

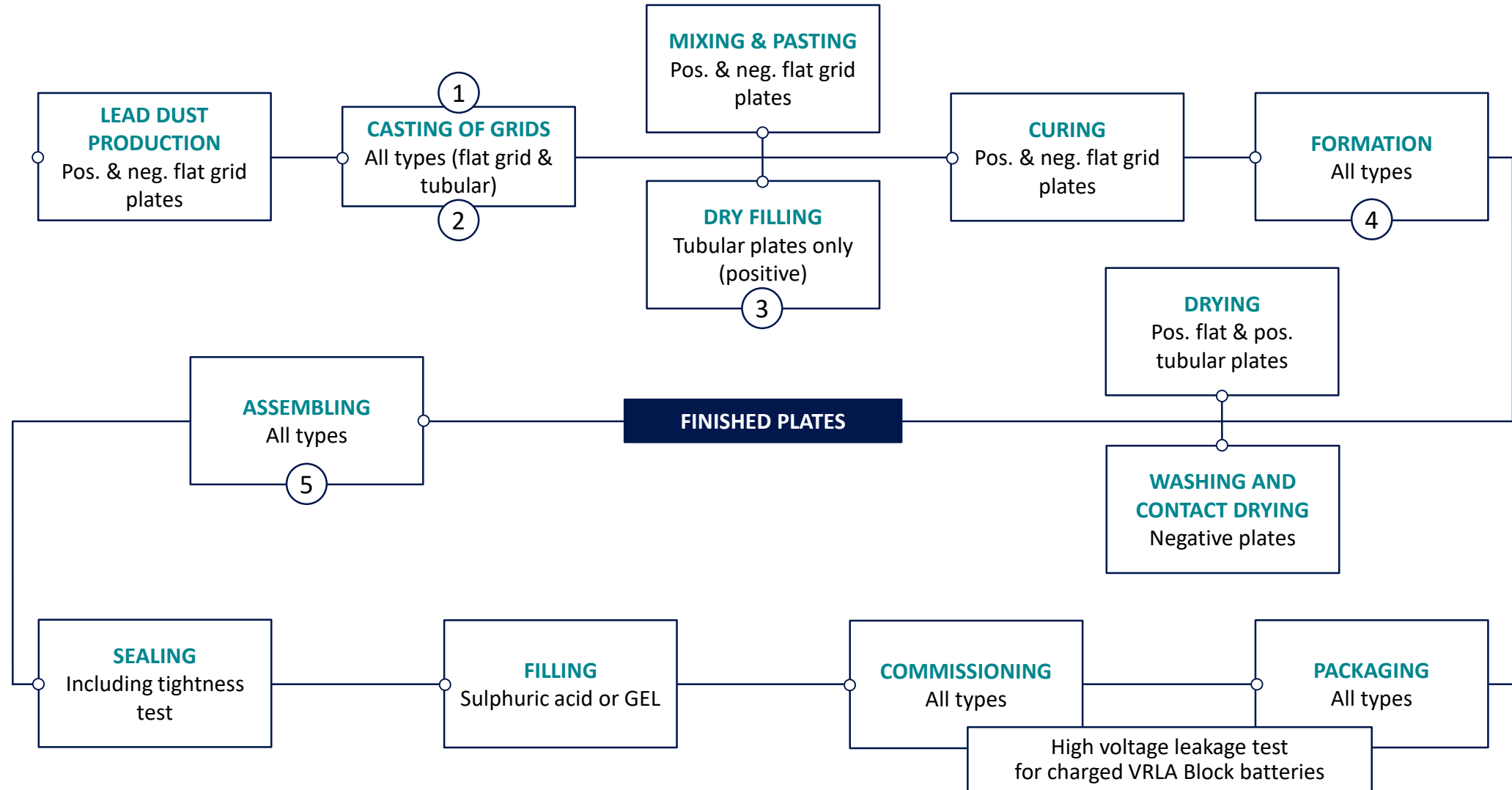
QUALITY OF BAE BATTERIES

*TRADITION, RELIABILITY
AND INNOVATION*



BAE SETS THE FOLLOWING QUALITY STANDARDS FOR BATTERY CELLS:

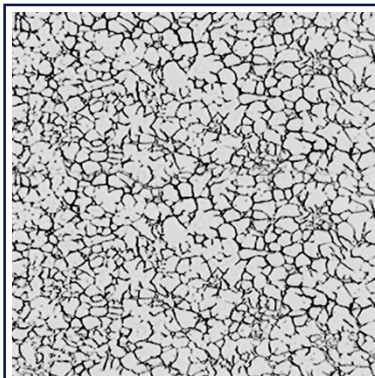
- 1 High pressure casting
- 2 Use of reinforced woven gauntlets
- 3 Dry filling of red lead
- 4 Tank formation
- 5 Patented BAE Panzerpol



1 TUBULAR PLATE MANUFACTURING: BAE HIGH PRESSURE CASTING



PRESSURE CASTING MACHINE



SEM OF THE PLATE STRUCTURE
1:200

- PRESSURE CASTING OF THE GRID: 120 BAR
- PERMANENT TEMPERATURE CONTROL AND PERIODICAL CHECK OF CASTING QUALITY
- ANTIMONY FREE LEAD CALCIUM TIN ALLOY PBCASN (VRLA)
- OPTIMISED ANTIMONY SELENIUM ALLOY (VLA)
- HIGH COOLING RATE, WHILE PRESSURE CASTING, LEADS TO SMALL GRAINS WITH GLOBULITIC STRUCTURE
- VERY LOW CORROSION

**SECURE OUTSTANDING LIFETIME
FOR STANDBY AND CYCLING
OPERATION, DUE TO VERY LOW
CORROSION**

2 TUBULAR PLATE MANUFACTURING: USE OF REINFORCED WOVEN GAUNTLETS



TUBULAR POCKET

- HIGHER RESIN CONTENT IMPROVES THE OXIDATION RESISTANCE AND THE MECHANIC STABILITY
→ REDUCED MASS SHEDDING, DUE TO SMALL PORES
- REINFORCED NON-WOVEN GAUNTLET: 29 μm
- 100% TIGHT LATERAL PROTECTION, DUE TO HOT MELT
- AVOID LATERAL SHORT CIRCUITS
- LOW INTERNAL RESISTANCE AND HIGH POROSITY
- HIGH ENERGY DENSITY

STABLE LIFETIME CYCLE

2 TUBULAR PLATE MANUFACTURING: USE OF REINFORCED WOVEN GAUNTLETS



TUBULAR PLATE

Constant pressure to the positive, active mass leads to:

- Best possible contact between conductive lead and active mass (prevents effective PCL1 effect)
- Reduced mass softening and shedding (prevents effective PCL1 effect)

STABLE LIFETIME CYCLE

SCHEMATIC VIEW OF A TUBULAR PLATE, BEFORE AND AFTER FILLING

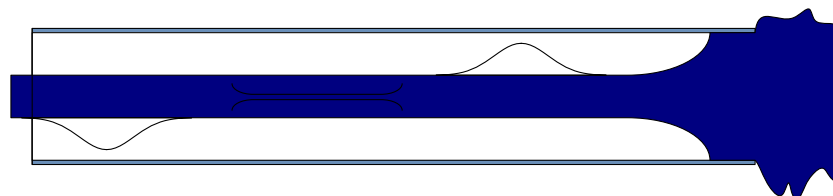


PLATE BEFORE FILLING

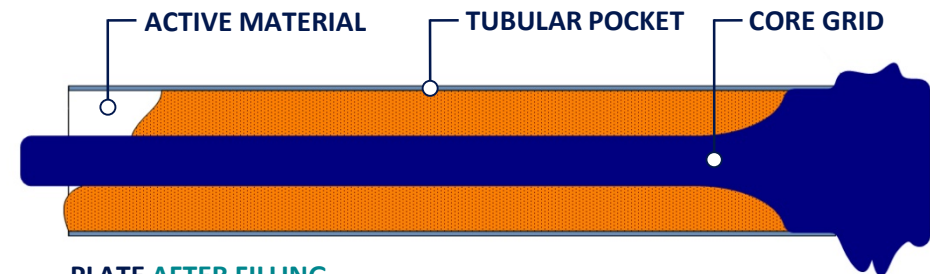


PLATE AFTER FILLING

2 TUBULAR PLATE MANUFACTURING: USE OF REINFORCED WOVEN GAUNTLETS



SEM OF THE WOVEN
GAUNTLET TUBULAR POCKET

- Holding back the active material
- Flexible and stable at the same time for long term periodical cycling; while withstanding the extending of tubes at each cycle
- Porous enough to let the sulphate ions pass

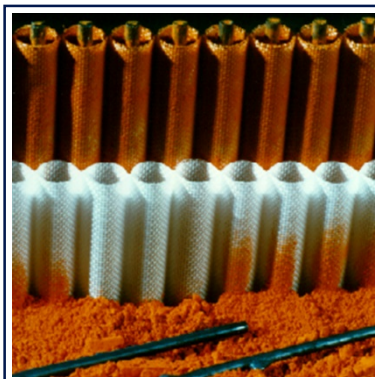
3 TUBULAR PLATE MANUFACTURING: DRY FILLING OF RED LEAD (MINIUM)



DRY FILLING OF RED LEAD

RED LEAD FILLING (Pb_3O_4) WITH A CALIBRATED PARTICLE SIZE LEADS TO:

- LOW PLATE TOLERANCES AND CELL CAPACITY DEVIATIONS
- FAST FORMATION PROCESS WITH LOW STRESS OF ACTIVE MASS
- LOWEST EFFORT FOR PUTTING INTO OPERATION PROCESS FOR FLOODED BATTERIES (VLA)



TUBULAR PLATES BEFORE AND AFTER FILLING

- HIGHEST INITIAL CAPACITY FOR SEALED AND FLOODED BATTERIES (VRLA/VLA)
- UNIFORM FILLING OF ALL TUBES, OVER THE COMPLETE LENGTH, GUARANTEES LOW MASS SHEDDING

BEST INITIAL CAPACITY AND EASY PUTTING INTO OPERATION PROCESS

4 FORMATION PROCESS: BAE TANK FORMATION

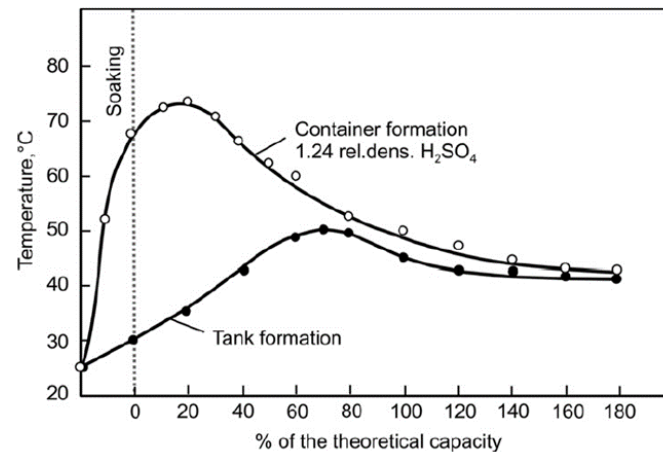


TANK FORMATION

- IDEAL ACID DENSITY OF FORMATION OF 1.10 kg/l, LARGE SURPLUS ACID
- EXCELLENT FORMATION RESULTS UNDER CONSTANT CONDITIONS (TEMPERATURES)



CONTAINER FORMATION

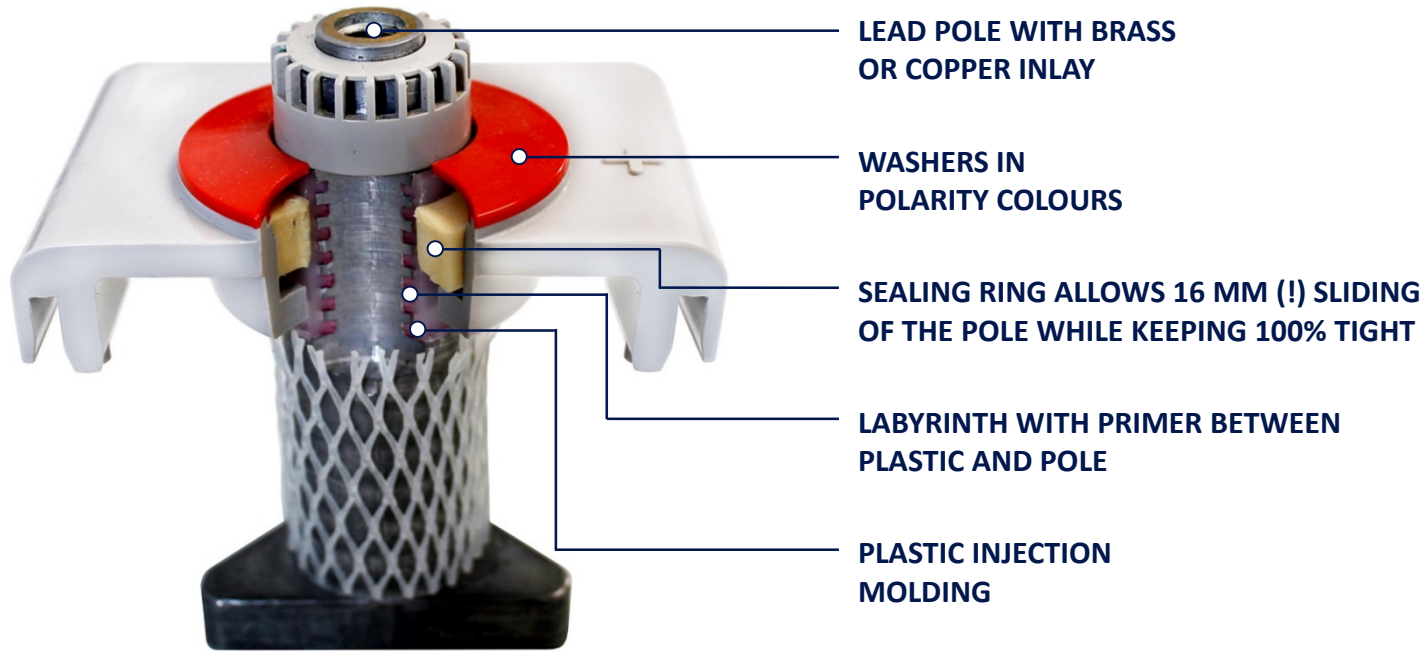


TEMPERATURE DEVELOPMENT CONTAINER VS. TANK FORMATION

[Source: Lead-Acid Batteries: Science and Technology, D. Pavlov]

BEST INITIAL CAPACITY AND EASY PUTTING INTO OPERATION PROCESS

5 DESIGN PROTECTED BAE PANZERPOL – POLE BUSHING FOR CELLS AND BLOCK BATTERIES:



LEAD POLE WITH BRASS
OR COPPER INLAY

WASHERS IN
POLARITY COLOURS

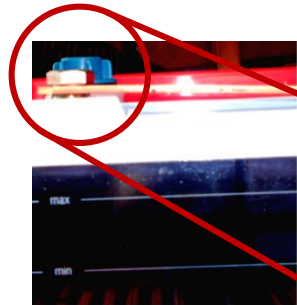
SEALING RING ALLOWS 16 MM (!) SLIDING
OF THE POLE WHILE KEEPING 100% TIGHT

LABYRINTH WITH PRIMER BETWEEN
PLASTIC AND POLE

PLASTIC INJECTION
MOLDING

BAE "PANZERPOL"

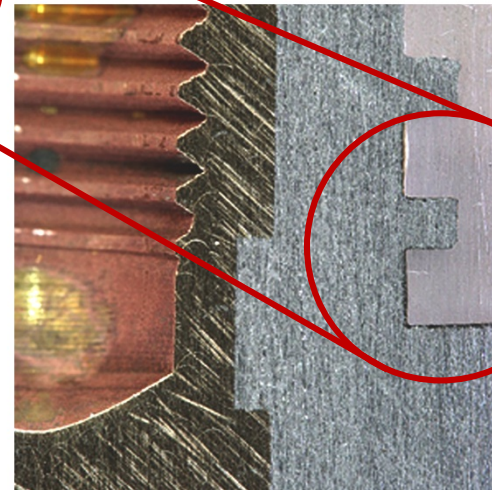
5 POLE BUSHING AND TERMINAL DESIGN "PANZERPOL":



6 V 11 OGi 275
block battery – 10
years in operation
at airport Dresden

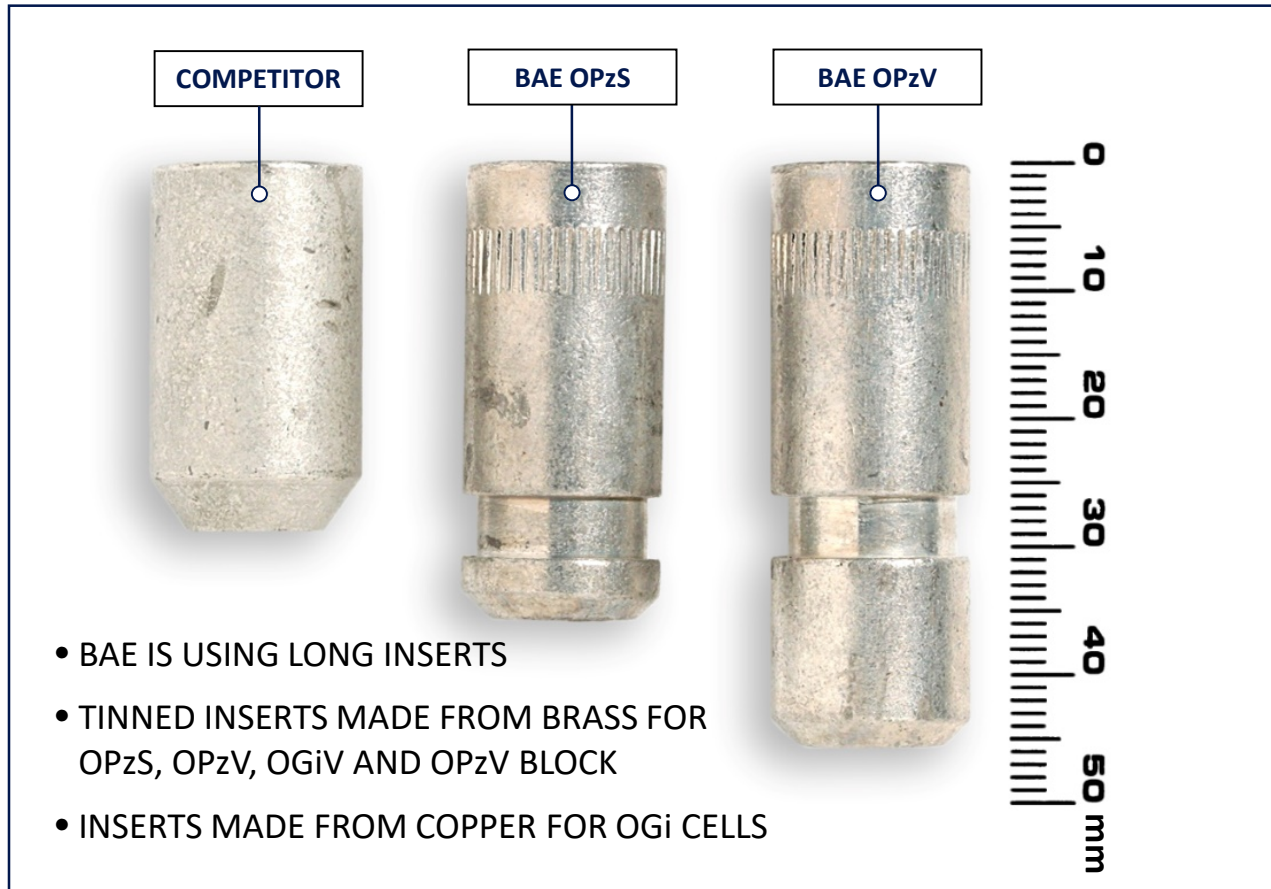


BAE "PANZERPOL"



**NO CORROSION, NO ACID
PENETRATION, AFTER 10
YEARS IN OPERATION!**

5 BLOCK AND SINGLE CELL PRODUCTION: BAE "PANZERPOL" INSERTS:

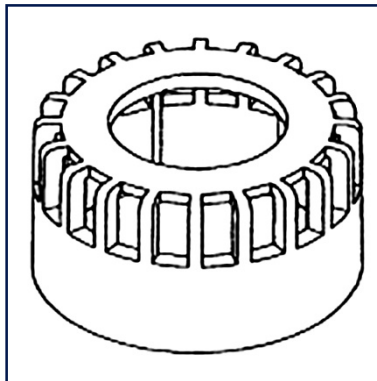


**BEST CONDUCTIVITY AND
CURRENT CARRY CAPABILITY**

5 PATENTED SERVICE CAP AND TERMINAL DESIGN "PANZERPOL":



BAE INSULATED BATTERY POLE WITH SERVICE CAP



OPTIMISED POLE BUSHING SET WITH PATENTED SERVICE CAP:

- SLIDING TERMINAL CONSTRUCTION ALLOWS GROWTH OF PLATE SET DURING THE LIFETIME AND PREVENTS DAMAGING THE BATTERY LID
- DESIGN OF "PANZERPOL" IS USED FOR CELLS AS WELL AS FOR BLOCK BATTERIES (FOR EVERY SINGLE CELL OF THE BLOCK BATTERY)
- ADDITIONAL SERVICE RING FOR CELLS ALLOWS ACCESS FOR MAINTENANCE (VOLTAGE READING) WITH INSTALLED CONNECTORS

TIGHT TERMINAL BUSHING AND ACCESS TO POLES OVER COMPLETE BATTERY LIFETIME

THANK YOU

FOR YOUR ATTENTION!

*TRADITION, RELIABILITY
AND INNOVATION*