


Furnaces corrosion / prevention to improve the longevity of campaigns

Th Roustan 2016/10

Superstructures

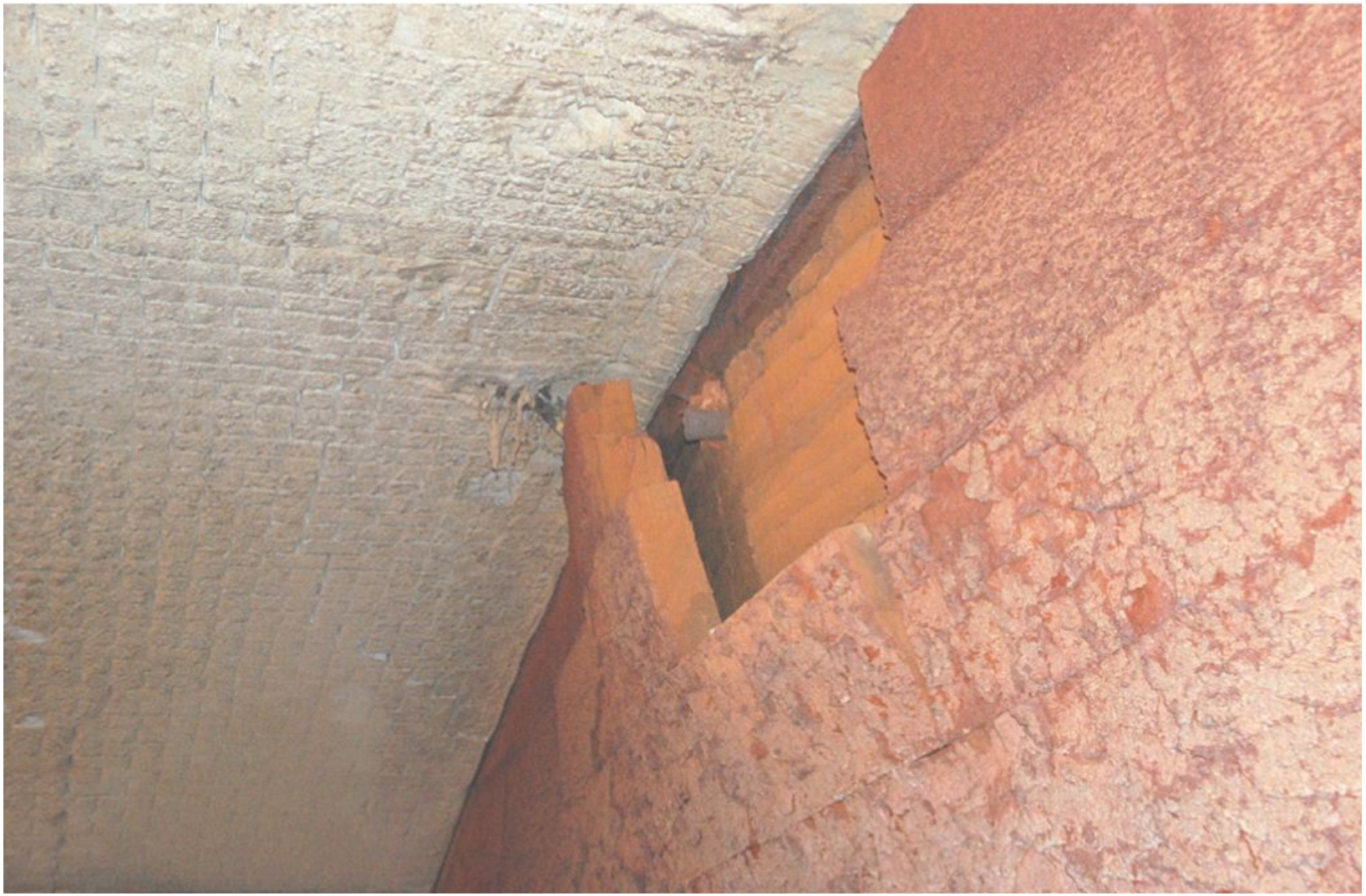
Place	Origin	Consequences	Detections and Actions
Melting crown	- Injectors adjustment (inclination, azimuth, burners blocks fouling /dirty /blocked)	Flame deviation, locally silica crown corrosion (1, 2, 3m² silica leakage)	- Over limits temperatures / Alarms + optical temperatures measurements - Visual look : flame abnormally near crown ⇒ Setting injectors in good position / clean burners blocks deposits
	- High performing + time / pull and temperature ≥ 1620°	Acceleration of silica crown corrosion	- Reinforce temperatures controls (alarms limits, optical controls)
	- Important raw materials deposits	Locally insulation overheated who provoke silica melting (Soda and alumina eutectic)	- Ascertainment important raw materials deposits (under dog houses generally -Flame passages -Reporting to cleaning and repair if necessary
Melting crowns	- Excess temperatures	Acceleration of silica crown corrosion	- Repetitive crowns temperatures alarms / => reduce fossil energy / compensation with boosting and cullet if possible and reporting - Batch chargers setting or repair -Thermocouple problem setting or repair (silica block corrosion) setting injectors gas pressure Reinforce temperatures controls (alarms limits, optical controls)

Superstructures

Place	Origin	Consequences	Detections and Actions
Breast walls / front wall / burners wall / dog houses arches	Flames too much long	Important corrosion of silica skewbacks and crown who will leak on AZS blocks and degrade them. Important evolution AZS corrosion with temperature = AZS blocks fallen down ricks.	- Visual control : impossible to look refining glass area. - Reinforce temperatures controls (alarms limits, optical controls : ≤1600°
	Broken tuck stones	Iron cast support exposure = iron cast leakage (melting), destabilization superstructures blocks = ricks of blocks fallen down. Iron cast leak on AZS tank or over coat = tank destruction	Install fibber in gap (don't covering iron cast or tank surface !), install supplementary provisory cooling (compress air), reporting for repair
	Dog house mantel block corrosion or broken	Batch charger exposure = important water jacket corrosion = water leakage on glass surface = dog house glass surface frozen = no possibility to introduce raw material (from this side), dog house refractories broken risks by thermal choc	Reporting, install provisory air cooling in case of flame passages.
	Batch charger water jacket broken (water leakage)	Water leakage on glass surface = dog house glass surface frozen = no possibility to introduce raw material (from this side), dog house refractories broken risks by thermal choc	Stop water on concerning water jacket, and install provisory cooling with compress air + water (full air opening and a little water), reporting to replacement

Crown flames passages

Lagnieu F2 front wall / concrete wall protection



Kamyshin F1 front wall repair

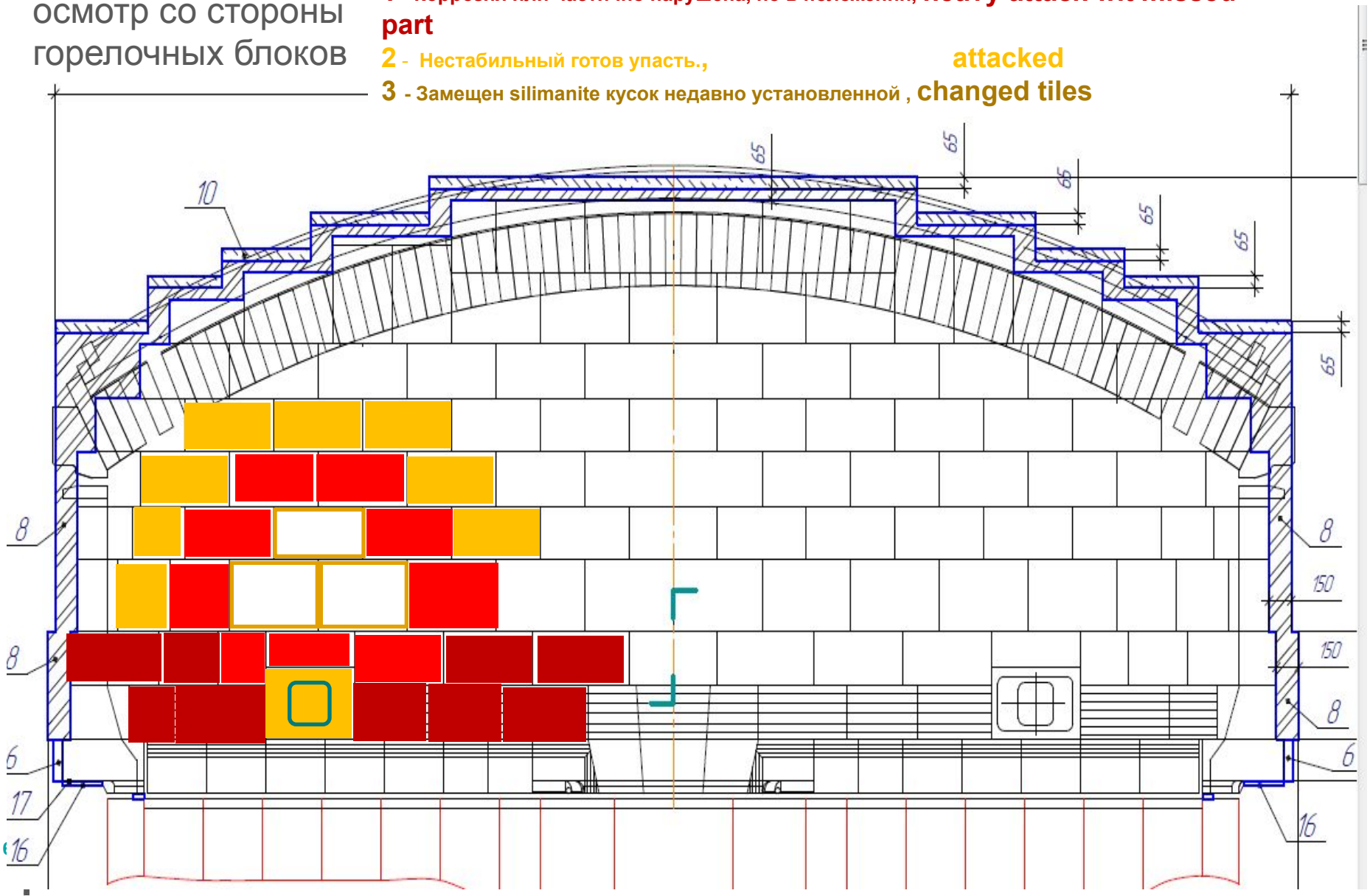
Визуальный осмотр со стороны горелочных блоков

0 - Уже упал, следующий слой видим , already felt down

1 - Коррозия или частично нарушена, но в положении, heavy attack wit missed part

2 - Нестабильный готов упасть., attacked

3 - Замещен silimanite кусок недавно установленной , changed tiles



Kamyshin F1 front wall repair with concrete blocks

Infrastructures

Place	Origin	Consequences	Detections and Actions
Top tank (0 to -350 mm)	- Adjustment batch chargers, oscillating breakdown	- Locally batch piles impacts / locally important corrosion tuck stones and top tank (0 to -150mm) - Glass quality degradation (seeds, stones)	-Batch chargers alarms, crowns temperatures alarms (T° 1rst ring increase , 2/3rd ring fallen down) - Visual detection on batch chargers, on glass surface looking. - Adjust batch charger, reporting
	- Top tank cooling	- Top tank corrosion acceleration, premature over coating	- Hot point (red) on top tank - Ascertainment general air cooling shortage - Checking nozzles position and air pressure - Checking particularly downstream dog houses angle blocks and throat angle blocks
	- high performing (pull ≥ 3,7t/m², boosting ≥ 90% capacity)	- Corrosion acceleration by glass convection and temperatures - Risks acceleration at the end of campaign	- Reinforce vigilance, reporting. - Imperative respect of temperatures instructions

verallia

Dog house angle bloc not enough air cooling

Extremity angle tank joint glass infiltration

Infrastructures

Place	Origin	Consequences	Detections and Actions
tank	- Weakness identified at the beginning of campaign (tank broken, glass infiltrated joint)	- Corrosion more important on weakness	- Reinforce vigilance , reporting - Cooling provisory with compress air, reporting
	Prolong campaign duration, partial repair, quality refractories, high pull	Important ricks to have glass infiltrations	- Reinforce vigilance , reporting - preventives over coating
	- Tank with horizontal electrodes	- Locally corrosion on electrodes periphery	- Particular vigilance, reporting, (broken block , cracks opened, glass infiltrations, temperatures holder alarms, hot and red points) - Cooling provisory with compress air, reporting
Throat (s)	- Quality refractories, cumulative pull, important glass temperatures, insufficient cooling system	- Corrosion more important	- Particular vigilance, reporting, (broken block , cracks opened, glass infiltrations, hot and red points) Cooling provisory with compress air, reporting

verallia

Glass level corrosion, leakage potential ricks After 6 mouths in case of air cooling breackdonwn

*

Throat angle block corrosion with bad air cooling….. And glass leakage

*

Infrastructures

Place	Origin	Consequences	Detection and Actions
Bottom	- Glass or metal infiltration in joints	- Glass leakage risks by corrosion , enlargement joints with glass or metal convection	- Visuals checking evolution - Cooling provisory with compress air if evolution , reporting
	- Thermocouple block infiltrated with glass	- Glass leakage risks - Wrong temperature measurement	- Visual checking evolution , derivative temperature , reporting. - Cooling provisory with compress air, reporting
	- Electrodes problems : broken, block infiltrated, deviation temperature, electrode inclined	-Glass leakage risks -Pull reduction	- Amperage measurement deviation, reporting - Visual checking, reporting - Stopping electrode group, reporting - Cooling provisory with compress air and water, reporting
	Water leak on electrode holder	Electrical short-circuit risks (electrical connection between electrode and framework by water) and human risks electrocution. Oxidation of every mechanic and electrical holder and electrodes pieces.	Reporting for repairing or replacing holder. Stop water cooling and install compress air cooling

verallia

Infrastructures

Place	Origin	Consequences	Detection and Actions
Bottom	Contact between electrode holder and steels work	Electrical short-circuit risks (electrical connection between electrode and framework by water) and human risks electrocution Electrode destruction, glass leakage risks	Stopping boosting group , reporting
	- Bubblers problems (hot, red point on block, glass infiltrated)	- Glass leakage risks - Pull reduction, glass quality deviation	Cooling with compress air + water, supplementary water lances if necessary. Stopping bubblers concerning + periphery bubblers
	- Weakness identified at the beginning of campaign (glass infiltration in joints)	- Corrosion more important on weakness	- Reinforce vigilance , reporting - Cooling provisory with compress air if evolution , reporting

*

verallia

Water leack on electrode water jacket during 2 years without repair

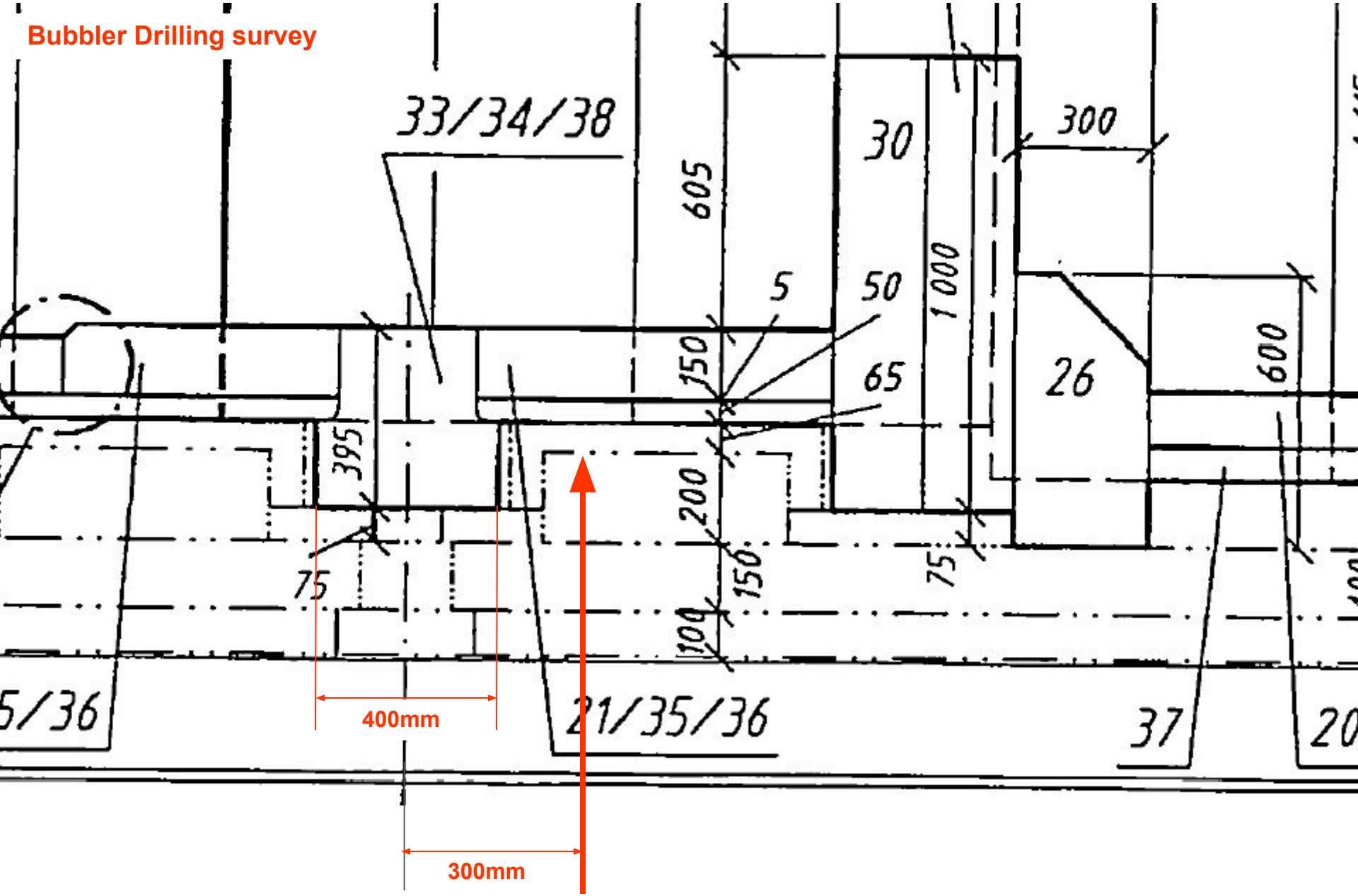
*

Bubbler block corroded, important glass infiltration

*

verallia

Bubbler Drilling survey



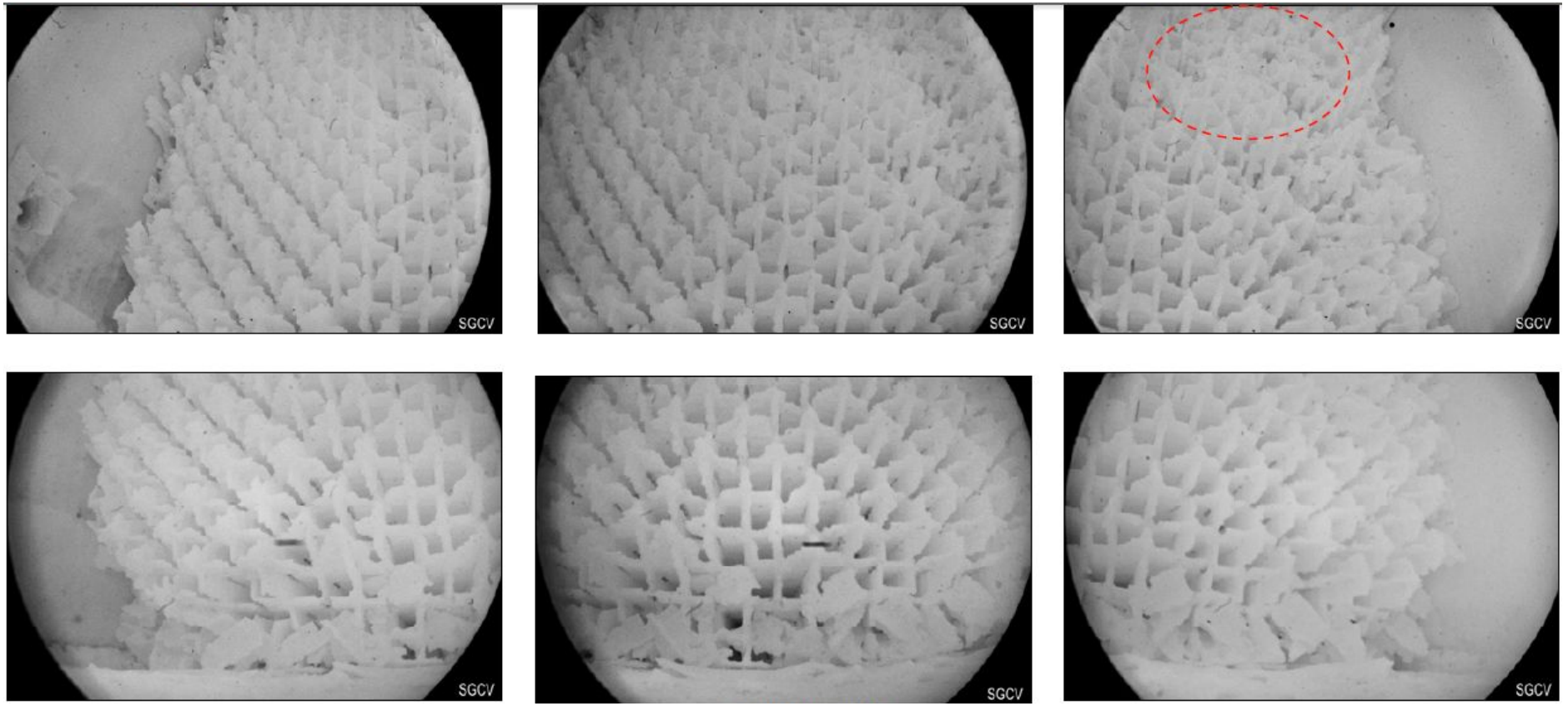
drilling Ø 16mm
Glass in contact of Zirmul, no AZS 150mm
+ no ERSOL concrete 50mm

Regenerateurs

Place	Origin	Consequences	Detections and Actions
crowns	Combustion too much reduced (CO >5000ppm)	Premature corrosion crown (silica reduction)	- Regenerators temperatures increasing - Bad analysis results - Increase air combustion , setting injectors
	Furnace over-pressure	Premature corrosion crowns and walls (division and laterals walls)	- Flames appearance from peep holes and dog houses, reporting - Checkers, gas flue, regenerators bottom, cleaning - regenerators depressions measurements
Checkers	Combustion too much reduced (CO >5000ppm)	Premature corrosion checkers (lose mechanic resistivity)	- Regenerators temperatures increasing - Bad analysis results - Increase air combustion , setting injectors
	Raw material carry over	Mechanic checkers blockage	- Dry raw material mix, dusty raw materials deposits around dog houses - Regulation butterfly percentage evolution - furnace pressure measurement increasing - Humidification raw materials mix, in mixer if possible, or just before batch charger. - Reporting for checkers cleaning

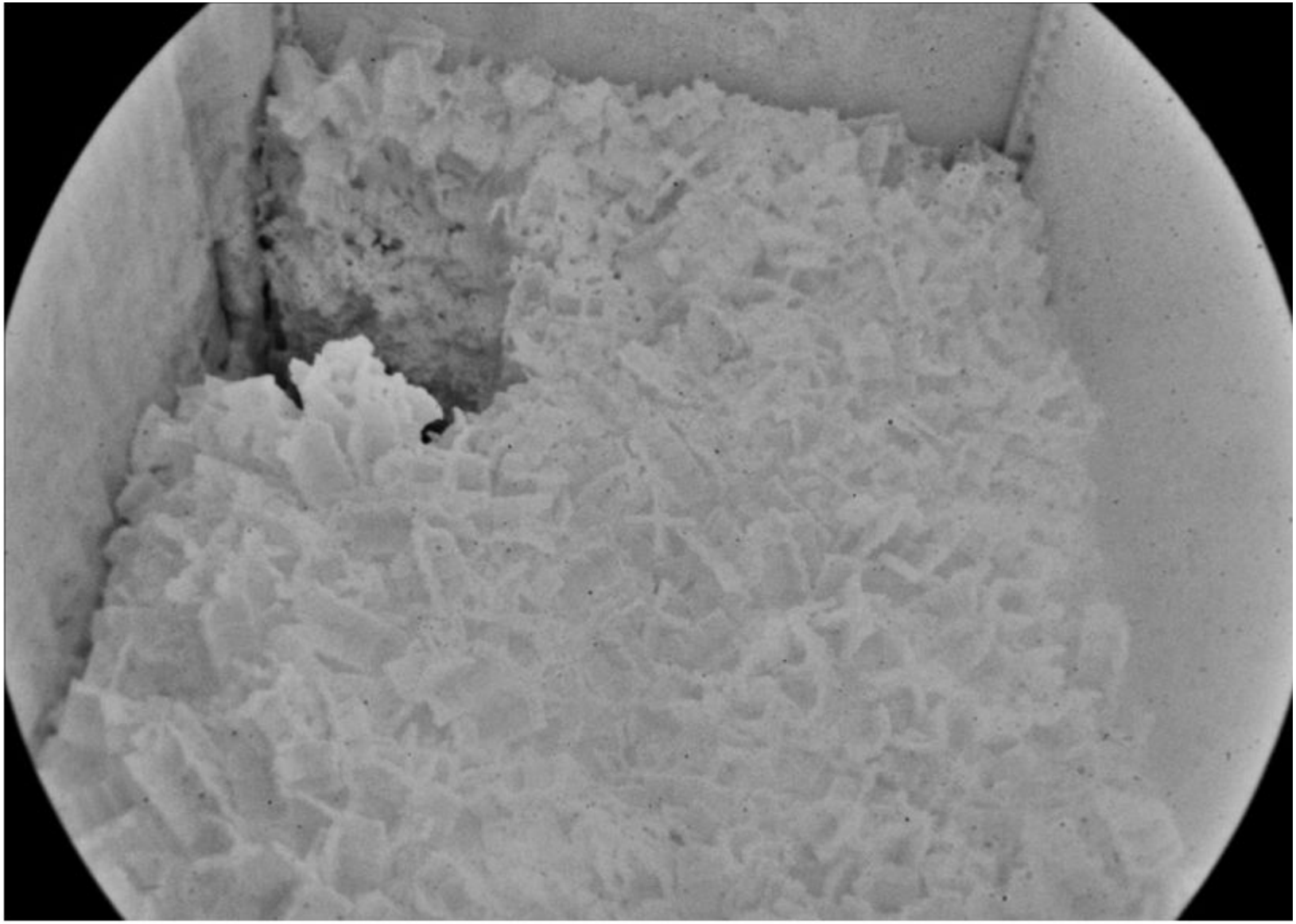
verallia

Checkers corrosion…….



*

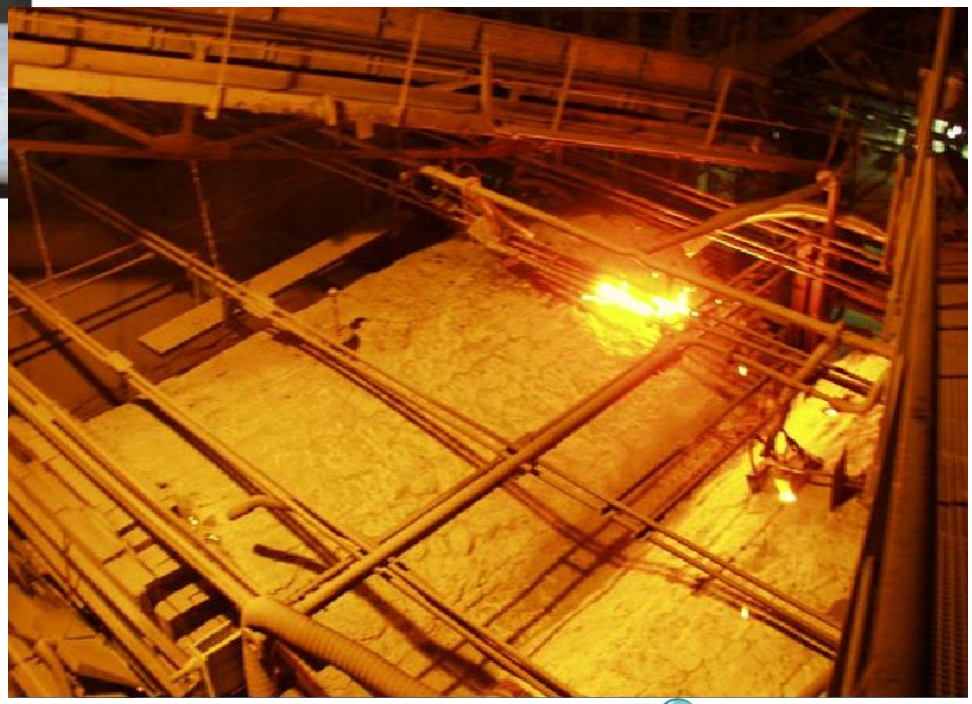
…and 3m checkers crushing, by-pass realization



*

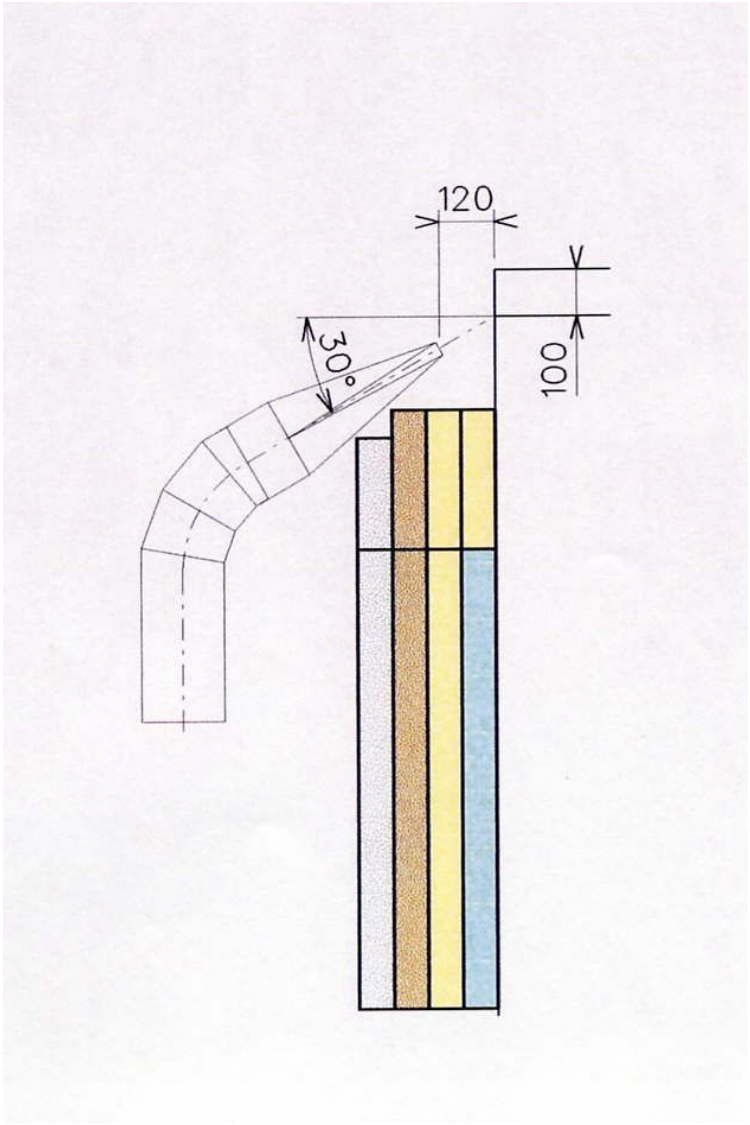
verallia

Flames passage on regenerator's crowns (checkers frequently locked)



Important raw materials deposits…… batch charger Mechanic problems

Tank air cooling preconizations



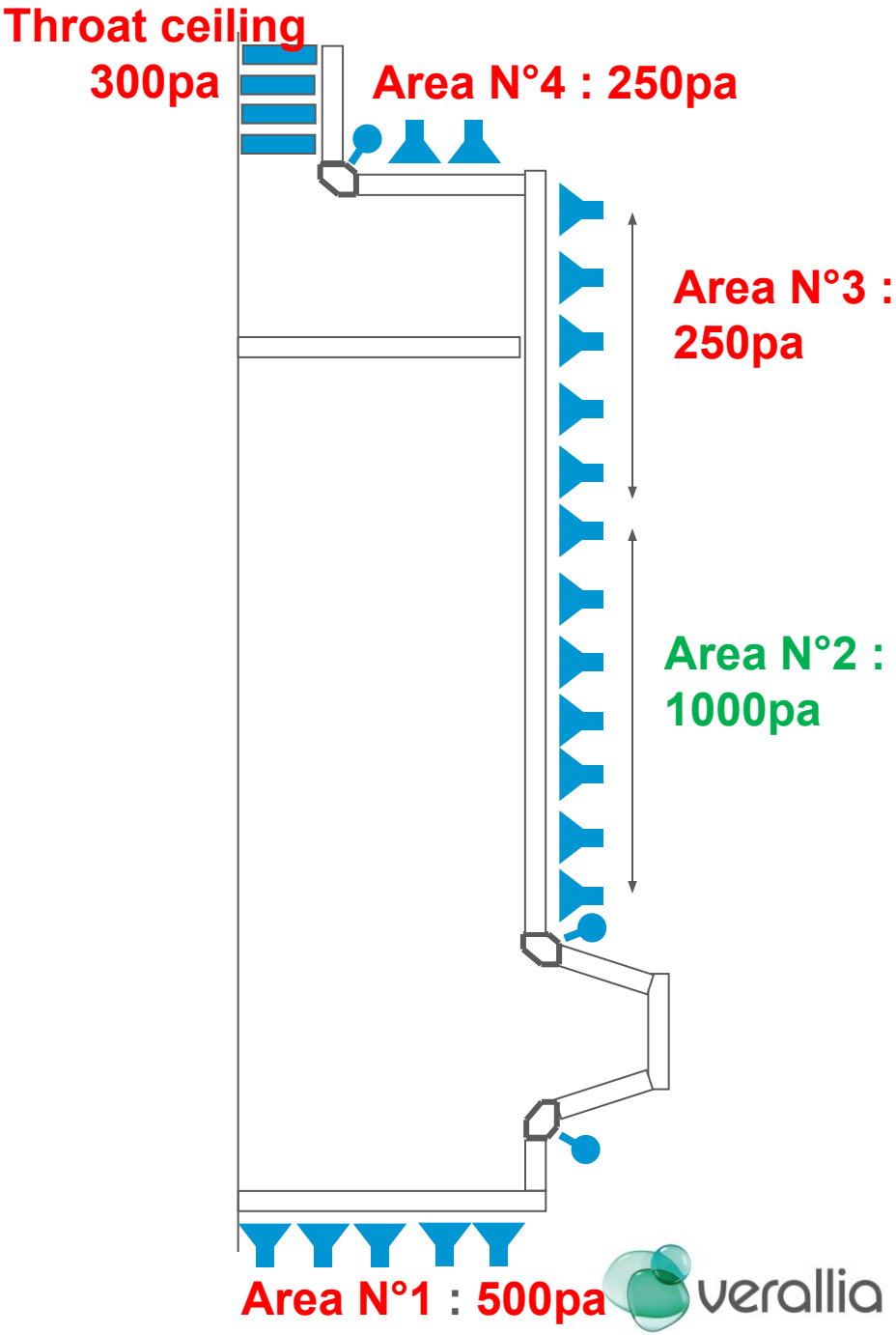
- Impact point : ~100 mm from top tank
- Air quantity : ≥25 m/s et 1000 l/s/ml

When ? From heating up starting, only vertically cracks formation on tank (not horizontally cracks who increasing corrosion).

Tank air cooling nozzles

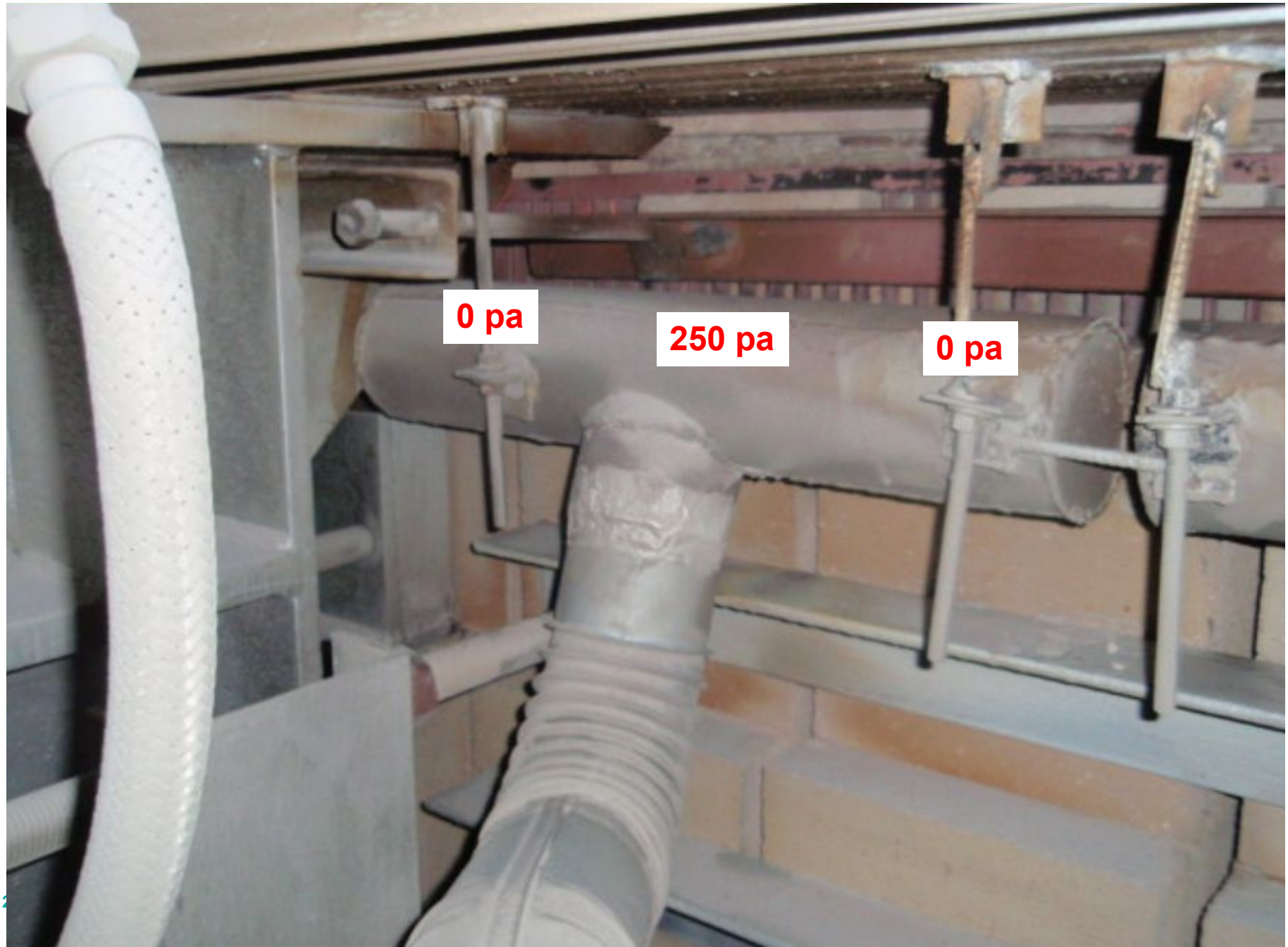
Air cooling pressure measurement on nozzles example

In red color insufficient air cooling quantity (≥700 Pa)

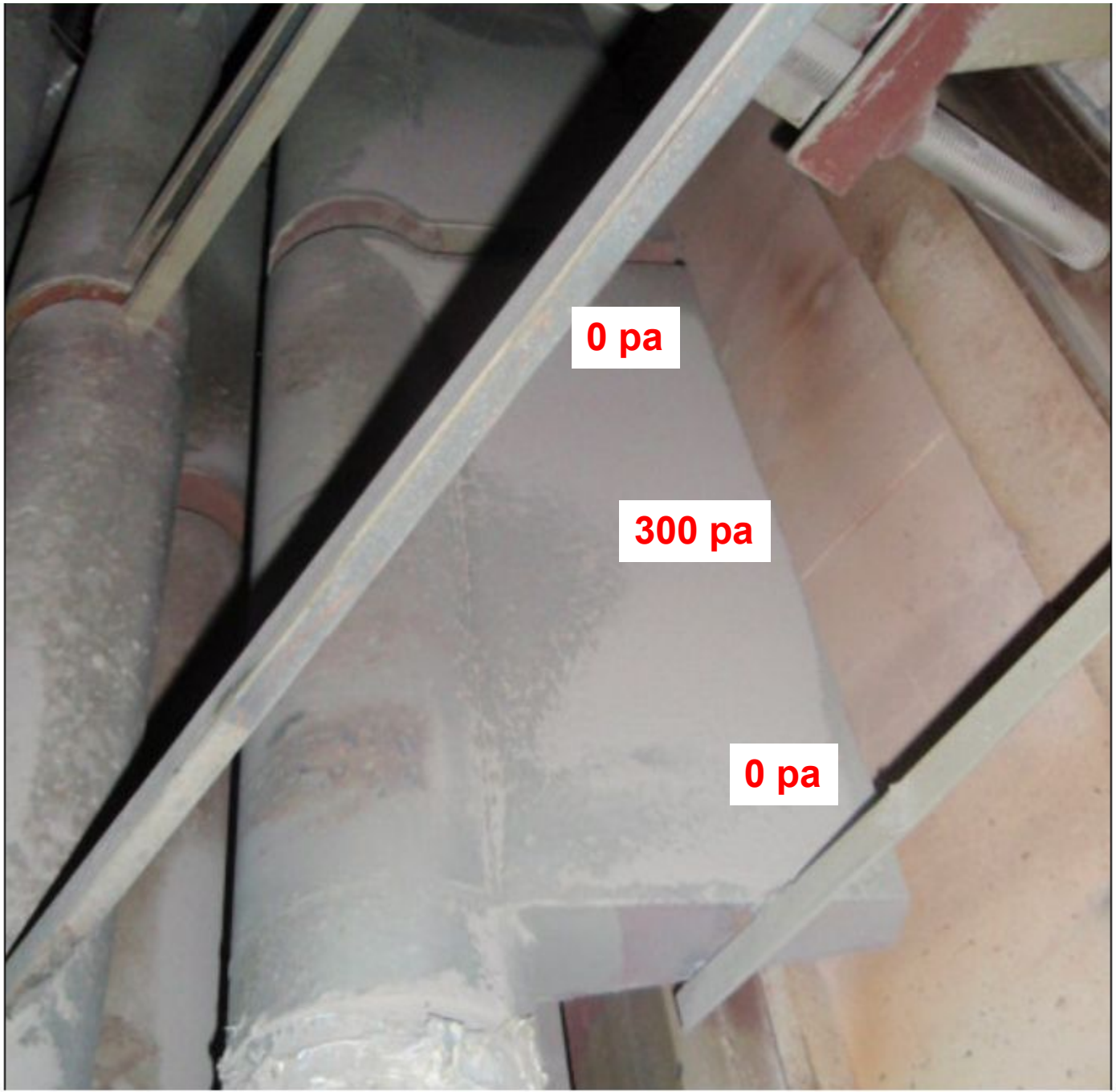


*

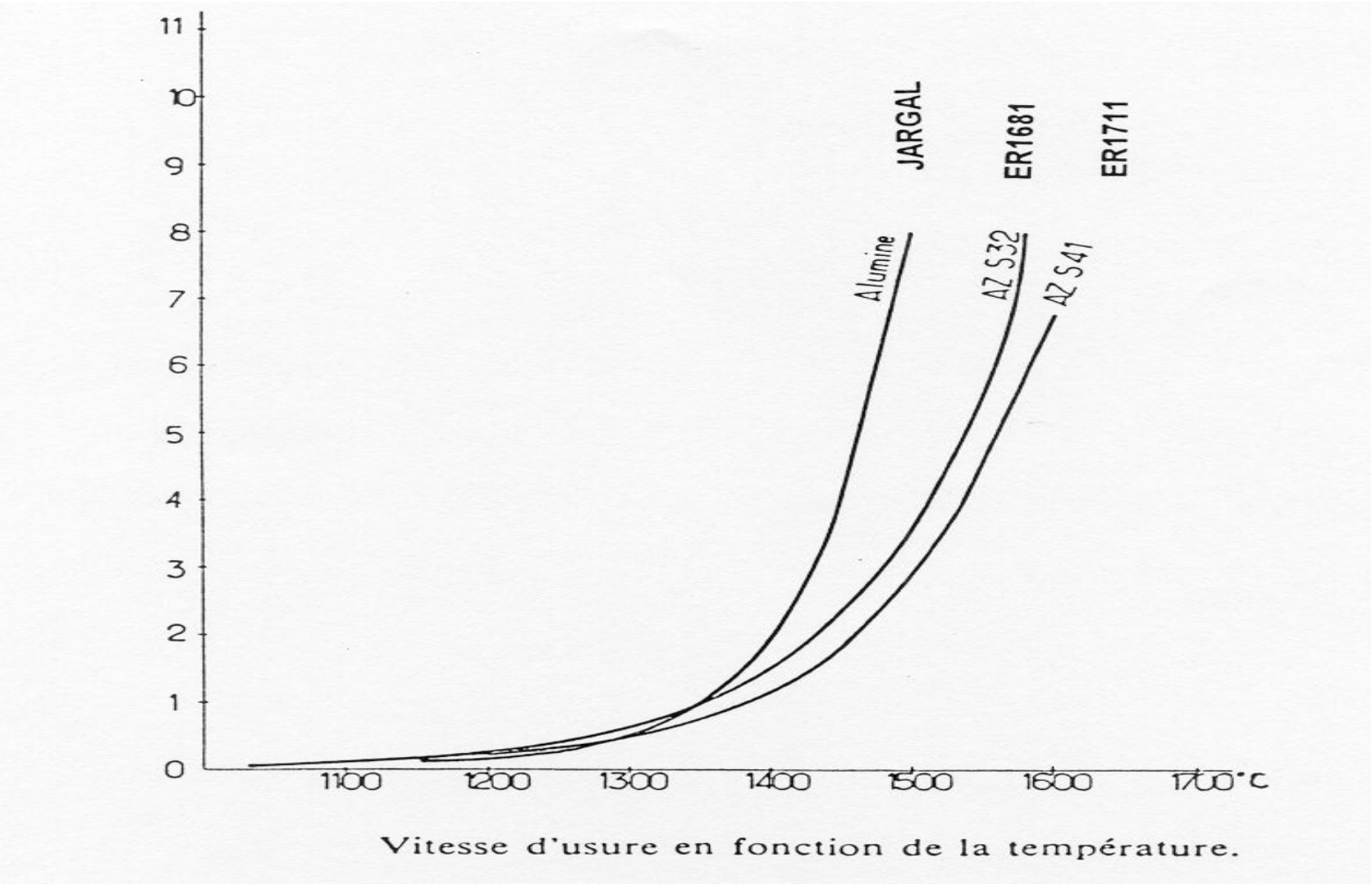
Bad nozzles shape



Bad nozzles shape in throat



Corrosion Speed evolution with temperature :



Vitesse d'usure en fonction de la température.

Throat angle blocks after 11 years campaign with efficient air cooling (average air pressure nozzles : 1000 Pa)

*

Throat angle blocks after 5 years campaign with insufficient air cooling

Throat angle blocks after 5 years campaign with insufficient air cooling