

SPECIFICATION

RETROFITTING EXISTING FACILITIES FOR AVIAN PROTECTION

1. SCOPE:

1.1 The purpose of this document is to provide detailed guidelines for both internal and contracted persons performing staking and construction duties for retrofitting existing facilities to improve avian protection that are not defined within other internal PRECorp documents or which are in excess of RUS standards.

2. DOCUMENTS:


- 2.1 RUS Bulletin 1728F-803 24.9/14.4 KV Construction
- 2.2 Suggested Practices for Avian Protection On Power Lines: The State of the Art in 2006
- 2.3 PRECorp avian safety construction standards:
 - 2.3.1.1 VC1.11MA-1 24.9/14.4kV 3-PHASE SINGLE SUPPORT ON CROSSARM (TANGENT) AVIAN SAFETY RETROFIT
 - 2.3.1.2 VC1.11MAG-1 24.9/14.4kV 3-PHASE SINGLE SUPPORT ON CROSSARM (TANGENT) AVIAN SAFETY RETROFIT
 - 2.3.1.3 VC1.11MAG-2 24.9/14.4kV 3-PHASE SINGLE SUPPORT ON CROSSARM (TANGENT) AVIAN SAFETY RETROFIT
 - 2.3.1.4 VC1.41MA-1 24.9/14.4kV 3-PHASE SINGLE SUPPORT, NEUTRAL ON CROSSARM AVIAN SAFETY RETROFIT
 - 2.3.1.5 VC2MAG-1 24.9/14.4kV 3-PHASE DOUBLE SUPPORT ON CROSSARMS (TANGENT) AVIAN SAFETY RETROFIT
 - 2.3.1.6 VC2.5MAG-1 24.9/14.4kV 3-PHASE DOUBLE SUPPORT ON CROSSARMS (TANGENT) AVIAN SAFETY RETROFIT
 - 2.3.1.7 VC5MA-1 24.9/14.4kV 3-PHASE SINGLE DEADEND ON CROSSARMS AVIAN SAFETY RETROFIT
 - 2.3.1.8 VC5MAG-1 24.9/14.4kV 3-PHASE SINGLE DEADEND ON CROSSARMS AVIAN SAFETY RETROFIT
 - 2.3.1.9 VC5MAG-2 24.9/14.4kV 3-PHASE SINGLE DEADEND ON CROSSARMS AVIAN SAFETY RETROFIT
 - 2.3.1.10 VC5MAG-3 24.9/14.4kV 3-PHASE SINGLE DEADEND ON CROSSARMS AVIAN SAFETY RETROFIT
 - 2.3.1.11 VC5TMA-1 24.9/14.4kV 3-PHASE TAKEOFF ARM – AVIAN SAFETY RETROFIT
 - 2.3.1.12 VC5TMAG-1 24.9/14.4kV 3-PHASE TAKEOFF ARM – AVIAN SAFETY RETROFIT
 - 2.3.1.13 VC6MA-1 24.9/14.4kV 3-PHASE DOUBLE DEADEND ON CROSSARMS AVIAN SAFETY RETROFIT
 - 2.3.1.14 VC6MAG-1 24.9/14.4kV 3-PHASE DOUBLE DEADEND ON CROSSARMS AVIAN SAFETY RETROFIT
 - 2.3.1.15 VG2MAG-124.9/14.4kV 2-PHASE TRANSFORMER BANK AVIAN/GROUSE RETROFIT
 - 2.3.1.16 VG3MAG-1 24.9/14.4kV 3-PHASE TRANSFORMER BANK AVIAN/GROUSE RETROFIT
 - 2.3.1.17 VG3MA(G)-2 24.9/14.4kV 3-PHASE TRANSFORMER BANK WITHOUT CUTOUTS AVIAN/GROUSE RETROFIT
 - 2.3.1.18 VG3MA-3 24.9/14.4kV 3-PHASE TRANSFORMER BANK AVIAN/GROUSE RETROFIT
 - 2.3.1.19 VG3MA-3A 24.9/14.4kV 3-PHASE TRANSFORMER BANK WITHOUT CUTOUTS AVIAN/GROUSE RETROFIT
 - 2.3.1.20 VG3MA(G)-4 24.9/14.4kV 3-PHASE TRANSFORMER BANK WITHOUT CUTOUTS AVIAN/GROUSE RETROFIT
 - 2.3.1.21 VP1.3MA-1 GANGED ARRESTOR ASSEMBLY FOR AVIAN SAFETY RETROFIT
 - 2.3.1.22 VP1.3MAG-1 GANGED ARRESTOR ASSEMBLY FOR AVIAN/GROUSE RETROFIT
 - 2.3.1.23 VS1.3MA-1 CUTOUTS (THREE SINGLE-PHASE) AVIAN SAFETY RETROFIT

3. EQUIPMENT:

3.1 Figure 1 provides a listing of specific equipment and materials for avian protection retrofitting work.

4. MATERIALS:

4.1 Figure 1 provides a listing of specific equipment and materials for avian protection retrofitting work.

ENGR	ENGR	DATE	ENGR	DATE	REV
James Carlin	07/17/17	Pamela Hobden	9/21/10		
APPD	James Carlin	07/24/17	James Carlin	8/6/13	
			James Carlin	10/23/14	
DR	James Carlin	07/11/17	James Carlin	03/14/16	E
			James Carlin	05/06/16	
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5. STAKING NOTES:

5.1 Evaluation of condition of existing facilities:

5.1.1 Existing poles that are forty years or older as identified by pole brands or other data shall be retired and replaced with a new pole and current construction assemblies.

5.1.2 If the condition of the pole is non-serviceable or is at risk for reduced system reliability then the pole shall be retired and replaced with a new pole and current construction assemblies.

5.1.3 Existing assembly units that exhibit damage or extreme wear than the appropriate assemblies, then the existing assemblies shall be retired and replaced with current construction assemblies.

5.2 Non-current styles of arrestors and cutouts will be retired and replaced with present configurations of cutout combos.

5.3 All gapped arrestors will be retired and replaced with arrestors of current configuration.

5.4 All transformer bushing covers that do not fully encompass the top insulative skirt (such as "Hand-Wheel" style covers) will be retired and replaced with current transformer bushing covers, i.e. AB-SBC or AB-LBC.

5.5 All retrofit standards are developed with the assumption that the existing jumpers shall be replaced.

5.6 All retrofit standards assume that only insulated ground wires are carried above the neutral conductor.

5.7 Vertical clearance between energized lines or an energized line and ground must be equal to or greater than 40 inches.

5.8 Horizontal/diagonal clearance between energized lines or an energized line and ground must be equal to or greater than 60 inches.

5.9 Taps that are not servicing active meters are to be deenergized instead of retrofitting at the time. If the tap is reenergized in the future to service reconnected or new meters; it is to be retrofitted for avian safety accordingly.

5.9.1 When taps are deenergized, the tap jumpers are to be tied back to the tap conductors to reduce lightning exposure and avian electrocutions.

5.10 Where an extension link/epoxilator combination is utilized on deadends or double deadends, there must be a 36" minimum clearance maintained from the crossarm face to the energized line.

5.11 When the assembly is in a grouse protected area and perch deterrents are utilized, their placement shall be such that a maximum of 5 inches of horizontal space is allowed on surfaces where birds may perch.

5.11.1 Perch deterrent extenders shall be used over line insulators on crossarms to discourage perching.

5.11.2 Pole top pin insulators shall have pole top perch deterrents installed over the insulator to discourage perching.

5.11.3 A pole without a pole top pin shall have a cap installed on the pole top.

5.12 The individual material assemblies given in Figure 1 may be used to document the necessary changes to an existing structure.

5.13 Construction standards are available for retrofitting existing structures that exhibit the most significant number of raptor mortalities on PRECorp's system. These construction standards are identified by a suffix being added to the assembly's normal designation as follows:

5.13.1 'M' – The first character in the suffix that designates that the assembly has been modified after its initial construction to improve avian safety or discourage perching.

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5.13.2 'A' – The second character in the suffix that designates that the modification of the assembly has improved the avian safety of the structure.

5.13.2.1 This character may be omitted if the modified assembly was originally avian safe.

5.13.3 'G' – The second or third character in the suffix that designates that the modification of the assembly has perch deterred the original assembly in an effort to protect sage-grouse.

5.13.3.1 This character may be omitted if the modified assembly does not include perch deterrents.

5.14 THREE-PHASE OVERHEAD TRANSFORMER BANKS:

5.14.1 Perch deterrents shall be added to all lower crossarms to encourage perching on the safer upper arms.

5.14.1.1 Modifying and/or adding perch deterrents to lower cross-arms will not be performed if no other additional work is being performed.

5.14.2 Protective caps shall be installed on all primary bushing covers, arrestors, and cutouts.

5.14.3 Inactive transformer banks and services will not require retrofitting if deenergizing the service will allow for adequate clearances to be maintained for avian safety. If the transformer bank is reenergized in the future, it is to be retrofitted for avian safety accordingly.

5.14.3.1 All transformer equipment and similar equipment is assumed to be at ground potential if case grounded.

5.14.3.2 Opening cut-outs typically does not achieve the required clearances and typically requires dropping of the equipment jumpers.

5.14.4 The following standards are available for retrofitting existing transformer structures:

5.14.4.1 *VG2MAG-124.9/14.4kV 2-PHASE TRANSFORMER BANK AVIAN/GROUSE RETROFIT*

5.14.4.2 *VG3MAG-1 24.9/14.4kV 3-PHASE TRANSFORMER BANK AVIAN/GROUSE RETROFIT*

5.14.4.3 *VG3MA(G)-2 24.9/14.4kV 3-PHASE TRANSFORMER BANK WITHOUT CUTOUTS AVIAN/GROUSE RETROFIT*

5.14.4.4 *VG3MAG-3 24.9/14.4kV 3-PHASE TRANSFORMER BANK AVIAN/GROUSE RETROFIT*

5.14.4.5 *VG3MAG-3A 24.9/14.4kV 3-PHASE TRANSFORMER BANK WITHOUT CUTOUTS AVIAN/GROUSE RETROFIT*

5.14.4.6 *VG3MA(G)-4 24.9/14.4kV 3-PHASE TRANSFORMER BANK WITHOUT CUTOUTS AVIAN/GROUSE RETROFIT*

5.15 INLINE OVERHEAD ARRESTOR BANKS:

5.15.1 The following standard is available to modify existing arrestor structures:

5.15.1.1 *VP1.3MA-1 GANGED ARRESTOR ASSEMBLY FOR AVIAN SAFETY RETROFIT*

5.15.1.2 *VP1.3MAG-1 GANGED ARRESTOR ASSEMBLY FOR AVIAN/GROUSE RETROFIT*

5.16 THREE-PHASE TAPS:

5.16.1 All three phases need to have extension links and epoxilators installed to extend thirty- six (36) inches away from the crossarm face.

5.16.2 The following standards are available to modify tap structures:

5.16.2.1 *VC5TMA-1 24.9/14.4kV 3-PHASE TAKEOFF ARM – AVIAN SAFETY RETROFIT*

5.16.2.2 *VC5TMAG-1 24.9/14.4kV 3-PHASE TAKEOFF ARM – AVIAN SAFETY RETROFIT*

5.16.2.3 *VC5TMAG-2 24.9/14.4kV 3-PHASE TAKEOFF ARM – AVIAN SAFETY RETROFIT*

5.17 THREE-PHASE DEADENDS:

5.17.1 Extension links and epoxilators shall be installed on the center phase of the assembly, and shall extend thirty-six (36) inches from the face of pole/crossarm. If neutral is less than forty-two (42) inches below crossarm, extension links and epoxilators shall be installed out the outside phases.

5.17.2 The following standards are available for single and double-deadend structures:

5.17.2.1 *VC5MA-1 24.9/14.4kV 3-PHASE SINGLE DEADEND ON CROSSARMS AVIAN SAFETY RETROFIT*

5.17.2.2 *VC5MAG-1 24.9/14.4kV 3-PHASE SINGLE DEADEND ON CROSSARMS AVIAN SAFETY RETROFIT*

5.17.2.3 *VC5MAG-2 24.9/14.4kV 3-PHASE SINGLE DEADEND ON CROSSARMS AVIAN SAFETY RETROFIT*

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- 5.17.2.4 VC5MAG-3 24.9/14.4kV 3-PHASE SINGLE DEADEND ON CROSSARMS AVIAN SAFETY RETROFIT
- 5.17.2.5 VC6MA-1 24.9/14.4kV 3-PHASE DOUBLE DEADEND ON CROSSARMS AVIAN SAFETY RETROFIT
- 5.17.2.6 VC6MAG-1 24.9/14.4kV 3-PHASE DOUBLE DEADEND ON CROSSARMS AVIAN SAFETY RETROFIT

5.18 THREE-PHASE TANGENTS:

5.18.1 The following tangent structure is available for modification of three-phase tangent structures:

- 5.18.1.1 VC1.11MA-1 24.9/14.4kV 3-PHASE SINGLE SUPPORT ON CROSSARM (TANGENT) AVIAN SAFETY RETROFIT
- 5.18.1.2 VC1.11MAG-1 24.9/14.4kV 3-PHASE SINGLE SUPPORT ON CROSSARM (TANGENT) AVIAN SAFETY RETROFIT
- 5.18.1.3 VC1.11MAG-2 24.9/14.4kV 3-PHASE SINGLE SUPPORT ON CROSSARM (TANGENT) AVIAN SAFETY RETROFIT
- 5.18.1.4 VC1.41MA-1 24.9/14.4kV 3-PHASE SINGLE SUPPORT, NEUTRAL ON CROSSARM AVIAN SAFETY RETROFIT
- 5.18.1.5 VC2MA-1 24.9/14.4kV 3-PHASE DOUBLE SUPPORT ON CROSSARMS (TANGENT) AVIAN SAFETY RETROFIT
- 5.18.1.6 VC2MAG-1 24.9/14.4kV 3-PHASE DOUBLE SUPPORT ON CROSSARMS (TANGENT) AVIAN SAFETY RETROFIT
- 5.18.1.7 VC2.5MA-1 24.9/14.4kV 3-PHASE DOUBLE SUPPORT ON CROSSARMS (TANGENT AVIAN SAFETY RETROFIT
- 5.18.1.8 VC2.5MAG-1 24.9/14.4kV 3-PHASE DOUBLE SUPPORT ON CROSSARMS (TANGENT AVIAN SAFETY RETROFIT

5.19 OTHER ASSEMBLIES:

- 5.19.1.1 VC1.41MA-1 24.9/14.4kV 3-PHASE SINGLE SUPPORT, NEUTRAL ON CROSSARM AVIAN SAFETY RETROFIT
- 5.19.1.2 VS1.3MA-1 CUTOUPS (THREE SINGLE-PHASE) AVIAN SAFETY RETROFIT
- 5.19.1.3 Grounding Assemblies: Table 1 gives the unit length called out for AP-GIW#6
 - 5.19.1.3.1 AP-GIW#6 GREEN INSULATED COVERED #6AWG COPPER WIRE
 - 5.19.1.3.2 AP-GG COVERED GROUND WIRE ASSEMBLY FOR 3-PHASE SINGE DEADEND ON CROSSARM
 - 5.19.1.3.3 AP-AG COVERED GROUND WIRE ASSEMBLY FOR CUTOUT/ARRESTOR CROSSARM

Assembly Unit	Description	Length of AP-GIW #6
AP-GIW #6	#6 AWG Green Insulated Wire	1ft
AP-GG	Guy Ground Unit	6ft
AP-AG	Arrestor Ground Unit	20ft

Table 1: Insulated Ground Assembly Units

6. INSTALLATION NOTES:

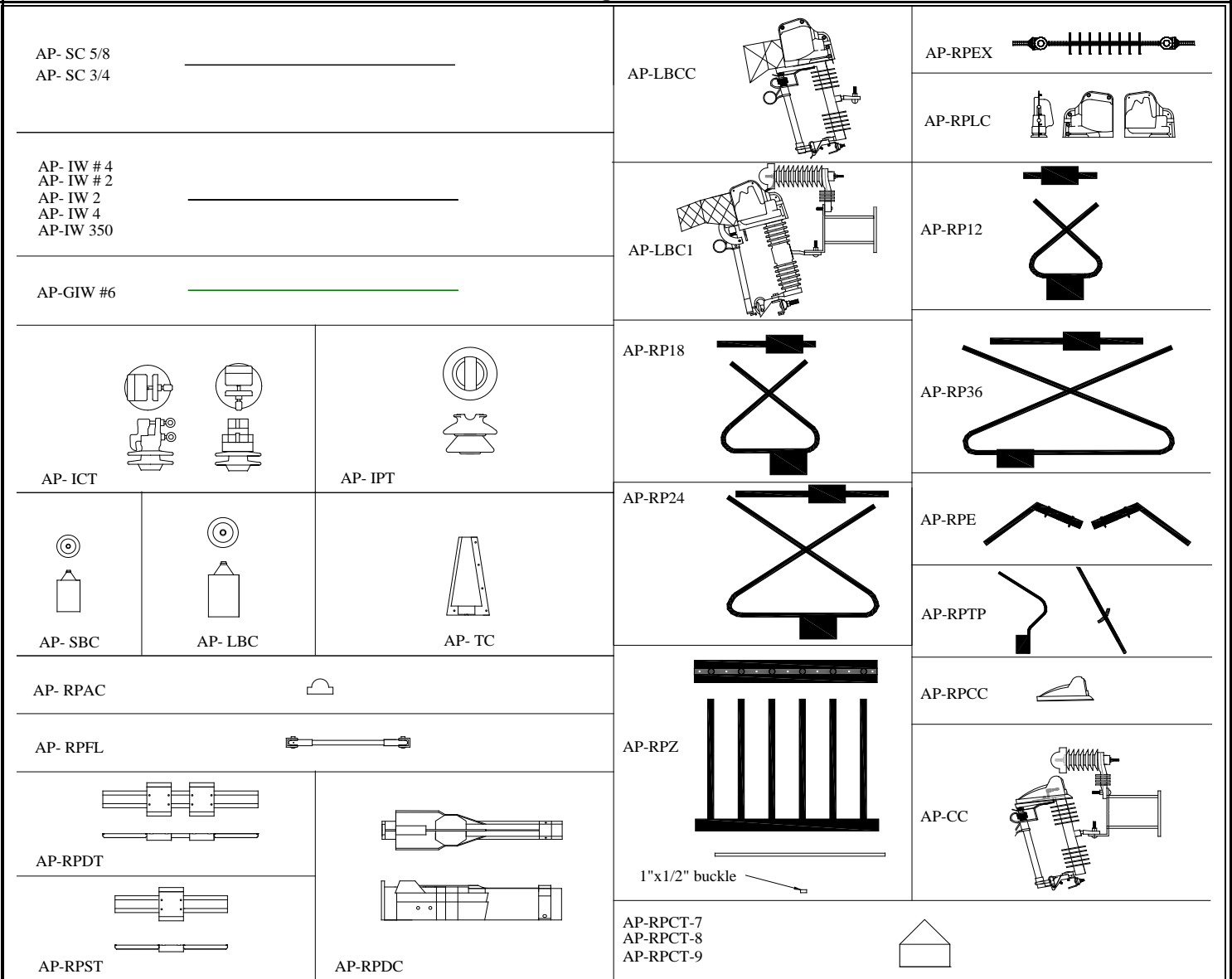
- 6.1 Jumpers should be inspected on all assemblies.
 - 6.1.1 All energized jumpers must be insulated.
 - 6.1.2 Jumpers with inadequate insulation coverage to a point within bushing or other covers shall be replaced.
 - 6.1.3 Jumpers exhibiting cracked or crazing insulation shall be replaced.
- 6.2 All pole top grounds should be removed to the height of the neutral conductor.
- 6.3 Any ground wire or neutral jumper required above the neutral connection shall be insulated and of sufficient gauge.
 - 6.3.1 Covered ground wire will continue to be installed from the bare pole ground to all equipment grounding lugs during avian protection retrofitting and the existing bare equipment ground wire is to be removed. If removal of the staples is too labor intensive, the bare ground wire can be removed between the staples by cutting the wire as close to the staples as practical.
- 6.4 Conductor Cover-Up Items, AP-RPDT, AP-RSPT, and AP-RPDC of Figure, 1 shall only be used on Avian Mortality Sites.

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- 7. ENVIRONMENTAL AND SAFETY:
 - 7.1 None.

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Figure 1



ASSEMBLY #	MATERIAL	PART #	ASSEMBLY #	MATERIAL	PART #
AP-SC 5/8"	Conductor Cover Up (5/8" X Req'd Length)	4711	AP-LBCC	Load Break Cutout W\ Covers	4130/4730
AP-SC 3/4"	Conductor Cover Up (3/4" X Req'd Length)	4715	AP-LBC1	Load Break Cutout Combo W\ Covers	4171/4730/4720
AP-IW #4	Insulated Tap Wire, #4AWG	3113	AP-RPFL	Fiberglass Extension Link	4281
AP-IW #2	Insulated Tap Wire, #2AWG	3114	AP-RPEX	18.75" Epoxillator	4280
AP-IW 2	Insulated Tap Wire, 2/0AWG	3115	AP-RP12	Perch Deterrent, 12"	4760
AP-IW 4	Insulated Tap Wire, 4/0AWG	3116	AP-RP18	Perch Deterrent, 18"	4762
AP-IW 350	Insulated Tap Wire, 350MCM	3117	AP-RP24	Perch Deterrent, 24"	4764
AP-GIW #6	Green Insulated Wire, #6AWG	3011	AP-RP36	Perch Deterrent, 36"	4766
AP-IPT	Insulator, Pin Type 14kV	4310	AP-RPE	Perch Guard Extender	4769
AP-ICT	Insulator, Clamp Top 25kV	4311	AP-RPZ	7 Zena Spikes And 30" Base	4780
AP-RPTP	Pole Top Pin	4772	AP-RPCT-7	Pole Top Cone - 7-1/4"	4740
AP-SBC	Small Bushing Cover	4705	AP-RPCT-8	Pole Top Cone - 8-3/8"	4743
AP-LBC	Large Bushing Cover	4708	AP-RPCT-9	Pole Top Cone - 9-1/2"	4747
AP-RPAC	Arrestor Cover	4720	AP-RPST	Single Insulator Cap And Conductor Cover	4816
AP-RPCC	Cutout Coverup	4725	AP-RPDT	Double Insulator Cap And Conductor Cover	4818
AP-RPLC	Load Break Cutout Cover	4730	AP-RPDC	Deadend Shoe And Conductor Cover	4810
AP-CC	Cutout Combo W\ Covers	4170/4720/4725			
AP-TC	Terminator Cover Up	4710			