



TOMSK POLYTECHNIC UNIVERSITY

EQUIPMENT OF ONE-CIRCUIT NPP



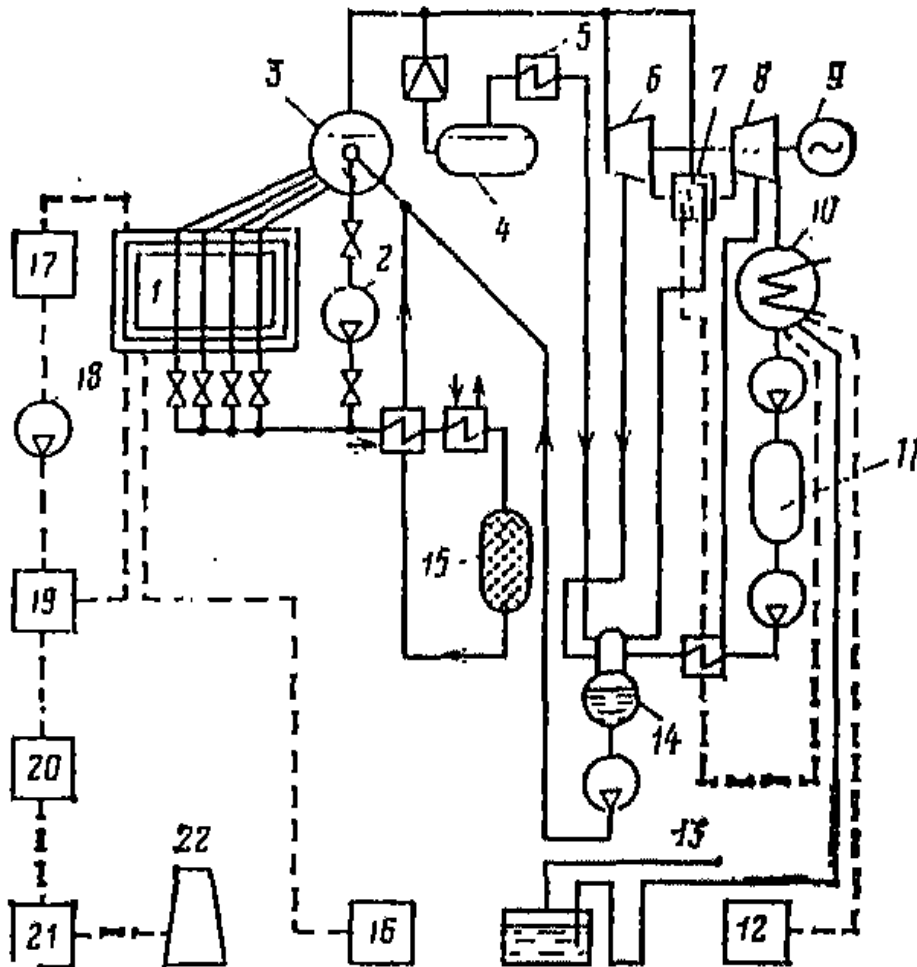
MAIN FEATURES

- Definition and main properties of reactor
- Main schemes and equipment
- Construction of reactor part
- Subsystems of I-circuit NPP

DEFINITION AND MAIN FEATURES

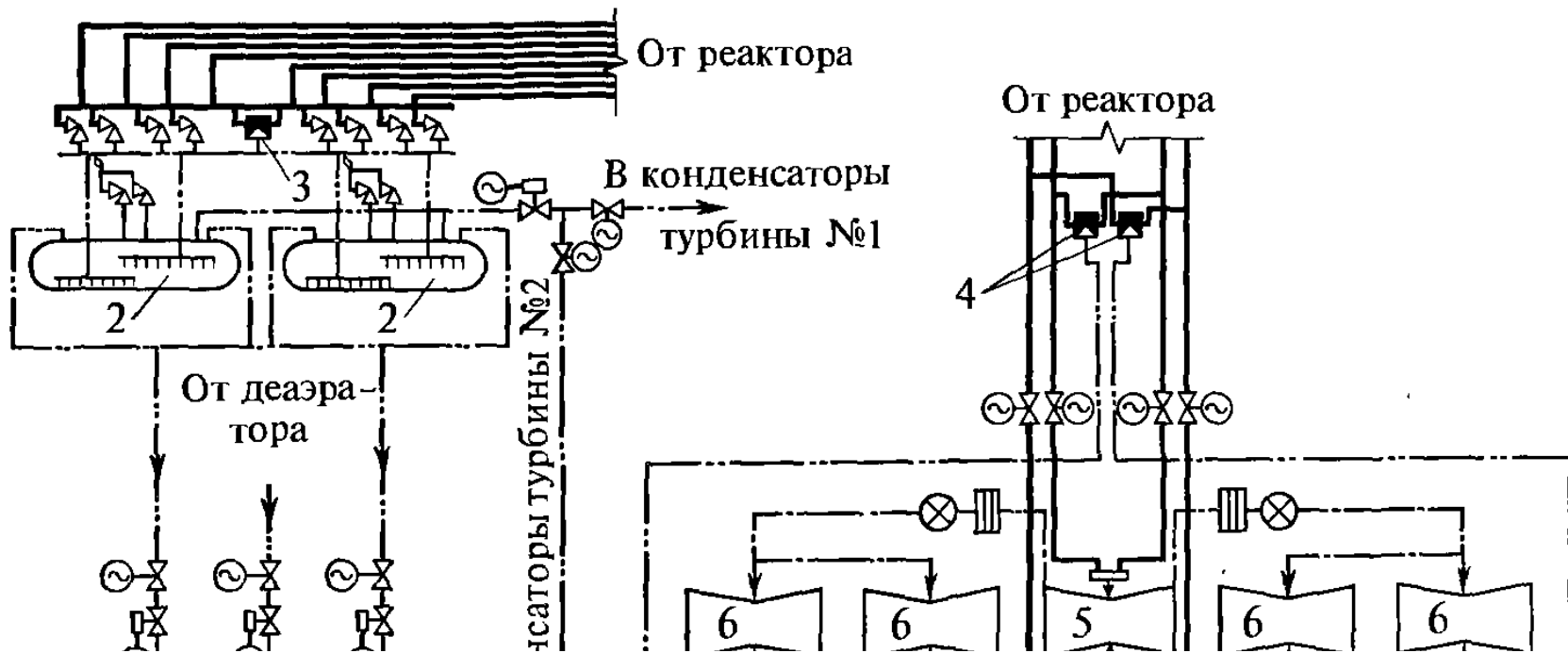
- One-circuit NPP are the first ones developed for energy purposes. Majority of the most dangerous emergency situations happen to such plants. This results into fact that nearly no new I-circuit NPP are being built nowadays. However, for some future applications (e.g., for local low power plants) I-circuit solutions are preferable.
- The one-circuit NPP will be studied on the example of RBMK-1000.
- RBMK-1000 is one-circuit nuclear energy system consisting of nuclear steam-generating part (water-graphite channel-type with boiling heat carrier), two turbine units and auxiliary systems. RBMK-1000 is operated on dry saturated steam (sometimes with small superheating) with intermediate heating.
- Steam is produced directly into active zone of reactor, then it is separated into drum and proceeded into turbine. After the first stage steam enters separator-superheater before entering the second stage of turbine. The superheating is realized using fresh steam.

PRINCIPAL SCHEME OF RBMK-1000



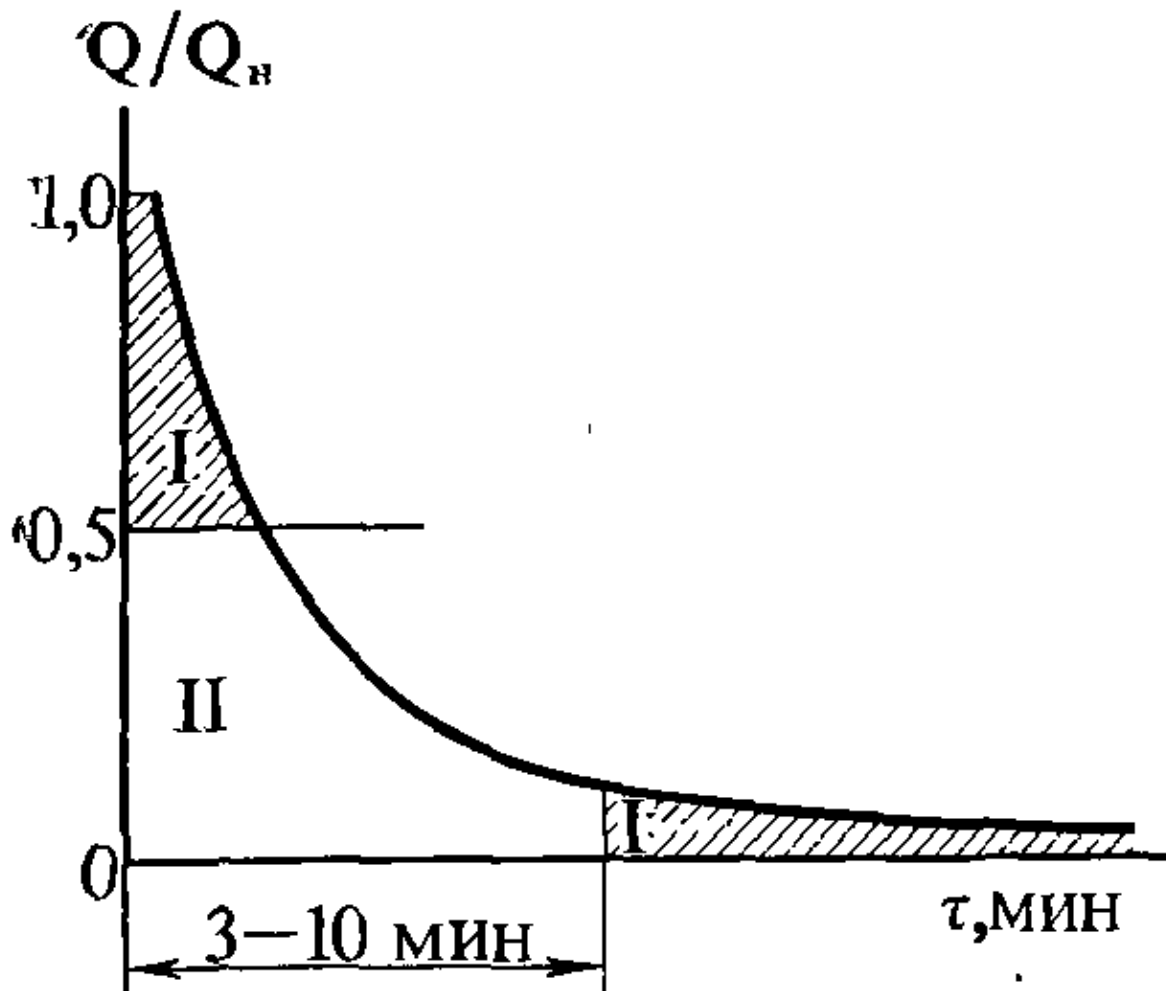
1. Reactor
2. Main circulation pump
3. Drum-separator
4. Barboteur
5. Technological condenser
6. HPC
7. Separator-superheater
8. LPC
9. Generator
10. Main condenser
11. Condensate filter
12. Gas cleansing
13. Additional water pump
14. Deaerator
15. Filter
16. Nitrogen station
17. Aerosol and iodide filter
18. Compressor
19. Gas-adsorber
20. Gasholder
21. Additional filter
22. Vent tube

EMERGENCY STEAM REMOVAL SYSTEM



1. Technological condensers
2. Barboteur
3. Reduction device for barboteurs
4. Reduction device for condenser
5. High pressure cylinder of turbine
6. Low pressure cylinder of turbine
7. Turbine condensers
8. Separators-superheaters

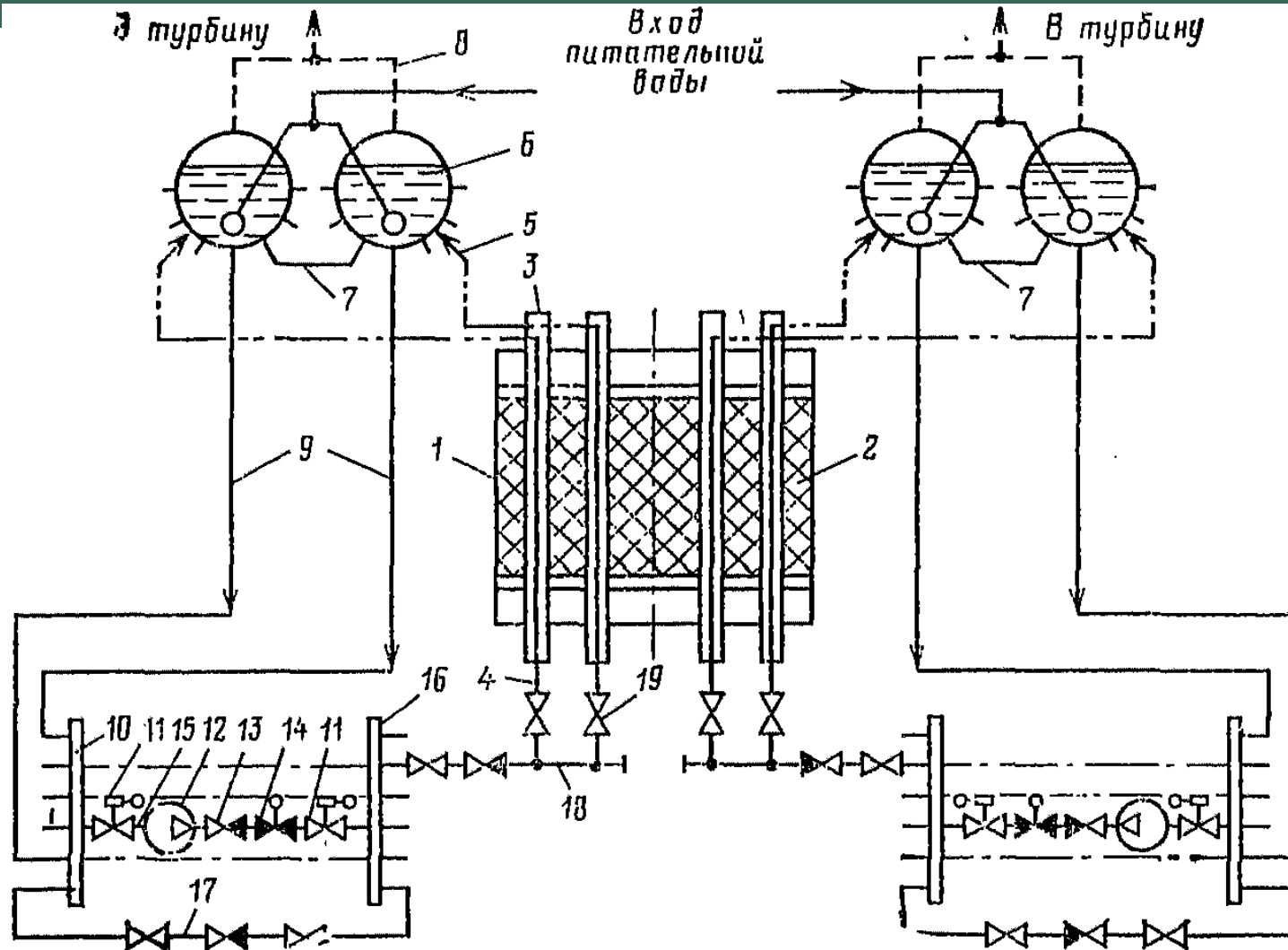
DISTRIBUTION OF COOLING BY SOURCES AFTER COMPLETE SHUTDOWN



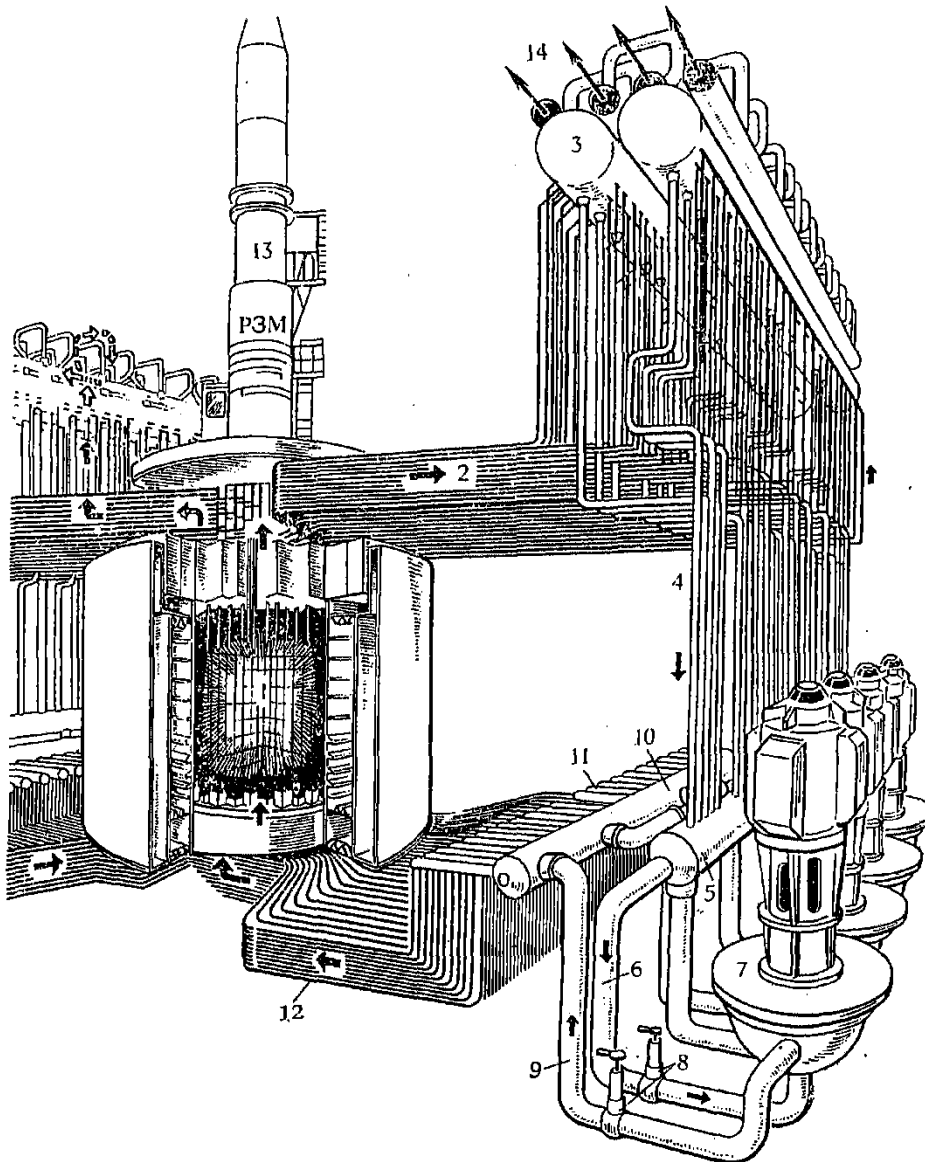
I – to barboteur

II – to turbine condenser

PRINCIPAL SCHEME OF MULTIPLE FORCED CIRCULATION CONTOUR

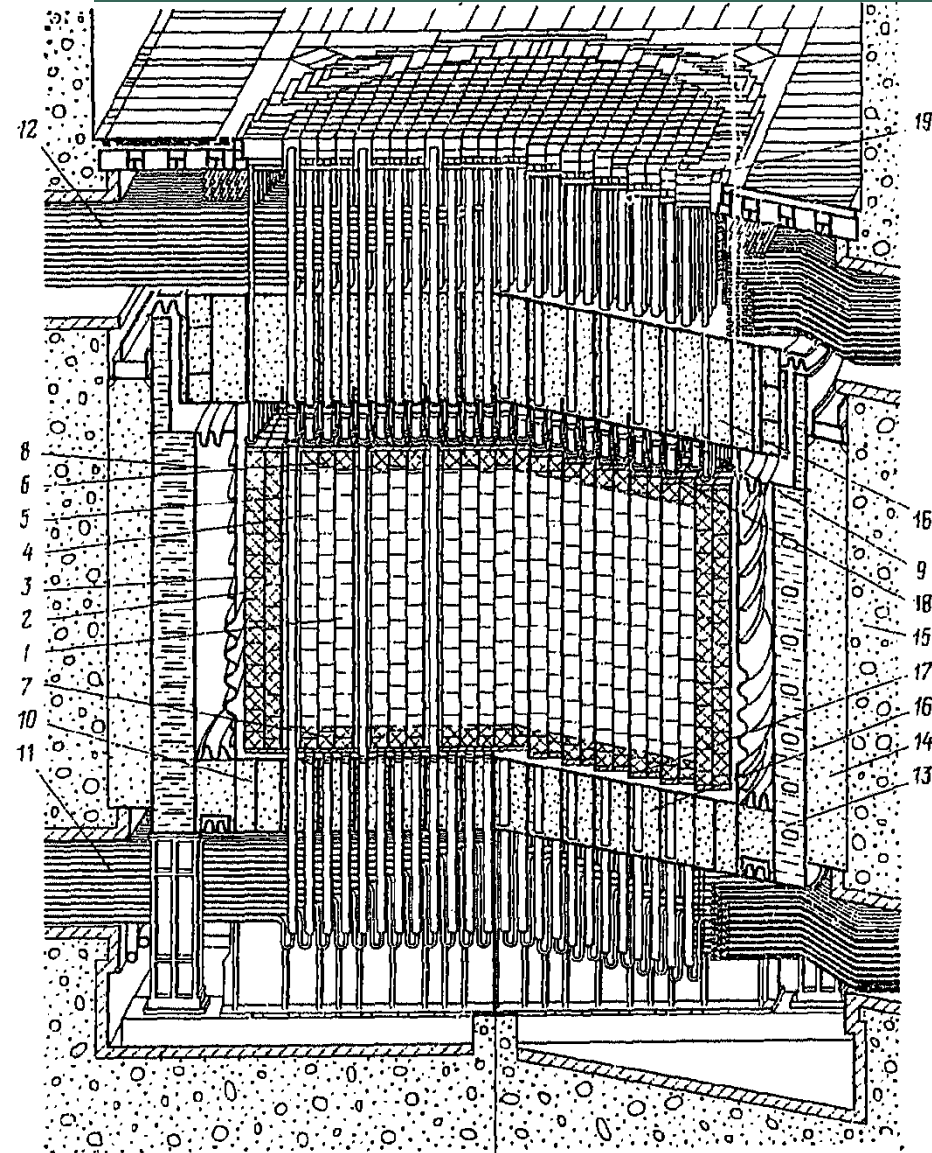


COMPOUNDING OF REACTOR PART



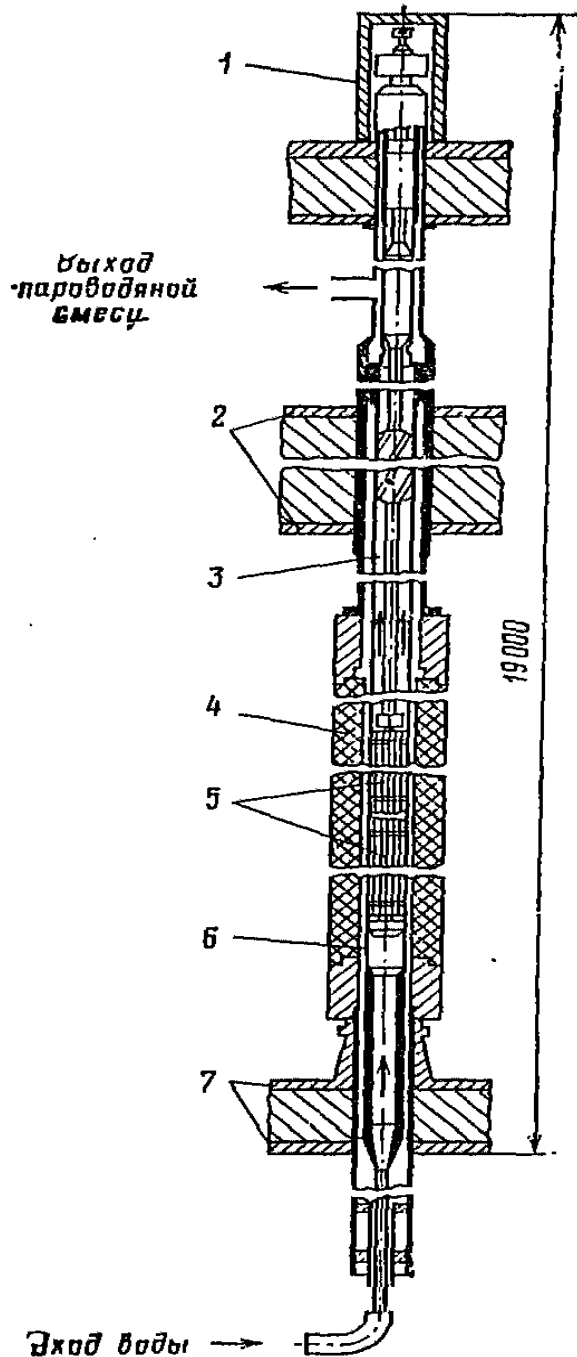
1. Reactor
2. Individual tubes for channels
3. Horizontal drum-separator
4. Descending tubes
5. Inlet collector
6. Inlet tube
7. Main circulating pump
8. Closing valves
9. Outlet tubes
10. Outlet collector
11. Group collector
12. Individual tubes for communication
13. Loading device
14. Steam pipes

DETAILED CONSTRUCTION OF REACTOR



1. Active zone
2. Side reflector
3. Casing
4. Graphite laying
5. Tube channel
6. Upper reflector
7. Bottom reflector
8. Ring gas space
9. Upper metal bearing
10. Bottom metal bearing
11. Water channel
12. Individual channel
13. Ring water tank
14. Side isolation
15. Concrete shaft
16. Serpentine protection
17. Metal bottom protective blocks
18. Metal upper protective blocks
19. Serpentine cover

TECHNOLOGICAL CHANNEL



1. Upper biological protection
2. Frontal protective metal construction
3. Technological channel
4. Graphite laying
5. Heat releasing compounding
6. Central tube of technological channel
7. Lower base metal construction

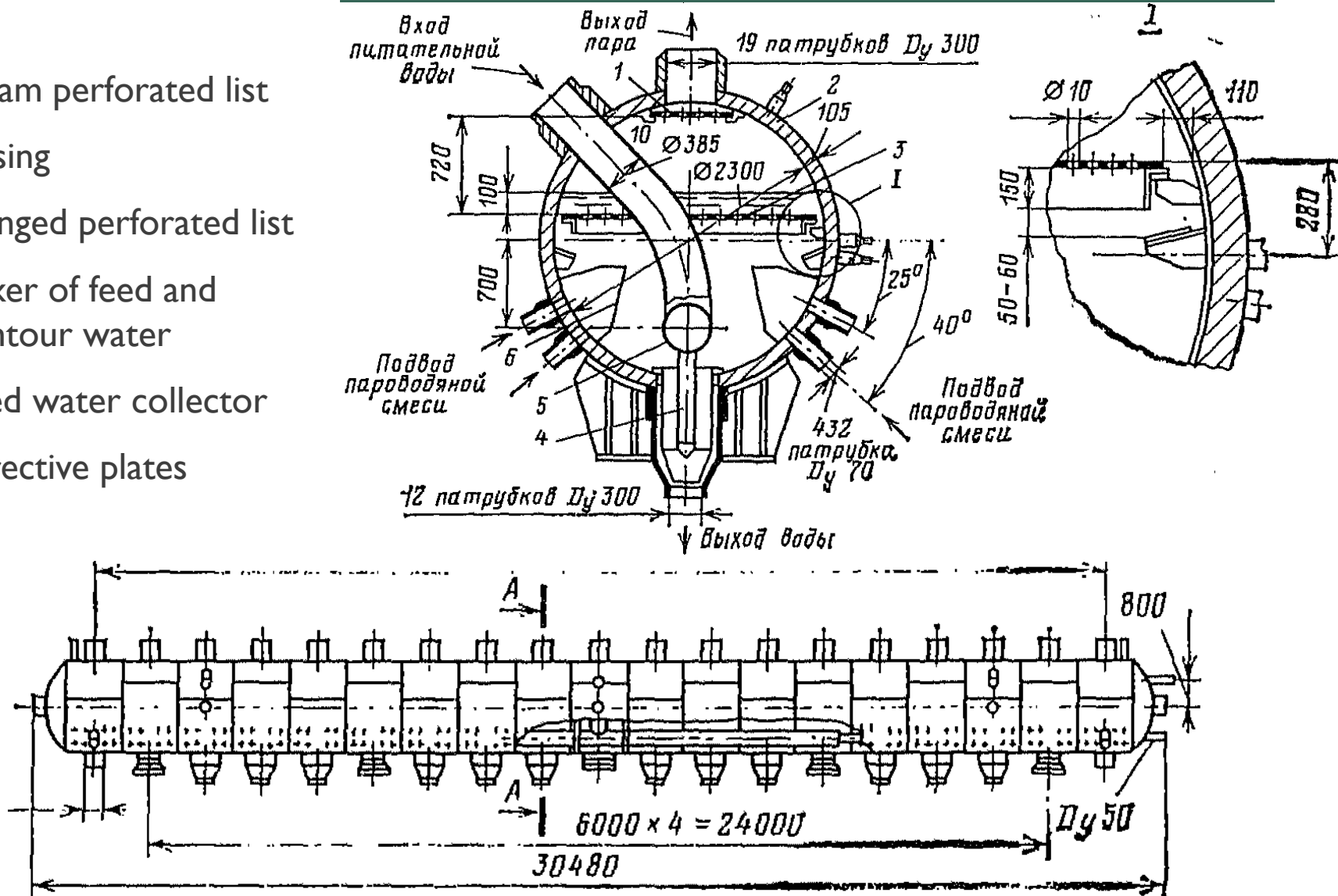
AUXILIARY SYSTEMS

- Reactor technological control systems (RTS):
 - Cooling of RTS technological channel.
 - Control of energy release.
 - Control of heat release compound tightness.
 - Control of technological channel security.
 - Control of water flow rate.
 - Control of metal and graphite temperature.
- Heat release control detectors.
- Side biological protection.
- Emergency reactor cooling.

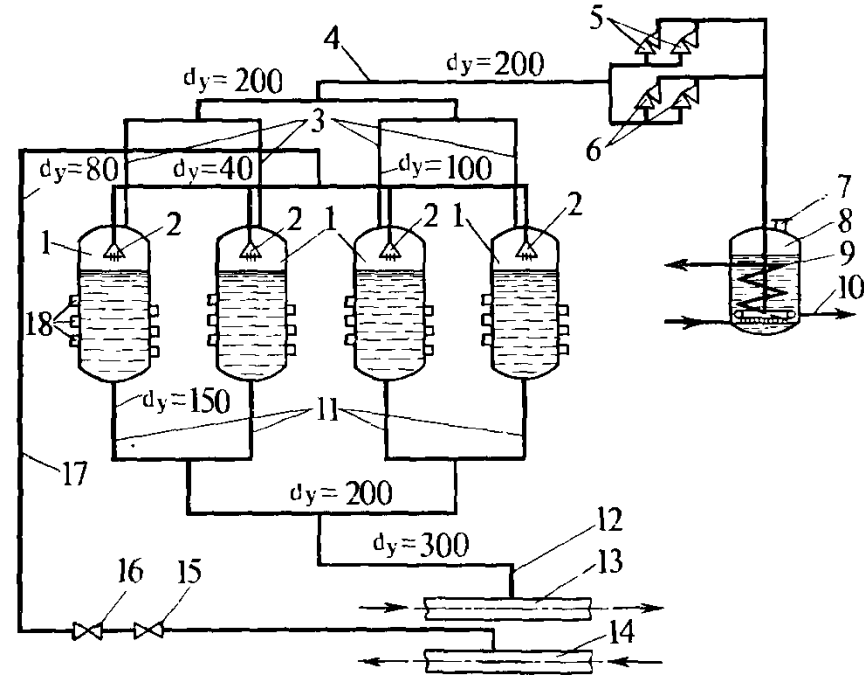
Gas circuit of RBMK reactor is meant to ensure circulation of helium-nitrogen mixture through internal cavities of metal constructions and active zone, ensure tightness of reactor.

DRUM-SEPARATOR OF RBMK-1000

1. Steam perforated list
2. Casing
3. Plunged perforated list
4. Mixer of feed and contour water
5. Feed water collector
6. Directive plates

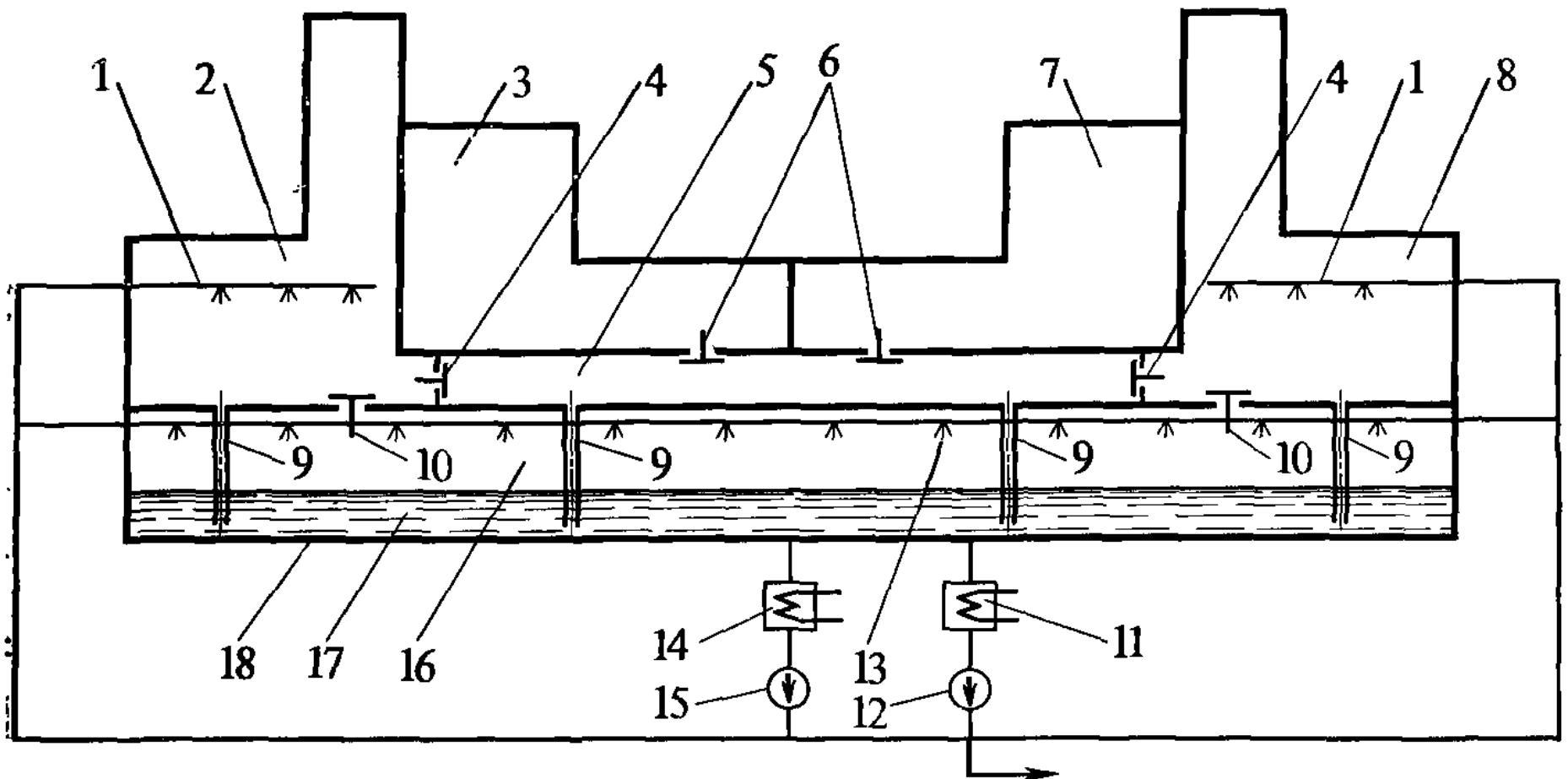


COMPENSATION OF STEAM SPACE



1. Compensator casing
2. Inlet nozzles
3. Connection steam tubes
4. Steam collector
5. Safety valves
6. Safety valves
7. Explosive valve
8. Cooling coil
9. Water drainage
10. Water drainage
11. Connective tubes
12. Connection tube with main circulation circuit
13. "Hot" connection tube with main circulation circuit
14. "Cool" connection tube with main circulation circuit
15. Shut-off valve
16. Regulating valve
17. Water inject line
18. Electrical heaters

PRINCIPAL SCHEME OF RBMK-1000 NPP REACTOR LOCALIZATION





THANK YOU FOR YOUR ATTENTION