Alstom/Areva HGF Dashpot Rebuild Process

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92nd International Conference of Doble Clients

AGENDA

- Background
- Initial breaker failure
- Immediate checks
- Decision making and prioritization
- Repairs performed
- Testing
- Conclusion

BACKGROUND

- Advisory issued in 2018 for checking oil level, confirming, and repairing if needed

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INITIAL BREAKER FAILURE

Areva HGF 1014
245kV, 2000A, 40kA
FKF 2-9 Spring Mech

- Operated with empty dashpot
  - Possibly many times
- P1 drive rod breaks in service upon close
- Upon trip P1 does not open, ***significant*** system impact
- Obvious from relay records, ductor that P1 had failed to trip

INITIAL BREAKER FAILURE

	Technical Enhancement Notification Grid Solutions	Report: HGF-001-SER Date: 23-03-2018 Category: Technical Enhancement

HGF-10X and HGF-10XX Circuit Breakers Dashpot Oil Level

PRODUCT LINE: Services

CATEGORY: ☒Technical Enhancement ☐New Services Introduction ☐End of Service/Support

Equipment Type

Dead-Tank Breaker type HGF 1000 series	Live-Tank Breaker type HGF 100 series
	

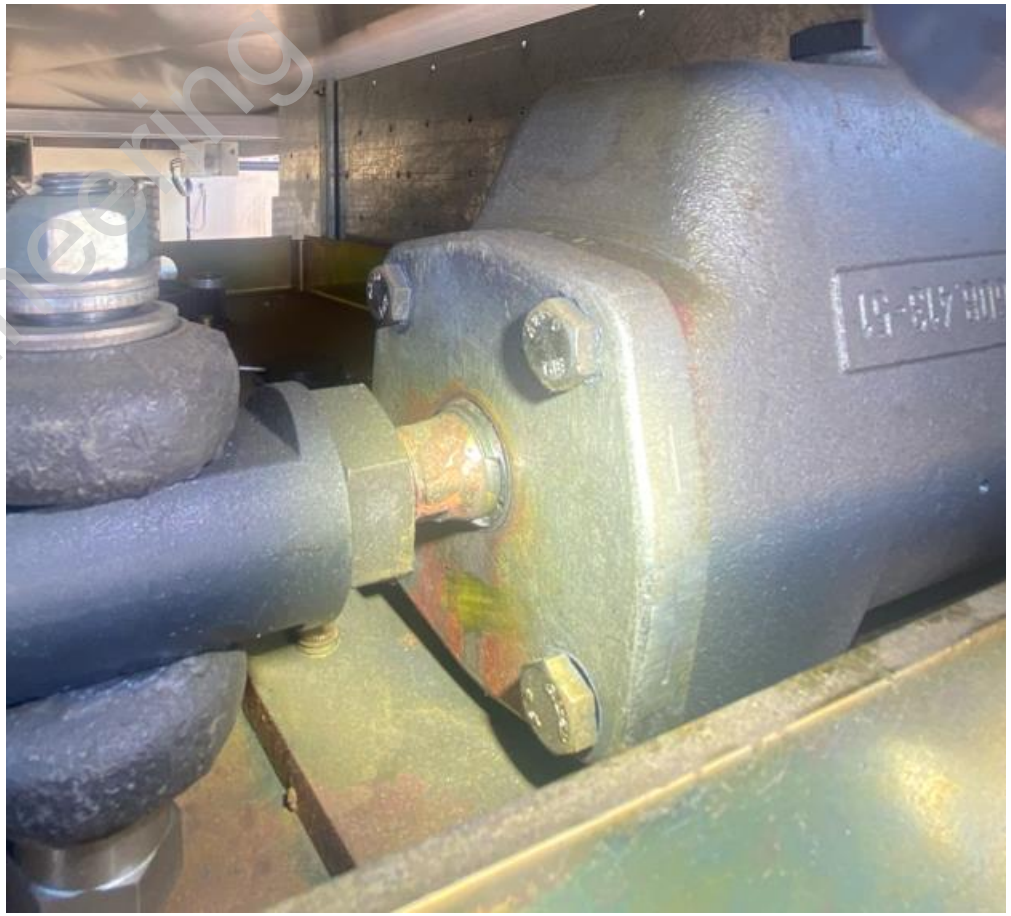
Purpose of this Document

The purpose of this document is to inform the users for the potential risk of operating the HGF 1000 and HGF 100 Series Breakers with low dashpot oil level and as such advise the importance of following the recommendations stated in this document. These 2 families of breakers are all equipped with the FKF2-x series mechanisms all using the same dashpot design.

Picture 7 : Minimum dashpot oil level

INITIAL BREAKER FAILURE

No oil in sight glass



Dried oil residue and cracked seals

INITIAL BREAKER FAILURE

Crank stop buried into casting 0.25” in open position

INITIAL BREAKER FAILURE

Significant metal shavings

Linkage bent and scraping housing

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IMMEDIATE CHECKS

- Check oil levels immediately!
- Use of formal substation maintenance bulletin
  - Short and long term use
- Completion documented, engineering tracked and monitor
- Get rebuild kits and oil on order, long lead times
- Discharge damaged breaker

IMMEDIATE CHECKS

- Most had acceptable oil level
- Post bulletin in cabinet
- Inspect in bi-monthly patrols
- End of action

IMMEDIATE CHECKS

- 10% had some deficiency
- **Low oil/signs of leakage**
  - Response:
    - Inspect crank stops
    - Inspect particle level in crank housing
    - Inspect linkage for visible issues
    - If no visible concerns, add oil, and get rebuild kit
      - Oil added via DGA syringe
      - Inspect bi-weekly initially
      - Rebuild as soon as practical

Low oil level

IMMEDIATE CHECKS

- 10% had some deficiency
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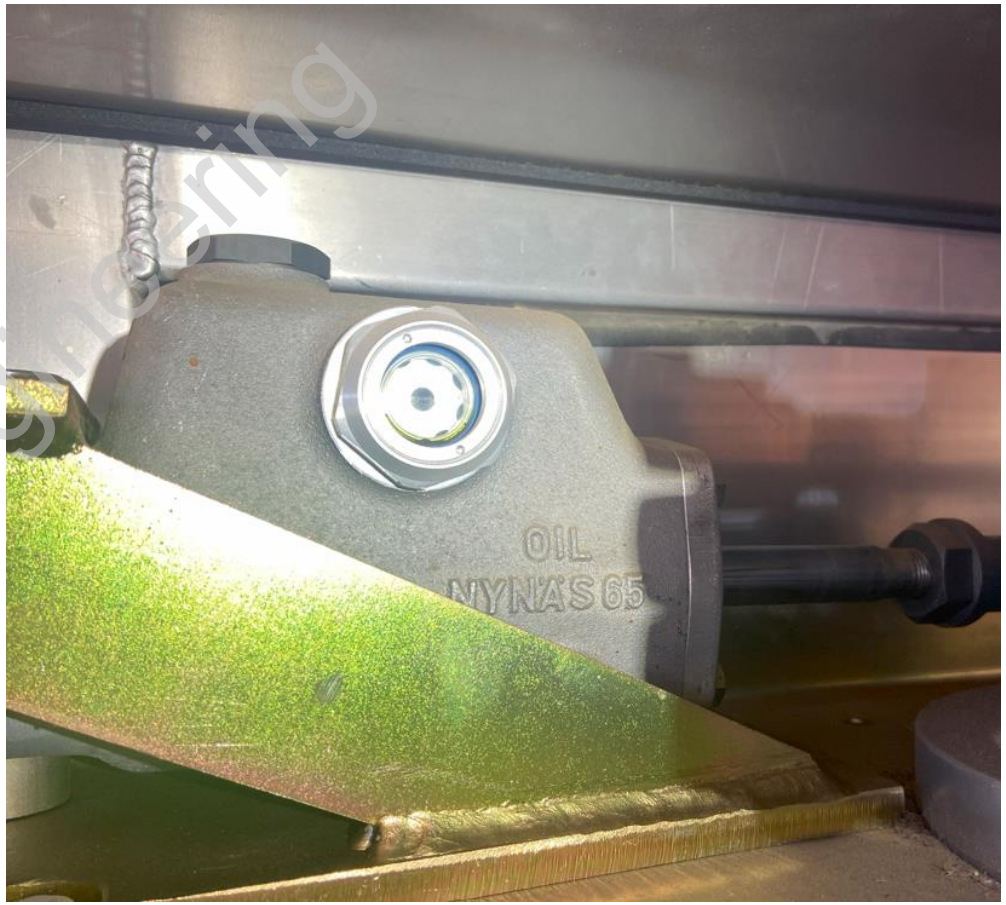
Signs of Leakage

IMMEDIATE CHECKS

IMMEDIATE CHECKS

- 10% had some deficiency
- **No oil**
  - Response:
    - Keep breaker out of service
    - Due to age and operations count, replacement project initiated



No oil visible

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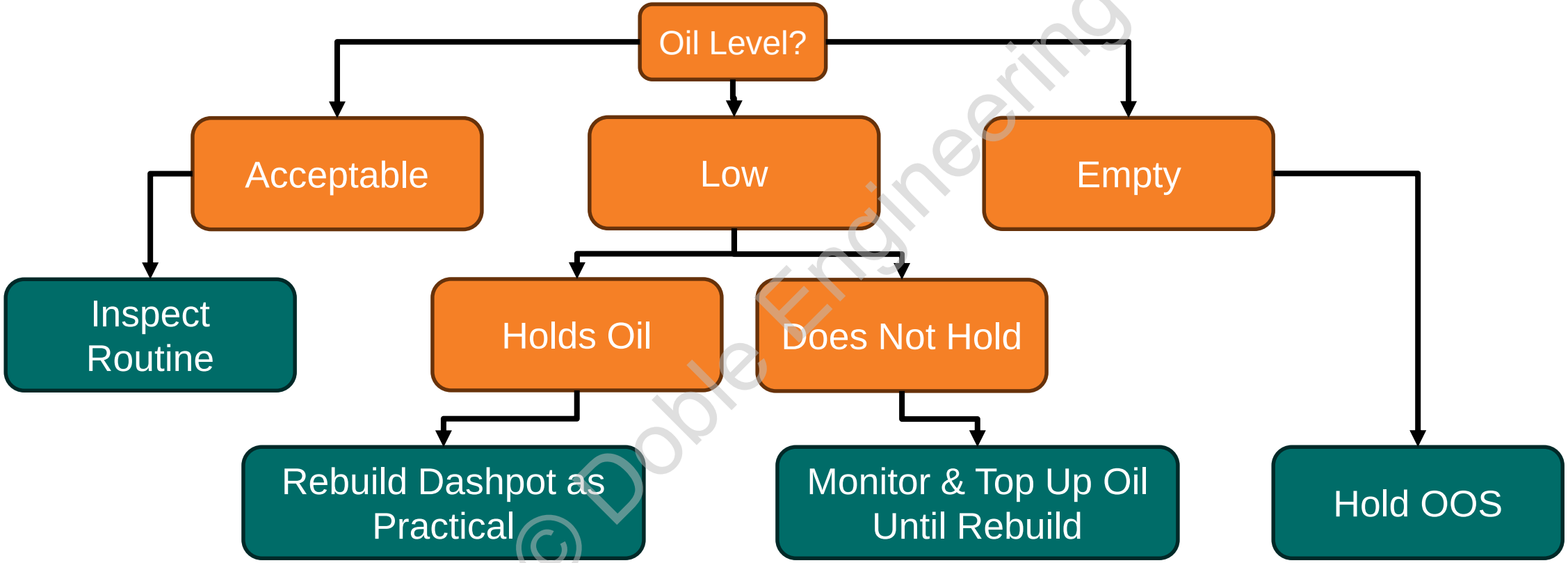
DECISION MAKING AND PRIORITIZATION

- Decided on course of action based on different scenarios



DECISION MAKING AND PRIORITIZATION

- Field plan - refine as more information available
- Make decisions based on scenarios before hard decisions need to get made
- Easy to bend rules when pressed by operations, resource constraints, optimistic lead times - stick to the plan!

- **4+ months to get adequate parts on-hand**
- Kit includes all materials and dashpot oil
- Set up as warehouse item for future use
- Entire process would have been easier with on-hand inventory intially

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REPAIRS PERFORMED

- Set up dashpot rebuild kits as warehouse stock
  - One of the first actions take due to lead time concerns
- Repair instructions cryptic
  - Worked with GE to get updated and show details
- No documentation on use of slow-close device
  - Worked with GE to get drawings and instructions

REPAIRS PERFORMED

- New maintenance process with little room for error
- Training for each region prior to removing dashpot and rebuilding
  - Incorporated into Annual Equipment Training
- Take time to understand slow-close device prior to use
  - Potentially very dangerous

REPAIRS PERFORMED

Slow Close Setup

Slow Close Linkage Connection

Jack with Saddle – Right Side Trimmed

REPAIRS PERFORMED

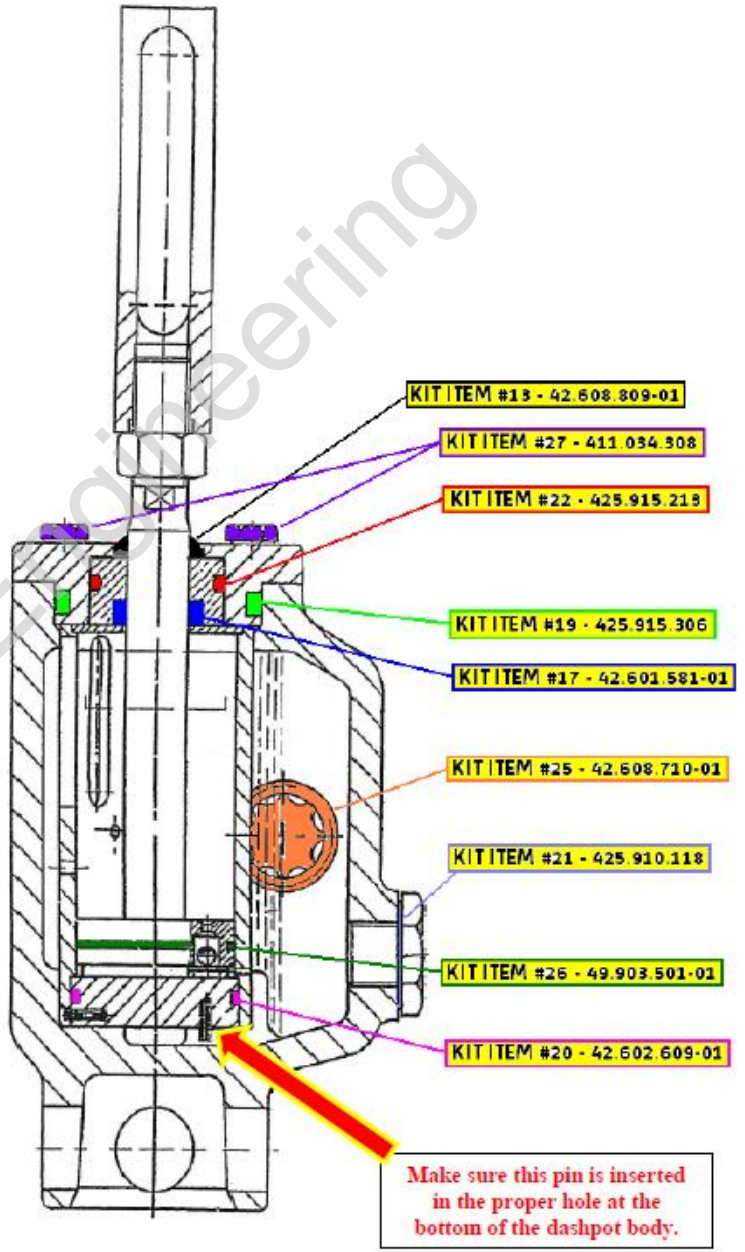
- Jack dimensions very specific
- Grinder to trim down right side
- Saddle fabricated to sit atop jack head
  - Keep from slipping out
- Strapping to hold jack base in place

REPAIRS PERFORMED

- Move breaker towards closed position (extend jack)
  - Far enough to touch back of slotted block
- Much more effort than expected
- Loosen locknut
- Back off piston rod from slotted block, flats on rod
- Remove dashpot

REPAIRS PERFORMED

- Dashpot comes apart easily for rebuild
- Kit available from GE with clearly labelled components



REPAIRS PERFORMED

- Add oil per instructions
- Reinstall, tighten piston rod into slotted block
- Slow open with jack, toggle linkage position to dashpot as described in instructions
  - Biggest potential problem
  - Avoids bottoming out dashpot at end of trip stroke
- Set locknut – 185 ft-lbs
  - Challenging location

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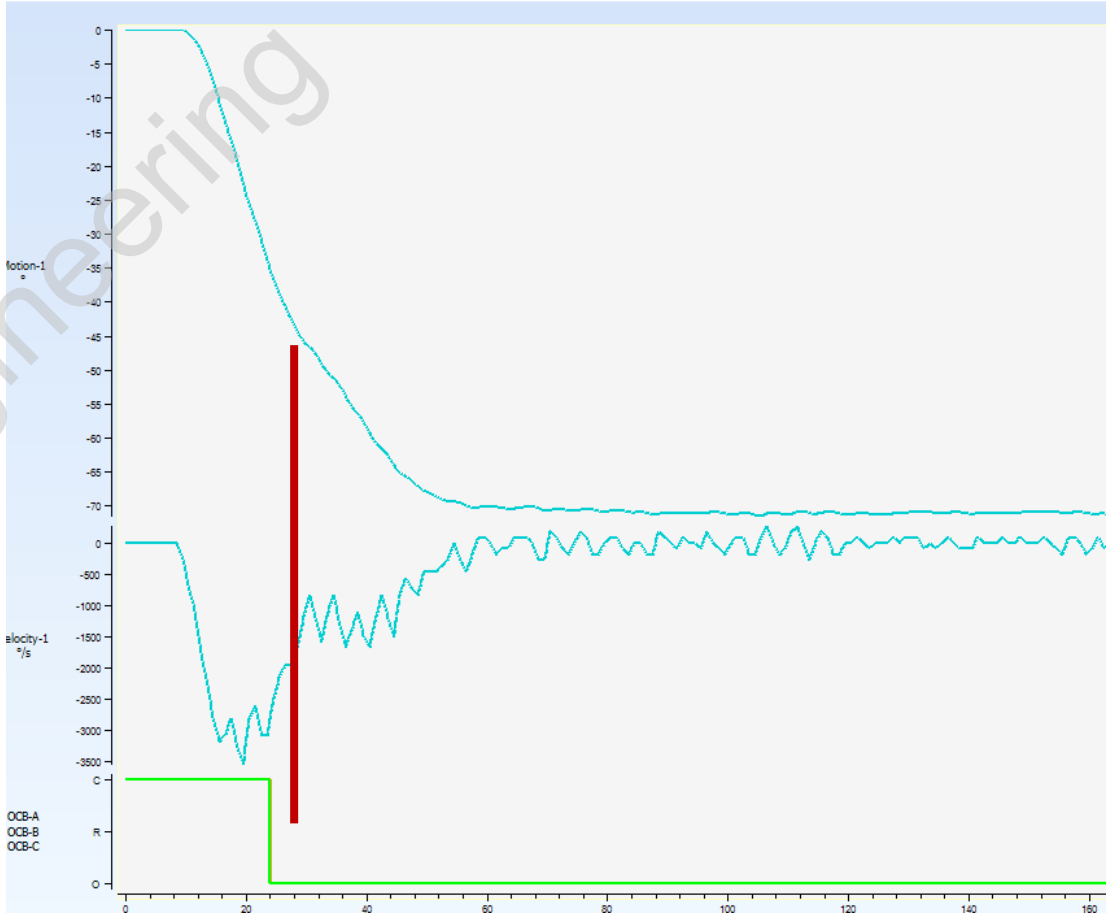
TESTING

- Tests to confirm workmanship and validate dashpot action
- Test plan complicated due to rotary limits (degrees) but velocity stated in book as m/s
- Verify in-spec/acceptable travel and timing compared to manuf. limits
- Close attention to dashpot action



TESTING

- Consider full diagnostic maintenance to reset triggers in CMMS
- Address any other concerns while out of service

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CONCLUSION

- Important to stay current with service advisories
- On-hand spare parts inventory more important now than ever
- Develop and train on new maintenance tasks
- Set up decision-tree ahead of time before hard decisions need to be made

Thank you.