GUIDELINES FOR SELECTING RETARDER CONTROLS — WTEC-III CONTROLS —

TECHNICAL DOCUMENT NO. 162A

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ALLISON TRANSMISSION
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GUIDELINES FOR SELECTING WTEC-III RETARDER CONTROLS

1.0 PURPOSE
In order to satisfy the different needs and desires of operators in a wide variety of applications, vocations, and vehicle configurations, several types of retarder apply systems are offered for Allison transmissions with WTEC-III controls. Although certain types of apply systems may not be recommended for specific vocations — because the retarder performance may not be appropriate for the class or type of vehicle, installation may be cumbersome, or some other factor — a viable choice of two or more apply types is available for most vehicles. The purpose of this document is to define each available retarder apply system, describe factors which influence the selection of each type, and provide basic guidance for the installation of each type of system.

2.0 RETARDER APPLY SYSTEMS
Several basic retarder apply system designs are available and supported by Allison. A brief overview of each type is summarized in Section 3.0. Additional details of each are summarized on the individual schematics on the pages which follow.

Allison parts described in this section are available through your order correspondent at the Allison Parts Distribution Center (P.D.C.). If you do not have an order correspondent, contact Allison P.D.C. per instructions in the Support Equipment section of any Allison Transmission Installation Manual.

2.1 WHEN IS THE RETARDER APPLIED?
The retarder apply system does not actuate the retarder directly. The apply system provides a means for the operator to request a desired level of retardation. This request is processed by the Electronic Control Unit (ECU) in conjunction with other input data which defines the current operating status of the transmission and vehicle. After evaluating the appropriate input data, the ECU determines (1) if the retarder should be applied, and (2) at what level of retarder capacity. The ECU then commands the retarder application accordingly.

**NOTE:** The following apply conditions must be met before the ECU will command activation of the retarder:
- The “Retarder Enable” switch must be ON, and
- The engine must be at closed throttle, and
- Transmission output speed must be above a preset (calibration) value.

2.2 TAKING ADVANTAGE OF THE AUTOMATIC APPLY FEATURE
Several of the recommended retarder apply systems automatically activate the retarder whenever the ECU apply conditions (section 2.1) are met. Depending upon the control system which is chosen, the retarder may be applied at full capacity (100%), or at a lesser capacity level.

Throttle position is a significant, operator-controllable input signal which determines whether or not the retarder will be actuated. Assuming that the other factors (retarder switch and output speed) favor actuation of the retarder, a skilled operator may use the throttle pedal to command three distinct modes for operating the vehicle:
- **to accelerate** the vehicle, depress throttle
- **to slow** the vehicle, release the throttle fully to the closed throttle position, or
- **to coast** the vehicle, apply the throttle lightly (keeping it above closed throttle, which would apply the retarder), but at a level which is too low to accelerate the vehicle.
2.3 INTEGRATING RETARDER CONTROLS WITH VEHICLE BRAKE SYSTEMS
Several retarder apply systems are designed to apply the retarder based on the status (apply pressure) of the vehicle air-brake system. A variety of pressure switches (actuated at different brake system pressures) are available for use in these systems, either individually or in combination. To design a retarder control system which utilizes one or more brake system pressure switches requires a thorough understanding of the brake system operation (e.g. apply pressures) in order to properly integrate the retarder apply schedule with the vehicle braking function. In general, any system which activates the retarder before the vehicle service brakes are applied will improve life of the service brakes.

3.0 RETARDER APPLY SYSTEMS
1. MANUAL APPLY WITH SEPARATE RETARDER PEDAL — Once the apply conditions are met and the retarder apply system is activated, retarder capacity is infinitely variable between full-off (0%) and full-on (100%), depending upon the apply position of the retarder foot pedal.

2. AUTOMATIC FULL-ON APPLY AT CLOSED THROTTLE — Once the apply conditions are met and the retarder apply system is activated, the retarder is automatically applied at full-on (100%) capacity.

3. AUTOMATIC APPLY WITH HAND LEVER — Once the apply conditions are met and the retarder apply system is activated, the retarder is automatically applied at the capacity selected on the retarder hand lever control. Capacity levels are approximately: 0%, 17%, 33%, 50%, 63%, 83%, 100%.

4. ONE-STEP APPLY WITH BRAKE PEDAL — Once the apply conditions are met and the retarder apply system is activated, the retarder is applied at full-on (100%) capacity whenever the vehicle brake apply pressure reaches the level of the apply pressure switch.

5. THREE-STEP APPLY – BRAKE PRESSURE SWITCHES — Once the apply conditions are met and the retarder apply system is activated, the retarder is applied when the vehicle brakes are applied. Three separate levels of retarder capacity (approximately 33%, 67%, 100%) are commanded as brake demand (brake system pressure) is increased.

6. AUTOMATIC ONE-HALF APPLY, PLUS BRAKE PRESSURE SWITCH — Once the apply conditions are met and the retarder apply system is activated, the retarder is applied at half-on (50%). Retarder capacity increases to full-on (100%) when the vehicle brakes are applied.

7. AUTOMATIC ONE-THIRD APPLY, PLUS BRAKE PRESSURE SWITCHES — Once the apply conditions are met and the retarder apply system is activated, the retarder is applied at one-third capacity (33%). Retarder capacity increases to two-thirds (67%) capacity when the vehicle brakes are initially applied, then to full-on (100%) when a higher level of brake apply is detected.

8. AUTOMATIC APPLY WITH HAND LEVER, PLUS FULL-ON WITH BRAKES — Once the apply conditions are met and the retarder apply system is activated, the retarder is automatically applied at the capacity selected on the retarder hand lever control. Capacity levels are approximately: 0%, 17%, 33%, 50%, 63%, 83%, 100%.

If the retarder has been automatically applied (as above) at a capacity less than full-on (100%), it will subsequently be applied full-on when the vehicle brakes are applied.
9. **MANUAL APPLY WITH RETARDER PEDAL, PLUS FULL-ON WITH BRAKES** — Once the apply conditions are met and the retarder apply system is activated, retarder capacity is infinitely variable between full-off (0%) and full-on (100%), depending upon the apply position of the retarder foot pedal.

Independently from the above, once the apply conditions are met and the retarder apply system is activated, the retarder is applied at full-on (100%) capacity whenever the vehicle brakes are applied.

This control system is especially useful in a vehicle which uses the retarder for downhill speed control (with modulated partial capacity via retarder pedal), plus full-capacity (full-on with brakes) during stop-and-go driving.

10. **AUTOMATIC APPLY WITH HAND LEVER, PLUS THREE-STEP APPLY WITH BRAKES** — Once the apply conditions are met and the retarder apply system is activated, the retarder is automatically applied at the capacity selected on the retarder hand lever control. Capacity levels are approximately: 0%, 17%, 33%, 50%, 63%, 83%, 100%.

Independently from the above, once the apply conditions are met and the retarder apply system is activated, the retarder is applied when the vehicle brakes are applied. Three separate levels of retarder capacity (approximately 33%, 67%, 100%) are commanded as brake demand (brake system pressure) is increased.

This control system is useful in a vehicle which uses the retarder for downhill speed control (with selected partial capacity via retarder hand lever), plus increasing retarder capacity as brake pressure is increased during stop-and-go driving.

4.0 **RECOMMENDED CONTROL SYSTEMS**

On the pages which follow, several detailed items relating to each retarder control system configuration are presented. An individual page is dedicated to each retarder control configuration. On each page, the following topics are discussed:

- Description of operation. Note that these descriptions assume that several operating conditions are satisfied. If these conditions do not exist, the ECU will not activate the retarder, even though it may be requested by the operator. For a description of these conditions, see Section 2.1.
- Advantages and disadvantages of this configuration, as compared to others
- List of components required for this configuration
- System schematic for installation
5.0 RETARDER CONTROL SYSTEM COMPONENT PART NUMBERS

The following Allison part numbers are believed to be accurate as of the publication date of this document. To verify the accuracy of part numbers or availability of parts, consult your order correspondent at the Allison Parts Distribution Center (P.D.C.). If you do not have an order correspondent, contact Allison P.D.C. per instructions in the Support Equipment section of any Allison Transmission Installation Manual.

<table>
<thead>
<tr>
<th>Component</th>
<th>Allison Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operator Interface Controls:</strong></td>
<td></td>
</tr>
<tr>
<td>Retarder pedal – 35º pedal travel</td>
<td>29538485</td>
</tr>
<tr>
<td>Retarder pedal – 45º pedal travel</td>
<td>29538486</td>
</tr>
<tr>
<td>Hand lever – 120 mm (4.7 in) length</td>
<td>29521372</td>
</tr>
<tr>
<td>Hand lever – 200 mm (7.9 in) length</td>
<td>29522721</td>
</tr>
<tr>
<td><strong>Pressure Switches:</strong></td>
<td></td>
</tr>
<tr>
<td>2 psi switch</td>
<td>29506478</td>
</tr>
<tr>
<td>4 psi switch</td>
<td>29511307</td>
</tr>
<tr>
<td>7 psi switch</td>
<td>29511308</td>
</tr>
<tr>
<td>10 psi switch</td>
<td>29511309</td>
</tr>
<tr>
<td><strong>Resistance Module for:</strong></td>
<td></td>
</tr>
<tr>
<td>Retarder pedal</td>
<td>29509895</td>
</tr>
<tr>
<td>Hand lever</td>
<td>29506474</td>
</tr>
<tr>
<td>Full-on</td>
<td>29506470</td>
</tr>
<tr>
<td>Half-on</td>
<td>29509894</td>
</tr>
<tr>
<td>One pressure switch</td>
<td>29506471</td>
</tr>
<tr>
<td>Auto 1/3 apply + two pressure switches</td>
<td>29511320</td>
</tr>
<tr>
<td>Three pressure switches</td>
<td>29511306</td>
</tr>
<tr>
<td><strong>Retarder Modulation Request (RMR) “Y” Harness:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>29521875</td>
</tr>
</tbody>
</table>
1. MANUAL RETARDER APPLY WITH SEPARATE RETARDER PEDAL

**DESCRIPTION:**

Conditions must be appropriate for retarder operation. See section 2.1 of text.

When the retarder apply system is operational, retarder capacity is infinitely variable between full-off (0%) and full-on (100%), depending upon the position of the operator’s control (retarder foot pedal).

**ADVANTAGES:**

- Retarder capacity is infinitely variable
- Retarder control does not have to be matched with configuration of the brake system (timing, brake apply pressures, etc.)
- Since retarder is not applied until the retarder pedal is pushed, the vehicle may be allowed to coast at closed throttle without the retarder being applied.

**DISADVANTAGES:**

- Space claim required for two operator pedals – one for brake, one for retarder
- Not easy to maintain smooth deceleration when transitioning from retarder operation to brake

**COMPONENTS:** *(See Section 5.0 for source information)*

1. Foot pedal retarder control
2. “Retarder Pedal” resistance module

**INSTALLATION:**

[Diagram showing installation of retarder controls and components]

- RETARDER PEDAL
  See Installation Drawing AS07-106

- WIRING HARNESS (Customer supplied)

- “RMR” Connector may be on the “S” and/or “T” harness
  See Installation Drawing AS07-027
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2. AUTO APPLY (FULL ON) AT CLOSED THROTTLE

DESCRIPTION:
Conditions must be appropriate for retarder operation. See section 2.1 of text.

When the retarder apply system is operational, the retarder is automatically applied at full-on (100%) capacity.

ADVANTAGES:
- Ease of installation. Fewest number of add-on components
- Maximizes retarder-on time

DISADVANTAGES:
- Inhibits coasting at closed throttle. Depending upon amount of coast time in duty cycle, this apply system may adversely affect fuel economy.
- Driver has no facility to modulate retarder braking effect — it is either off or full-on.

COMPONENTS: (See Section 5.0 for source information)
1. “Full-On” resistance module

INSTALLATION:

“FULL-ON” Resistance Module
See Installation Drawing AS07-109

“RETARDER MODULATION REQUEST” (RMR) Harness Connector
See Installation Drawing AS07-027

“RMR” Connector may be on the “S” and/or “T” harness
See Installation Drawing AS07-027

WIRING HARNESS (Customer supplied)
3. AUTOMATIC APPLY WITH HAND LEVER

DESCRIPTION:
Conditions must be appropriate for retarder operation. See section 2.1 of text.

When the retarder apply system is operational, the retarder is automatically applied at the capacity selected on the retarder hand lever control.

Capacity levels selectable on the lever are:

<table>
<thead>
<tr>
<th>Lever Position</th>
<th>Approx. Retarder Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>0 %</td>
</tr>
<tr>
<td>1</td>
<td>17 %</td>
</tr>
<tr>
<td>2</td>
<td>33 %</td>
</tr>
<tr>
<td>3</td>
<td>50 %</td>
</tr>
<tr>
<td>4</td>
<td>67 %</td>
</tr>
<tr>
<td>5</td>
<td>83 %</td>
</tr>
<tr>
<td>6</td>
<td>100 %</td>
</tr>
</tbody>
</table>

*NOTE: A pin, provided with each lever, may be inserted at any lever position (except “Off”) to limit handle travel at or beyond that position. For example, if the lever is placed in a high position and the pin is inserted at position 3, only positions 4, 5, and 6 may be selected. Conversely, if the lever is in a low position when “pinned” at position 3, only positions Off, 1, and 2 may be selected.

ADVANTAGES:
- Permits selection of various levels of retardation, which are driver-selectable
- Lever may be left in desired position (capacity) and switched on/off automatically by ECU as conditions dictate.

DISADVANTAGES:
- If lever is left on and ECU is used for automatic on/off control, vehicle does not have the capability to coast at closed throttle – which may have a negative impact on fuel economy. Driver training is required to optimize both brake savings and fuel economy.

COMPONENTS: (See Section 5.0 for source information)
1. Hand lever retarder control, with blocking pin
2. “Hand Lever” resistance module

INSTALLATION:

[Diagram showing installation details]
4. FULL APPLY WITH BRAKE PEDAL (SINGLE PRESSURE SWITCH)

DESCRIPTION:
Conditions must be appropriate for retarder operation. See section 2.1 of text.

When the retarder apply system is operational, the retarder is applied at full-on (100%) capacity whenever the service brakes are applied. Application of the service brake is detected by the presence of pressure in the service brake system in excess of $x$ psi.

ADVANTAGES:
- Ease of installation. Small number of add-on components.
- High retarder usage.
- As compared to configuration 2 (Auto Apply at Closed Throttle), this configuration does permit the vehicle to coast without the retarder being applied.

DISADVANTAGES:
- Driver has no facility to modulate retarder braking effect — it is either off or full-on.

COMPONENTS: (See Section 5.0 for source information)
1. One brake system pressure switch (choose one from list):
   (a) $x = 2$ psi
   (b) $x = 4$ psi
   (c) $x = 7$ psi
   (d) $x = 10$ psi (Do not use with S-cam type service brakes)

2. “One Pressure Switch” resistance module

INSTALLATION:

![Installation Diagram]

- PRESSURE SWITCH
  See Installation Drawing AS07-108

- WIRING HARNESS (Customer supplied)

- “ONE PRESSURE SWITCH” Resistance Module
  See Installation Drawing AS07-109

- “RETARDER MODULATION REQUEST” (RMR) Harness Connector
  See Installation Drawing AS07-027

- “RMR” Connector may be on the “S” and/or “T” harness
  See Installation Drawing AS07-027
5. THREE-STEP APPLY WITH BRAKE PRESSURE

DESCRIPTION:
Conditions must be appropriate for retarder operation. See section 2.1 of text.

When the retarder apply system is operational:
- Retarder is applied at one-third (33%) capacity when \( x \) psi apply pressure is detected in the service brake system.
- Retarder capacity is increased to two-thirds (67%) capacity when \( y \) psi apply pressure is detected in the service brake system.
- Retarder capacity is increased to full-on (100%) capacity when \( z \) psi apply pressure is detected in the service brake system.

ADVANTAGES:
- Provides increasing levels of retardation in proportion with the operator's demand for more braking.
- Since retarder is not applied until pressure is detected in the service brake system, the vehicle may be allowed to coast at closed throttle without the retarder being applied.

DISADVANTAGES:
- Requires a thorough understanding of the vehicle brake system operation (pressures, timing) to optimize this configuration to the brake system.

COMPONENTS: (See Section 5.0 for source information)
1. A combination of three brake pressure switches (choose from list):
   (a) \( x = 2 \) psi, \( y = 4 \) psi, \( z = 7 \) psi
   (b) \( x = 2 \) psi, \( y = 7 \) psi, \( z = 10 \) psi (Do not use with S-cam type service brakes)
   (c) \( x = 4 \) psi, \( y = 7 \) psi, \( z = 10 \) psi (Do not use with S-cam type service brakes)

2. “Three Pressure Switch” Resistance Module

INSTALLATION:
“RETARDER MODULATION REQUEST” (RMR) Harness Connector
See Installation Drawing AS07-027

“THREE PRESSURE SWITCH” Resistance Module
See Installation Drawing AS07-109

WIRING HARNESS (Customer supplied)
See Installation Drawing AS07-108

“RMR” Connector may be on the “S” and/or “T” harness
See Installation Drawing AS07-027
6. AUTOMATIC ONE-HALF APPLY PLUS BRAKE PRESSURE SWITCH

DESCRIPTION:
Conditions must be appropriate for retarder operation. See section 2.1 of text.

When the retarder apply system is operational:
- Retarder is applied at one-half (50%) capacity whenever apply conditions are met
- Retarder capacity is increased to full-on (100%) when the service brakes are applied (pressure in the service brake system exceeds \( x \) psi as detected by brake pressure switch).

ADVANTAGES:
- Maximizes retarder-on time, although initial retarder apply at half capacity provides less aggressive initial response than application at full capacity.

DISADVANTAGES:
- Inhibits coasting at closed throttle. Depending upon amount of coast time in duty cycle, this apply system may adversely affect fuel economy.

COMPONENTS: (See Section 5.0 for source information)
1. One brake pressure switch (choose from list):
   - \( x = 2 \) psi
   - \( x = 4 \) psi
   - \( x = 7 \) psi
   - \( x = 10 \) psi (Do not use with S-cam type service brakes)
2. "One Pressure Switch" Resistance Module
3. "Half-On" Resistance Module

INSTALLATION:

NOTE: "Y" harness, as shown for illustration purposes, may be connected to either the "S" or "T" harness. As an option, either retarder control may be connected to the "S" harness, and the other control connected to the "T" harness.

Connect to "S" and/or "T" harness. See "NOTE" above and Installation Drawing AS07-027
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7. AUTOMATIC ONE-THIRD APPLY PLUS BRAKE PRESSURE SWITCHES

DESCRIPTION:
Conditions must be appropriate for retarder operation. See section 2.1 of text.

When the retarder apply system is operational:

- Retarder is applied at approximately one-third (33%) capacity whenever apply conditions are met.
- Retarder capacity is increased to approximately two-thirds (67%) capacity when \( x \) psi apply pressure is detected in the service brake system.
- Retarder capacity is increased to full-on (100%) capacity when \( y \) psi apply pressure is detected in the service brake system.

ADVANTAGES:
- Maximizes retarder-on time, although initial retarder apply at one-third capacity provides less aggressive initial response than application at full capacity.

DISADVANTAGES:
- Inhibits coasting at closed throttle. Depending upon amount of coast time in duty cycle, this apply system may adversely affect fuel economy.

COMPONENTS: (See Section 5.0 for source information)
1. A combination of two brake pressure switches (choose from list):
   - (a) \( x = 2 \) psi, \( y = 4 \) psi (Allison “first choice”)
   - (b) \( x = 2 \) psi, \( y = 7 \) psi
   - (c) \( x = 2 \) psi, \( y = 10 \) psi (Do not use with S-cam type service brakes)
   - (d) \( x = 4 \) psi, \( y = 7 \) psi
   - (e) \( x = 4 \) psi, \( y = 10 \) psi (Do not use with S-cam type service brakes)
   - (f) \( x = 7 \) psi, \( y = 10 \) psi (Do not use with S-cam type service brakes)

2. Resistance Module for Auto 1/3 apply + two pressure switches

INSTALLATION:

- See Installation Drawing AS07-108
- See Installation Drawing AS07-027
8. AUTOMATIC APPLY W/ HAND LEVER, PLUS FULL-ON W/ BRAKES

DESCRIPTION:
Conditions must be appropriate for retarder operation. See section 2.1 of text.

When the retarder apply system is operational, the retarder is automatically applied at the capacity selected on the retarder hand lever control. Capacity levels selectable on the lever are 0%, 17%, 33%, 50%, 67%, 83%, and 100%. * See “NOTE” in Components section below.

When the retarder apply system is operational and apply pressure is detected in the service brake system, the retarder will be applied full-on (100%). This occurs whether the retarder was not applied or was partially applied when the brake system pressure was detected.

ADVANTAGES:
- Permits selection of various levels of initial retardation, which are driver-selectable
- Lever may be left in desired intermediate capacity position and switched on/off automatically by ECU as conditions dictate. Additional (full) retarder capacity is available when the brake system is activated.

DISADVANTAGES:
- If lever is left on, ECU provides automatic on/off control at the capacity selected on the lever. Vehicle does not have the capability to coast at closed throttle – which may have a negative impact on fuel economy.
- Driver training is required to optimize both brake savings and fuel economy.

COMPONENTS: (See Section 5.0 for source information)
1. Hand lever retarder control *
2. “Lever” resistance module
3. One brake pressure switch (choose from list):
   (a) $x = 2$ psi
   (b) $x = 4$ psi
   (c) $x = 7$ psi
   (d) $x = 10$ psi (Do not use with S-cam type service brakes)
4. “One Pressure Switch” resistance module

* NOTE: A pin, provided with each lever, may be inserted at any lever position (except “Off”) to limit handle travel at or beyond that position. For example, if the lever is placed in a high position and the pin is inserted at position 3, only positions 4, 5, and 6 may be selected. Conversely, if the lever is in a low position when “pinned” at position 3, only positions Off, 1, and 2 may be selected.

INSTALLATION:

```
*HAND LEVER*  
Resistance Module  
See Installation Drawing AS07-109

PRESSURE SWITCH  
See Installation Drawing AS07-108

“ONE PRESSURE SWITCH”  
Resistance Module  
See Installation Drawing AS07-109

RETARDER “Y” HARNESS  
See Installation Drawing AS07-107

WIRING HARNESS  
(Customer supplied)

RETARDER MODULATION REQUEST” (RMR)  
Harness Connector  
See Installation Drawing AS07-027

NOTE: “Y” harness, as shown for illustration purposes, may be connected to either the “S” or “T” harness. As an option, either retarder control may be connected to the “S” harness, and the other control connected to the “T” harness.
```
9. MANUAL APPLY WITH FOOT PEDAL, PLUS FULL-ON W/ BRAKES

DESCRIPTION:
Conditions must be appropriate for retarder operation. See section 2.1 of text.

When the retarder apply system is operational, retarder capacity is infinitely variable between full-off (0%) and full-on (100%), depending upon the position of the operator control (retarder pedal).

If the retarder has been automatically applied (above) at a capacity less than full-on (100%), it will subsequently be applied full-on when apply pressure is detected in the service brake system.

ADVANTAGES:
- Retarder capacity is infinitely variable with pedal. Additional (full) retarder capacity is available when the brake system is activated.
- Retarder control does not have to be matched with configuration of the brake system (timing, brake apply pressures, etc.) for intermediate retarder capacities.
- Since retarder is not applied until the retarder pedal is pushed, the vehicle may be allowed to coast at closed throttle without the retarder being applied.

DISADVANTAGES:
- Space claim required for two operator pedals – one for brake, one for retarder.

COMPONENTS: (See Section 5.0 for source information)
1. Retarder Pedal retarder control
2. "Retarder Pedal" resistance module
3. One brake pressure switch (choose from list):
   (a) \( x = 2 \text{ psi} \)
   (b) \( x = 4 \text{ psi} \)
   (c) \( x = 7 \text{ psi} \)
   (d) \( x = 10 \text{ psi} \) (Do not use with S-cam type service brakes)
4. "One Pressure Switch" resistance module

INSTALLATION:

```
\begin{center}
\begin{tikzpicture}
\node [anchor = west, align = left, text width = \textwidth] (node1) at (0,0) {
\textbf{RETARDER PEDAL CONTROL}
See Installation Drawing AS07-107
\textbf{PRESSURE SWITCH}
See Installation Drawing AS07-108
\node [anchor = west, align = left, text width = \textwidth] (node2) at (0,-2) {
\textbf{RETARDER "Y" HARNESS}
\node [anchor = west, align = left, text width = \textwidth] (node3) at (0,-4) {
\textbf{FOOT PEDAL" Resistance Module}
See Installation Drawing AS07-109
\node [anchor = west, align = left, text width = \textwidth] (node4) at (0,-6) {
\textbf{ \textbf{ONE PRESSURE SWITCH" Resistance Module}}
See Installation Drawing AS07-109
\node [anchor = west, align = left, text width = \textwidth] (node5) at (0,-8) {
\textbf{ \textbf{RETARDER MODULATION REQUEST" (RMR)}
Harness Connector
See Installation Drawing AS07-027
\end{tikzpicture}
\end{center}
```

NOTE: "Y" harness, as shown for illustration purposes, may be connected to either the "S" or "T" harness. As an option, either retarder control may be connected to the "S" harness, and the other control connected to the "T" harness.
10. AUTOMATIC APPLY WITH HAND LEVER, PLUS THREE-STEP APPLY WITH BRAKES

DESCRIPTION:
Conditions must be appropriate for retarder operation. See section 2.1 of text.

When the retarder apply system is operational, the retarder is automatically applied at the capacity selected on the retarder hand lever control. Capacity levels selectable on the lever are 0%, 17%, 33%, 50%, 67%, 83%, and 100%.

* See “NOTE” in Components section below.

If the retarder has been automatically applied (above) at a capacity less than full-on (100%), it will subsequently be applied to the highest level requested from either input when apply pressure is detected in the service brake system.

ADVANTAGES:
- Permits selection of various levels of initial retardation, which are driver-selectable with the lever
- Lever may be left in desired intermediate capacity position and switched on/off automatically by ECU as conditions dictate. Additional (full) retarder capacity is available when the brake system is activated.

DISADVANTAGES:
- If lever is left on, ECU provides automatic on/off control at the capacity selected on the lever. Vehicle does not have the capability to coast at closed throttle – which may have a negative impact on fuel economy. Driver training is required to optimize both brake savings and fuel economy.
- Requires a thorough understanding of the vehicle brake system operation (pressures, timing) to integrate and optimize this configuration to the brake system
- Installation complexity

COMPONENTS: (See Section 5.0 for source information)
1. A combination of three brake pressure switches (choose from list):
   (a) $x = 2$ psi, $y = 4$ psi, $z = 7$ psi
   (b) $x = 2$ psi, $y = 7$ psi, $z = 10$ psi **
   (c) $x = 4$ psi, $y = 7$ psi, $z = 10$ psi **
2. Hand lever retarder control*
3. “Lever” resistance module
4. “Three Pressure Switch” resistance module
   ** Do not use with S-cam type service brakes

NOTE: A pin, provided with each lever, may be inserted at any lever position (except “Off”) to limit handle travel at or beyond that position. For example, if the lever is placed in a high position and the pin is inserted at position 3, only positions 4, 5, and 6 may be selected. Conversely, if the lever is in a low position when “pinned” at position 3, only positions Off, 1, and 2 may be selected.

INSTALLATION:
“THREE PRESSURE SWITCH” Resistance Module
See Installation Drawing AS07-109

NOTE: “Y” harness, as shown for illustration purposes, may be connected to either the “S” or “T” harness. As an option, either retarder control may be connected to the “S” harness, and the other control connected to the “T” harness.

See Installation Drawing AS07-108

Connect to “S” and/or “T” harness.
See “NOTE” above and Installation Drawing AS07-027

“HAND LEVER” Resistance Module
See Installation Drawing AS07-109

“RETARDER MODULATION REQUEST” (RMR) Harness Connector
See Installation Drawing AS07-027

WIRING HARNESS (Customer Supplied)