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GM POWERTRAIN

4T65-E

HYDRA-MATIC

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PREFACE

The Hydra-matic 4T65-E Technician's Guide is intended for automotive technicians that are familiar with the operation of an automatic transaxle or transmission. Technicians or other persons not having automatic transaxle or transmission know-how may find this publication somewhat technically complex if additional instruction is not provided. Since the intent of this book is to explain the fundamental mechanical, hydraulic and electrical operating principles, technical terms used herein are specific to the transmission industry. However, words commonly associated with the specific transaxle or transmission function have been defined in a Glossary rather than within the text of this book.

The Hydra-matic 4T65-E Technician's Guide is also intended to assist technicians during the service, diagnosis and repair of this transaxle. However, this book is not intended to be a substitute for other General Motors service publications that are normally used on the job. Since there is a wide range of repair procedures and technical specifications specific to certain vehicles and transaxle models, the proper service publication must be referred to when servicing the Hydra-matic 4T65-E transaxle.

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INTRODUCTION

The Hydra-matic 4T65-E Technician's Guide is another Powertrain publication from the Technician's Guide series of books. The purpose of this publication, as is the case with other Technician's Guides, is to provide complete information on the theoretical operating characteristics of this transaxle. Operational theories of the mechanical, hydraulic and electrical components are presented in a sequential and functional order to better explain their operation as part of the system.

In the first section of this book entitled "Principles of Operation", exacting explanations of the major components and their functions are presented. In every situation possible, text describes component operation during the apply and release cycle as well as situations where it has no effect at all. The descriptive text is then supported by numerous graphic illustrations to further emphasize the operational theories presented.

The second major section entitled "Power Flow", blends the information presented in the "Principles of Operation" section into the complete transaxle assembly. The transfer of torque from the engine through the transaxle is graphically displayed on a full page while a narrative description is provided on a facing half page. The opposite side of the half page contains the narrative description of the hydraulic fluid as it applies components or shifts valves in the system. Facing this partial page is a hydraulic schematic that shows the position of valves, checkballs, etc., as they function in a specific gear range.

The third major section of this book displays the "Complete Hydraulic Circuit" for specific gear ranges. Fold-out pages containing fluid flow schematics and two dimensional illustrations of major components graphically display hydraulic circuits. This information is extremely useful when tracing fluid circuits for learning or diagnosis purposes.

The "Appendix" section of this book provides additional transaxle information regarding lubrication circuits, seal locations, illustrated parts lists and more. Although this information is available in current model year Service Manuals, its inclusion provides for a quick reference guide that is useful to the technician.

Production of the Hydra-matic 4T65-E Technician's Guide was made possible through the combined efforts of many staff areas within the General Motors Powertrain Division. As a result, the Hydra-matic 4T65-E Technician's Guide was written to provide the user with the most current, concise and usable information available regarding this product.

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HOW TO USE THIS BOOK

First time users of this book may find the page layout a little unusual or perhaps confusing. However, with a minimal amount of exposure to this format its usefulness becomes more obvious. If you are unfamiliar with this publication, the following guidelines are helpful in understanding the functional intent for the various page layouts:

- Read the following section, "Understanding the Graphics" to know how the graphic illustrations are used, particularly as they relate to the mechanical power flow and hydraulic controls (see Understanding the Graphics page 6).

- Unfold the cutaway illustration of the Hydra-matic 4T65-E (page 8) and refer to it as you progress through each major section. This cutaway provides a quick reference of component location inside the transaxle assembly and their relationship to other components.

- The Principles of Operation section (beginning on page 9A) presents information regarding the major apply components and hydraulic control components used in this transaxle. This section describes "how" specific components work and interfaces with the sections that follow.

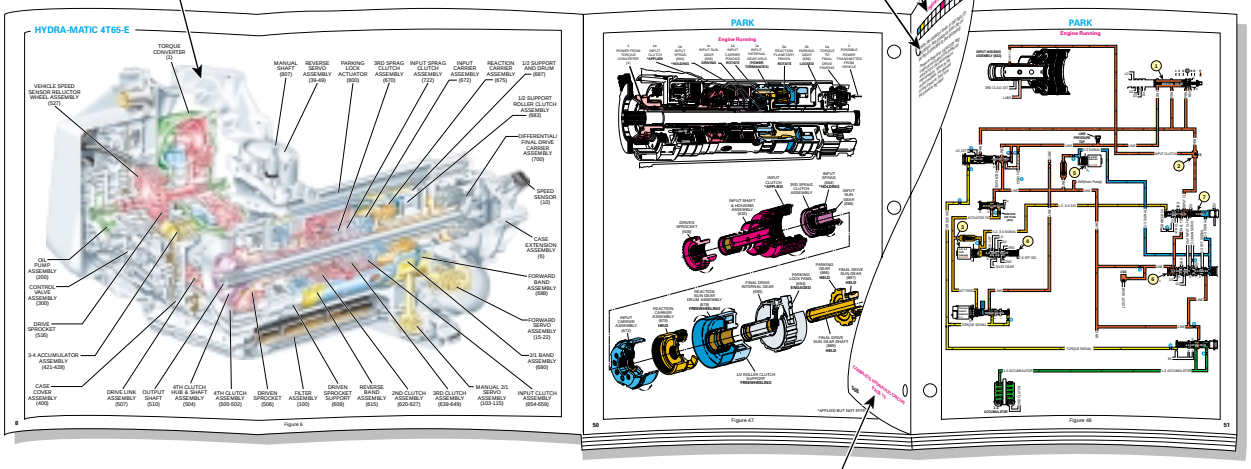
- The Power Flow section (beginning on page 53) presents the mechanical and hydraulic functions corresponding to specific gear ranges. This section builds on the information presented in the Principles of Operation section by showing specific fluid circuits that enable the mechanical components to operate. The mechanical power flow is graphically displayed on a full size page and is followed by a half page of descriptive text. The opposite side of the half page contains the narrative description of the hydraulic fluid as it applies components or moves valves in the system. Facing this partial page is a hydraulic schematic which shows the position of valves, checkballs, etc., as they function in a specific gear range. Also, located at the bottom of each half page is a reference to the Complete Hydraulic Circuit section that follows.

- The Complete Hydraulic Circuits section (beginning on page 81) details the entire hydraulic system. This is accomplished by using a fold-out circuit schematic with a facing page two dimensional fold-out drawing of each component. The circuit schematics and component drawings display only the fluid passages for that specific operating range.

- Finally, the Appendix section contains a schematic of the lubrication flow through the transaxle, disassembled view parts lists and transaxle specifications. This information has been included to provide the user with convenient reference information published in the appropriate vehicle Service Manuals. Since component parts lists and specifications may change over time, this information should be verified with Service Manual information.

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HOW TO USE THIS BOOK



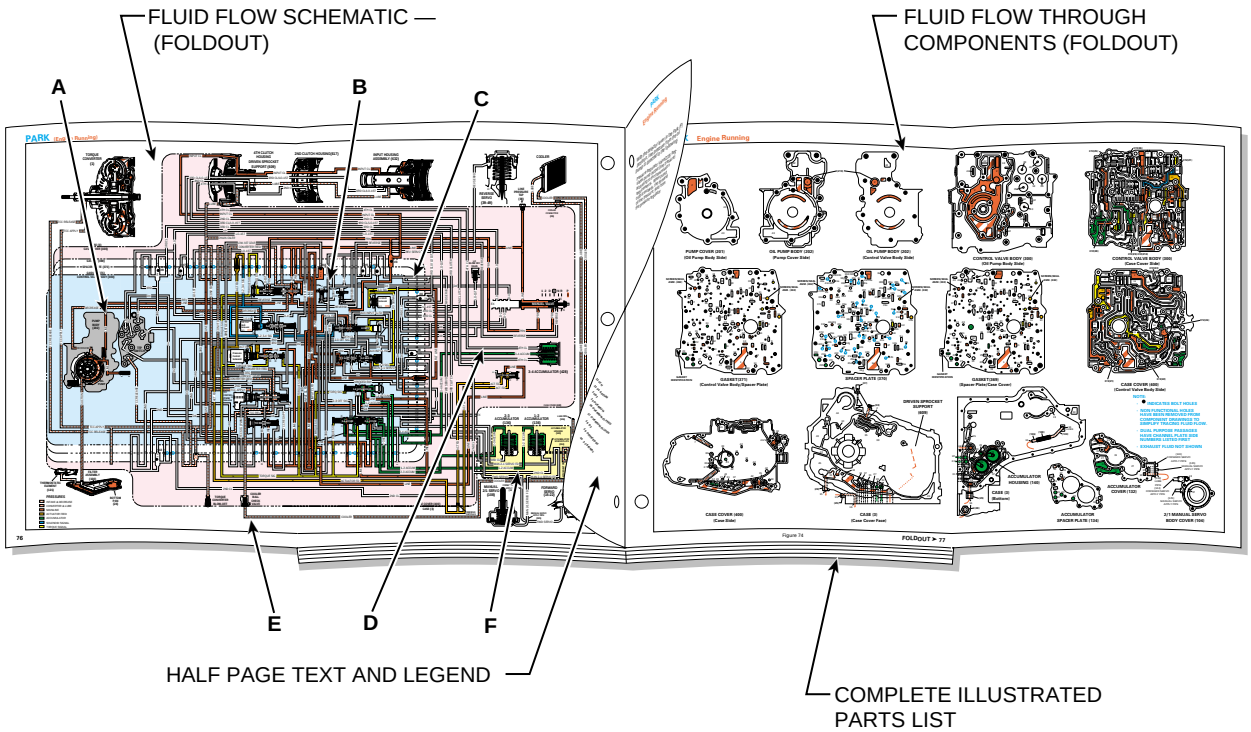


Figure 1

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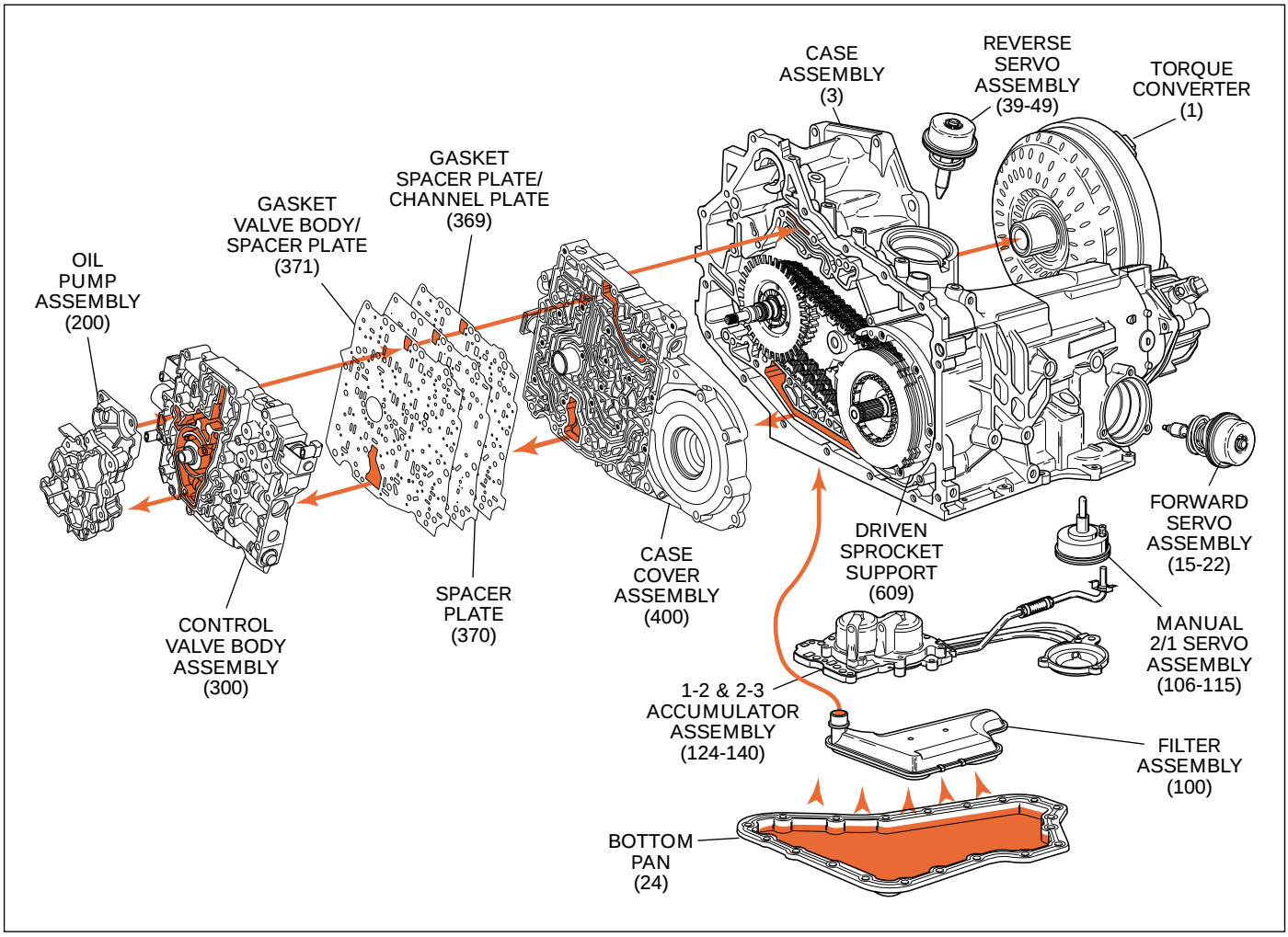


Figure 2

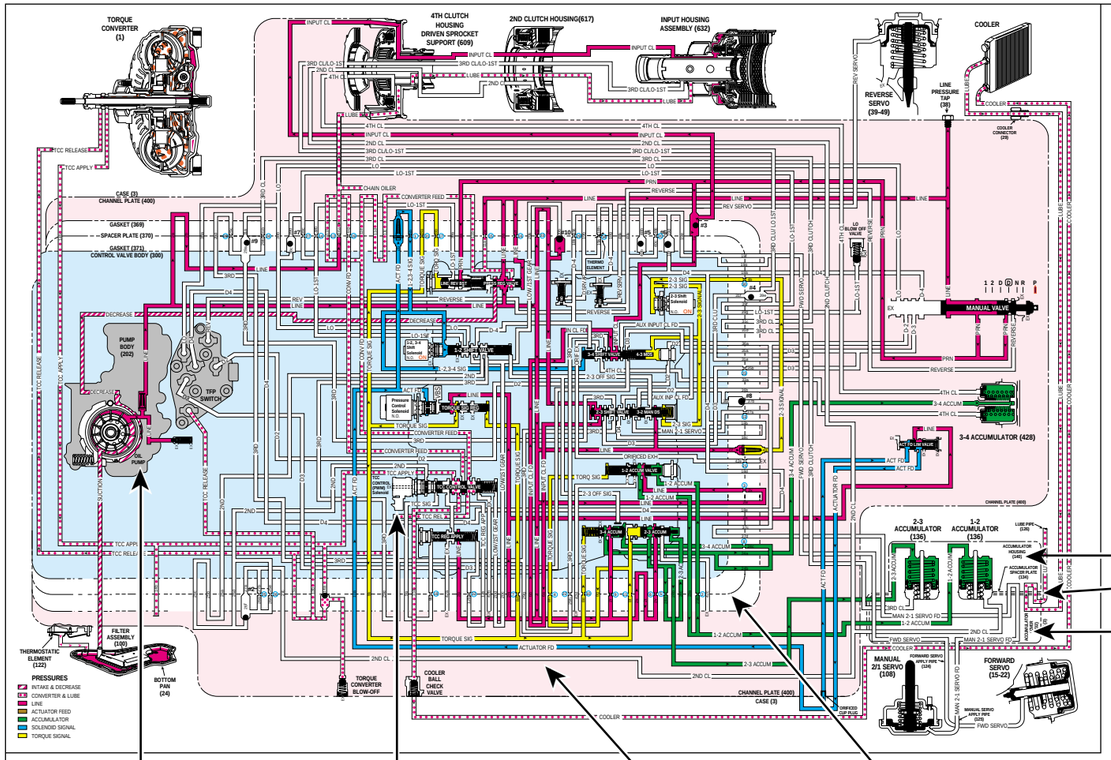
The flow of transaxle fluid starts in the bottom pan and is drawn through the filter, case assembly, channel plate assembly, spacer plate and gaskets, control valve assembly and into oil pump assembly. This is a basic concept of fluid flow that can be understood by reviewing the illustrations provided in Figure 2. However, fluid may pass between the valve body, spacer plate, channel plate and other components many times before reaching a valve or applying a clutch. For this reason, the graphics are designed to show the exact location where fluid passes through a component and into other passages for specific gear range operation.

To provide a better understanding of fluid flow in the Hydra-matic 4T65-E transaxle, the components involved with hydraulic control and fluid flow are illustrated in three major formats. Figure 3 (page 7-7A) provides an example of these formats which are:

- A three dimensional line drawing of the component for easier part identification.
- A two dimensional line drawing of the component to indicate fluid passages and orifices.
- A graphic schematic representation that displays valves, checkballs, orifices and so forth, required for the proper function of transaxle in a specific gear range. In the schematic drawings, fluid circuits are represented by straight line and orifices are represented by indentations in a circuit. All circuits are labeled and color coded to provide reference points between the schematic drawing and the two dimensional line drawing of the components.
- Figure 4 (page 7B) provides an illustration of a typical valve, bushing and valve train components. A brief description of valve operation is also provided to support the illustration.
- Figure 5 (page 7B) provides a color coded chart that references different fluid pressures used to operate the hydraulic control systems. A brief description of how fluid pressures affect valve operation is also provided.

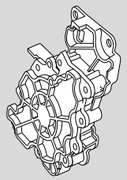
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UNDERSTANDING THE GRAPHICS



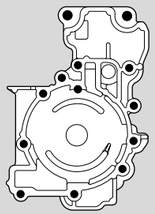
GRAPHIC SCHEMATIC REPRESENTATION

OIL PUMP BODY (202)



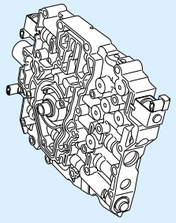
THREE DIMENSIONAL

PUMP COVER SIDE



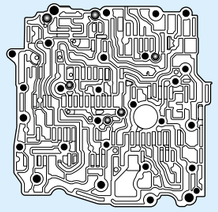
TWO DIMENSIONAL

CONTROL VALVE BODY ASSEMBLY (300)



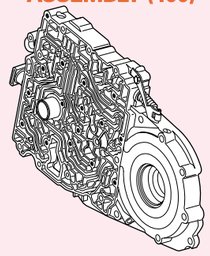
THREE DIMENSIONAL

CASE COVER SIDE



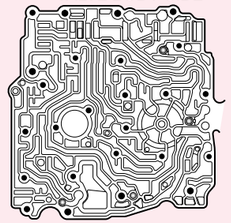
TWO DIMENSIONAL

CASE COVER ASSEMBLY (400)



THREE DIMENSIONAL

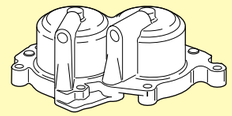
VALVE BODY SIDE



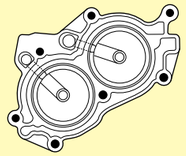
TWO DIMENSIONAL

ACCUMULATOR HOUSING ASSEMBLY (140)

ACCUMULATOR COVER SIDE



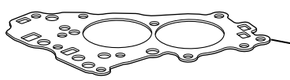
THREE DIMENSIONAL



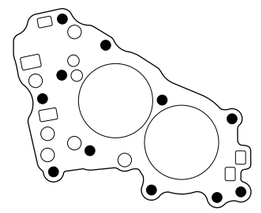
TWO DIMENSIONAL

ACCUMULATOR SPACER PLATE (134)

ACCUMULATOR HOUSING SIDE



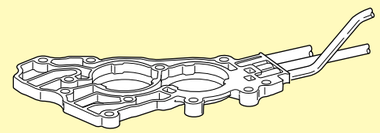
THREE DIMENSIONAL



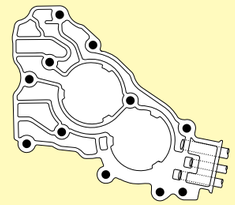
TWO DIMENSIONAL

ACCUMULATOR COVER (132)

ACCUMULATOR HOUSING SIDE

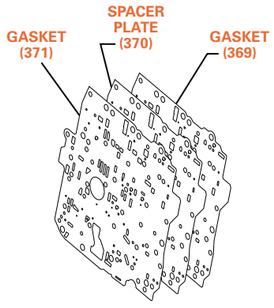


THREE DIMENSIONAL



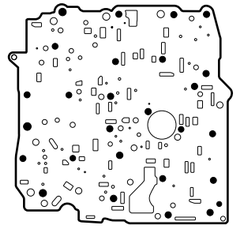
TWO DIMENSIONAL

VALVE BODY SPACER PLATE (370)



THREE DIMENSIONAL

CONTROL VALVE BODY SIDE



TWO DIMENSIONAL

Figure 3

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TYPICAL BUSHING & VALVE

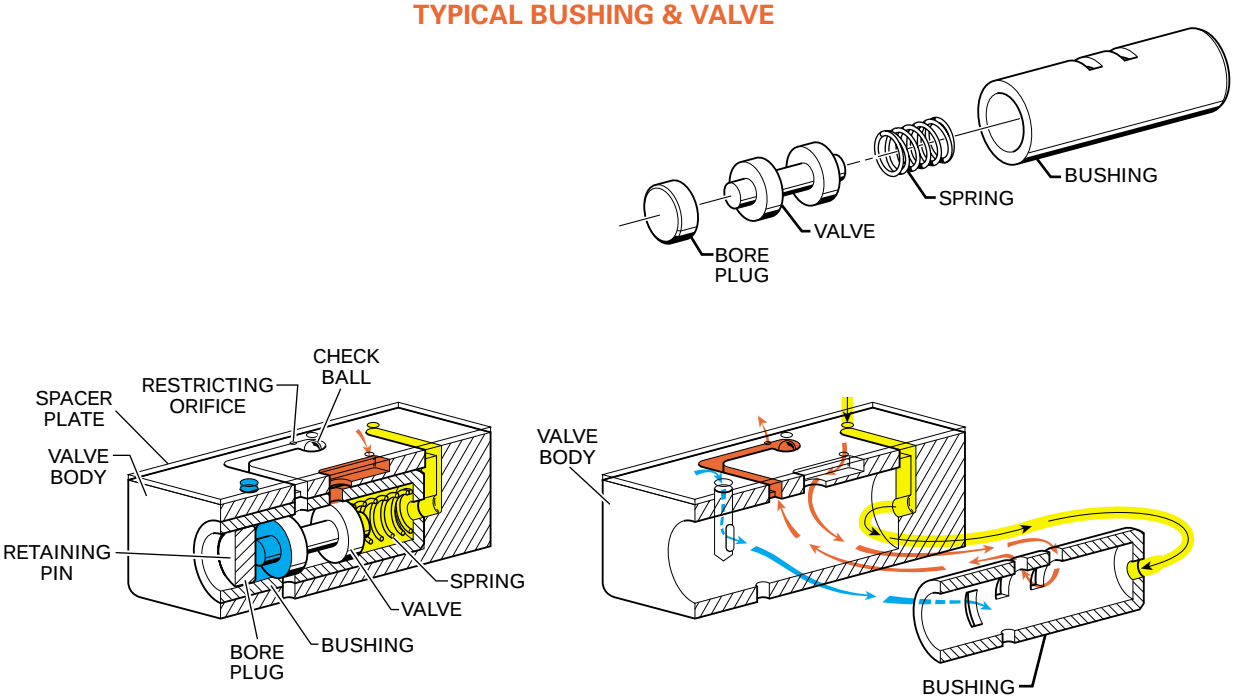
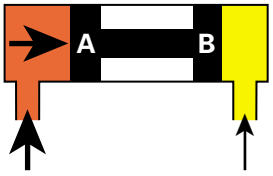


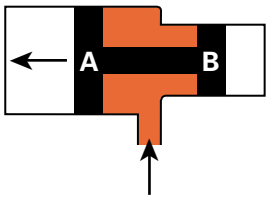
Figure 4

FLUID PRESSURES

- **INTAKE & DECREASE**
- **CONVERTER & LUBE**
- **LINE**
- **ACTUATOR FEED**
- **ACCUMULATOR**
- **SOLENOID SIGNAL**
- **TORQUE SIGNAL**
- **EXHAUST**
- **DIRECTION OF FLOW**



WITH EQUAL SURFACE AREAS ON EACH END OF THE VALVE, BUT FLUID PRESSURE "A" BEING GREATER THAN FLUID PRESSURE "B", THE VALVE WILL MOVE TO THE RIGHT.



WITH THE SAME FLUID PRESSURE ACTING ON BOTH SURFACE "A" AND SURFACE "B" THE VALVE WILL MOVE TO THE LEFT. THIS IS DUE TO THE LARGER SURFACE AREA OF "A" THAN "B".

Figure 5

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HYDRA-MATIC 4T65-E

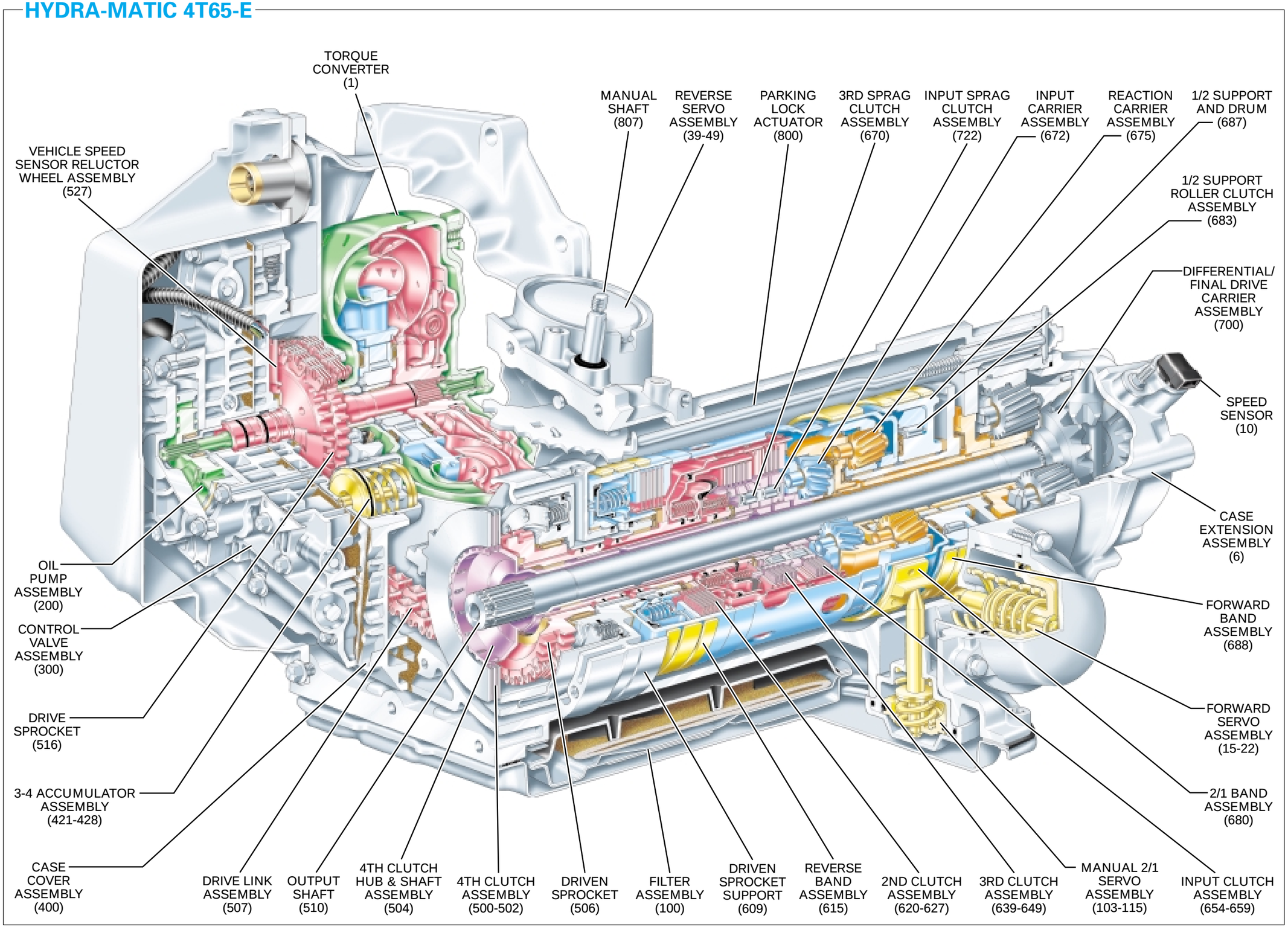


Figure 6

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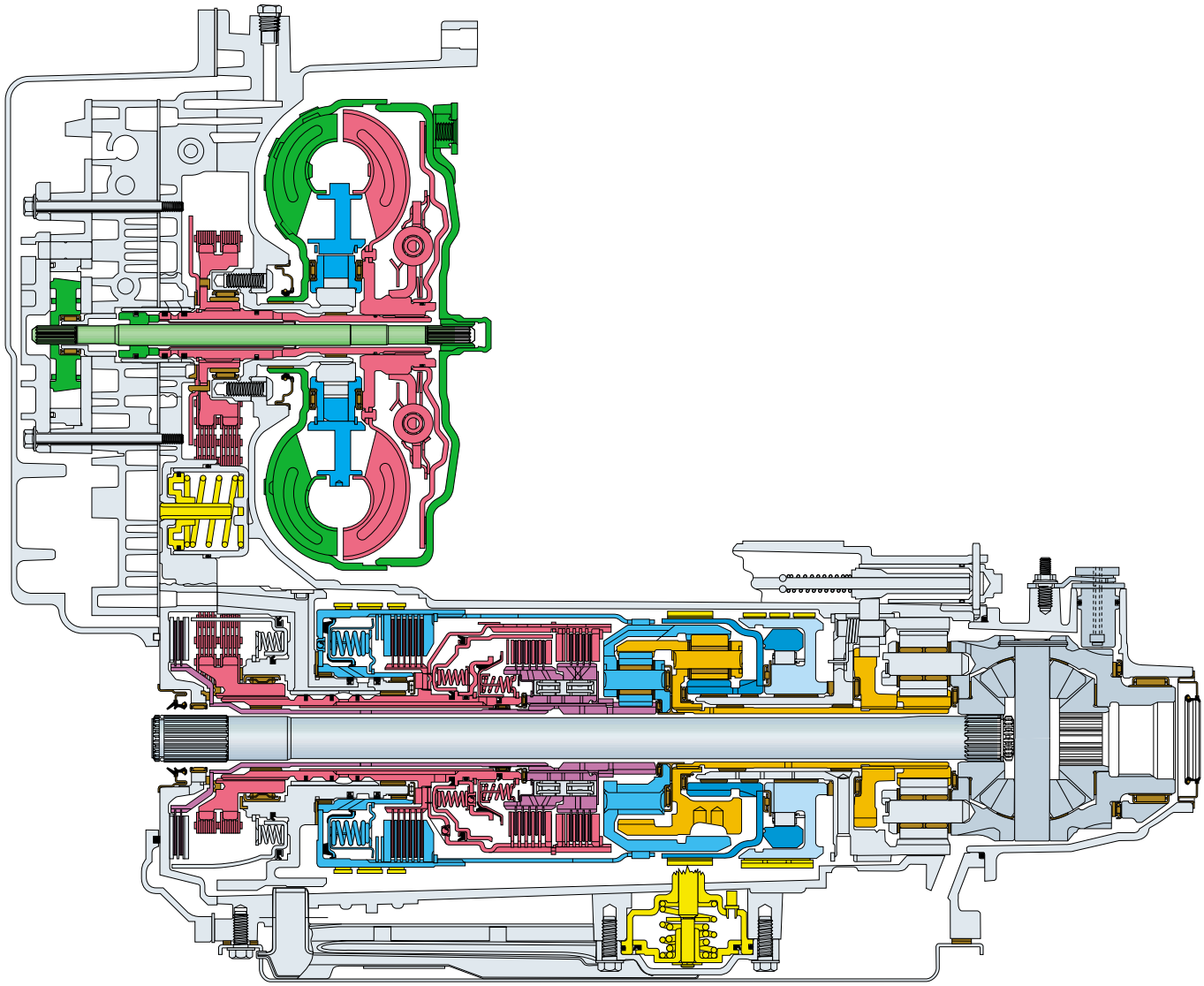


Figure 7

HYDRA-MATIC 4T65-E CROSS SECTIONAL VIEW

This illustration is a typical engineering cross sectional drawing of the Hydra-matic 4T65-E transaxle that has been used sparingly in this publication. Unless an individual is familiar with this type of drawing, it may be difficult to use when locating or identifying a component in the transaxle. For this reason, the three dimensional graphic illustration on page 8 has been the primary drawing used throughout this publication. It also may be used to assist in the interpretation of the engineering drawing when locating a component in the transaxle.

These illustrations, and others used throughout the book, use a consistent coloring of the components in order to provide an easy reference to a specific component. Colors then remain the same from section to section, thereby supporting the information contained in this book.

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