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TECHNICAL REPORT

AMENDMENT 1

Guidelines for operation and maintenance of line commutated converter (LCC) HVDC converter station

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GUIDELINES FOR OPERATION AND MAINTENANCE OF LINE COMMUTATED CONVERTER (LCC) HVDC CONVERTER STATION

AMENDMENT 1

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Amendment 1 to IEC TR 63065:2017 has been prepared by IEC technical committee 115: High Voltage Direct Current (HVDC) transmission for DC voltages above 100 kV.

The text of this Amendment is based on the following documents:

Draft	Report on voting
115/280/DTR	115/294/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Amendment is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications/.

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Add the following new Subclause 4.4.9 after the existing Subclause 4.4.8:

4.4.9 Fire protection system

4.4.9.1 Operating

a) Enable or disable the automatic function

The fire fighting system for converter transformers would be set to automatic mode when the converter transformer is energized so that in case of fire, the fire fighting system can take appropriate action automatically, e.g., spray water, foam or gas extinguishing agent.

In case of fire of thyristor valves, circulation fans should be stopped and smoke exhaust windows be closed automatically.

The fire fighting system can be set to manual mode when converter transformers and thyristor valves are deenergized and if the fire fighting system might malfunction during maintenance.

b) Activated remotely or locally

The fire fighting system can be activated remotely from an operator's workstation, or locally by opening the supply valve of the deluge systems. Appropriate safety measures shall be taken before approaching close to a transformer or valve hall that is on fire.

4.4.9.2 Monitoring from human-machine interface (HMI)

Check alarms from fire detection devices such as high-temperature sensors, ultraviolet flame detectors, and very early smoke detection apparatus.

4.4.9.3 Inspecting locally

Check the extinguishing agent supply pipes for leakage. Check if the valves are in the correct position.

4.4.9.4 Typical fault / alarm handling

a) Converter transformer fire fighting system activated

Check remotely through a video system or locally to confirm whether there is a fire. If there is a fire, make sure the converter transformers have been tripped, the firefighting system has been activated and the fire pumps are working correctly. Report to the local fire department or fire agent and ask for support.

For a 300 MW transformer with more than 100 tonnes of oil inside, it usually takes more than one hour to extinguish such a fire, with the fire fighting system continuously spraying the fire extinguishing medium at the required pressure and speed. So it is important that the converter station has adequate water, either from nearby rivers, or from the municipal water supply system, or from a reservoir at the station.

Besides keeping the Fire protection system working smoothly, operators on site can do some auxiliary firefighting work, such as to guide and assist external fire engines to extinguish the fire, to spray water to the transformer with fire hoses and fire hydrant, to seal cable trenches near the transformers with sand.

Special attention would be given to the sealing system for the converter transformer valve side bushings. If the sealing system catches fire, it is possible that high temperature fumes and the incomplete combustion transformer oil might access the valve hall from the broken sealing system, and spread fire into the valve hall.

b) Transformer protection trip

Check remotely through the video system or locally to confirm whether or not there is a fire. If there is a fire and the fire fighting system is not working, activate the fire fighting system remotely or locally, report to the local fire department and help to put out the fire.

c) Very early smoke detection apparatus alarm from valve hall

Since thyristor valves were built of material containing fire retardant elements, and adequate barriers and sealing materials were used to prevent fire propagation to adjacent modules and levels, it is usually much easier to put out a thyristor valve fire than a transformer fire.

If there is a very early smoke detection apparatus alarm, operators can confirm the presence of smoke, fire, or flash, either by video system or locally at the inspection corridor. If there is smoke, fire or flash, emergency stop the converter, isolate it from AC side, turn off the valve hall ventilation system and close the smoke exhaust window. Most likely the fire will extinguish automatically. Do not open the valve hall door and the smoke exhaust window until making sure the fire is completely put out.

In some applications, very early smoke detection apparatus or conventional smoke detectors send signals to other systems (valve hall ventilation system and HVDC control and protection system, etc.,) to initiate protective actions automatically such as shutting down the valve hall ventilation system and tripping faulted HVDC pole trip, etc.

d) Fire alarm from cables

As the insulation of power supply cables decreases, this can lead to a fire. In most cases the power supply cables and the signal or protection cables share the same cable trench or cable tray, so it is possible that protection devices will not work in this case and lead to an expansion of the failure scope. So sensors such as temperature sensing cables can be installed inside the cable trench. Once there is an alarm, operators can seal the cable trench with sand to prevent fire from spreading to other equipment.

Add the following new Subclause 5.2.5 after the existing Subclause 5.2.4:

5.2.5 Routine maintenance for Fire protection system

During normal operation, the following work needs to be carried out for the fire protection system:

a) Check the water supply pipes for leakage if the fire pump starts up too frequently;
b) Check the water level of the site reservoir every week;
c) Switching the redundant fire pumps every month to make sure both fire pumps are working normally and can set up pressure;
d) Organize at least one fire emergency drill per year.

Add the following new Subclause 5.3.8 after the existing Subclause 5.3.7:

5.3.8 Fire protection system

Under power outage, the following work can be done for the fire protection system:

a) Testing the fire detection device such as temperature sensing cables for transformers, very early smoke detection apparatus and ultraviolet flame detectors for the valve hall.
b) Checking the nozzles of the firefighting system whether or not clogging.
c) Fixing the pipe leakage, if any.
d) Fire extinguisher agent spray test once a year.
e) Foam effectiveness test every 4 years (for the premixed foam spray system only).
f) Nitrogen bottle pressure test (for the premixed foam spray system only).

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