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## REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

### APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.: 199-8223  
SRP Section: 03.08.01 – Concrete Containment  
Application Section: 03.08.01  
Date of RAI Issue: 09/08/2015

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### **Question No. 03.08.01-13**

Appendix A to 10 CFR Part 50, General Design Criteria (GDC) 1, 2, 4, 16 and 50, provide the regulatory requirements for the design of the concrete containment. Standard Review Plan (SRP) 3.8.1, Section II specifies the materials for the construction of concrete containments with emphasis on the extent of compliance with Article C-2.2.2 of Section III, Division 2, of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, with additional guidance provided in Regulatory Guide 1.136.

DCD Section 3.8.1.5.1.2, "Prestressing Systems" identifies the material for the prestressing elements and in the case of the anchorage components, refers to the tendon manufacturer's respective material specifications. However, the staff was unable to find the manufacturer's specifications for the bearing plates, anchor head assemblies, and the wedges which are part of the anchorage system for Appendix A to 10 CFR Part 50, GDC 1, 2, 4, 16 and 50; and SRP 3.8.1, the applicant is requested to identify what manufacture tendon system is used for the design of APR1400, and if this information is not publicly available, provide the manufacturer's technical literature on this type of tendon system, including their anchorage system.

### **Response**

The post-tensioning system of the containment is the VSL E6-42 multi-strand system using a wedge block with wedge type anchors. The VSL E6-42 multi-strand system uses the same anchorage system as VSL E6-43, which is identified in the VSL [International Brochure \(Attachment 1\)](#) available to the public. [Although VSL E6-42 system is not listed in the VSL International Brochure it is introduced in the VSL Korea Brochure \(Attachment 2\)](#). The multi-strand system employs 0.6 inch diameter, seven wire, low relaxation strand manufactured in accordance with ASTM A416, Grade 270, as described in DCD Tier 2, Appendix 3.8A, Subsection 3.8A.1.2.4.

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**Impact on DCD**

There is no impact on DCD.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical Specifications**

There is no impact on the Technical Specifications.

**Impact on Technical/Topical/Environmental Reports**

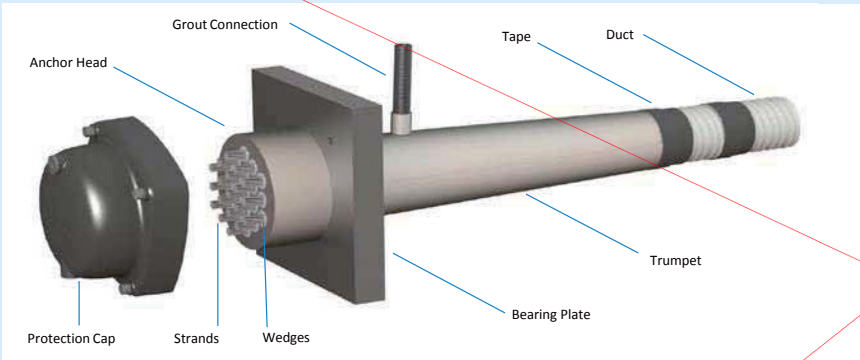
There is no impact on any Technical, Topical, or Environmental Report.

**DRAFT**

Multistrand Post-Tensioning System Internal Bonded Post-Tensioning



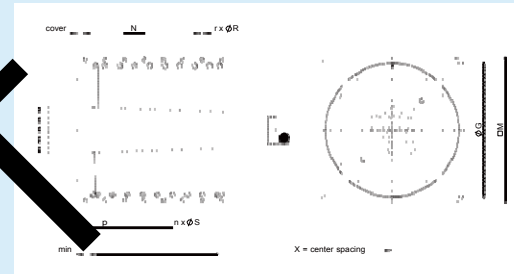
ANCHORAGETYPEE0.6



Multistrand Post-Tensioning System Internal Bonded Post-Tensioning



ANCHORAGE TYPE E (Strand F<sub>n0</sub> cr3 nN/ LOCAL ZONE REINFORCEMENT 8,ø &00 N5mm<sup>2</sup>)



Reinforcement consists of a combination of spiral and stirrups

E6-43 Post-tensioning System

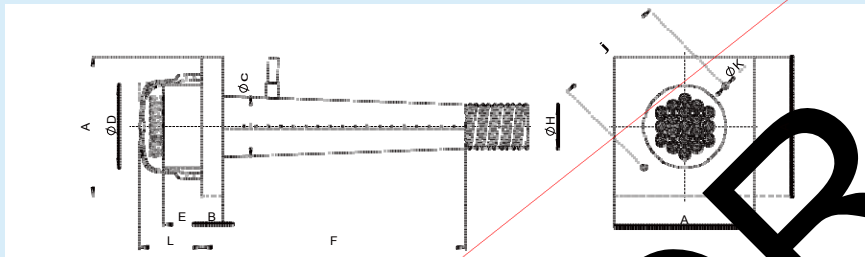


Table for CONCRETE 28/38 MPa showing spiral and orthogonal reinforcement dimensions for various units.

Table for CONCRETE 28/35 MPa showing spiral and orthogonal reinforcement dimensions for various units.

Table for CONCRETE 32/40 MPa showing spiral and orthogonal reinforcement dimensions for various units.

Table for CONCRETE 36/45 MPa showing spiral and orthogonal reinforcement dimensions for various units.

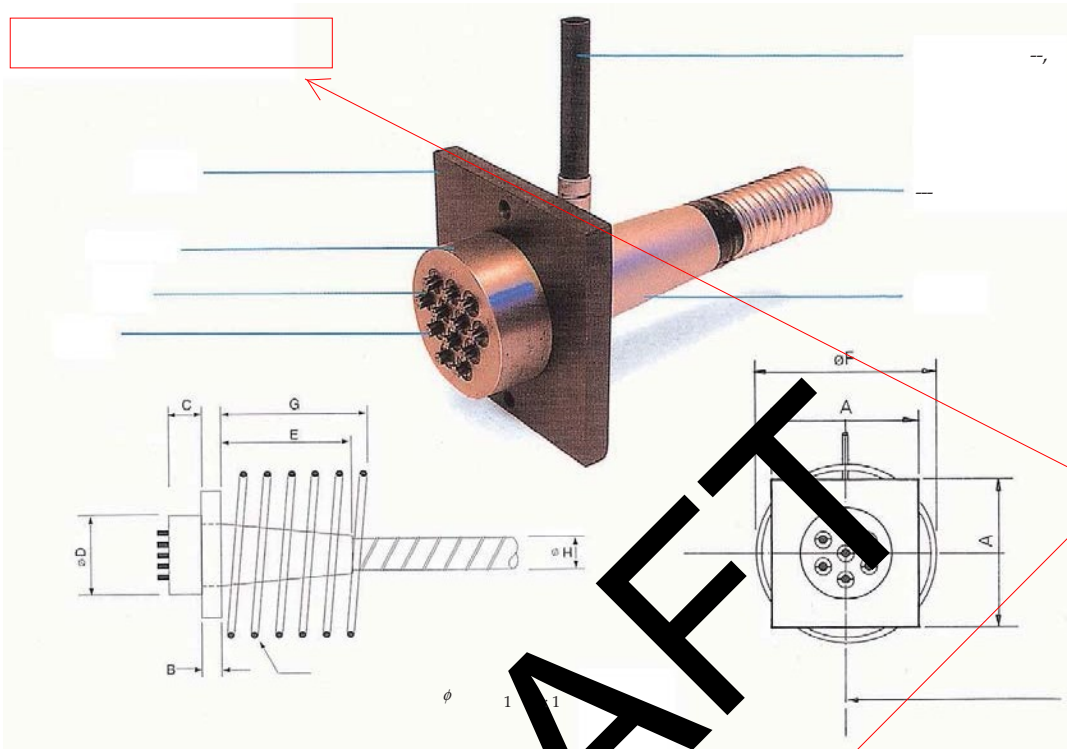
Large table showing concrete strength specifications (23/28 & 28/35 MPa, 32/40 & 36/45 MPa, 43/53 MPa) and dimensions for units 6-1 to 6-55.

Notes: All dimensions in [mm], System applicable to strands with A<sub>p</sub> = 140 mm<sup>2</sup> or A<sub>p</sub> = 150 mm<sup>2</sup>, Concrete strength is defined as minimum required f<sub>c,cyl</sub> / f<sub>c,cube</sub> in MPa at time of stressing...

Notes: All dimension in [mm], Min. yield strength for local zone reinforcement fy = 500N/mm<sup>2</sup>, Min. required concrete strength f<sub>c,cyl,local</sub> / f<sub>c,cube</sub> in MPa at stressing...

Notes: X = minimal center spacing between anchorages, For calculation of minimum edge distance refer to 4.4.1, n = number of spiral turns including first and last required as anchorage length...

**VSL** MULTISTRAND SYSTEMS



E6-42  
Post-tensioning  
system

		A	B	c	øD	E	øF	G	H	ø	n	X <sup>2</sup>
□□□ 12.7mm(0.5)	5 1	70	15	45	42	70	80	90		10	2	90
	5 3	115	20	50	90	190	130	150		10	3	155
	5 4	130	20	50	95	190	160	150	51/54	10	3	180
	5 7	175	25	55	110	190	205	200	51/54	13	4	235
	5 12	230	35	60	150	370	285	250	63/66	16	5	305
	5 19	290	40	75	180	470	365	300	84/87	16	6	385
	5 22	315	45	85	190	480	395	360	87/90	19	6	415
	5 31	370	55	95	230	550	470	400	100/103	19	8	490
	5 37	405	60			570	510	420		19	7	535
	5 42	440	60			680	550	480		22	8	580
5 55	500	70			680	620	540		22	9	655	
□□□ 15.2mm(0.6)	6 1	75	15	50	53	70	80	90		10	2	105
	6 2	110	15			190	130	150		10	3	150
	6 3	135	20	50	95	190	160	150	51/54	10	3	185
	6 4	160	25	55	110	190	190	200	51/54	13	4	210
	6 7	205	35	60	150	290	260	250	63/66	16	5	280
	6 12	270	40	75	180	460	345	300	84/87	16	6	365
	6 19	340	50	95	230	590	440	350	100/103	19	7	460
	6 22	370	55	100	230	690	470	400	110/113	19	8	495
	6 31	435	65	120	290	690	560	480	130/133	22	8	590
	6 37	480	70			830	610	540		22	9	640
	6 42	520	75			950	650	640		25	8	690
	6 55	580	90			950	740	630		25	9	780

T: mm

• <math>\phi 1.7\text{mm}0.5</math>  
• <math>\phi 15.2\text{mm}0.6</math>  
• <math>\phi 1.7\text{mm}0.5</math>  
• <math>\phi 15.2\text{mm}0.6</math>

• <math>\phi 1.7\text{mm}0.5</math>  
• <math>\phi 15.2\text{mm}0.6</math>  
• <math>\phi 1.7\text{mm}0.5</math>  
• <math>\phi 15.2\text{mm}0.6</math>

• <math>\phi 1.7\text{mm}0.5</math> <math>\leq 18,700\text{kg}</math>  
• <math>\phi 15.2\text{mm}0.6</math> <math>\leq 6,600\text{kg}</math>  
• <math>\phi 1.7\text{mm}0.5</math> <math>\leq 4,000\text{kg cm D 40}</math>