Think Aesculap.

Reprocessing, Care and Maintenance of Aesculap Surgical Instruments.

- Surface Changes of Surgical Instruments
SURFACE CHANGES

Water spots

**Appearances**

- Milky white to grey coating
- Laminar cover or irregular stains with clearly defined edges
- Does not lead to corrosion damage

**Causes**

- Increased calcium content in rinsing waters/sterilizing steam
- Due to overloading of sterilization equipment increased formation of condensate

**Remedies**

- Simply wipe off with a wet cloth (works in most cases)
- If necessary, remove spots with an acid detergent (follow manufacturers’ instructions)
  
  **Not recommended** for instruments with tungsten carbide inserts, laser edged instruments or chromium- or nickel-plated surfaces


**Preventive measures**

- Final rinse with fully demineralized water
- If necessary, use softened or fully demineralized water for the entire mechanical reprocessing cycle
- Use of pure steam (EN 285)
- Don’t overload sterilizers
SURFACE CHANGES
Silicate deposits
Discolouring/Stain formation

Appearances
- yellow - brownish - blue - violet (rainbow colours)
  covering large areas or forming stains
- Drop-shaped or irregular, insular shapes
- Sometimes clearly defined edges of stains

Causes
- Increased content of silicate or silicic acid in final rinse water of the washing machine (e.g. due to silicic acid slippage in the production of fully demineralized water through ion exchangers)
- Residues of cleaning agents containing silicate

Remedies
First remove the causes:
- Optimize the mechanical cleaning and disinfection program cycle:
  Prevent residues of detergents containing silicate from being carried over from earlier program steps.
- Check detergent feeder unit for proper function
- In some cases, change cleaning agent where necessary
  (use low-silicate detergent)
- Use fully demineralized water free of silicic acid for final rinse
- Optimize steam generation according to EN 285

Optional measures after removing the causes
- Removing the coating depending on its thickness; perhaps treatment with cleaning agents based on phosphoric or hydrofluoric acid (only for stainless steel instruments)
  **Not recommended** for instruments with tungsten carbide inserts, laser edged instruments or chromium- or nickel-plated surfaces
  Instrument surfaces may be eroded = destruction of protective passive layer
- Instrument manufacturers recommend: Apply safe mechanical surface treatment
SURFACE CHANGES
Grey-black discolourations on stainless steel instruments

Appearances
- Glossy grey-black chromium dioxide coatings
  Consequence: enhanced protection against corrosion (no hygiene risk)

Appearances at high concentrations
- Dull grey-black discolouring
  Consequence:
  - the surface activation results in pickling
  - the chromium oxide passive layer has been destroyed
  - danger of surface corrosion

Causes
- Due to dosage errors, cleaning or neutralizing agents based on phosphoric or citric acid could have been carried through to the final rinse, or
- there was a fault in the machine program.
- Residues of acids/cleaning agents could have lead to surface reactions in cleaning and disinfecting machines and/or in the subsequent steam sterilization process.

Remedies
- Instrument showing even black discolouration can be left in the instrument cycle. The growing passive layer results in enhanced anticorrosive protection.
- Efforts to remove discolourations through treatment with chemical detergents will not be successful.
- Instrument manufacturers recommend applying safe mechanical surface treatment (once the causes have been remedied)
- Eroded instruments which show a dull black discolouration must be set aside and disposed.

Preventive measures
- Optimize the machine program cycle
- Use only the recommended doses of acid detergents and/or neutralizers.
- Avoid carrying through residues of the acid cleaning and neutralizing agents to subsequent steps of the reprocessing cycle.
- Rinse thoroughly after cleaning and disinfection
Pinhole corrosion

Appearances

- Crater-shaped
- Pinhole-type, surface-undermining impressions surrounded by brown or multicoloured, glistening edges (can lead to stress crack corrosion)
- Reddish brown, partial discolourations
- Rust emanating from the holes

Causes

- Mainly chloride ions
  (in blood, water and physiological saline solution)
- Other halogenous ions (iodide, bromide)

Remedies

- Set aside defective instruments
- If necessary, mechanical restoration by manufacturer/repair service

Preventive measures

- Clean instruments immediately after use
- Remove chloride-containing residues
  (e.g. blood, physiological saline solution)
- Final rinse with demineralized water
- Observe guideline figures for steam quality (EN 285)
Stress crack corrosion

**Appearances**

- Cracks/fractures at
  - Joints or links – rivet or screw joints, welded or soldered joints
  - Working tips (where the material cross section tends to be weakest)

**Causes**

- Inappropriate application (overstraining) of clamps, needle holders, etc.
- Tension in joints caused by fully closed ratchet locks during sterilization
- Material defect/manufacturing fault
- Inadequate repairs

**Remedies**

- Set aside defective instruments (irreparable)

**Preventive measures**

- Open the instruments for cleaning
- Remove chloride-containing residues immediately
- Lubricate joints (links) with a sterilizable, steam-penetrable lubricant (paraffin, white oil) at regular intervals
- Do not close the ratchet of instruments ready for sterilization beyond the first catch
- Repairs by qualified staff only
SURFACE CHANGES

Friction corrosion

Appearances

- Metal abrasion in narrow, moveable joint or link gaps – leads to reduced functionality
- Brown discoloration around a rubbed down shiny area in the joint
- Possible formation of pinhole corrosion
- Rust emanating from the abrasion if humidity enters the area

Causes

- Insufficient lubrication – metal abrasion
- Mechanical destruction of the passive layer of stainless steel
- Chemical residues (e.g. encrusted blood)

Remedies

- Set aside defective instruments
- Send off for repairs if necessary

Preventive measures

- Remove chloride-containing residues immediately
- Regular, targeted maintenance of joints
- Proper care of surgical instruments
  1. Allow instruments to cool down to room temperature
  2. Manual application of lubricants (drop by drop or as a spray e.g. art. no. JG600, JG598)
  3. Repeated opening and closing of instruments for better distribution of the oil in the joint
  4. Check the correct function of the instrument
SURFACE CHANGES

Crevice corrosion

Appearances

- Brown discolouration in narrow joint gaps for certain instrument designs (tweezer-type forceps/link gaps)
- Between metals and other materials
- Rust emanating from the gap
Often mistaken for organic residues

Causes

- Chemical residues (e.g. incrusted blood)
- Insufficient drying/humidity in narrow gaps

Remedies

- Set aside defective instruments

Preventive measures

- Remove chloride-containing residues immediately
- Careful cleaning
- Final rinse with fully demineralized water
- Meticulous drying at the end of reprocessing
Areal corrosion

**Appearances**

Attacks the entire metal surface/metal abrasion area, for instance:
- On carbon steel (e.g. single-use scalpel blades) = extreme rust formation
- Very rarely on stainless steel = dull grey surface
- On naturally anodized aluminum – whitish grey corrosion products/crater formation
- On colour anodized aluminum – colour loss
- On sintered inlays made of cobalt-bonded tungsten carbide (WC/CO) and at soldered joints – material abrasion

**Causes**

- Chemical (e.g. acid or alkaline agents)
- Water/humidity on stainless steel/carbon steel

**Remedies**

- For stainless steel: acid basic cleaning
- Set aside defective instruments
- Damage to anodized layer and sintered carbide (WC/CO) is irreparable

**Preventive measures**

- Do not reprocess single-use materials (e.g. disposable scalpel blades made of unalloyed carbon steel)
- Avoid long-term exposure to water / humidity
- Only use neutral or mildly alkaline cleaning and disinfecting agents on anodized aluminum
Brown-blue discolourations with minor corrosion film formation e.g. rust rings/islands without holes at the centre

Caution: Do not confuse with pinhole corrosion

Appearance on material combination
Stainless steel – stainless steel:

- Micro friction/partial abrasion of the passive layer
  (possible with mechanical cleaning of stainless steel instruments)
- Contact between stainless and non-stainless instruments (needles, cutters etc.)
- Nickel-/chromium-plated instruments with detached coatings

Causes

Remedies

- Remove corrosion coatings, using neutralizers in the mechanical reprocessing cycle
- Possible surface restoration (depending on the manufacturer’s advice)

Preventive measures

- Set aside defective (e.g. chromium-/nickel-plated) instruments
SURFACE CHANGES

Foreign rust/rust films – can possibly lead to secondary corrosion

Appears

- Brown, partial to areal rust/corrosion coatings (mostly local, limited areas)

Causes

- Reprocessing of steel that is not corrosion-proof (e.g. scalpel blades – carbon steel)
- Rust particles from
  - corroded instruments
  - nickel-/chromium-plated instruments with detached coatings
- Iron or rust carried in water
- Corrosion deposits on the internal walls of cleaning/disinfecting devices/sterilizers/steam supply systems (e.g. “black pipe” systems)

Remedies

- Treating the instruments, the decontamination system and the sterilizer with basic detergents based on phosphoric acid (only for stainless steel)
  Not recommended: for instruments with tungsten carbide inlays, laser edging and chrome- or nickel-plated surfaces
- Depending on the level of damage, set aside corroded instruments; send for repairs and/or surface restoration, if possible

Preventive measures

- Separate treatment of non-stainless medical products, e.g. non stainless steel pleurs
- Set aside/dispose of single-use products (e.g. scalpel blades) after use
- Avoid using products purchased from DIY shops!
- If there is no pure steam available and a “black pipe” system is installed:
  - Ensure continuous operation of the steam plant
  - Install steam purifier
  - Use filters to repel contamination (can be very costly in the long term)
  - Use suitable anti-corrosive additives
- Pipe systems made of
  - Cr Ni steel pipes (V2A/V4A) for pure steam
  - Plastic pipes demineralized water feeds to the steam generator