

## 6. HEAT TRANSPORT SYSTEM

- 6.1. Number of coolant loops
- 6.2. Coolant inventory

### Experimental Fast Reactors

Plant	Number of coolant loops		Coolant inventory (t)	
	Primary (or for pool reactors, the number of primary pumps)	Secondary	Primary	Secondary
Rapsodie (France)	2	2	36.8	20
KNK-II (Germany)	2	2	27	50
FBTR (India)	2	2	26.7	44
PEC (Italy)	2 (1*)	2 (1*)	118 (14*)	67 (3.4*)
JOYO (Japan)	2	2	126	73
DFR (UK)	24	12	51	63
BOR-60 (Russian Federation)	2	2	22	20
EBR-II (USA)	2	1	286	41
Fermi (USA)	3	3	160	102
FFTF (USA)	3	3	406	199
BR-10 (Russian Federation)	2	2	1.7	5
CEFR (China)	2	2	260	48.2

### Demonstration or Prototype Fast Reactors

Phénix (France)	3	3	800	381
SNR-300 (Germany)	3	3	550	402
PFBR (India)	2	2	1100	410
MONJU (Japan)	3	3	760	760
PFR (UK)	3	3	850	240
CRBRP (USA)	3	3	630	580
BN-350 (Kazakhstan)	6**	6**	470	450
BN-600 (Russian Federation)	3	3	770	830
ALMR (USA)	1	1	700	300
KALIMER-150 (Republic of Korea)	4	2	to be determined	
SVBR-75/100 (Russian Federation)	2	none	193	-
BREST-OD-300 (Russian Federation)	4	none	8600	-

\* test channel

\*\* one loop is a reserve loop

**Note:** all loops have one pump except the EBR-II primary and DFR secondary loops

## 6. HEAT TRANSPORT SYSTEM (cont.)

- 6.1. Number of coolant loops
- 6.2. Coolant inventory

### Commercial Size Reactors

Plant	Number of coolant loops		Coolant inventory (t)	
	Primary (or for pool reactors, the number of primary pumps)	Secondary	Primary	Secondary
Super-Phénix 1 (France)	4	4	3200	1500
Super-Phénix 2 (France)	4	4	3300	800
SNR 2 (Germany)	4	8	3300	1250
DFBR (Japan)	3	3	1700	570
CDFR (UK)	4	4	3000	1600
BN-1600 (Russian Federation)	3	6	2600	2700
BN-800 (Russian Federation)	3	3	820	1100
EFR	3	6	2200	1300
ALMR (USA)	1	1	700	30
SVBR-75/100 (Russian Federation)	2	none	193x16	-
BN-1800 (Russian Federation)	3	6	2620	to be determined
BREST-1200 (Russian Federation)	4	none	to be determined	-
JSFR-1500 (Japan)	2	2	1333	862

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.3. Coolant flow rate

#### Experimental Fast Reactors

Plant	Coolant flow rate (kg/s)			
	Primary		Secondary	
	Total	Per loop	Total	Per loop
Rapsodie (France)	230	115	204	102
KNK-II (Germany)	280	140	260	130
FBTR (India)	230	115	138	69
PEC (Italy)	630 (15.8*)	315 (15.8*)	624 (15.8*)	312 (15.8*)
JOYO (Japan)	750**	380***	670****	330*****
DFR (UK)	450	19	450	38
BOR-60 (Russian Federation)	270	135	220	110
EBR-II (USA)	500	250	297	297
Fermi (USA)	1185	395	1200	400
FFTF (USA)	2180	727	2180	727
BR-10 (Russian Federation)	48	24	50	25
CEFR (China)	400	200	274	137

#### Demonstration or Prototype Fast Reactors

Phénix (France)	3000	1000	2319	773
SNR-300 (Germany)	3550	1180	3270	1090
PFBR (India)	7080	3540	5800	2900
MONJU (Japan)	4250	1420	3090	1030
PFR (UK)	3090	1030	2925	975
CRBRP (USA)	5240	1747	4836	1612
BN-350 (Kazakhstan)	3950	790	4400	880
BN-600	6600*****	2200	6090	2030
ALMR (USA)	4762	4762	4409	4409
KALIMER-150 (Republic of Korea)	2143	536	1804	902
SVBR-75/100 (Russian Federation)	11760	5880	-	-
BREST-OD-300 (Russian Federation)	41600	10400	-	-

\* test channel

\*\* 600 in MK-I and MK-II

\*\*\* 300 in MK-I and MK-II

\*\*\*\* 600 in MK-I and MK-II

\*\*\*\*\* 300 in MK-I and MK-II

\*\*\*\*\* core excluding flowrate to the reactor vessel cooling system

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.3. Coolant flow rate

#### Commercial Size Reactors

Plant	Coolant flow rate (kg/s)			
	Primary		Secondary	
	Total	Per loop	Total	Per loop
Super-Phénix 1 (France)	15700	-	13100	3270
Super-Phénix 2 (France)	19700	4925	15700	3920
SNR 2 (Germany)	18000	4500	-	4000
DFBR (Japan)	8160	2720	6780	2260
CDFR (UK)	15400	3860	15000	3747
BN-1600 (Russian Federation)	19500*****	6500	17800	2970
BN-800 (Russian Federation)	8600*****	2900	8400	2780
EFR	19300	6433	15300	2550
ALMR (USA)	4762	4762	4409	4409
SVBR-75/100 (Russian Federation)	11760	5880	-	-
BN-1800 (Russian Federation)	to be determined			
BREST-1200 (Russian Federation)	to be determined			
JSFR-1500 (Japan)	18005	9002	15022	7511

\*\*\*\*\* core excluding flowrate to the reactor vessel cooling system

## 6. HEAT TRANSPORT SYSTEM (cont.)

- 6.4. Coolant velocity in core
- 6.5. Pressure drop across core

### Experimental Fast Reactors

Plant	Coolant velocity in core (m/s)		Pressure drop across core (MPa)
	Maximum	Average	
Rapsodie (France)	5.5	-	-
KNK-II (Germany)	-	-	-
FBTR (India)	6.2	5.4	0.3
PEC (Italy)	6.1	5.0	-
JOYO (Japan)	6.1 (6.6 in MK-I, II)	5.3	0.33
DFR (UK)	6.0	6.0	-
BOR-60 (Russian Federation)	11.0	8.0	0.35
EBR-II (USA)	8.0	~ 0.5	-
Fermi (USA)	-	4.8	-
FFTF (USA)	7.4	6.8	-
BR-10 (Russian Federation)	4.0	-	0.1
CEFR (China)	4.74	3.7	0.28

### Demonstration or Prototype Fast Reactors

Phénix (France)	12.0	9.0	0.45
SNR-300 (Germany)	-	5.0	-
PFBR (India)	8.0	7.7	0.54
MONJU (Japan)	6.9	5.8	0.25
PFR (UK)	9	7.3	-
CRBRP (USA)	7.3	6.7	-
BN-350 (Kazakhstan)	7.4	6.5	0.69
BN-600 (Russian Federation)	8.0	7.5	0.70
ALMR (USA)	5.3	4.7	0.5
KALIMER-150 (Republic of Korea)	5.1	4.2	≤ 0.6
SVBR-75/100 (Russian Federation)	-	2.0	0.4
BREST-OD-300 (Russian Federation)	1.67	-	0.155

## 6. HEAT TRANSPORT SYSTEM (cont.)

- 6.4. Coolant velocity in core
- 6.5. Pressure drop across core

### Commercial Size Reactors

Plant	Coolant velocity in core (m/s)		Pressure drop across core (MPa)
	Maximum	Average	
Super-Phénix 1 (France)	7.7	6.1	0.47
Super-Phénix 2 (France)	-	-	-
SNR 2 (Germany)	-	-	-
DFBR (Japan)	-	-	0.5
CDFR (UK)	7.0	6.5	-
BN-1600 (Russian Federation)	5.7	5.3	0.45
BN-800 (Russian Federation)	7.3	6.7	0.68
EFR	7.8	6.7	0.5
ALMR (USA)	5.3	4.7	0.5
SVBR-75/100 (Russian Federation)	-	2.0	0.4
BN-1800 (Russian Federation)	to be determined		
BREST-1200 (Russian Federation)	≤ 2.0	to be determined	-
JSFR-1500 (Japan)	4.1*	2.9	0.3

\* at sub-assembly outlet

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.6. Coolant temperature

#### Experimental Fast Reactors

Plant	Coolant temperature (°C)	
	Primary (hot leg)	Primary (cold leg)
Rapsodie (France)	515	400
KNK-II (Germany)	525	360
FBTR (India)	515	380
PEC (Italy)	545 (600 Max. *)	400 (450 Max. *)
JOYO (Japan)	500**	350***
DFR (UK)	350	230
BOR-60 (Russian Federation)	530	330
EBR-II (USA)	473	371
Fermi (USA)	427	288
FFTF (USA)	503	360
BR-10 (Russian Federation)	470	350
CEFR (China)	530	360

#### Demonstration or Prototype Fast Reactors

Phénix (France)	560	395
SNR-300 (Germany)	546	377
PFBR (India)	547	397
MONJU (Japan)	529	397
PFR (UK)	560	399
CRBRP (USA)	535	388
BN-350 (Kazakhstan)	430	280
BN-600 (Russian Federation)	535	365
ALMR (USA)	498	358
KALIMER-150 (Republic of Korea)	530	386
SVBR-75/100 (Russian Federation)	435	286
BREST-OD-300 (Russian Federation)	540	420

\* test channel

\*\* 465 in MK-I, 75 MWth

\*\*\* 370 in MK-I, II

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.6. Coolant temperature

#### Commercial Size Reactors

Plant	Coolant temperature (°C)	
	Primary (hot leg)	Primary (cold leg)
Super-Phénix 1 (France)	545	395
Super-Phénix 2 (France)	544	397
SNR 2 (Germany)	540	390
DFBR (Japan)	550	395
CDFR (UK)	540	370
BN-1600 (Russian Federation)	550	395
BN-800 (Russian Federation)	547	354
EFR	545	395
ALMR (USA)	498	358
SVBR-75/100 (Russian Federation)	482	320
BN-1800 (Russian Federation)	575	410
BREST-1200 (Russian Federation)	540	420
JSFR-1500 (Japan)	550	395

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.6. Coolant temperature

#### Experimental Fast Reactors

Plant	Coolant temperature (°C)	
	Primary (hot leg)	Primary (cold leg)
Rapsodie (France)	485	360
KNK-II (Germany)	504	322
FBTR (India)	510	284
PEC (Italy)	495 (470-585*)	350 (320-435*)
JOYO (Japan)	470 (445 in MK-I)	300**
DFR (UK)	335	195
BOR-60 (Russian Federation)	480	210
EBR-II (USA)	467	270
Fermi (USA)	408	269
FFTF (USA)	459	316
BR-10 (Russian Federation)	380	270
CEFR (China)	495	310

#### Demonstration or Prototype Fast Reactors

Phénix (France)	550	343
SNR-300 (Germany)	520	335
PFBR (India)	525	355
MONJU (Japan)	505	325
PFR (UK)	540	370
CRBRP (USA)	502	344
BN-350 (Kazakhstan)	415	260
BN-600 (Russian Federation)	510	315
ALMR (USA)	477	325
KALIMER-150 (Republic of Korea)	511	340
SVBR-75/100 (Russian Federation)	none	
BREST-OD-300 (Russian Federation)	none	

\* test channel

\*\* 355 and 340 in in MK-I, II, respectively

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.6. Coolant temperature

#### Commercial Size Reactors

Plant	Coolant temperature (°C)	
	Secondary (hot leg)	Secondary (cold leg)
Super-Phénix 1 (France)	525	345
Super-Phénix 2 (France)	525	345
SNR 2 (Germany)	510	340
DFBR (Japan)	520	335
CDFR (UK)	510	335
BN-1600 (Russian Federation)	515	345
BN-800 (Russian Federation)	505	309
EFR	525	340
ALMR (USA)	477	324
SVBR-75/100 (Russian Federation)	none	
BN-1800 (Russian Federation)	540	370
BREST-1200 (Russian Federation)	none	
JSFR-1500 (Japan)	520	335

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.6. Coolant temperature

#### Experimental Fast Reactors

Plant	Coolant temperature (°C)	
	Steam (water)	
	Steam generator (outlet)	Steam generator (inlet)
Rapsodie (France)	no SG, dump heat exchanger	
KNK-II (Germany)	485	200
FBTR (India)	480	200
PEC (Italy)	no SG, dump heat exchanger	
JOYO (Japan)	no SG, dump heat exchanger	
DFR (UK)	274	200
BOR-60 (Russian Federation)	430	200
EBR-II (USA)	433	301
Fermi (USA)	407	171
FFTF (USA)	no SG, dump heat exchanger	
BR-10 (Russian Federation)	no SG, dump heat exchanger	
CEFR (China)	480	190

#### Demonstration or Prototype Fast Reactors

Phénix (France)	512	246
SNR-300 (Germany)	495	230
PFBR (India)	493	235
MONJU (Japan)	487	240
PFR (UK)	515	342
CRBRP (USA)	482	242
BN-350 (Kazakhstan)	410	158
BN-600 (Russian Federation)	505	240
ALMR (USA)	454	215
KALIMER-150 (Republic of Korea)	483.2	230
SVBR-75/100 (Russian Federation)	260	225
BREST-OD-300 (Russian Federation)	525	355

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.6. Coolant temperature

#### Commercial Size Reactors

Plant	Coolant temperature (°C)	
	Steam (water)	
	Steam generator (outlet)	Steam generator (inlet)
Super-Phénix 1 (France)	490	237
Super-Phénix 2 (France)	490	237
SNR 2 (Germany)	490	240
DFBR (Japan)	495	240
CDFR (UK)	490	196
BN-1600 (Russian Federation)	495	240
BN-800 (Russian Federation)	490	190-210
EFR	490	240
ALMR (USA)	454	215
SVBR-75/100 (Russian Federation)	307	240
BN-1800 (Russian Federation)	525	270
BREST-1200 (Russian Federation)	525	355
JSFR-1500 (Japan)	497	240

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Experimental Fast Reactors

Plant	Piping	
	Primary circuit material: hot leg (for pool reactors, there is no hot leg piping)	Primary circuit material: cold leg (for pool reactors, this is the piping connecting the primary pumps to the diagrid)
Rapsodie (France)	316	316
KNK-II (Germany)	1.6770	1.6770
FBTR (India)	316	316
PEC (Italy)	316 (316 B.F.*)	316 (316*)
JOYO (Japan)	304	304
DFR (UK)	18/8/1	18/8/1
BOR-60 (Russian Federation)	Cr 18 Ni 9	Cr 18 Ni 9
EBR-II (USA)	304	304
Fermi (USA)	304	304
FFTF (USA)	316	304
BR-10 (Russian Federation)	Cr 18 Ni9	Cr 18 Ni9
CEFR (China)	-	304

#### Demonstration or Prototype Fast Reactors

Phénix (France)	316	316
SNR-300 (Germany)	1.4948	1.4948
PFBR (India)	316 LN	316 LN
MONJU (Japan)	304	304
PFR (UK)	321	321
CRBRP (USA)	316	304
BN-350 (Kazakhstan)	Cr 18 Ni 9	Cr 18 Ni 9
BN-600 (Russian Federation)	Cr 18 Ni 9	Cr 18 Ni 9
ALMR (USA)	316	316
KALIMER-150 (Republic of Korea)	316	316
SVBR-75/100 (Russian Federation)	EP 302	Cr 18 Ni 9
BREST-OD-300 (Russian Federation)	none	none

\* test channel

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Commercial Size Reactors

Plant	Piping	
	Primary circuit material: hot leg (for pool reactors, there is no hot leg piping)	Primary circuit material: cold leg (for pool reactors, this is the piping connecting the primary pumps to the diagrid)
Super-Phénix 1 (France)	Cr18 Ni12 Mo2.5 Mn1.8 Si	Cr18 Ni10
Super-Phénix 2 (France)	-	-
SNR 2 (Germany)	304	304
DFBR (Japan)	316 FR	304
CDFR (UK)	316	304
BN-1600 (Russian Federation)	Cr 18 Ni 9	Cr 18 Ni 9
BN-800 (Russian Federation)	Cr 18 Ni 9	Cr 18 Ni 9
EFR	Cr 18 Ni13	Cr18 Ni13
ALMR	316	316
SVBR-75/100 (Russian Federation)	EP 302	Cr 18 Ni 9
BN-1800 (Russian Federation)	Cr 18 Ni 9	Cr 18 Ni 9
BREST-1200 (Russian Federation)	none	none
JSFR-1500 (Japan)	12Cr-Steel	12Cr-Steel

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Experimental Fast Reactors

Plant	Piping	
	Secondary piping material	
	Hot leg	Cold leg
Rapsodie (France)	316	316
KNK-II (Germany)	1.6770	1.6770
FBTR (India)	316 LN	316 LN
PEC (Italy)	316	316
JOYO (Japan)	2 1/4 Cr-1 Mo	2 1/4 Cr-1 Mo
DFR (UK)	18/8/1	18/8/1
BOR-0 (Russian Federation)	Cr 18 Ni 9	Cr 18 Ni 9
EBR-II (USA)	304*	304*
Fermi (USA)	2 1/4 Cr-1 Mo	2 1/4 Cr-1 Mo
FFTF (USA)	316	304
BR-10 (Russian Federation)	Cr 18 Ni9	Cr 18 Ni9
CEFR (China)	304 H	304 L

#### Demonstration or Prototype Fast Reactors

Phénix (France)	321	304
SNR-300 (Germany)	1.4948	-
PFBR (India)	316 LN	316 LN
MONJU (Japan)	304	304
PFR (UK)	321	321
CRBRP (USA)	316H	304H
BN-350 (Kazakhstan)	Cr 18 Ni 9	Cr 18 Ni 9
BN-600 (Russian Federation)	Cr 18 Ni 9	Cr 18 Ni 9
ALMR (USA)	316	316
KALIMER-150 (Republic of Korea)	316	316
SVBR-75/100 (Russian Federation)	none	none
BREST-OD-300 (Russian Federation)	none	none

\* 2 1/4 Cr-1 Mo used for connection to steam generator components

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Commercial Size Reactors

Plant	Piping	
	Secondary piping material	
	Hot leg	Cold leg
Super-Phénix 1 (France)	Cr18 Ni12 Mo 2.5 Mn1.8 Si	Cr18 Ni12 Mo 2.5 Mn1.8 Si
Super-Phénix 2 (France)	316	316
SNR 2 (Germany)	304	304
DFBR (Japan)	304	304
CDFR (UK)	316	316
BN-1600 (Russian Federation)	Cr 18 Ni 9	Cr 18 Ni 9
BN-800 (Russian Federation)	Cr 16 Ni 11 Mo 3	Cr 18 Ni 9
EFR	Cr 18 Ni 13	Cr 18 Ni 13
ALMR (USA)	316	316
SVBR-75/100 (Russian Federation)	none	none
BN-1800 (Russian Federation)	to be determined	
BREST-1200 (Russian Federation)	none	none
JSFR-1500 (Japan)	12Cr-Steel	12Cr-Steel

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Experimental Fast Reactors

Plant	Piping	
	Steam (water) piping material	
	Hot leg	Cold leg
Rapsodie (France)	no SG, dump heat exchanger	-
KNK-II (Germany)	no SG, dump heat exchanger	-
FBTR (India)	A335 Gr.P2	SA106 Gr.B
PEC (Italy)	no SG, dump heat exchanger	-
JOYO (Japan)	no SG, dump heat exchanger	-
DFR (UK)	18/8/1 in Cu Bond	mild steel
BOR-60 (Russian Federation)	12 Cr 1 Mo	12 Cr 1 Mo
EBR-II (USA)	2¼ Cr-1 Mo	2¼ Cr-1 Mo
Fermi (USA)	no SG, dump heat exchanger	-
FFTF (USA)	no SG, dump heat exchanger	-
BR-10 (Russian Federation)	no SG, dump heat exchanger	-
CEFR (China)	12 Cr Mo1 V	12 Cr Mo1 V

#### Demonstration or Prototype Fast Reactors

Phénix (France)	1 and 2% Cr	A42
SNR-300 (Germany)	X20 Cr Mo 12	15 Ni Cu Mo Nb 5
PFBR (India)	SA335 Gr P12	SA106 Gr.C
MONJU (Japan)	low alloy steel	carbon steel
PFR (UK)	2¼ Cr-1 Mo and 18/8/1	mild steel
CRBRP(USA)	2¼ Cr-1 Mo	SA106 Gr. B
BN-350 (Kazakhstan)	12 Cr 1Mo, V	carbon steel
BN-600 (Russian Federation)	12 Cr 1Mo, V	carbon steel Mn1
ALMR (USA)	2¼ Cr-1 Mo	2¼ Cr-1 Mo
KALIMER-150 (Republic of Korea)	carbon steel	carbon steel
SVBR-75/100 (Russian Federation)	to be determined	
BREST-OD-300 (Russian Federation)	Cr 18 Ni 10	Cr 18 Ni 10

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Commercial Size Reactors

Plant	Piping	
	Steam (water) piping material	
	Hot leg	Cold leg
Super-Phénix 1 (France)	Cr 1 Mo Mn Si	Mn 1.2 Si
Super-Phénix 2 (France)	-	-
SNR 2 (Germany)	-	-
DFBR (Japan)	2¼ Cr-1 Mo	carbon steel
CDFR (UK)	9 Cr 1 Mo	mild steel
BN-1600 (Russian Federation)	not yet determined	-
BN-800 (Russian Federation)	12 Cr1 Mo,V	carbon steel, Mn1
EFR	20 Cr Mo 121	15 Ni Cu Mo Nb 5
ALMR (USA)	2¼ Cr 1 Mo	2¼ Cr 1 Mo
SVBR-75/100 (Russian Federation)	to be determined	-
BN-1800 (Russian Federation)	to be determined	-
BREST-1200 (Russian Federation)	Cr 18 Ni 10	Cr 18 Ni 10
JSFR-1500 (Japan)	carbon steel	carbon steel

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Experimental Fast Reactors

Plant	Piping	
	Outer diameter of primary piping, hot leg (mm)	Thickness of primary piping, hot leg (mm)
Rapsodie (France)	302	4
KNK-II (Germany)	200	-
FBTR (India)	300	4
PEC (Italy)	609 (114*)	9.5 (6*)
JOYO (Japan)	510	9.5
DFR (UK)	101	3.5
BOR-60 (Russian Federation)	325	12
EBR-II (USA)	356	6.35
Fermi (USA)	760	9.5
FFTF (USA)	710	10
BR-10 (Russian Federation)	127	8
CEFR (China)**	-	-

#### Demonstration or Prototype Fast Reactors

Phénix (France)**	-	-
SNR-300 (Germany)	610	-
PFBR (India)**	-	-
MONJU (Japan)	810	11
PFR (UK)**	-	-
CRBRP (USA)	914	13
BN-350 (Kazakhstan)	630	13
BN-600 (Russian Federation) **	-	-
ALMR (USA)**	-	-
KALIMER-150 (Republic of Korea)**	-	-
SVBR-75/100 (Russian Federation)**	-	-
BREST-OD-300 (Russian Federation)**	-	-

\* test channel

\*\* pool type reactor

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Commercial Size Reactors

Plant	Piping	
	Outer diameter of primary piping, hot leg (mm)	Thickness of primary piping, hot leg (mm)
Super-Phénix 1 (France)**	-	-
Super-Phénix 2 (France)**	-	-
SNR 2 (Germany)	900	-
DFBR (Japan)	965	15.9
CDFR (UK)**	-	-
BN-1600 (Russian Federation)**	-	-
BN-800 (Russian Federation)**	-	-
EFR**	-	-
ALMR (USA)**	-	-
SVBR-75/100 (Russian Federation)**	-	-
BN-1800 (Russian Federation)**	-	-
BREST-1200 (Russian Federation)**	-	-
JSFR-1500 (Japan)	1270	15.9

\*\* pool type reactor

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Experimental Fast Reactors

Plant	Piping	
	Outer diameter of secondary piping, hot leg (mm)	Thickness of secondary piping, hot leg (mm)
Rapsodie (France)	208	4
KNK-II (Germany)	200	-
FBTR (India)	200	8
PEC (Italy)	355.6 (114*)	8 (6*)
JOYO (Japan)	320	10.3
DFR (UK)	152	3.5
BOR-60 (Russian Federation)	325/219	12/10
EBR-II (USA)	305	6.35
Fermi (USA)	305	9.5
FFTF (USA)	405	10
BR-10 (Russian Federation)	127	8
CEFR (China)	219	10

#### Demonstration or Prototype Fast Reactors

Phénix (France)	510	6
SNR-300 (Germany)	610	-
PFBR (India)	558.8/406.4	8/10
MONJU (Japan)	560	9.5
PFR (UK)	360	10
CRBRP (USA)	610	13
BN-350 (Kazakhstan)	529/377	12/12
BN-600 (Russian Federation)	630	13
ALMR (USA)	711	13
KALIMER-150 (Republic of Korea)	356/508	7.9/9.5
SVBR-75/100 (Russian Federation)	none	
BREST-OD-300 (Russian Federation)	none	

\* test channel

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Commercial Size Reactors

Plant	Piping	
	Outer diameter of secondary piping, hot leg (mm)	Thickness of secondary piping, hot leg (mm)
Super-Phénix 1 (France)	700	11
Super-Phénix 2 (France)	760	-
SNR 2 (Germany)	800	-
DFBR (Japan)	711	12.7
CDFR (UK)	864	10
BN-1600 (Russian Federation)	820	13
BN-800 (Russian Federation)	630/820	12
EFR	711	11
ALMR (USA)	711	13
SVBR-75/100 (Russian Federation)	none	
BN-1800 (Russian Federation)	820	12
BREST-1200 (Russian Federation)	none	
JSFR-1500 (Japan)	1117.6	14.3

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Experimental Fast Reactors

Plant	Piping	
	Outer diameter of steam (water) piping, hot leg (mm)	Thickness of steam (water) piping, hot leg (mm)
Rapsodie (France)	no SG, dump heat exchanger	
KNK-II (Germany)	no SG, dump heat exchanger	
FBTR (India)	100	13.5
PEC (Italy)	no SG, dump heat exchanger	
JOYO (Japan)	no SG, dump heat exchanger	
DFR (UK)	20	2
BOR-60 (Russian Federation)	100*	-
EBR-II (USA)	273	21.4
Fermi (USA)	305	-
FFTF (USA)	no SG, dump heat exchanger	
BR-10 (Russian Federation)	no SG, dump heat exchanger	
CEFR (China)	133	18.0

#### Demonstration or Prototype Fast Reactors

Phénix (France)	330	25
SNR-300 (Germany)	291	20.5
PFBR (India)	708.82	74.41
MONJU (Japan)	510	50
PFR (UK)	325	65
CRBRP (USA)	406	40.5
BN-350 (Kazakhstan)	350*	-
BN-600 (Russian Federation)	219	25
ALMR (USA)	508	38.1
KALIMER-150 (Republic of Korea)	to be determined	
SVBR-75/100 (Russian Federation)	250x2	20
BREST-OD-300 (Russian Federation)	273	36

\* internal diameter

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Commercial Size Reactors

Plant	Piping	
	Outer diameter of steam (water) piping, hot leg (mm)	Thickness of steam (water) piping, hot leg (mm)
Super-Phénix 1 (France)	458	42
Super-Phénix 2 (France)	-	-
SNR 2 (Germany)	-	-
DFBR (Japan)	508	72
CDFR (UK)	300	64
BN-1600 (Russian Federation)	500*	-
BN-800 (Russian Federation)	495	34
EFR	500*	-
ALMR (USA)	507	38.1
SVBR-75/100 (Russian Federation)	250x2	20
BN-1800 (Russian Federation)	to be determined	
BREST-1200 (Russian Federation)	to be determined	
JSFR-1500 (Japan)	812.8	90

\* internal diameter

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Experimental Fast Reactors

Plant	Piping		
	Outer diameter of primary piping, cold leg (mm)	Thickness of primary piping, cold leg (mm)	Outer diameter of secondary piping, cold leg (mm)
Rapsodie (France)	300	-	200
KNK-II (Germany)	200	-	200
FBTR (India)	300	4	200
PEC (Italy)	355.6 (114*)	8 (6*)	355.6 (114*)
JOYO (Japan)	450/300	7.9/6.5	300/250/200
DFR (UK)	101	-	152
BOR-60 (Russian Federation)	325/219	12/10	325/219/108
EBR-II (USA)	324*	10.3	324
Fermi (USA)	760	9.5	460/305
FFTF (USA)	405	10	405
BR-10 (Russian Federation)	127**	8**	127
CEFR (China)	127	8	325

#### Demonstration or Prototype Fast Reactors

Phénix (France)	-	-	510
SNR-300 (Germany)	560	-	560
PFBR (India)	620	10	812.8/558.8/406.4
MONJU (Japan)	610	9.5	560
PFR (UK)	-	-	610
CRBRP (USA)	610	13	457/610
BN-350 (Kazakhstan)	630/529	13/12	529/377
BN-600 (Russian Federation)	636***	16	820
ALMR (USA)	-	-	-
KALIMER-150 (Republic of Korea)	to be determined	-	356/508
SVBR-75/100 (Russian Federation)	none		
BREST-OD-300 (Russian Federation)	none		

\* test channel

\*\* for each of two primary pipes

\*\*\* two pipes per loop

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Commercial Size Reactors

Plant	Piping		
	Outer diameter of primary piping, cold leg (mm)	Thickness of primary piping, cold leg (mm)	Outer diameter of secondary piping, cold leg (mm)
Super-Phénix 1 (France)	-	-	1000
Super-Phénix 2 (France)	-	-	1000
SNR 2 (Germany)	900		800
DFBR (Japan)	762	15.9	711
CDFR (UK)	-	-	864
BN-1 600 (Russian Federation)	1020****	20	920
BN-800 (Russian Federation)	820	12	630/820
EFR	885	14.5	711
ALMR (USA)	-	-	711
SVBR-75/100 (Russian Federation)	none		
BN-1800 (Russian Federation)	820	12	820
BREST-1200 (Russian Federation)	none		
JSFR-1500 (Japan)	863****	17.5	1117.6

\*\*\*\* two pipes per loop

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Experimental Fast Reactors

Plant	Piping		
	Thickness of secondary piping, cold leg (mm)	Outer diameter of steam (water) piping, cold leg (mm)	Thickness of steam (water) piping, cold leg (mm)
Rapsodie (France)	-	-	-
KNK-II (Germany)	-	-	-
FBTR (India)	8	114.3	13.5
PEC (Italy)	8 (6*)	-	-
JOYO (Japan)	10.3/9.3/8.2	none	none
DFR (UK)	-	-	-
BOR-60 (Russian Federation)	8/6	100**	-
EBR-II (USA)	6.35	168	14.3
Fermi (USA)	9.5	200	-
FFTF (USA)	10	-	-
BR-10 (Russian Federation)	8	-	-
CEFR (China)	12	108	11.0

#### Demonstration or Prototype Fast Reactors

Phénix (France)	7	219	29
SNR-300 (Germany)	-	395	22.5
PFBR (India)	10/8/10	541.26	60.63
MONJU (Japan)	9.5	-	-
PFR (UK)	12	575	100
CRBRP (USA)	13	254	28.6
BN-350 (Kazakhstan)	12	250**	-
BN-600 (Russian Federation)	13	219	25
ALMR (USA)	13	406	36.5
KALIMER-150 (Republic of Korea)	7.9/9.5	to be determined	
SVBR-75/100 (Russian Federation)	none	150x2	15
BREST-OD-300 (Russian Federation)	none	194	30

\* test channel

\*\* internal diameter

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Commercial Size Reactors

Plant	Piping		
	Thickness of secondary piping, cold leg (mm)	Outer diameter of steam (water) piping, cold leg (mm)	Thickness of steam (water) piping, cold leg (mm)
Super-Phénix 1 (France)	20	444	52
Super-Phénix 2 (France)	-	-	-
SNR 2 (Germany)	-	-	-
DFBR (Japan)	12.7	356	-
CDFR (UK)	-	-	-
BN-1600 (Russian Federation)	14	200	25
BN-800 (Russian Federation)	20	273	20
EFR	11	800**	-
ALMR (USA)	13	406	36.5
SVBR-75/100 (Russian Federation)	none	150x2	15
BN-1800 (Russian Federation)	to be determined		
BREST-1200 (Russian Federation)	none	to be determined	
JSFR-1500 (Japan)	14.3	609.6	50

\*\* internal diameter

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Experimental Fast Reactors

Plant	Piping	
	Provision of leak jacket	
	Primary	Secondary
Rapsodie (France)	yes	no
KNK-II (Germany)	yes*	no
FBTR (India)	yes	no
PEC (Italy)	yes (yes**)	no (no**)
JOYO (Japan)	yes	no
DFR (UK)	yes	no
BOR-60 (Russian Federation)	yes	no
EBR-II (USA)	yes	No
Fermi (USA)	no	no
FFTF (USA)	guard vessels	guard vessels
BR-10 (Russian Federation)	yes	no
CEFR (China)	not applicable	yes (partial)

#### Demonstration or Prototype Fast Reactors

Phénix (France)	not applicable	no
SNR-300 (Germany)	yes*	-
PFBR (India)	yes (for piping)	yes (for piping inside RCB)
MONJU (Japan)	guard vessels	no
PFR (UK)	not applicable	yes
CRBRP (USA)	guard vessels	guard vessels, catch pans
BN-350 (Kazakhstan)	yes	no
BN-600 (Russian Federation)	yes (for piping)	yes (for piping inside RCB)
ALMR (USA)	not applicable	yes
KALIMER-150 (Republic of Korea)	not applicable	yes
SVBR-75/100 (Russian Federation)	guard vessel	guard vessel
BREST-OD-300 (Russian Federation)	not applicable	not applicable

\* below min. Na level

\*\* test channel

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.7. Piping

#### Commercial Size Reactors

Plant	Piping	
	Provision of leak jacket	
	Primary	Secondary
Super-Phénix 1 (France)	not applicable	no
Super-Phénix 2 (France)	not applicable	yes
SNR 2 (Germany)	not applicable	-
DFBR (Japan)	yes	yes
CDFR (UK)	not applicable	yes
BN-1600 (Russian Federation)	yes	no
BN-800 (Russian Federation)	yes	no
EFR	not applicable	yes
ALMR (USA)	not applicable	yes
SVBR-75/100 (Russian Federation)	guard vessel	guard vessel
BN-1800 (Russian Federation)	to be determined	
BREST-1200 (Russian Federation)	not applicable	not applicable
JSFR-1500 (Japan)	yes	yes

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.8. Valving

#### Experimental Fast reactors

Plant	Valving			
	Primary			Secondary
	Hot leg stop	Cold leg stop	Check	Steam generator isolation
Rapsodie (France)	no	no	yes	-
KNK-II (Germany)	yes	yes	yes	no
FBTR (India)	no	no	yes	yes
PEC (Italy)	no (no)	no (no)	yes (yes)	-
JOYO (Japan)	no	no	yes	none
DFR (UK)	no	no	no	no (yes)
BOR-60 (Russian Federation)	yes	yes	yes	yes
EBR-II (USA)	no	-	no	no
Fermi (USA)	no	no	yes	no (yes)
FFTF (USA)	yes	yes	yes	-
BR-10 (Russian Federation)	yes	yes	yes	-
CEFR (China)	no	no	n/a	yes

#### Demonstration or Prototype Fast Reactors

Phénix (France)	no	no	yes	yes
SNR-300 (Germany)	no	no	yes	no
PFBR (India)	no	no	no	yes
MONJU (Japan)	no	no	yes	yes
PFR (UK)	yes	yes	no	yes
CRBRP (USA)	no	no	yes	yes
BN-350 (Kazakhstan)	yes	yes	yes	no
BN-600 (Russian Federation)	no	no	yes	yes
ALMR (USA)	no	no	no	yes
KALIMER-150 (Republic of Korea)	no	no	no	yes
SVBR-75/100 (Russian Federation)	no	no	no	no
BREST-OD-300 (Russian Federation)	no piping			yes

## 6. HEAT TRANSPORT SYSTEM (cont.)

### 6.8. Valving

#### Commercial Size Reactors

Plant	Valving			
	Primary			Secondary
	Hot leg stop	Cold leg stop	Check	Steam generator isolation
Super-Phénix 1 (France)	no	no	no	no isolation valve on the sodium circuit
Super-Phénix 2 (France)	-	-	-	no
SNR 2 (Germany)	-	yes	-	-
DFBR (Japan)	no	no	no	no
CDFR (UK)	yes	yes	-	yes
BN-1600 (Russian Federation)	no	no	yes	yes
BN-800 (Russian Federation)	no	no	yes	yes
EFR	no	no	no	no isolation valve on the sodium circuit
ALMR (USA)	no	no	no	yes
SVBR-75/100 (Russian Federation)	no	no	no	no
BN-1800 (Russian Federation)	to be determined			
BREST-1200 (Russian Federation)	no piping			yes
JSFR-1500 (Japan)	no	no	no	no