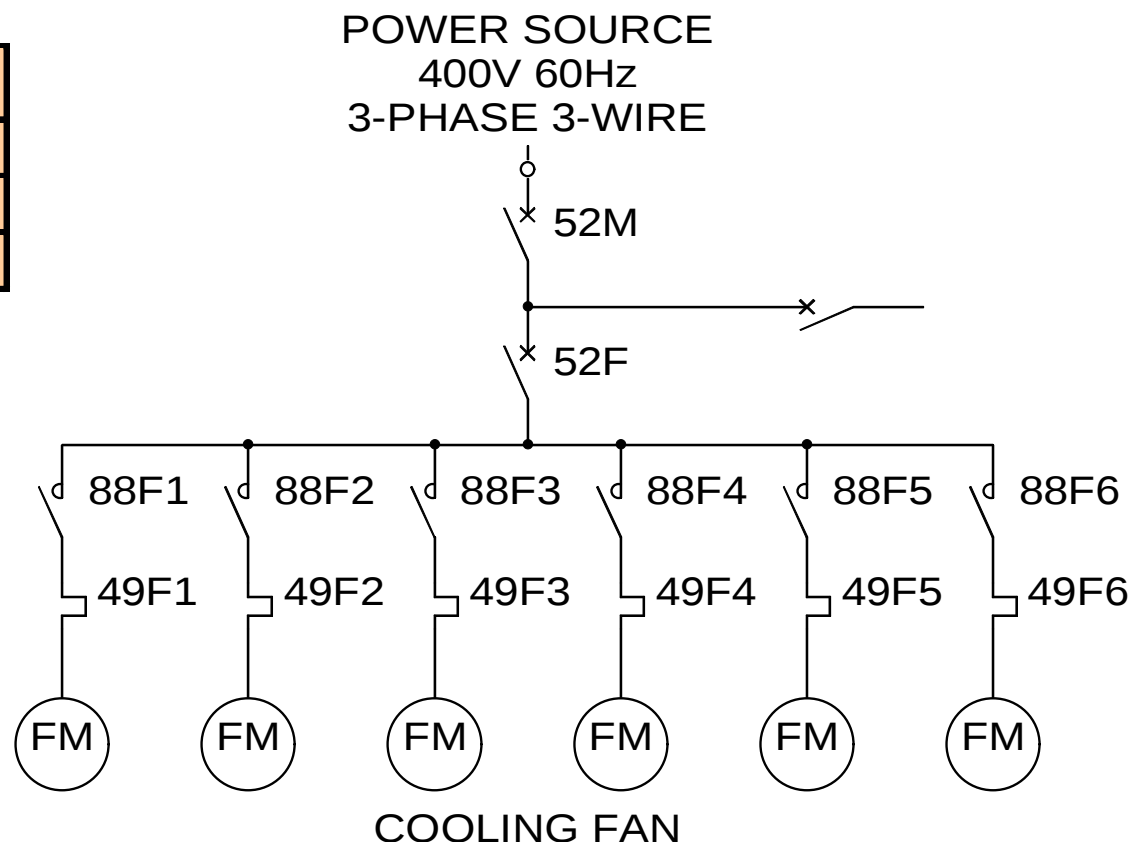
Reset Button



Cooler Control (Power Plant Aux. TR)

Control SW		Operation of Cooling Fans
43F	"MANU"	Cooling fans are controlled by control SW 3-88F.
	"AUTO"	Cooling fans are started when winding temperature reached to 75 °C or oil temperature reached to 65 °C.

Lamp	Description
WL	Power Source
GL	Cooling Fan OFF
RL	Cooling Fan ON

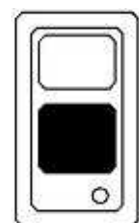


Cooler Control (Power Plant Aux. TR)

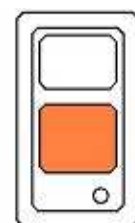
Arrangement of Control Devices

Fault Indicators: Total 16

- Buchholz relay
- Oil/Winding temp.
- Pressure relief device
- Cooler abnormal etc.



Normal



Faulty

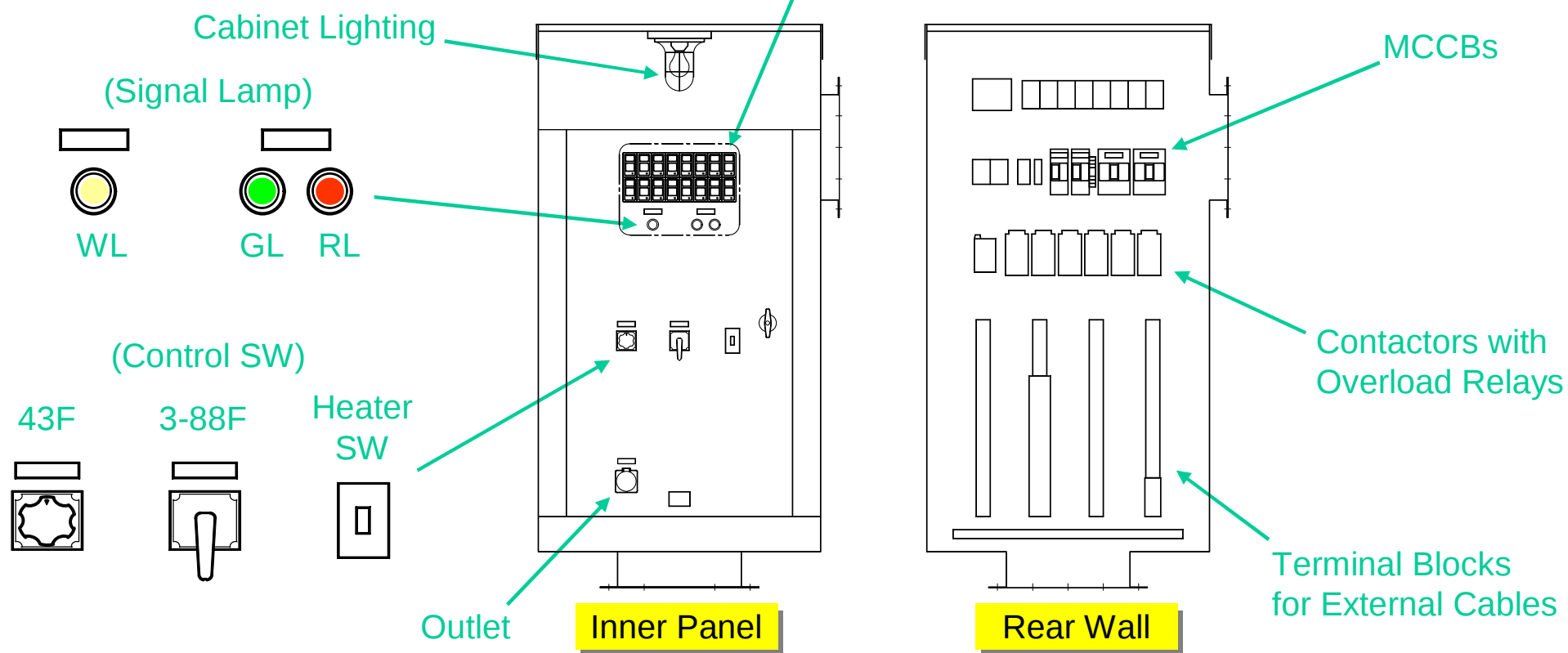


Continual Faulty

Card Holder

Display Panel

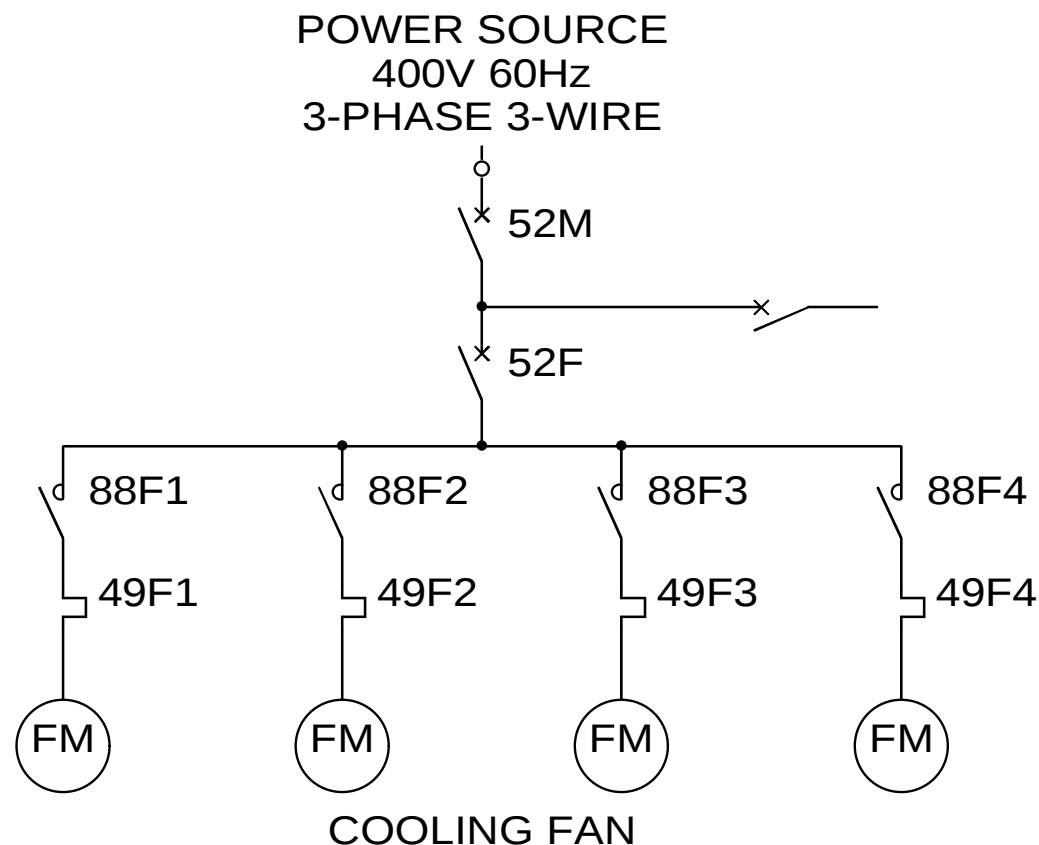
Reset Button



Cooler Control (RO Plant Aux. TR)

Control SW		Operation of Cooling Fans
43F	"MANU"	Cooling fans are controlled by control SW 3-88F.
	"AUTO"	Cooling fans are started when winding temperature reached to 75 °C or oil temperature reached to 65 °C.

Lamp	Description
WL	Power Source
GL	Cooling Fan OFF
RL	Cooling Fan ON

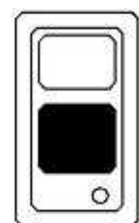


Cooler Control (RO Plant Aux. TR)

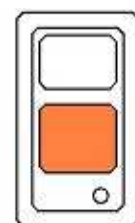
Arrangement of Control Devices

Fault Indicators: Total 16

- Buchholz relay
- Oil/Winding temp.
- Pressure relief device
- Cooler abnormal etc.



Normal



Faulty

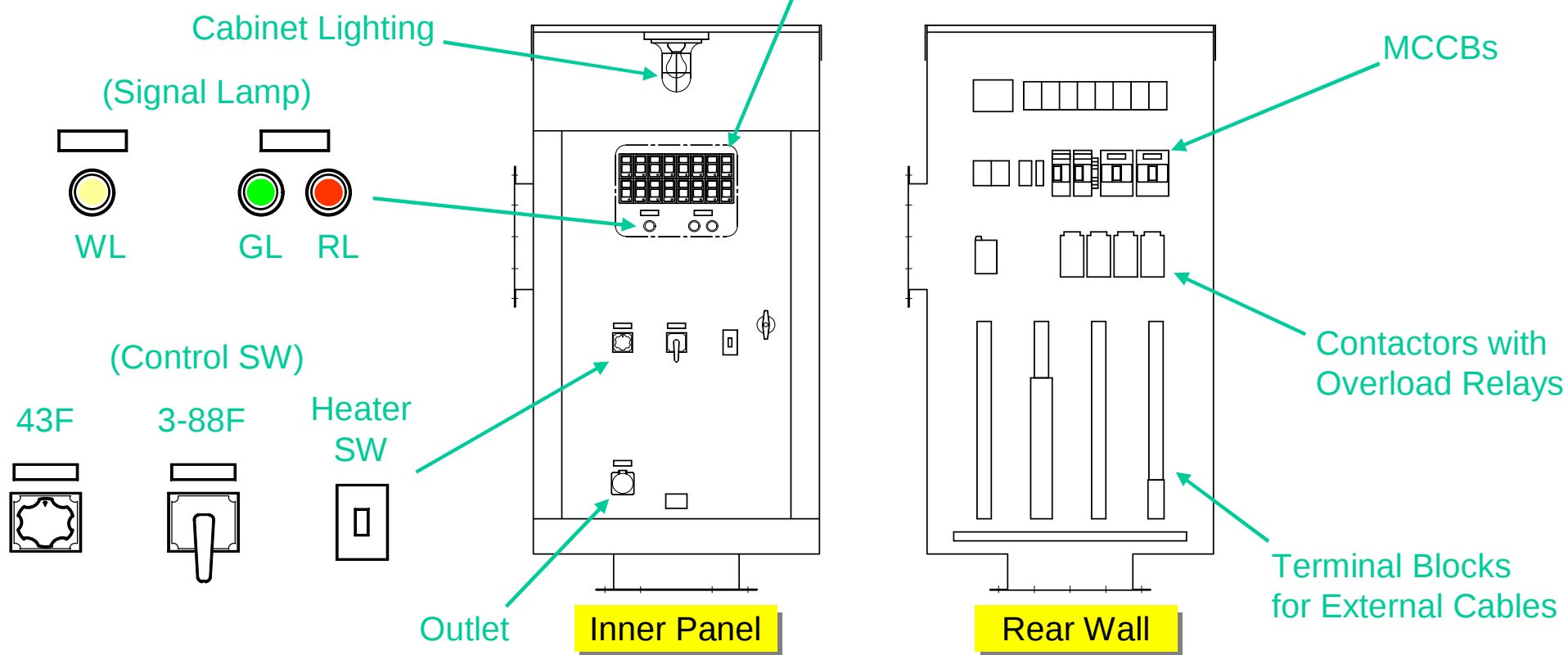


Continual Faulty

Card Holder

Display Panel

Reset Button

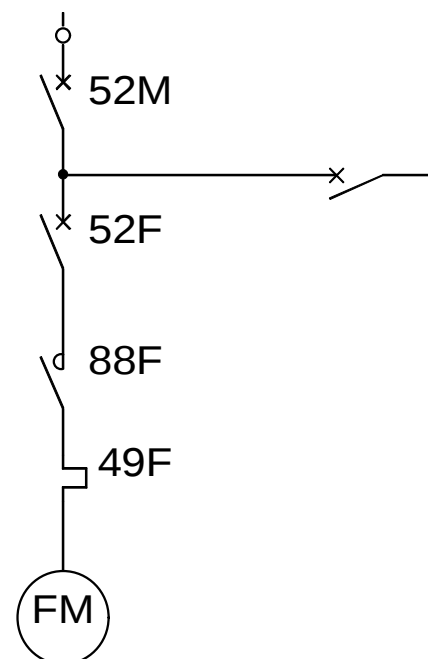


Cooler Control (Sea Water Intake Aux. TR)

Control SW		Operation of Cooling Fans
43F	"MANU"	Cooling fans are controlled by control SW 3-88F.
	"AUTO"	Cooling fans are started when winding temperature reached to 75 °C or oil temperature reached to 65 °C.

Lamp	Description
WL	Power Source
GL	Cooling Fan OFF
RL	Cooling Fan ON

POWER SOURCE
400V 60Hz
3-PHASE 3-WIRE



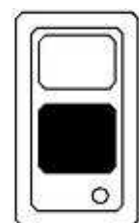
COOLING FAN

Cooler Control (Sea Water Intake Aux. TR)

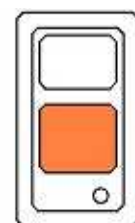
Arrangement of Control Devices

Fault Indicators: Total 16

- Buchholz relay
- Oil/Winding temp.
- Pressure relief device
- Cooler abnormal etc.



Normal



Faulty

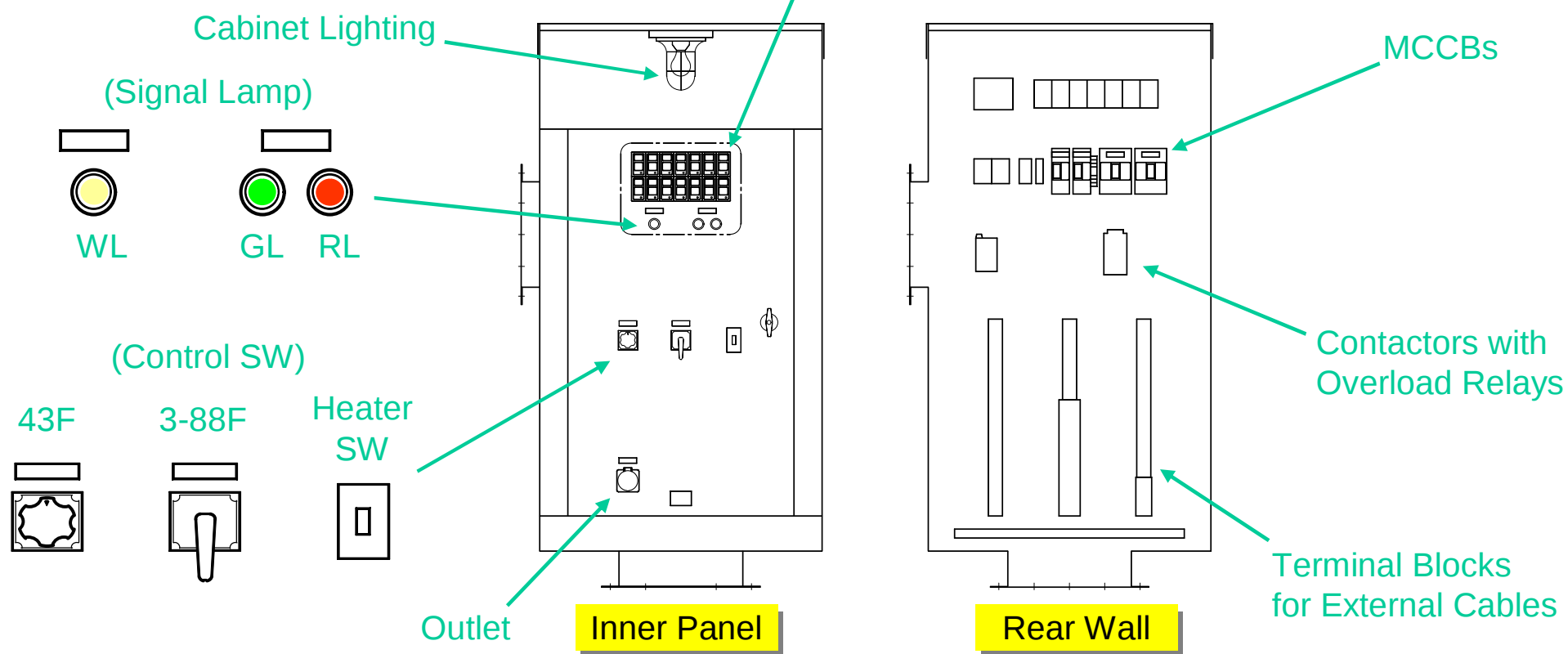


Continual Faulty

Card Holder

Display Panel

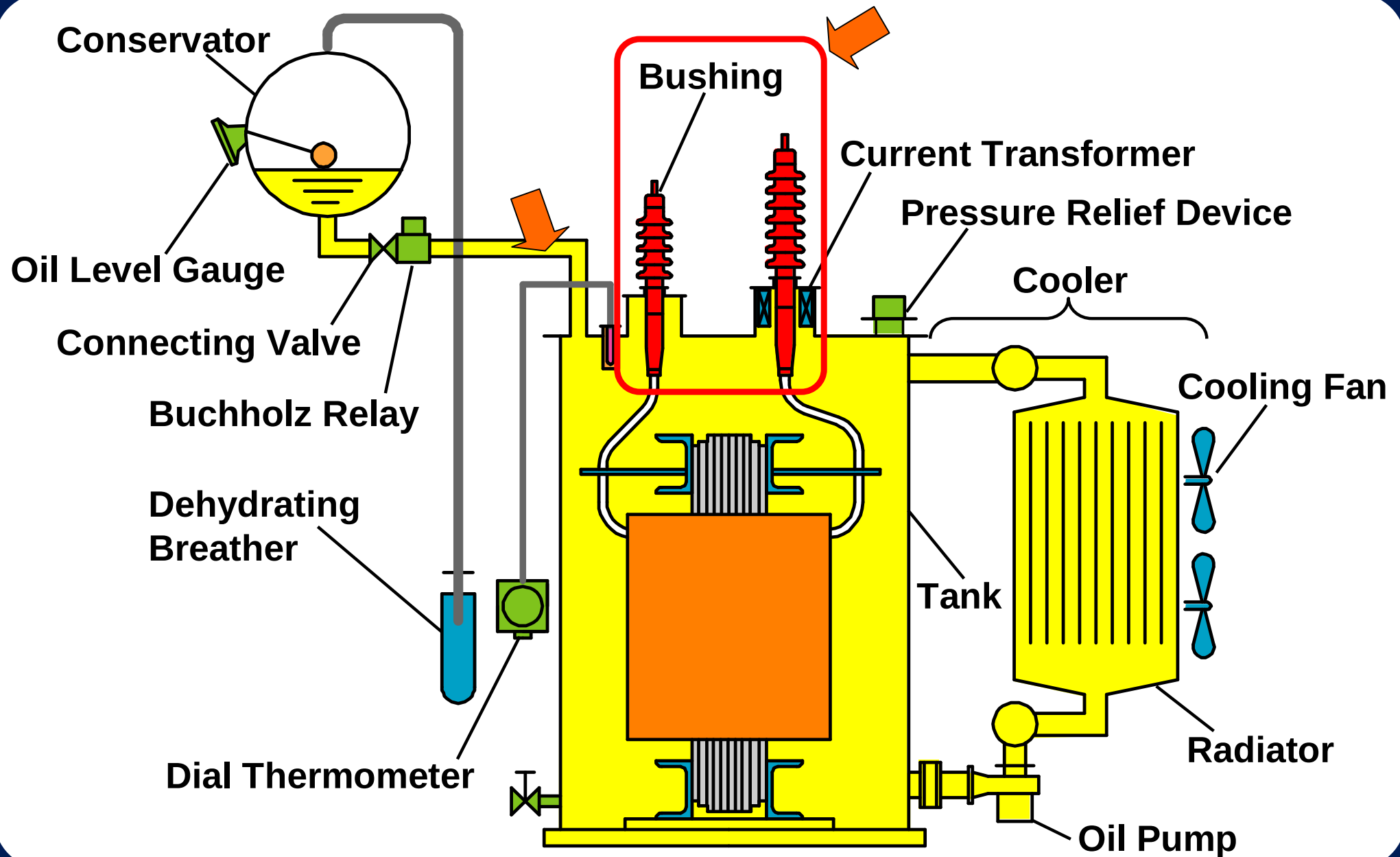
Reset Button



Agenda

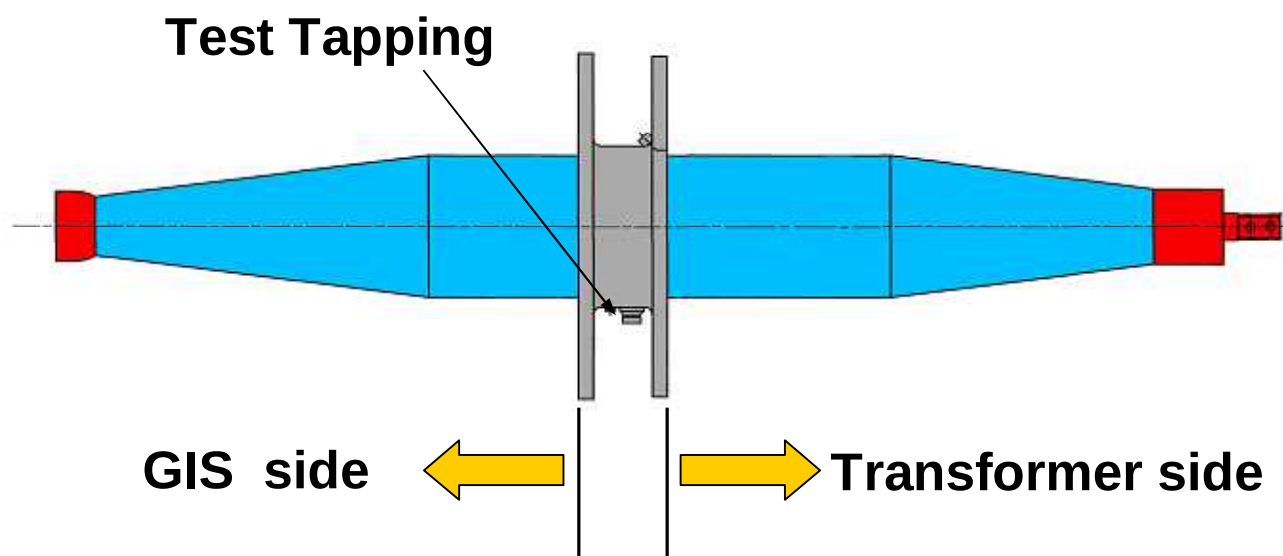
- General Explanation of Power Transformers
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External Construction : Oil Filled Transformer



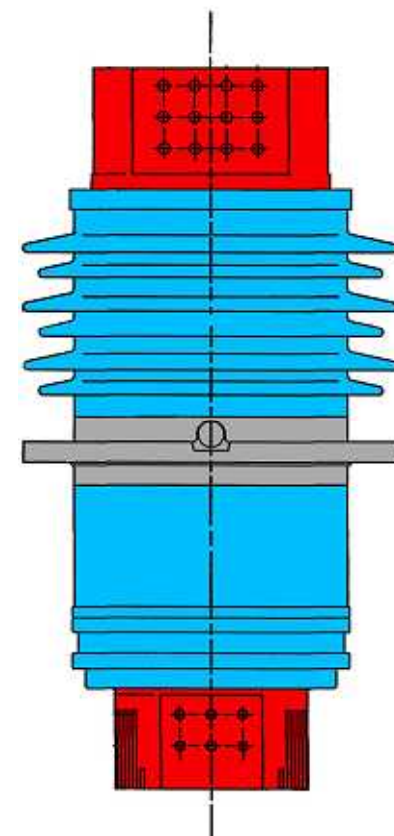
Bushing (1/2)

Condenser



HV of Gen. Step-up TR

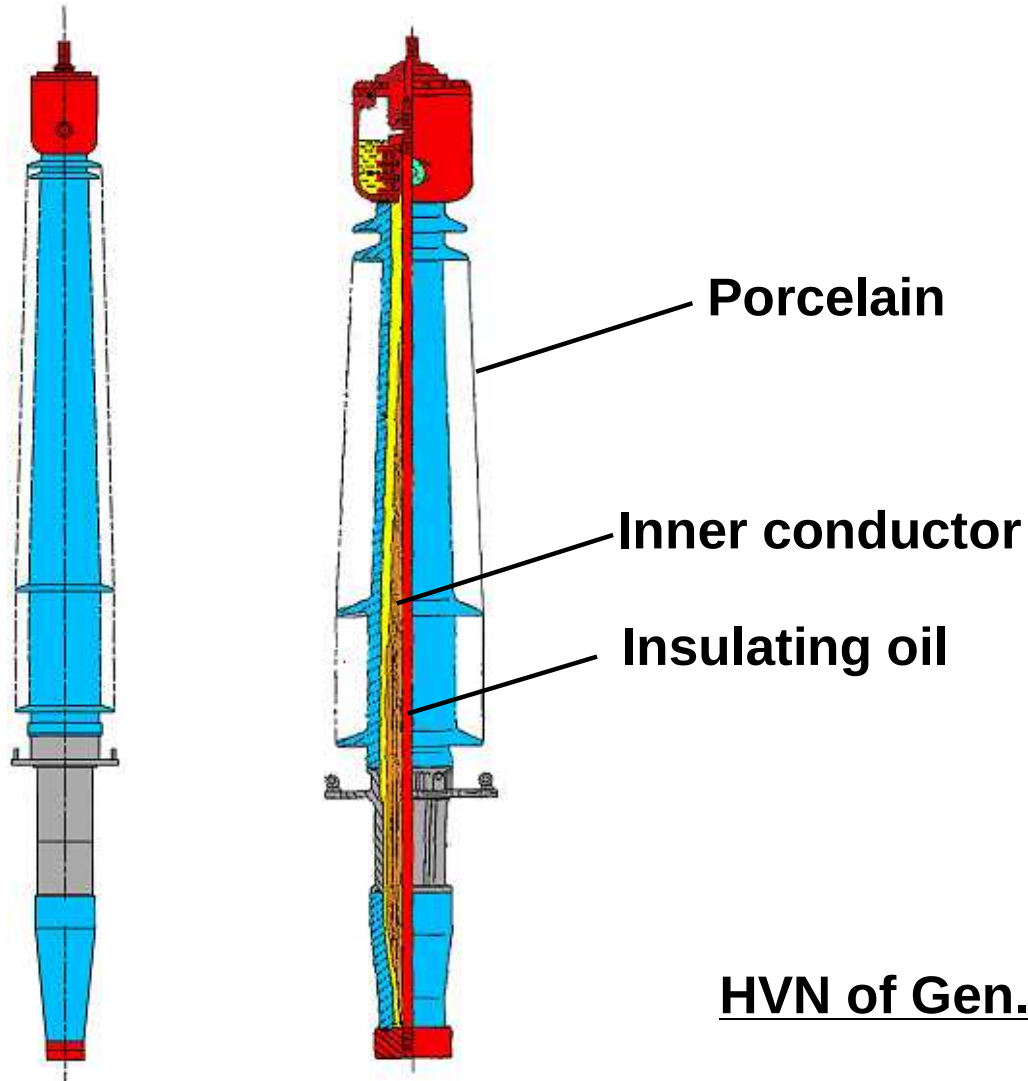
Oil Filled Porcelain



LV of Gen. Step-up TR

Bushing (2/2)

Oil Filled Porcelain

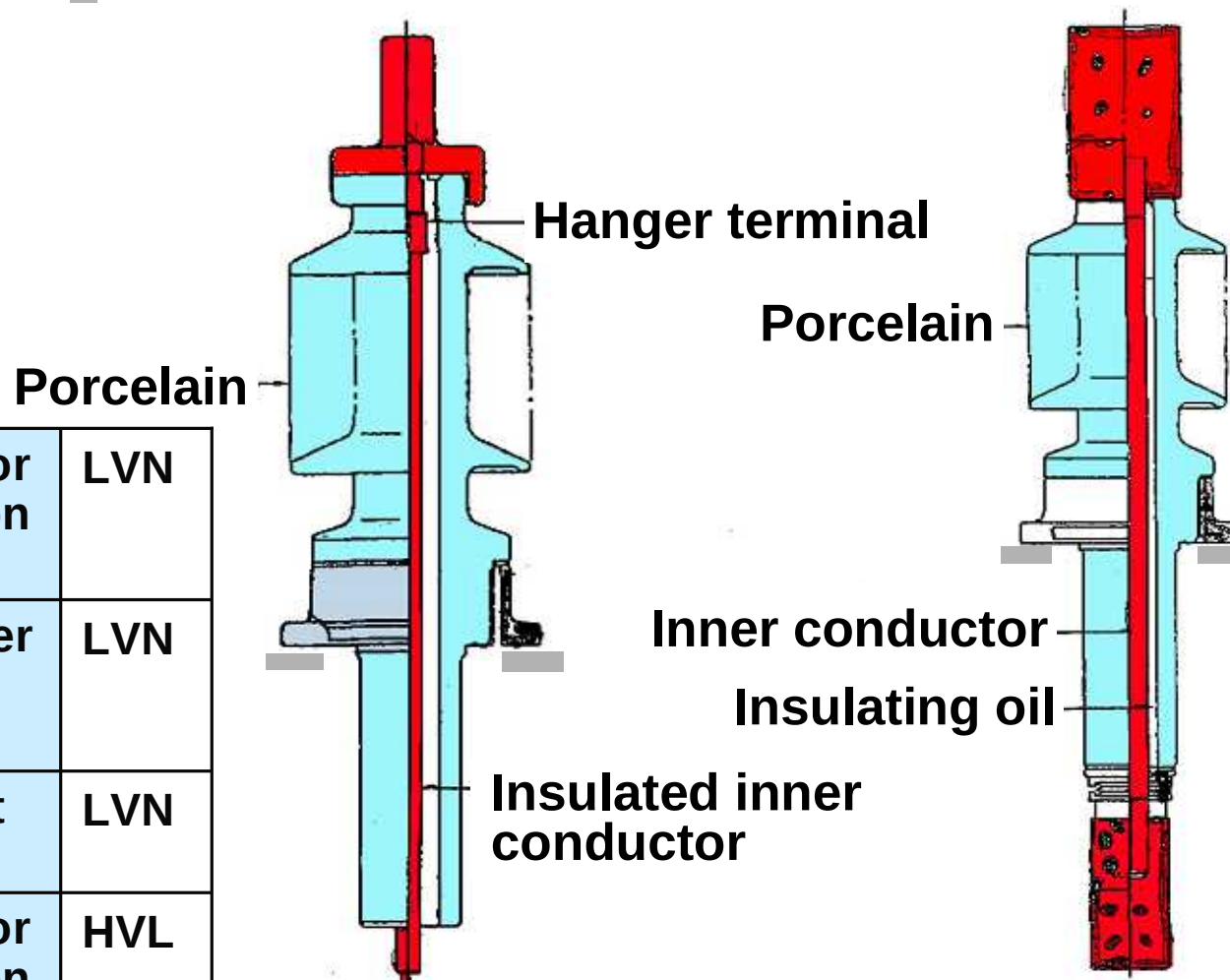


HVN of Gen. Step-up TR

Bushing (2/2)

Porcelain

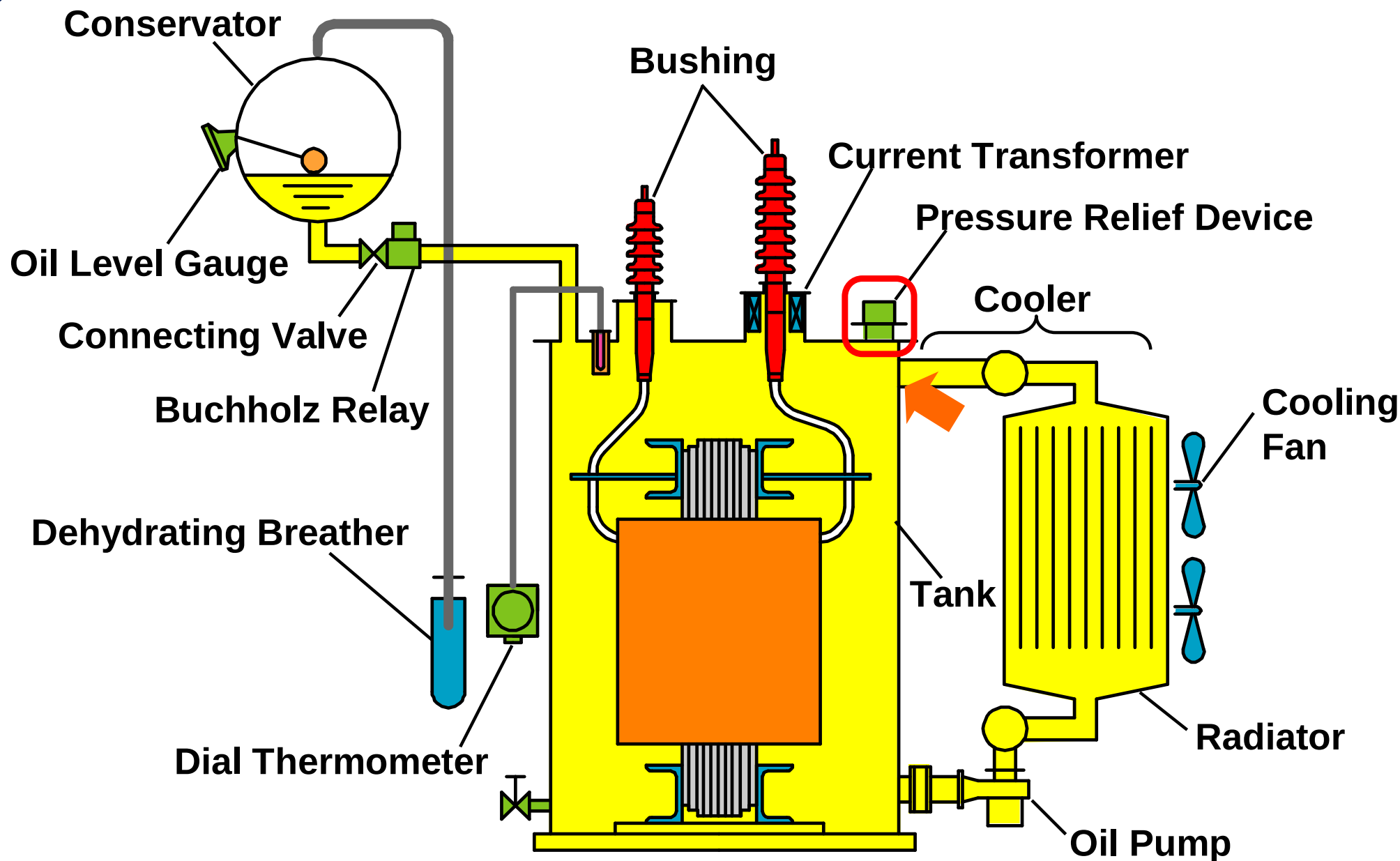
Oil Filled Porcelain



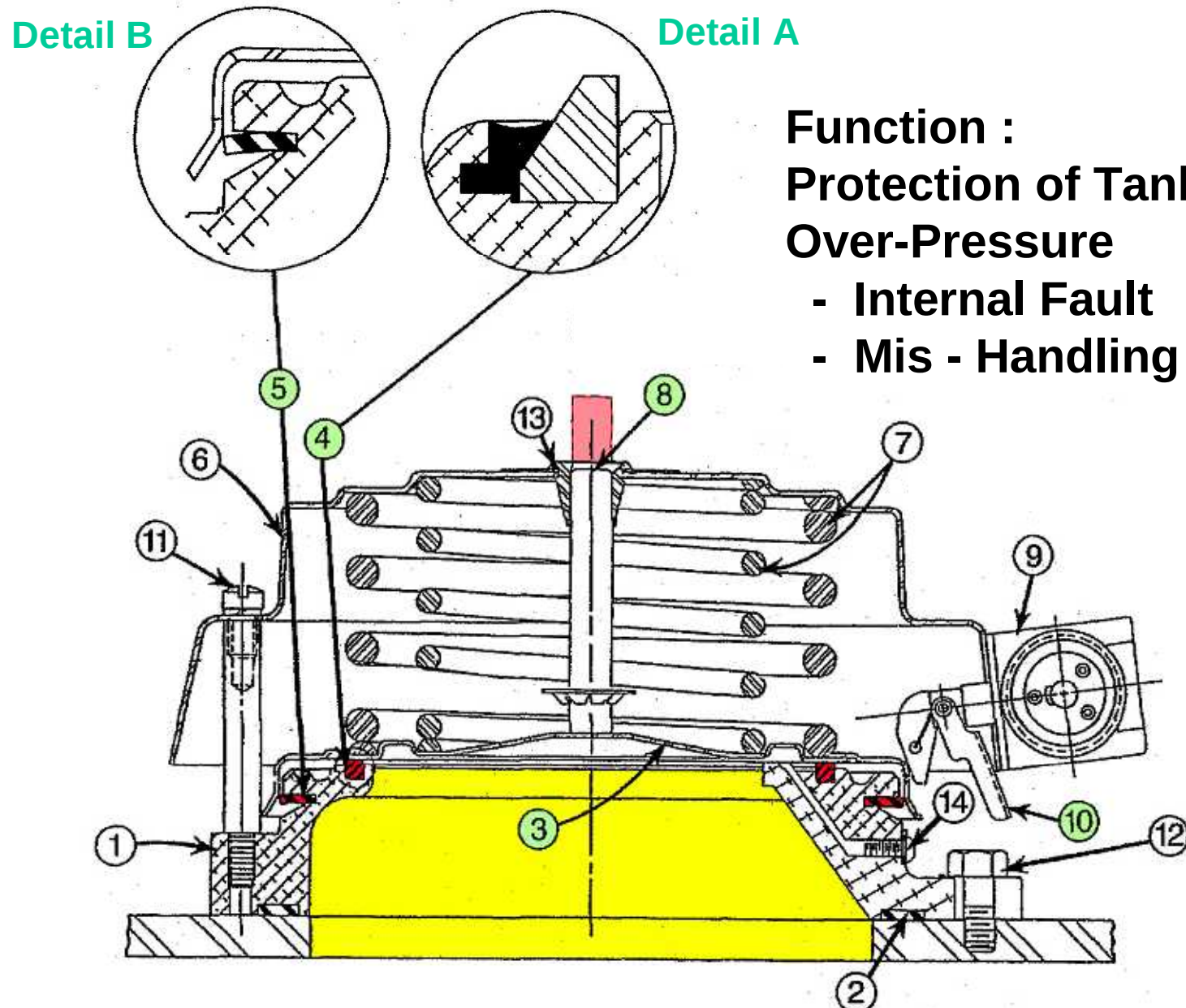
Generator Excitation TR	LVN
Sea Water Intake Aux. TR	LVN
RO Plant Aux. TR	LVN
Generator Excitation TR	HVL

Generator Excitation TR	HVL LVL
Sea Water Intake Aux. TR	HVL LVL
RO Plant Aux. TR	HVL LVN
Generator Excitation TR	LVL

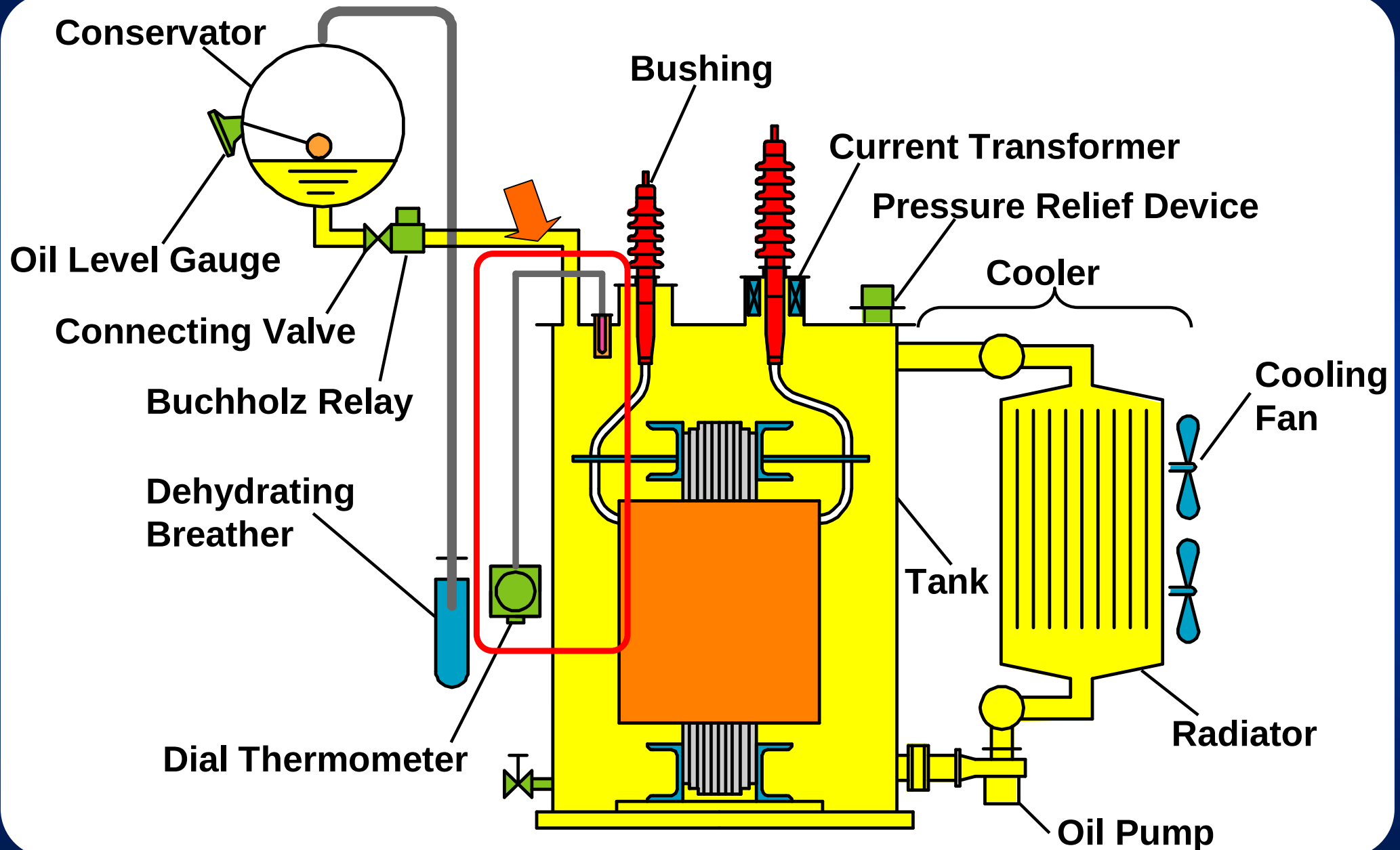
External Construction : Oil Filled Transformer



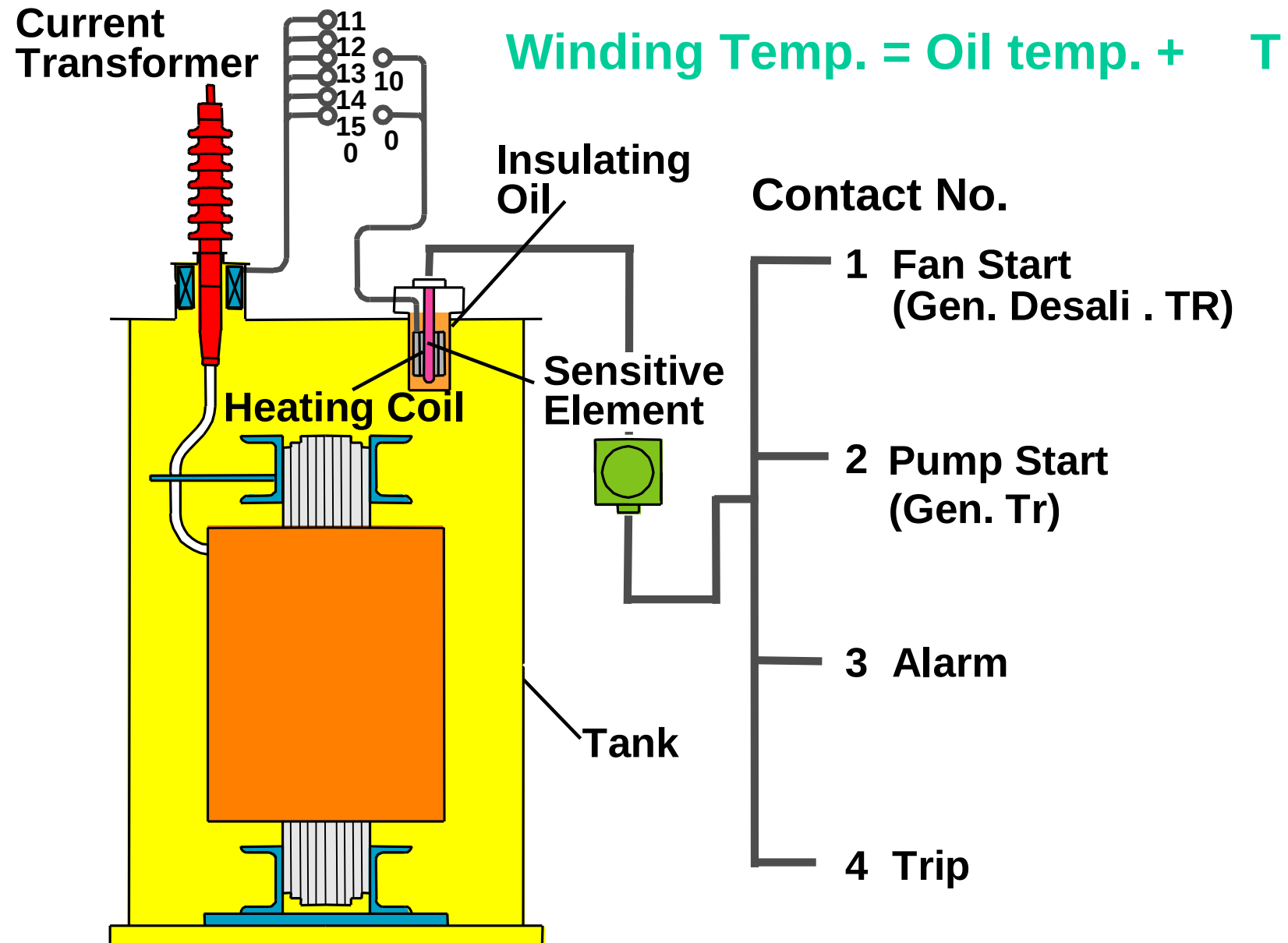
Pressure Relief Device [Qualitrol Type]



External Construction : Oil Filled Transformer

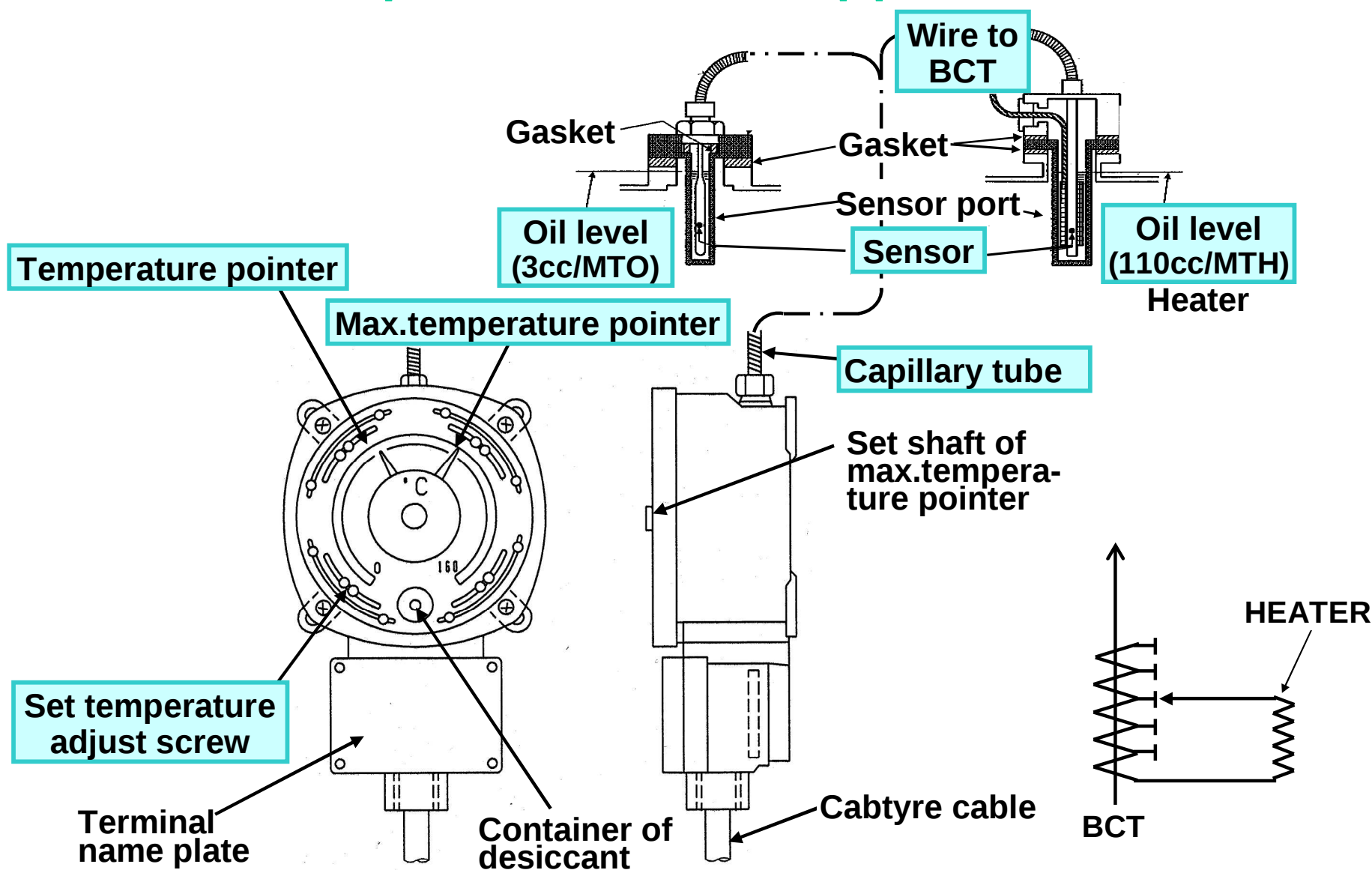


Winding Temp. Indicator

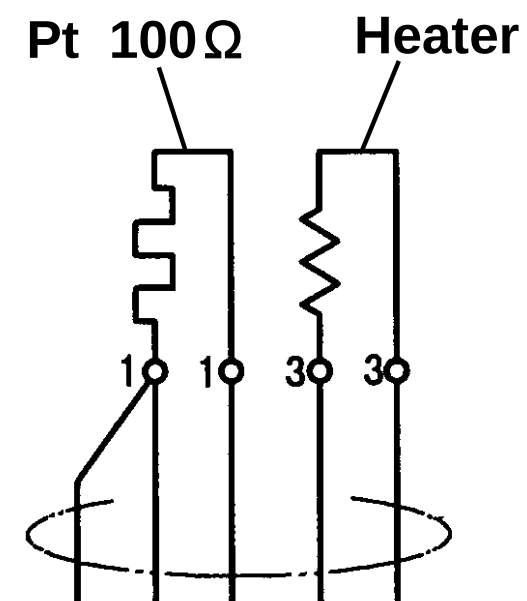
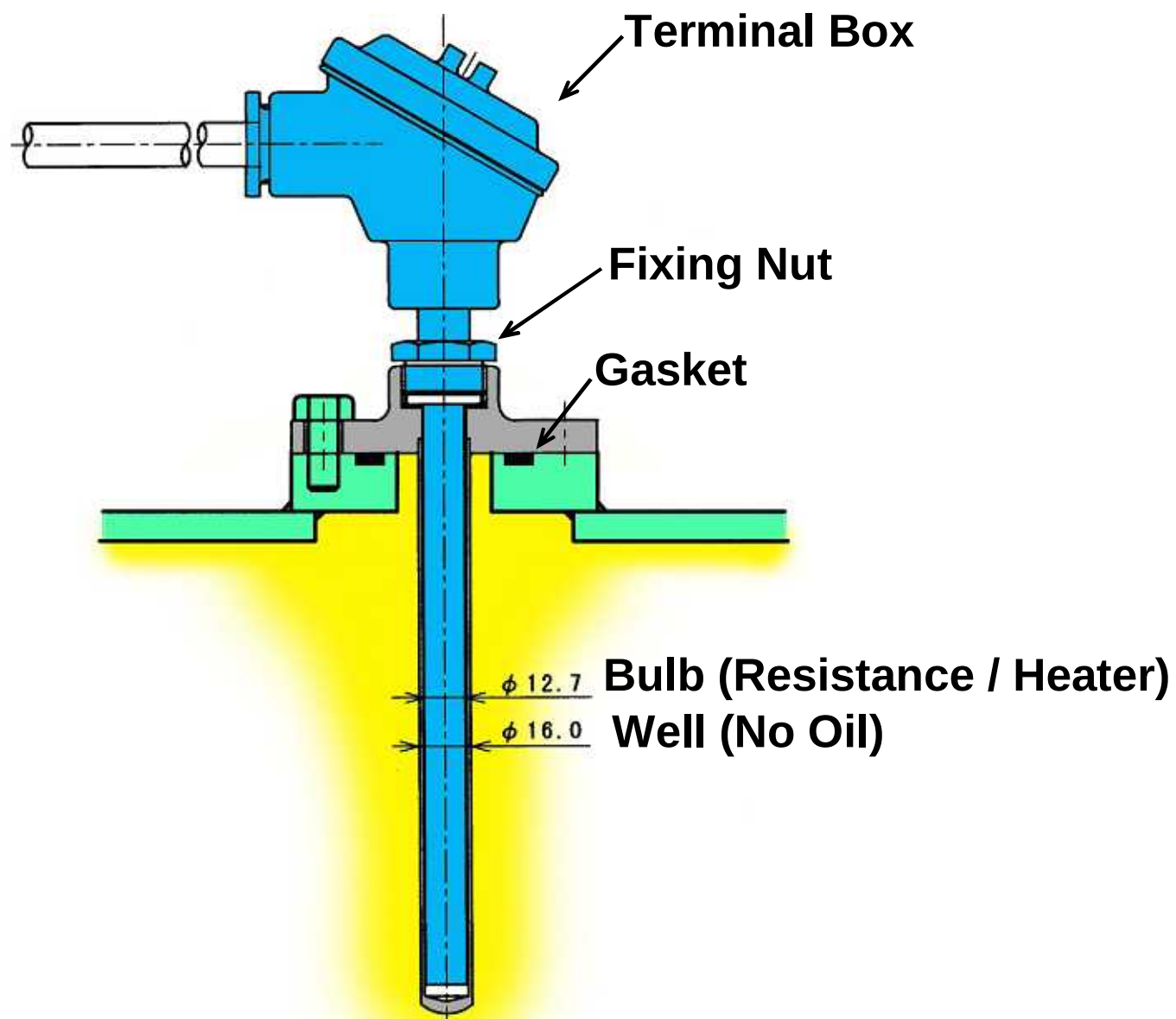


Oil and Winding Temp. Indicator

[OIL TEMP. INDICATOR] [WINDING TEMP. INDICATOR]



Resistance Element Pt 100 Ω (For Remote Winding Temp. Indicator)



Contact Setting Values of Protective devices

		Gen. Step-up TR	Power Plant Aux. TR	RO Plant Aux. TR	Sea Water Aux.TR	Gen. Excitation TR
Winding Temp. Indicator	C/ Control	#1 65	#1 75	#1 75	#1 75	-
	Alarm	#2 115	#2 115	#1 115	#2 115	#1 115
	Trip	#3 120	#3 120	#2 120	#3 120	#2 120
Oil Temp. Indicator	C/control	#1 55	#1 65	#1 65	#1 65	-
	Alarm	#2 90				#1 90
	Trip	#3 100				#2 100
Buchholz Relay	#1 Alarm	450cc gas accumulation				
	#2 Trip	100cm/sec.	50cm/sec. (Oil velocity)			
Pressure Relief Device	TR Tank	12PSI	12PSI	12PSI	12PSI	12PSI
	OLTC	20PSI	-	-	-	-
Oil Level Gauge	TR Tank	Low				
	OLTC	Low	-	-	-	-
Oil Flow Indicator	Low flow	600L/min	-	-	-	-
OLTC Protective Device	Oil flow speed	3.0m/s	-	-	-	-

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Daily Patrol

Appearance check:

Check, visually, the exterior of transformer whether any abnormality exists or not.

Noise and vibration:

Listen operation sound of transformer and cooler (oil pump & fan).

In case that any abnormal sound was found out, investigate the location and vibration.

Routine Maintenance Check List (1/3)

Description	Major Check Item (Check Method)	Check Reference	Action to be Taken at outage (If beyond acceptable limit)
1.Cleanliness	Dust on radiator (Visual)	No serious accumulation	Clean by water or air
	Rust on radiator (Visual)	No rust	Repaint
2.Unusual noise and vibration	Fans, pumps & oil pipes, etc. (Visual, audible & touching)	Not abnormal	Tighten loose bolts. Replace bearings of noisy fan.
3.Temperature	Winding & Oil temperature (Read & record and compare with previous	Abnormally high or low considering load current & ambient temp.	Check cooling system is functioning in normal. Check temperature indicator itself. Check heater of WTI

Routine Maintenance Check List (2/3)

Description	Major Check Item (Check Method)	Check Reference	Action to be Taken at outage (If beyond acceptable limit)
4. Oil leaks	Oil filled compartments and joints(Visual)	No leakage	Exchange gasket. Adjust oil level (If necessary)
5. Oil level	Oil level gauge (Read & record)	Oil level-oil temp. curve (See page-96)	Check actual oil level by vinyl hose. Check oil level gauge & rubber cell. Check seal of OLTC chamber. Adjust oil level. (if necessary)
6. Silica-gel breather	Color of silicagel. Breathing action in oil pot (Visual)	Blue silicagel, clean & clear oil,breathing action is normal.	If two thirds of total become pink, exchange with new one or dry them. Exchange silicon oil. Clean filter in oil pot.



Routine Maintenance Check List (3/3)

Description	Major Check Item (Check Method)	Check Reference	Action to be Taken at outage (If beyond acceptable limit)
7. Buchholz relay	Gas accumulation in relay (Visual)	No gas accumulation	Analyze gas. Analyze dissolved gas in oil, and investigate the reasons.
8. OLTC	Oil level (Read & record)	Oil level-oil temp. curve (See Page-96)	Check the seal of OLTC chamber. Adjust oil level to normal. (if necessary)
	Silicagel breather: Same as to item-6 above. (Visual)		
9. OLTC operation mechanism	Tap position (Read and record) Tap change indication	-Read, record and compare with previous data. If operation time is extremely many or few, Investigate reason such as actual voltage variation, sensitive range of voltage relay. -Pointer must be within center zone	

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Outage Maintenance Check List (1/8)

Description (Maintenance Freq.)	Major Check Item	Check Reference
	Check Method	Action to be Taken (if beyond acceptable limit)
1. Breather silica Gel (Every 6 months)	Moisture contamination	Normal silica gel color is blue. Pink color signifies it has moisture
	Visual	Replace the silica gel if more than two third of it has turned into pink
2. Insulating oil (Once a year)	Dielectric strength	Main tank : More than 40kV OLTC tank : More than 30kV
	Oil tester (Sphere electrode) IEC pub.60156 or equivalent	Perform oil filtration
	Moisture content	Main tank : Less than 30ppm OLTC tank : Less than 40ppm
	Karl-Fischer Method ASTM-D1533	Perform oil filtration

Outage Maintenance Check List (2/8)

Description (Maintenance Freq.)	Major Check Item	Check Reference
	Check Method	Action to be Taken (if beyond acceptable limit)
2. Insulating oil (Once a year)	Power factor (Tan d) & resistivity	Tan d: Less than 0.5% Resistivity: More than $1E^{13}$
	IEC pub.60247 or equivalent	Perform oil filtering & degassing. If it can not be improved, exchange with new oil is preferable.
	Acidity	Acidity: <0.2mg/KOH/g
	IEC Pub.60296 or equivalent	Acidity: 0.2 ~ 0.4mg/KOG/g: Filter or replace oil at earliest opportunity Acidity: More than 0.4mg/KOH/g: Filter immediately
	Dissolved gas analysis	Refer to page- 97 & 98
	Analyze by taking oil sample IEC pub 60567 or equivalent	Perform internal inspection

Outage Maintenance Check List (3/8)

Description (Maintenance Freq.)	Major Check Item	Check Reference
	Check Method	Action to be Taken (if beyond acceptable limit)
3. Fan and Oil Pump motors (Once every 2 years)	Insulation resistance	Fan motor : > 1 MΩ Pump motor : > 2 MΩ
	Measure with 500V Megger	Dry out interior of the fan motors
	Casing temperature	Fan motor : Amb. Temp. +40 Oil Pump : Oil Temp. +10
	Measure by thermometer	- Check motor insulation resistance - Check motor current of each phase to ensure there is no imbalance
4. Control panel, terminal box and cables (Once a year)	Water tightness	- No seepage of water
	Visual	- Replace worn out rubber gaskets

Outage Maintenance Check List (4/8)

Description (Maintenance Freq.)	Major Check Item	Check Reference
	Check Method	Action to be Taken (if beyond acceptable limit)
4. Control panel, terminal box and cables (Once a year)	Tightness of terminal connections	- Not loosened
	Visual and touch	- Retighten
	Switch, lamp and alarm function	- No malfunction
	Check with schematics	- Replace faulty parts
	Connection cables IR	- Minimum 2 Meg Ohm - No abrasion or crack
	Measure with 500V megger Visual	- Dry out and retest - Replace damaged cable
5. Protective relays (Once every 2 years)	Insulation resistance	- Minimum 2 Meg Ohm
	Measure with 500V megger	- Dry out any dew on the terminals
	Connections	- No sign of overheating
	Visual	Clean and retighten connections



Outage Maintenance Check List (5/8)

Description (Maintenance Freq.)	Major Check Item	Check Reference
	Check Method	Action to be Taken (if beyond acceptable limit)
5. Protective relays (Once every 2 years)	Operational tests	Smooth operation and contact closing
	Operation	Investigate cause and rectify
6. Windings (Once every 2 years)	Insulation resistance (Use a 2000V Megger)	Refer to Page-95
	Measure between : -HV and ground -LV and ground -HV and ground	Determine the cause of low IR value Clean transformer bushing if necessary
7. Conservator (When oil level is abnormal)	Rubber bag	No damage
	Visual	Replace
8. Radiator (Once every 6 months)	Dust, rust and paint	No accumulation of dust. No peeling of paint or rust
	Visual	Clean by washing. Repaint

Outage Maintenance Check List (6/8)

Description (Maintenance Freq.)	Major Check Item	Check Reference
	Check Method	Action to be Taken (if beyond acceptable limit)
9. OLTC (Once a year)	Protective relay	Contacts operate
	Test push button	Repair/replace
10. Motor Drive Unit (Once a year)	Water-proof of housing	No water in housing
	Visual	Replace door gasket
	Function of space heater	Functioning
	Supply power	Remedy or replace
	Condition of equipment	No abnormality
	Visual	Remedy or replace
	Step-by-step operation	Stop operation after one tap changing
	Keeping Switch-ON	Investigate and remedy

Outage Maintenance Check List (6/8)

Description (Maintenance Freq.)	Major Check Item	Check Reference
	Check Method	Action to be Taken (if beyond acceptable limit)
10. Motor Drive Unit (Once a year)	End position switch	No operation
	Switch-ON toward passage direction	Investigate and remedy
	Protective device against passage of position	Protective device operate
	Turn by hand crank toward passage	Investigate and remedy

Outage Maintenance Check List (7/8)

Lift-up Inspection of OLTC Diverter Switch (DIV-SW)

Important:

- Lift-up inspection of OLTC diverter switch must be done under supervising of Qualified and MR trained personnel or MR Technical Service.
- Permissible exposing time of DIV-SW in atmosphere is less than 8 hours.

Description	Major Check & Maintenance Item	Reference
OLTC Type R III 1200Y (Generator Step-up Transformer)	1) Cleaning of DIV-SW, SW compartment, conservator 2) Changing of SW oil 3) Checking of DIV-SW, SW compartment, conservator 4) Measurement of contact wear 5) Measuring of transition resistance 6) Checking protective relay, shaft, drive unit, etc.	1) Inspection Frequency: 80,000 operation times or 7 years (whichever comes earlier) 2) DIV-SW has to be replaced if operation times exceed 800,000. 3) Tap Selector is generally maintenance free, however, contact with MR Technical Service if number of operation exceed 800,000 times.

Outage Maintenance Check List (8/8)

Lift-up Inspection of OLTC Diverter Switch (DIV-SW)

Description	Major Check/Maintenance Item	Reference
OLTC Type R III 1200 (Generator Transformer)	-The same items as to above-	1) Inspection Frequency: 60,000 operation times or 7 years (whichever earlier) 2) DIV-SW has to be replaced if operation times exceed 800,000. 3) Tap Selector is generally maintenance free, however, contact with MR Technical Service if number of operation exceed 800,000 times.

Guideline for Parts Replacement(1/2) (Expected Life of Parts)

Material & Parts	Expected Life	Remarks
*Bearings of oil pump	Approx. 10 years	When abnormal noise would be found out.
*Bearings of fan motor	Approx. 3-5 years	When abnormal noise would be found out.
*Protective relays	Approx. 10 years	When abnormal function would be found out.
Gaskets	Approx. 10 years	When oil leakage would be found out.
*Rubber bag	Approx. 15 years	When damage of rubber bag would be found out.
Paint	Approx. 5 years	Paint on radiator is very important. (thin steel plate)
*OLTC diverter SW	-	Depending on results of periodical inspection.(contact wear, resister, insulation material, etc.)

Note for asterisk marks (*)

Before replacing the parts with asterisk mark, please also prepare the sealing gaskets for reassembly.

Guideline for Parts Replacement(2/2) (Expected Life of Parts)

Material & Parts	Expected Life	Remarks
Motor drive ED - Door gasket	Approx. 10 years	When deterioration of gasket would be found out.
- Other electrical parts	Approx. 10 years	When abnormal function would be found out.
Cooler control panel - Door gasket	Approx. 10 years	When deterioration of gasket would be found out.
- Other electrical parts (Except lamps)	Approx. 10 years	When abnormal function would be found out.

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Trouble shooting(1/2)

Fault	Possible Cause	Remedial Action
Oil and/or winding temp. (High)	Overloading	Reduce load
	Inefficient cooler units: - Dust & foreign material on radiator - Faulty operation of fan & pump	- Arrange to clean coolers - Remedy or replace them
	Faulty operation of defective thermometer	If thermometer indication is incorrect: - Check/adjust oil level in sensor pocket - Replace with new thermometer (if necessary)
Reduced oil flow (Not reach to "RUN" position)	Radiator valves shut off	Open the valves
	Oil pump tripped or stopped	Service the motor
	Power supply of oil pump motor (Reversed rotation)	Correct phase rotation

Trouble shooting(2/2)

Fault	Possible Cause	Remedial Action
Oil level (High or Low)	Shortage or excess of oil	Adjust oil level
	Oil leakage	Locate and repair leak
	Damaged rubber bag in the conservator	Replace rubber bag
	Seal between OLTC and transformer broken	Replace seal
Buchholz relay (stage I operates)	Gas formation (minor trouble in transformer) because of local heating or electric discharge	- Perform dissolved gas analysis - Perform internal inspection if necessary
Buchholz relay (stage II operates)	Sudden pressure rise in tank because of internal fault	Shut down and investigate the cause
Pressure release device operates	High tank pressure as a result of internal fault	Shut down and investigate the cause
OLTC protective relay	Fault in the diverter insert	Lift up inspection of DIV SW.
	Fault in the whole OLTC	Internal inspection of Tr.
	Malfunction of OLTC relay	Remedy or replace with new relay

APPENDIX