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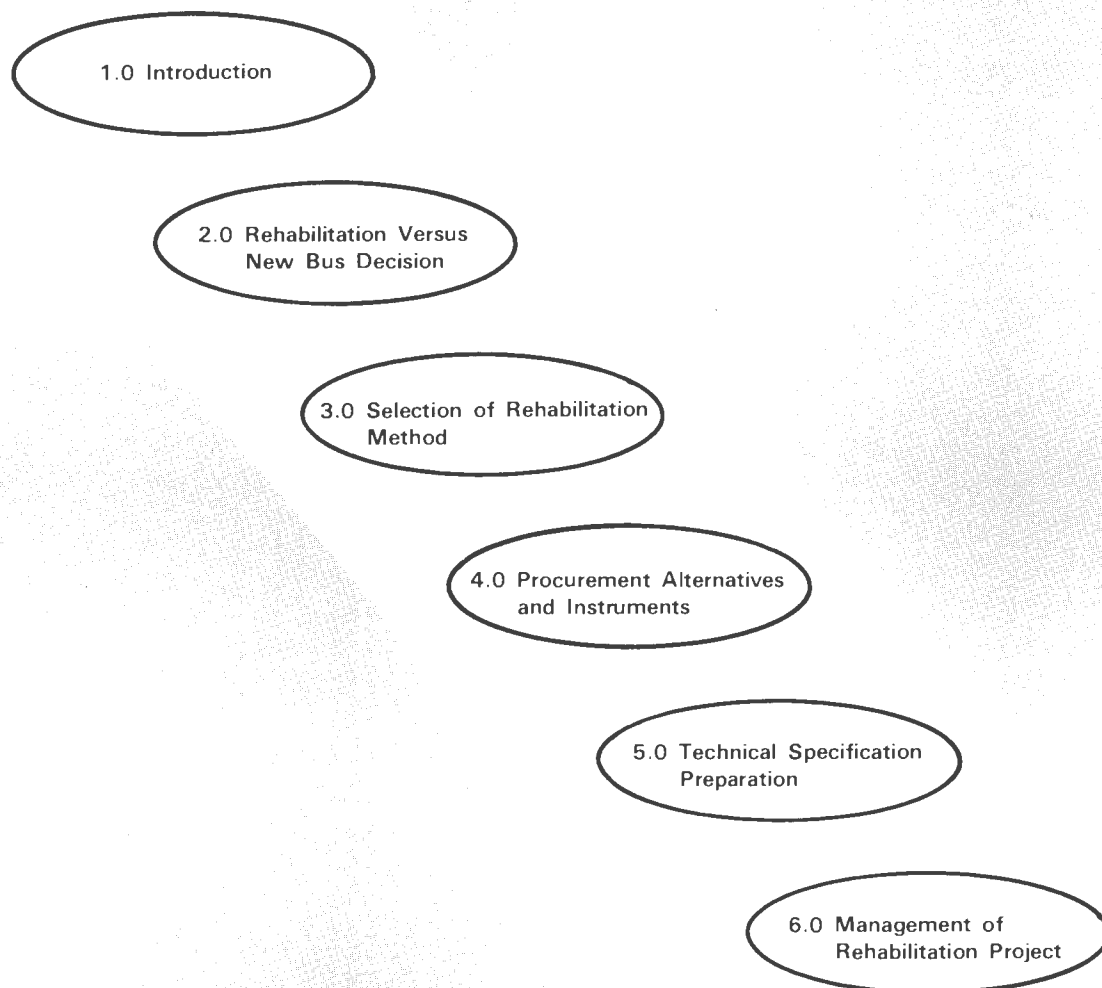
**Urban Mass
Transportation
Administration**

Bus Rehabilitation Guidelines

Office of Technical Assistance
Office of Bus and Paratransit Systems

Prepared by:
Battelle Columbus Laboratories
ATE Management & Service Co.

January 1983



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BUS REHABILITATION GUIDELINES

FEBRUARY 1983

for

DEPARTMENT OF TRANSPORTATION/UMTA
OFFICE OF BUS AND PARATRANSIT SYSTEMS

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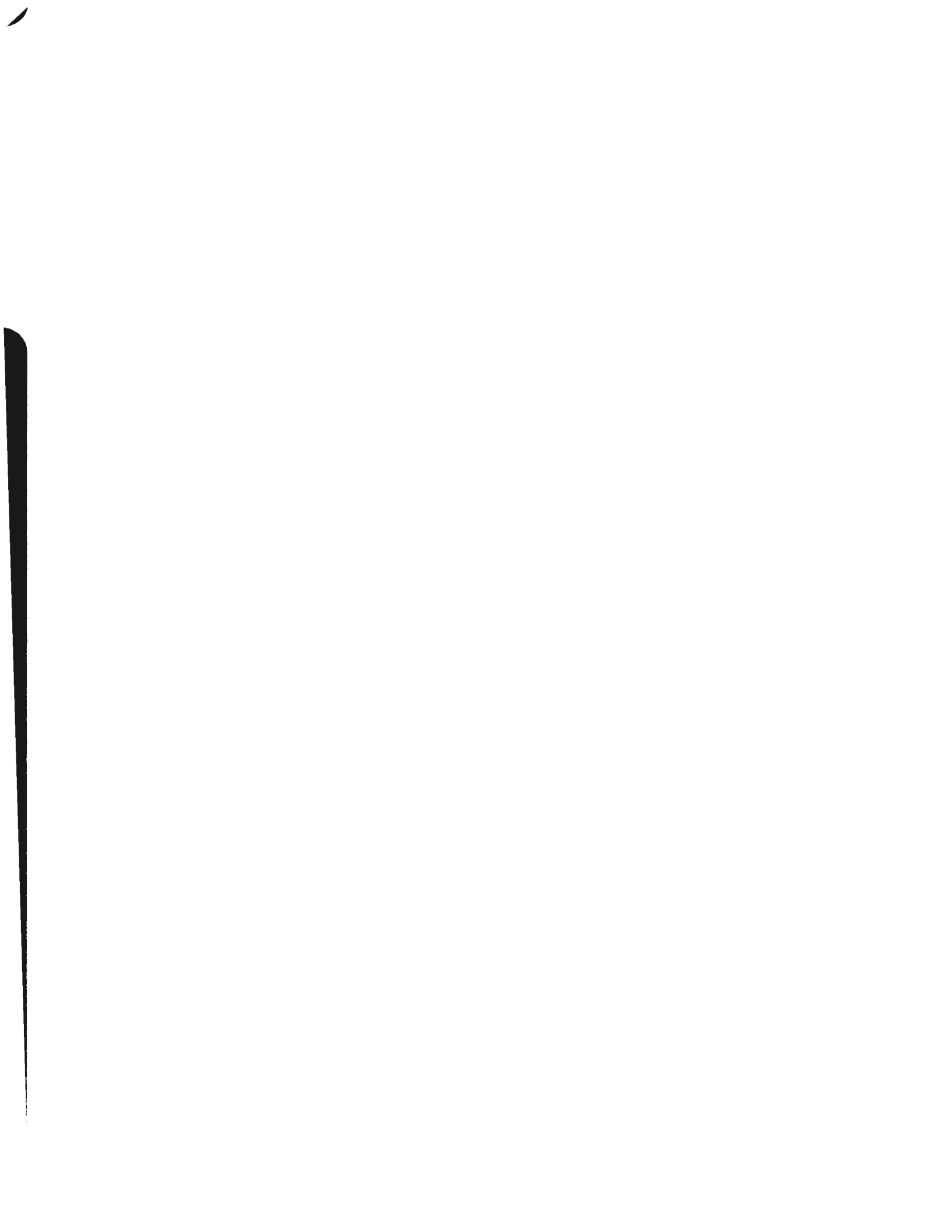
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16. Abstract <p>This manual provides managers of transit systems a set of guidelines for evaluating, implementing, and managing a bus rehabilitation program. The guidelines were based on a field study of bus rehabilitation projects in the U.S. Input was also received from bus remanufacturers and from a transit industry committee.</p> <p>Following background information and an overview of the rehabilitation process, the manual discusses key issues in the choice between new buses and rehabilitated buses. Life cycle cost analysis is presented as a decision tool. The merits and demerits of performing rehabilitation in-house versus hiring a contractor are discussed. Next, procurement methods and issues are presented. The two-step bid process is recognized as a mechanism for assuring bid responses are only from responsible contractors. Appropriate development of technical specifications is addressed. Finally, the key ingredients for successful management of a rehabilitation program are presented. These guidelines can be used to assist transit systems with the major aspects of bus rehabilitation.</p>			
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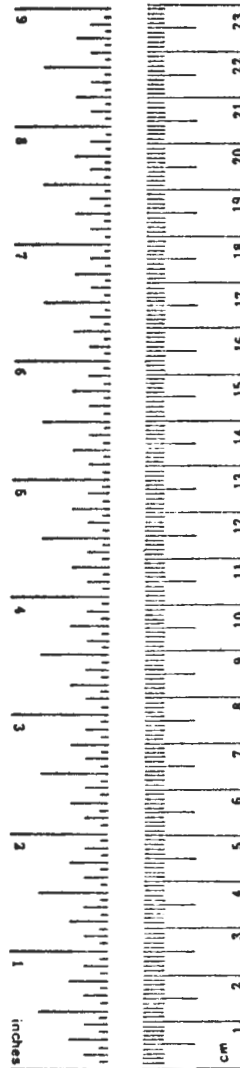


METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
in ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.8	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³
TEMPERATURE (exact)				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 exactly. For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price \$2.25, SD Catalog No. C13.10.286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
AREA				
cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares (10,000 m ²)	2.5	acres	
MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m ³	cubic meters	35	cubic feet	ft ³
m ³	cubic meters	1.3	cubic yards	yd ³
TEMPERATURE (exact)				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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EXECUTIVE SUMMARY

Bus rehabilitation has been growing in popularity as a capital improvement alternative for transit managers. Since the availability of state and federal assistance, the number of bus rehabilitation projects undertaken by transit managers has increased. Consequently, the industry's experience with and knowledge of bus rehabilitation has grown substantially.

Bus rehabilitation is not presented in this guidelines manual as a substitute for new bus procurement. It should be used in combination with new bus acquisition and preventive maintenance for effective and efficient fleet management. The contents of this manual are to be used as guidelines and not viewed as regulation or policy.

The end result of this field study of bus rehabilitation projects in the U.S. is a manual that provides managers of transit systems a set of guidelines for evaluating, implementing, and managing a bus rehabilitation program. The manual is organized to correspond with the sequence of events that occur in the life of such a program. Chapter 1 presents background information, the definition of rehabilitation, and an overview of the process. Chapter 2 discusses the merits and demerits of rehabilitating buses versus purchasing new buses, based on factors such as time to availability, life cycle cost, source of funds, and public image. According to the survey, acquisition of new buses entails major capital outlay. In some cases it has had an adverse impact on service and maintenance, although in theory an entirely new fleet of buses is appealing. Rehabilitation, therefore, has been viewed as a more rapid and more economical method of alleviating an immediate problem. Life cycle cost analysis is suggested as an important tool to arrive at a sound decision.

Once a decision to rehabilitate buses has been made, transit systems must decide whether to hire a contractor or to perform the work in-house. Chapter 3 addresses this question and provides some guidance for an in-house rehabilitation program. The decision whether to implement an in-house program or seek an outside contractor or use a combination of the two is based on several factors: availability of facilities and equipment, availability of skills, labor relations, management and contracting considerations or constraints, cost savings, funding sources, impact on daily transit system operations, and total time to perform the work.

When the advantages and disadvantages of the alternatives were set against each other, the consensus was that the contractor alternative was generally more

cost-effective. The availability of federal funds for rehabilitation was also a very important factor in the decision-making.

Chapter 4 provides guidelines towards assessing the procurement options (e.g., sealed bids and negotiated bids) based on the merits and demerits of each option and the legal and other requirements that exist for each option. The two-step bid process, which meets federal requirements, is identified as a mechanism for assuring bid responses are from responsible contractors only. The survey indicated that awarding portions of the contract to more than one bidder and dividing each contract portion into increments could be used to assure quality and timeliness.

The next step is to implement the contract. Chapter 5 addresses the question of technical specifications that must be prepared and included in the contract so as to ensure quality work and the lowest cost. It was found that the key to successful contracting was to lay down clear and unambiguous specifications and state the actual level of work (e.g., refurbish, rebuild, or remanufacture) desired. However, specifications should not be too inflexible to preclude unanticipated repairs.

The final step in a bus rehabilitation program is the management of the project. Chapter 6 discusses (1) an "engagement" plan that assigns priorities and responsibilities, enumerates specific tasks, describes time frames, and commits resources; (2) complete and accurate documentation for future audits; (3) the importance of supporting a project manager and quality assurance inspectors; (4) warranty provisions and the vital importance of the maintenance staff's knowledge of those provisions.

There are nine appendices. Their titles included under the Table of Contents are self-explanatory.

TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION	1
1.1 Objective	1
1.2 Methodology	1
1.3 Terminology	3
1.4 UMTA Rehabilitation Policy Guidelines	5
1.5 Organization of the Guidelines Manual	6
2.0 REHABILITATION VERSUS NEW BUS DECISION	8
2.1 Overview.	8
2.2 Alternative Courses of Action	9
2.2.1 Purchase All New Buses	9
2.2.2 Rehabilitation of Old Buses.	10
2.2.3 A Mixture of New Purchase and Rehabilitation	12
2.3 Decision Factors.	12
2.3.1 Decision Factors Used by Transit Systems Interviewed.	12
2.3.2 Current and Emerging Decision Factors.	13
2.4 Life Cycle Cost Analysis.	16
2.4.1 LCC Model Approach	17
2.4.2 Discount and Inflation Factors	18
2.4.3 LCC Model.	18
2.4.4 LCC Model Application Considerations	24
2.5 Scope of Work	24
3.0 SELECTION OF A REHABILITATION METHOD	26
3.1 In-House Method	26
3.1.1 Facilities, Equipment, and Component Requirements. . .	26
3.1.2 Availability of Skills	29
3.1.3 Start-Up and Shut-Down Consideration	30
3.1.4 Labor Relations.	30
3.1.5 Other Factors.	31
3.1.6 Costing.	31

TABLE OF CONTENTS
Continued

	<u>Page</u>
3.2 Combination In-House and Contractural Bus Rehabilitation Method.	32
3.3 Contracting Work to a Commercial Firm Method.	32
4.0 PROCUREMENT ALTERNATIVES AND INSTRUMENTS	34
4.1 Overview.	34
4.1.1 Contractor Qualifications.	35
4.1.2 Competitive Sealed Bids.	36
4.1.3 Competitive Negotiation.	38
4.1.4 Non-Competitive Negotiation.	38
4.1.5 Two-Step Bid Process	38
4.2 Options for Inclusion With the Contract	39
4.2.1 Partial Award of Contract.	39
4.2.2 Dividing the Contracts into Increments	39
4.2.3 Performance Bonding.	40
4.3 Additional Considerations	40
5.0 TECHNICAL SPECIFICATION PREPARATION.	42
6.0 MANAGEMENT OF A REHABILITATION PROJECT	45
6.1 Engagement Plan	45
6.1.1 Committed Resources.	45
6.1.2 Timing	46
6.1.3 Progress Reviews	47
6.2 Documentation	47
6.3 Key Personnel	49
6.4 Warranty.	50
Bibliography	51
Appendix A. Bus Rehabilitation Working Group Members	A-1
Appendix B. Site Visit Contacts, Questionnaire and Summaries	B-1
Appendix C. A Guide to Type of Component Work Relating to Three Alternative Levels of Bus Rehabilitation	C-1

TABLE OF CONTENTS
Continued

	<u>Page</u>
Appendix D. LCC Model Variations.	D-1
Appendix E. Sample Cost Analysis for In-house Rehabilitation.	E-1
Appendix F. UMTA Third Party Contracting Guidelines.	F-1
Appendix G. Sample Approaches for Screening Bidders	G-1
Appendix H. Sample Approach to Competitive Negotiation.	H-1
Appendix I. Sample Technical Specifications	I-1

LIST OF TABLES

Table 1-1. List of Transit Systems Visited.	2
Table 1-2. Levels of Rehabilitation	4
Table 2-1. Historical Ranking of Bus Rehabilitation Decision Factors Based on Survey	14
Table 2-2. Typical Capital Cost Elements for Three Alternatives.	19
Table 2-3. Annual Cost Elements.	21
Table 2-4. Annual O&M Cost Formulas.	23
Table 3-1. Summary of Characteristics of Alternative Rehabilitation Methods	27

LIST OF FIGURES

Figure 1-1. Overview of a Bus Rehabilitation Program	7
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1.0 INTRODUCTION

1.1 Objective

This manual provides guidance to transit systems in evaluating, implementing, and managing bus rehabilitation programs with particular focus on standard size 35-foot and 40-foot transit buses. The guidelines are written from a user-oriented, managerial perspective.

Various bus rehabilitation efforts have been undertaken by transit systems over the past several years, many of which have been supported by UMTA. Recognizing a need for rehabilitation guidance, UMTA contracted with Battelle's Columbus Laboratories (BCL), in association with ATE Management and Service Company, Inc. (ATE), to investigate the following areas:

- Factors surrounding the decision to rehabilitate buses
- Use of outside contractors for rehabilitation work versus in-house personnel
- Procurement processes
- Written technical specifications
- Procurement options
- Quality control of rehabilitation
- Other project management guidelines.

1.2 Methodology

This manual is based on the results of a series of visits to transit systems which had rehabilitated buses during the past four years and to rehabilitation contractors. Several important supporting activities were performed prior to the site visits. Pertinent literature on bus rehabilitation was reviewed; key documents and articles are listed in the bibliography. Life cycle cost (LCC) models developed for bus acquisitions were reviewed and evaluated. Subsequent to these efforts, a meeting was held with the Bus Rehabilitation Working Group (BRWG), an ad hoc committee established with the cooperation and participation of the American Public Transit Association (APTA) to assist in providing transit industry input. A list of the participants is included in Appendix A.

At the first BRWG meeting, Battelle and ATE presented their initial ideas for the content of the guidelines and the results of their early project work. A modified proposed outline for the guidelines, enhanced understanding of bus rehabilitation issues by the study team, and a list of sites to be surveyed were also discussed.

The site visits were conducted by teams of two or three people over a two-month period during the summer of 1982. Table 1-1 lists the systems visited during each trip. Appendix B provides a list of key contacts at the sites as well as a summary of each visit. A copy of the questionnaire developed to guide discussion during the visits is included in Appendix B.

Draft material was prepared following the site visits. A second meeting of the BRWG was held to review the draft material. The comments and suggestions were incorporated in this final version.

TABLE 1-1. LIST OF TRANSIT SYSTEMS VISITED

Alameda-Contra Costa Transit District Oakland, CA	New Jersey Transit Newark, NJ
Capitol Area Transportation Authority Lansing, MI	New Orleans Public Transit System New Orleans, LA
Detroit Department of Transportation Detroit, MI	Santa Clara County Transportation Agency San Jose, CA
Long Beach Transit Corporation Long Beach, CA	Southeastern Michigan Transportation Authority Detroit, MI
Metropolitan Transit Authority Houston, TX	Southeastern Pennsylvania Transit Authority Philadelphia, PA

1.3 Terminology

Bus rehabilitation is a transit manager's alternative for fleet improvement, and is gaining significant attention and popularity among transit system operators as a cost effective means of both fleet expansion and fleet replacement. The concept is not new because many transit managers have been traditionally repairing and rebuilding vehicle components and complete vehicles as part of on-going fleet maintenance.

Bus rehabilitation offers a continuum of possibilities. The term "rehabilitation" implies a wide range of repair activities associated with older vehicles, usually those that are at least 12 years old or that are extremely costly to maintain and operate. Rehabilitation has been used to refer to minimal or cosmetic repairs to prolong the life of a vehicle for several years as well as to entire remanufacturing of a vehicle to almost double its life. Rehabilitation can involve replacement of parts that still have some (but limited) useful life remaining. Some rehabilitation programs have incorporated mechanical and structural upgrading of the bus. Different approaches have been used by different transit operators.

The process has a variety of other names such as refurbishing, reconditioning, and remanufacturing. Variations in meaning create confusion and misinterpretation in discussion of bus rehabilitation; therefore, one of the objectives of this manual is to define bus rehabilitation and identify the associated technical specifications of repair work.

For these guidelines, rehabilitation is defined as a program to improve all systems on a bus in a single effort so as to add a minimum service life extension to the bus. Because of the wide range of repair activities and the resultant vehicle life extensions, three levels of bus rehabilitation are defined:

- Level I: Remanufacture
- Level II: Rebuild
- Level III: Refurbish.

These levels are summarized in Table 1-2.

TABLE 1-2. LEVELS OF REHABILITATION

Level	Life Extension	Cost
I - Remanufacture	8-10 years	\$50,000-80,000
II - Rebuild	5-8 years	\$40,000-70,000
III - Refurbish	3-5 years	\$30,000-60,000

Level I involves completely remanufacturing the bus. This level normally requires the installation of a new or completely rebuilt engine, transmission, and other new major components. Such a level will achieve an 8-to 10-year life extension of a bus at a cost of between \$50,000 and \$80,000* without optional add-ons and upgrades (e.g., wheelchair lifts).

Level II involves rebuilding the vehicle's component systems and structure to the original manufacturer's specifications. Emphasis is placed on more extensive repair and preventive replacement than in Level I. Level II or rebuilding process usually includes: (1) mechanical rebuilding and mechanical work, e.g., engine rebuilding, transmission rebuilding, brake and brake system replacement, suspension rebuilding, steering system rebuilding, engine and transmission cooling system rehabilitation, engine exhaust system replacement, and passenger and driver heating and defrosting system rehabilitation ; (2) electrical work, e.g., replacement of wire harness, instruments and gauges, and interior lighting; and (3) body work with both interior and exterior repainting, floor cover replacement, seat reupholstering, wheel house replacement, window latch and seal replacement, and the addition of energy-absorption bumpers. A Level II rehabilitation will provide a 5- to 8-year life expectancy. The cost for rebuilding, excluding optional add-ons and upgrades, is estimated to range between \$40,000 and \$70,000.*

*Expressed in 1982 dollars based on experience with GMC "New Look" bus designs.

Level III represents a refurbishing or "repair as necessary" approach to bus rehabilitation, particular attention being given to mechanical areas. It is expected to extend vehicle life 3 to 5 years at a cost, excluding optional add-ons and upgrades, of \$30,000 to \$60,000* depending on the amount of labor and parts required and on the method of work utilized, such as in-house or contracted.

The three levels of rehabilitation are illustrated in more detail in Appendix C. Since the federal guidelines for bus rehabilitation, as specified by UMTA, require a minimum of 5 years life extension to qualify for federal assistance, Level I or II rehabilitation is required. The detailed specifications for a Level II rehabilitation are discussed in Chapter 5.0.

1.4 UMTA Rehabilitation Policy Guidelines

On January 29, 1981, UMTA published bus rehabilitation program policy and regulations in the Federal Register. Pursuant to President Reagan's January 29, 1981 memorandum on postponement of pending regulations, UMTA postponed the effective date of the regulation and has subsequently announced that the regulation has been withdrawn, and that non-regulatory policy guidance will be published. UMTA is continuing to fund rehabilitation projects on a case-by-case basis.

The bus rehabilitation regulations of January 1981 underwent considerable revision from the initial proposed regulations based on industry comment. For these Guidelines, it has been assumed that the policy guidance to be published by UMTA will substantially repeat the content of the January regulation which applies to standard buses 35-foot and over used in mass transit service. UMTA will participate in projects to rehabilitate up to 20 percent of an applicant's fleet, and has established the following guidelines for rehabilitation grants.

- Buses should be selected from an identifiable group with similar rehabilitation needs.
- Buses should be at least 12 years old or have accumulated 500,000 miles.
- Rehabilitation should extend the useful life at least 5 years.

*Expressed in 1982 dollars based on experience with GMC "New Look" bus designs.

- Rehabilitation work will be done on a predetermined, timely schedule and completed no later than 12 months after the award of a grant.
- Rehabilitated buses must be used in mass transit service through the extended life of the bus.
- The need to rehabilitate a bus must be determined first on the need for structural improvements.

The program allows grantees to perform the work in-house or to have the work done by outside sources under contract. If the work is performed in-house, it must not interfere with normal bus maintenance activities.

Bus rehabilitation projects in the past have received UMTA capital funds on an 80 percent federal, 20 percent local share basis. The Public Transportation Act of 1982 indicates that future support will use Section 9 funding. The level of support may vary.

1.5 Organization of the Guidelines Manual

The guidelines manual is organized to correspond with the sequence of events which occur in the life cycle of a bus rehabilitation program. Figure 1.1 provides an overview of bus rehabilitation from start to finish. Bulleted items in each activity box highlight the key issues. Chapter 2 discusses the issue of rehabilitation versus new bus purchases, including decision factors and life cycle cost analysis. Once a decision to rehabilitate buses has been made, a transit system must decide whether to hire a contractor or to perform the work in-house. Chapter 3 addresses this decision and provides some guidance for in-house rehabilitation. Chapter 4 summarizes available procurement alternatives, if the contractor option is selected. Technical specifications are addressed in Chapter 5. Chapter 6 identifies key issues in the management of a rehabilitation program. The Appendices provide detailed supporting information on several topics.

This manual assumes that the transit system has determined a need for fleet expansion and/or upgrade, and that it knows the incremental needs in terms of numbers of seats or buses. Thus, this issue is not addressed in the manual. The manual focuses on the rehabilitation program to aid in the procurement and management of such programs.

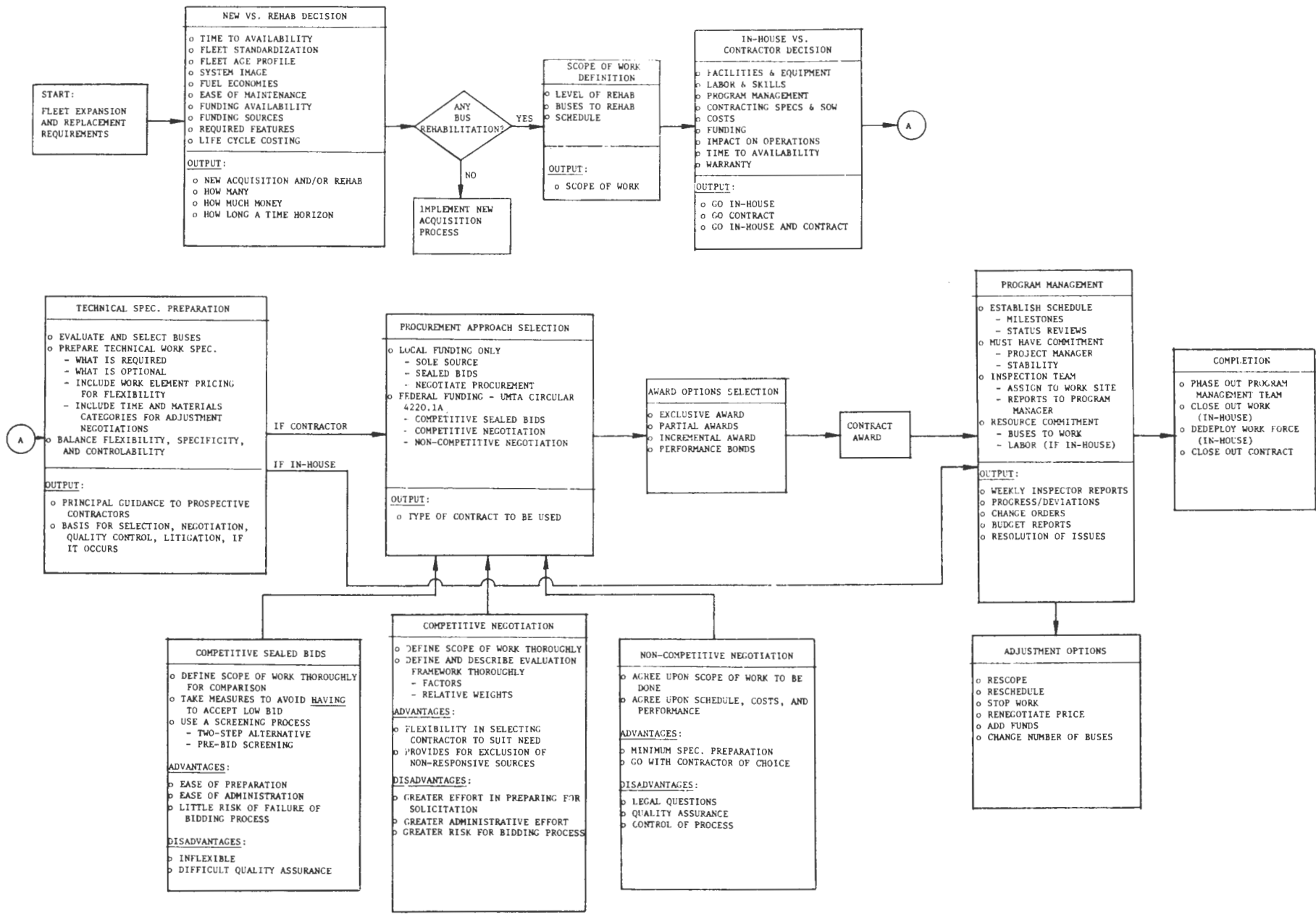


FIGURE 1.1 OVERVIEW OF A BUS REHABILITATION PROGRAM





2.0 REHABILITATION VERSUS NEW BUS DECISION

2.1 Overview

The relative weight of emphasis on the different factors contributing to the rehabilitation versus new purchase decision has been changing over the past few years. The situation facing each transit authority has been and continues to be sufficiently unique to prevent generalization. However, the following discussion of the general considerations involved in the rehabilitation versus new purchase decision should prove helpful to the users of this manual.

When bus rehabilitation as a substitute for or supplement to new acquisition became widespread in the late 1970's, one overriding factor was the age and deteriorating state of the fleet. This was, in many cases, accompanied by a growth in ridership, which necessitated a rapid fleet upgrade and capacity expansion. Given these conditions, the primary reason cited by systems for selecting rehabilitation was the considerably shorter acquisition lead time as compared to that of purchasing new advanced design buses (ADB's) (at the time 4 to 6 months versus 12 to 18 months, respectively). Obviously, a number of other factors contributed to the rehabilitation decision, some of which were of a local political nature, such as public and media reaction. Life cycle cost tradeoff analyses were not used formally to evaluate the alternative options, although the anticipated reduction in operations and maintenance (O&M) costs, improved fuel economy, and reduced road calls, resulting from bus rehabilitation were cited. At the same time, some transit systems were concerned about the cost, performance, and reliability of the new ADB's, an added incentive for adopting the rehabilitation route.

Section 2.2 addresses the basic options available to a transit system faced with a need for fleet expansion, fleet upgrade, or a mix thereof. The various rehabilitation decision factors are discussed further in Section 2.3. Section 2.4 describes ways in which life cycle cost considerations can be used to quantify the alternative courses of action for decision making.

2.2 Alternative Courses of Action

While myriad variations can be generated, the following six basic alternative courses of action are available to a transit system faced with a fleet expansion or upgrade requirement:

- Purchase all new buses
- Meet the need completely by bus rehabilitation
- Purchase used buses (rehabilitate or not)
- Leasing (short-term)
- A mixture of the above
- Continue present operations.

The following subsections address the new bus and rehabilitation alternatives in some detail.

2.2.1 Purchase All New Buses

This option is frequently preferred when sufficient funds are available. In many cases, this approach will make economic sense. It is also true that a fleet of brand new vehicles on the streets has considerable appeal to management. New buses generally create a good public impression. However, the effect of bus appearance on ridership and revenues is open to question.

Certain considerations may mitigate against a major new acquisition as the total answer. Among these are the capital outlay requirements and the impact of absorbing large numbers of a new vehicle type into service. The acquisition of a large number of new vehicles in a short timespan may create major block* obsolescence problems in the future as well as possible block failure problems that can adversely impact service and/or maintenance workload. Some of the current ADB designs have less passenger capacity than the New Look designs. For some transit systems where this extra capacity potential can be effectively utilized, it may be a significant economic and

*Block refers to a group of buses/obtained in a single purchase.

service-related issue in the decision process. The route structure and ridership characteristics of the different transit systems plays a major role in determining the importance of bus passenger capacity.

2.2.2 Rehabilitation of Old Buses

In most cases, rehabilitation has been used as a "one time only" solution to meet situations of deteriorating service which had to be countered as rapidly as possible. Costs were in consideration also. The investigations for this manual did not uncover any case where bus rehabilitation programs were considered an alternative to ultimate replacement with new vehicles. Rehabilitation was viewed as a more rapid and/or more economic method of alleviating an immediate problem. The availability of state and federal (UMTA) grants to partially fund rehabilitation work also played a role in adopting this course of action, although this was not the overriding factor.

The bus rehabilitation alternative thus represents a deferral of the replacement option, cost effectively extending the useful life of an established bus design. Ultimately, the rehabilitated buses have to be replaced, either by totally new vehicles or by other newer or rehabilitated ones.

When considering a rehabilitation program, a host of alternatives faces the decision makers. The total number involved is generally well established based on service requirements and available funding. However, definition of the amount of work to be done, expected life extension, selection of candidate vehicles for rehabilitation, in-house versus contract decision, ensuring contractor qualifications; bid solicitation and contract definition; and program management are key areas that must be individually addressed as done in this manual.

The selection of vehicles for rehabilitation is an issue that warrants some comment. Several clear-cut alternatives can be identified, and have been adopted under various circumstances. These are:

- Select the "worst" vehicles for rehabilitation in terms of criteria such as:
 - Number of road calls per vehicle
 - Number of maintenance man-hours per vehicle
 - O&M cost per vehicle
 - Mechanical condition

- Age
- Interior/exterior condition
- Select the "best" vehicles in terms of appropriate criteria
- Purchase vehicles for rehabilitation
- A mix of some or all of the above.

It is impossible to provide universal guidance in this regard. However, a transit authority that has overloaded maintenance shops and/or high maintenance costs may well prefer to select the worst vehicles to provide relief as soon as possible.

Selection of the best vehicles could be appropriate for a transit authority seeking long-life extension for the minimum feasible investment, and which has sufficient maintenance capability to meet service needs using some of its less reliable vehicles as substitutes until rehabilitated ones start returning to service. Another motivation for this choice could be the desirability of upgrading the better vehicles, thus discarding buses that require extensive rehabilitation or that have inferior operating characteristics.

The alternative of buying vehicles for rehabilitation from an outside source may be appealing when they can be purchased and brought up to the desired level of rehabilitation for a cost less than that of rehabilitating the transit system's own vehicles, or when it might be accomplished faster. This could also be the preferred solution when it allows increased fleet standardization on a preferred bus design. However, a drawback is the uncertainty as to the operating histories of the vehicles unless detailed records on each vehicle's history of use is available.

Many of the same considerations apply to purchasing already rehabilitated vehicles from an outside source. Note that some states impose additional taxes on rehabilitated buses bought from outside the state.

The last alternative is simply a mix of the others. The precise manner in which this might be done is primarily a matter of local decisions and needs.

All the alternatives should be studied economically and operationally prior to selecting the preferred rehabilitation approach. If federal funds are to be used, UMTA policies on minimum added life, minimum age of candidate vehicles, and dollar amount ceilings need to be factored into the evaluation.

2.2.3 A Mixture of New Purchase and Rehabilitation

This approach may have considerable appeal to a transit system since it can be used to produce several beneficial effects. Among these are the following:

- Easing absorption of new vehicle types
- Smoothing out the age profile of the fleet
- Avoidance of future large block obsolescence
- Allowing for a constant long-term replacement program
- Avoidance of possible age or usage dependent block failures in the fleet of new vehicles (e.g., fatigue problems)
- Maximization of cost-effective vehicle service life.

Most or all of these effects could be involved when a transit authority, faced with a substantial fleet aging problem, establishes a mixed rehabilitation/new purchase program. Replacing all of the aged buses with new buses would create the possibility of future block failure or obsolescence problems. Instead, some of the aged buses could be rehabilitated. This would reduce the number of new buses needed and level out the age profile of the fleet. This lays the basis for an orderly acquisition of new vehicles in a steady periodic purchase of relatively constant quantities, and an orderly phaseout of older rehabilitated and unrehabilitated buses as they reach the end of their economic life. However, note that a mixed program will be significantly more complex to design and manage.

2.3 Decision Factors

The discussion in previous subsections of this chapter indirectly address several bus rehabilitation decision factors and how they affect the decision process at different times and under different local conditions. The following subsection describes the decision factors identified during the bus rehabilitation field survey and summarizes the similarities, dissimilarities, and trends.

2.3.1 Decision Factors Used by Transit Systems Interviewed

The formal questionnaire used during the field study (see Appendix B) included a set of four specific decision factors that interviewees were asked to rank as to

their importance in their rehabilitation decisions. Additionally, allowance was made for other factors to be identified.

Responses from six transit systems were obtained, and these are listed in Table 2.1. Other transit authorities interviewed did not rank the factors but provided discussion of some. Generally, the decisions made to rehabilitate in 1978 to 1979 were based to a large extent on time to availability, given an urgent need for improved/expanded fleets. From 1979 to 1980, there was apprehension about the new ADBs accentuated by difficulties experienced at the time by some transit systems in introducing the initial ADB models into service.

As some of the initial difficulties experienced with the first ADBs have been overcome through modifications and experience, coupled with an expanding field of available bus designs, some of the earlier perceptions probably will not hold true in the future. However, many transit systems interviewed felt that the rehabilitated buses exhibit greater reliability, ease of maintenance, and fuel economies than ADBs operated under comparable service conditions.

2.3.2 Current and Emerging Decision Factors

The preceding subsection provides insight into some of the factors that contributed to the decision of some transit systems to adopt the rehabilitation alternative. Since circumstances vary among systems, and perspectives change with time, it is not possible to provide a rigid set of decision factors that should be used in the decision process. This discussion is thus limited to providing a summary of the decision factors considered important when evaluating bus rehabilitation as an alternative. These are:

- Life cycle cost (LCC)

LCC provides a means of quantifying and integrating many factors pertinent to a new versus rehabilitated decision. When done on a fair comparison basis (e.g., annualized cost) LCC aids in focusing on the economic implications, and can be used to support the economically superior solution.

TABLE 2.1. RANKING OF BUS REHABILITATION DECISION FACTORS BY SURVEYED TRANSIT SYSTEMS
 Most important = 1; least important = 5

Decision Factor	Transit System					
	A (1978)*	B (1980)	C (1982)	D (1979)	E (1979)	F (1980)
1. Time to Availability	1	2	1	4	1	1
2. Life Cycle Cost	—	3	2 (Annualized Capital Cost)	1	—	2
3. Source of Funds	3 (Internal only)	4 (Local)	4 (State)	2	2	4
4. Public Image	4	5	3	3	—	5
5. Other: - Description	2 No new bus orders on the horizon at the time	1 Need for operating equipment	—	5 Pressure to acquire new equipment	—	3 Ability to maintain rebuilt and their fuel economy

*Year of decision.

- Fleet standardization

The reduction of diversity in the fleet mix may yield savings in O&M costs sufficient to warrant a rehabilitation program either exclusively or in conjunction with new acquisition.

- Fuel economy

The fuel economy of rehabilitated buses versus newer buses is a factor that has favored rehabilitation of older buses. As fuel costs rise, this question will become more important. Introduction of more fuel-efficient new buses may alter the previous perceptions.

- Ease of maintenance and training

For many systems, the familiarity of the maintenance work force with existing buses continues to be a strong point in favor of rehabilitation. The simplicity of the older buses compared to the initial ADBs is another factor of importance, including greater ease of training new mechanics to work on them.

- Operational familiarities

Many transit systems see direct benefits in continuing to undertake bus rehabilitation from an operator's viewpoint. The operational familiarity and ruggedness of the rehabilitated New Look buses favor continued bus rehabilitation as a supplement to new bus acquisitions.

- Public image

Rehabilitation can improve both the interior and exterior appearance of a bus, but the bus will not look like a new bus. A transit system should consider the potential impact on ridership of rehabilitated buses versus new buses.

- Fleet age balancing

The decision to rehabilitate buses may be influenced by the goal of leveling out the age profile of a transit fleet since rehabilitation effectively reduces the age of a bus. This can be used to support a steady, balanced acquisition of new buses.

- Acquisition lead time

This may be an issue depending on the status of the industry. It was a major consideration in favor of early rehabilitation decisions, while at the present time it is not as important because of slack demand for new buses.

- Time out of service

Rehabilitation of buses currently in service will either temporarily reduce the level of service or require some means of providing substitute buses (e.g., leasing).

- Availability of parts

Availability of parts is required for rehabilitation and is important for continuing maintenance of rehabilitated buses. Consideration should be given to the difficulty and cost of obtaining parts for buses which are rehabilitation candidates.

- Availability of and constraints on federal UMTA grants

The presence of federal grants for rehabilitation and their limitations may affect the economic viability of rehabilitation. Any new minimum life extension and/or maximum cost constraints on bus rehabilitation supported by UMTA grants will need to be carefully considered.

- Local and state requirements

These may include a variety of local requirements that may influence the new versus rehabilitation decision. For example, if local or state law requires all new buses to be wheelchair lift equipped, this may influence the decision toward going to the rehabilitation alternative.

The above listing of factors is not exhaustive, but it highlights some of the main issues related to decision factors.

LCC is an effective way of integrating a variety of these factors into an economic trade-off framework. The next section addresses LCC in more detail to aid in the incorporation of this approach into the analysis process.

2.4 Life Cycle Cost Analysis

Life cycle cost (LCC) analysis is a quantitative tool for comparing alternative decisions on the basis of the economic impacts over time. In the context of a rehabilitation versus new bus purchase decision, a life cycle cost analysis may be used as a quantitative decision aid. This can include decisions on the level of rehabilitation to be performed. LCC has not been and probably should not be the sole criterion used for such

decisions, but it clearly can be a major factor. LCC analysis is not required at this time by federal regulations for bus rehabilitation.

Most of the systems interviewed had given some consideration to the LCC implications of their rehabilitation versus new bus purchase decision. This consideration ranged from an informal estimate to the application of a simple LCC model.

2.4.1 LCC Model Approach

This section presents a LCC model designed to help transit systems evaluate the rehabilitation versus new bus purchase decision. The model focuses on cost elements that differ for each candidate alternative. The level of detail in the model was selected to correspond with the type of data that will be available to most transit systems and the level of decision to be made. If more detailed data are available, they can be incorporated into the model in a straightforward fashion.

The different life spans of rehabilitated buses and new buses are dealt with by comparing annualized costs. The annualized cost of an alternative is essentially its LCC divided by the number of service years associated with the alternative. If discount factors are applied to the future cost, then the annualized cost is called the annualized "present value" cost.

Annualized cost can be expressed using various cost measures. The selected measures should reflect whether a transit system is more interested in the number of buses or in seating capacity. For a system primarily interested in acquiring a certain number of buses, the LCC of each alternative should be measured in the units "annualized cost per bus". If seating capacity is the primary concern, then the units should be "annualized cost per seat".

Both of these measures assume that the buses in each alternative are used to provide the same service (i.e., they are driven the same number of miles per year). If a system wishes to compare alternatives in which buses are used for different numbers of annual miles, then the LCC model can be modified to generate LCC in terms annualized cost per bus-mile or annualized cost per seat-mile. The modifications are provided in Appendix D.

The LCC model is basically identical for the two measures identified above. Differences appear only in the final computation and in the treatment of bus operator costs.

2.4.2 Discount and Inflation Factors

Discount factors are used in economic analyses to account for the time value of money. Money has time value when alternative investments are available. This time value is distinct from the effects of inflation, as evidenced by the availability of interest on investments in times of little or no inflation.

A technically precise LCC model includes factors for discounting and inflation. For reasons described below, the basic LCC model for bus rehabilitation decisions omits these factors. A version of the model with these factors is provided in Appendix D. The basic model is less complex and is expected to have sufficient accuracy for the available data.

2.4.3 LCC Model

The LCC of an alternative is the sum of capital costs and operating and maintenance (O&M) costs minus the salvage value for the lifespan of the alternative:

$$LCC = CAP + YRS \cdot A - S$$

where

CAP = sum of all capital costs

YRS = number of years (lifespan)

A = annual O&M costs

S = salvage value of parts and buses.

LCC estimates will be used to compute the measures for comparing alternatives. The specific cost elements included in CAP will be a function of the alternative. Table 2.2 summarizes the cost elements most likely to occur for the three basic alternatives. Administrative costs are not included since they typically will be affected very little by the choice of alternative. Of course, if a system would incur extra administrative costs for an alternative, then those costs should be included.

TABLE 2.2. TYPICAL CAPITAL COST ELEMENTS FOR THE THREE ALTERNATIVES

Rehabilitation In-House	Rehabilitation Contractor	New Bus Purchase
Bus purchase (if any)	Contractor cost	Bus costs
Setup cost	Inspections	Inspections
Labor, wages and benefits	Transportation	Transportation
Parts	Warranty	Training
Overhead	Performance bond	Parts inventory
Self-warranty (on rebuilt parts)		Tools/Equipment
		Warranty
		Performance bond

The majority of the capital cost of rehabilitation is for parts and labor. The analogy approach to estimate these costs is to compare the candidate program with recent industry experience for the same level of rehabilitation. Chapter 7 includes the average cost per bus for each rehabilitation program investigated. In addition, historical UMTA grant information can be used.

One factor that can significantly impact the cost of rehabilitation by a contractor is the level of competition. A number of contractors have entered the bus rehabilitation market over the past four years. In several instances, competition has resulted in lower prices to transit systems. In general, more competition will exist for programs involving a small quantity of buses. Most, if not all, contractors could handle rehabilitation of, say, 15-30 buses. However, few could handle a job of 200 buses. Of course, the required delivery schedule may impact the ability of a contractor to handle a given number of buses. Competition also causes significant variation in the purchase price of new buses.

The LCC model should be used to compare alternatives that provide identical levels of service. Accordingly, the cost computations should use values for the total number of buses which represent a fixed service level. These values should account for the affects of bus failures. The following paragraphs describe the method to compute the total number of buses.

If a transit system measures service level by the number of buses provided on its routes, then each alternative should use the same value for the number of buses to be placed into service, denoted by NSERV. Since buses are subject to failure, the actual number of buses needed to provide NSERV buses for service will be greater than NSERV. Let NBUS denote the total number of buses for the alternative, and let RES denote the reserve factor for the type of bus under consideration. For example, if a svstem typically has 10 percent of their GMC 5300 series buses out of service for repairs, then RES for this bus type would be 0.10. The total number of buses is computed as follows:

$$NBUS = (1+RES) \cdot NSERV.$$

It must be emphasized that using the cost of NBUS buses in the LCC model is a device to account for the availability of the buses.

If a transit system measures service level by the number of seats provided, then each alternative should use the same value for the number of seats to be placed into service, SSERV. Let SEATS denote the number of seats per bus for the bus type under consideration. Then the number of buses to be placed into service is:

$$NSERV = SSERV/SEATS.$$

(Alternatively, the total passenger capacity could be used in place of the number of seats.) The computation for the total number of buses, NBUS, is identical to that shown above.

Table 2.3 presents the cost elements that should be included in the annual costs, A. They are divided into two major categories: operations and maintenance. Note, under Operations, that operator cost need be included only if the number of buses is not the same for each alternative.

TABLE 2.3. ANNUAL COST ELEMENTS

Operations	Maintenance
Fuel	Engines
Oil	Transmissions
Operators	Brakes
Other	Tires
	Air conditioning
	Body
	Other

The first six cost elements shown under Maintenance in Table 2.3 were selected since they are the major elements which could be different among the alternatives. If a system recognizes that an additional cost element could be a significant contributor to maintenance costs, then that element should be added.

Note that the maintenance cost elements in Table 2.3 must account for preventive maintenance and roadcalls (i.e., repair of bus failures). In some cases, it may be easier to estimate the two types of maintenance costs separately.

The formulas in Table 2.4 can be used for the operations and preventive maintenance costs. Corrective maintenance costs could be computed as the product of "repair cost per roadcall" times "number of roadcalls".

Where insufficient data are available in existing information records to extract these costs directly for LCC analysis, an approach of fleet sampling (or direct analysis if the number of vehicles is small) may be used as an alternative. A sample batch of representative vehicles can be selected to estimate these cost drivers. The size of the sample batch needed will depend on the total number of vehicles involved. Typically this number would be in the range of 5 to 20 vehicles.

The cost element "Other" can be used to estimate all maintenance costs not included in the other six elements. One approach to accomplish this is the following: estimate the fraction of total maintenance costs accounted for by the six major maintenance cost elements for the given situation; then multiply the sum of the annual

costs for the major elements by one minus the fraction divided by the fraction. This figure represents the "Other" maintenance costs. For example, if the annual sum of the six major elements is D dollars, and they are estimated to account for 0.80 of all maintenance costs, then:

$$\text{"Other"} = \frac{1 - .80}{.80} (D).$$

Formulas for the annual cost elements are provided in Table 2.4.

Salvage value should be considered for the buses and for any parts that can be recovered from a rehabilitation program for future use on other buses in the fleet. Ideally, income from all items with significant salvage value should be estimated and subtracted from the sum of capital costs and O&M costs.

Historically, the resale price of used buses has been volatile. This fact makes it difficult to estimate the salvage value of buses 5 to 15 years in the future. If a system expects to retain buses for emergency use or contingency plan after their useful economic life has expired or determines that the bus has no more useful life, then a salvage value of zero dollars can be used.

In rehabilitation programs, components that are replaced may be useful as spares for non-rehabilitated buses. For example, if new tinted acrylic windows are installed in a GMC New Look bus, then the old windows could be stocked as spares.

Following estimation of the basic cost elements, the LCC of each alternative is computed. The appropriate measure for comparison can then be computed using one of the following formulas:

Annualized cost per bus:

$$ACB = LCC / (YRS \cdot NBUS)$$

Annualized cost per seat:

$$ACS = LCC / (YRS \cdot SEATS)$$

where

YRS = number of years

NBUS = number of buses

SEATS = number of seats (for all buses).

TABLE 2.4. ANNUAL O&M COST FORMULAS

Annual Fuel Cost	=	$\frac{\text{Total miles/year}}{\text{Miles/gallon}} \times (\text{Cost/gallon})$
Annual Oil Cost	=	$\frac{\text{Total miles/year}}{\text{Miles/quart}} \times (\text{Cost/quart})$
Annual Operator Cost	=	Number of operators for the buses \times Annual wages and benefits per operator
Annual Engine Cost	=	$\frac{\text{Total miles/year}}{\text{Miles/overhaul}} \times (\text{Cost/overhaul})^*$
Annual Transmission Cost	=	$\frac{\text{Total miles/year}}{\text{Miles/overhaul}} \times (\text{Cost/overhaul})^*$
Annual Brakes Cost	=	$\frac{\text{Total miles/year}}{\text{Miles/overhaul}} \times (\text{Cost/overhaul})^*$
Annual Tires Cost**	=	$\frac{\text{Total miles/year}}{\text{Miles/tire replacement}} \times \text{Number tires per bus}$ $\times (\text{Cost per replacement})$
Annual Air Conditioning Cost	=	$\frac{\text{Total miles/year}}{\text{Miles/repair}} \times (\text{Cost/repair})$
Total miles/year	=	Number of buses in the alternative \times Miles/year for each bus

*Cost/overhaul includes labor, parts, and overhead.

**If tires are leased, then annual taxes cost = (total miles/year) \times (tire cost/mile).

2.4.4 LCC Model Application Considerations

Two points must be emphasized regarding application of this LCC model. First, the quality of the results can be no better than the quality of the input data. The temptation to attribute more accuracy or meaning to the results than was present in the input data should be avoided. For example, a 2 percent difference in LCC values is not persuasive if the data are accurate to only plus-or-minus 10 percent.

The second point is that this LCC model is designed to aid the decision-making process within a transit system. The model does not attempt to account for every dollar of expense associated with each alternative. This would be impractical in the new bus versus rehabilitated bus decision phase. The LCC model can be used to identify significant differences in the LCC implications of the alternatives.

2.5 Scope of Work

As indicated in the preceding discussion, an initial idea of the scope of work is needed to intelligently compare the rehabilitation and new bus purchase options. The number of buses in the initial scope of work should be defined by the identified need for fleet expansion or upgrade. The transit system should perform, at minimum, an inspection of a representative sample of buses that it considers to be rehabilitation candidates. A more detailed estimate can be achieved by a thorough inspection of one or two buses. "Thorough" implies some disassembly to determine the condition of structural, mechanical, and electrical subsystems which are not readily visible.

A transit system may wish to consider several alternatives for the scope of work. Areas of choice include:

- Level of rehabilitation
- Condition of buses selected for rehabilitation
- Upgrade or modification.

Selection of the level of rehabilitation should consider impacts on capital cost, added life, and fleet age profile. The condition of the selected buses also will affect the capital cost. Some systems have rehabilitated the "best" of their candidate buses. This approach has less cost but may have more impact on current service levels. Other systems have selected the candidates which were in poorer condition. This approach may cost more,

but it may have less impact on current service levels and may allow a system to catch up on its maintenance backlog.

Upgrades and modifications of the original bus design can be incorporated into a rehabilitation program. Such work may or may not be eligible for federal funding support.

An example modification of interest is a front for GMC 5300 series buses designed by Santa Clara. The new front is simpler to construct and maintain than the original, and it has a modern appearance. If extensive work on the front body is required, then it may cost no more to use the new front than the original.

A more refined definition of the scope of work may be needed to compare the in-house and contractor options. A greater level of accuracy in cost estimates may be required to differentiate these options, compared to accuracy required to compare new bus purchase with rehabilitation.

The scope of work should include the schedule. A minimum of 90 days is usually required for delivery of the first rehabilitated bus by a contractor. Contractors may prefer 120 days because of the time required to set up the work and to order parts. The rate of delivery of subsequent buses depends on the availability of facilities, equipment, and labor.





3.0 SELECTION OF A REHABILITATION METHOD

After making the decision to rehabilitate, the next major decision should be the methodology to be used. The primary means most transit systems use, as of this writing, is contracting the work to a commercial firm, although some systems perform the work totally in-house. There also exists the possibility of performing the rehabilitation work with a combination of in-house and contractual work. Table 3.1 provides a summary of the major pros and cons of the different methods, including an indication of advantage (+), disadvantage (-), or indifference of each factor (o).

The following is a guide in helping a transit system review some of the major factors affecting each rehabilitation method.

3.1 In-House Method

Undertaking an in-house rehabilitation project will require the dedication of buses for a steady flow of work over time, as well as adequate facilities. It may also require additional shop equipment and, in all probability, manpower will have to be added to the maintenance work force. Investment in capital equipment and hiring additional work force imply a long-term commitment. UMTA policy dictates that a work force and work area must be dedicated solely to bus rehabilitation for an in-house program to qualify for federal assistance.

In-house performance of bus rehabilitation work has been subjectively considered by some systems because of potential cost savings and improved management control. As a result of the site visits and the BRWG meetings, factors were identified which are important in deciding whether to perform rehabilitation in-house or to use a contractor. These factors are treated in the following subsections.

3.1.1 Facilities, Equipment, and Component Requirements

Facilities and equipment must be available for the in-house rehabilitation work. They may need to be purchased or shared with regular maintenance. The following guidelines are provided to aid in the evaluation:

TABLE 3.1 SUMMARY OF CHARACTERISTICS OF ALTERNATIVE REHABILITATION METHODS
 Symbols: +, advantage; -, disadvantage; o, indifference

Factors	In-House Method	Outside Contract Method	Mix of In-House and Outside Contract
Facilities and Equipment	<ul style="list-style-type: none"> - Requires additional equipment in most cases - Requires dedicated facilities 	<ul style="list-style-type: none"> + No additional equipment or facilities required - Excess capacity if it exists is not utilized 	<ul style="list-style-type: none"> + Allows maximum use of existing capacity - Some additional equipment and facilities may be needed
Availability of Skills	<ul style="list-style-type: none"> - Requires highly skilled mechanics for most rehabilitation work - Requires dedicated personnel for duration - May require additional labor to support operations + Can offer opportunity for training new hires or upgrading current skill levels 	<ul style="list-style-type: none"> + No additional labor required - Any excess skills are not taken advantage of 	<ul style="list-style-type: none"> -o Limited diversion of more skilled labor may occur -o Limited hiring may be required
Labor Relations Factors	<ul style="list-style-type: none"> - Hiring of additional staff may cause friction - Skilled workers may prefer rehabilitation work - At end of work—phasing out of personnel may be necessary - Quality control issues may arise 	<ul style="list-style-type: none"> + Minimal; but questions about why work is not done in-house may arise - In-house personnel may perceive contracted rehabilitation work as inferior 	<ul style="list-style-type: none"> + Should be minimal if no major hirings occur
Management Considerations	<ul style="list-style-type: none"> o Requires dedicated in-house management team - Enforcement of quality inspections is needed + Adherence to schedules easier to observe and control - None; self warranty except for subcontract work or new items 	<ul style="list-style-type: none"> o Requires project manager - Requires an inspection team of qualified personnel on contractor premises - Schedule conformances not directly under transit systems control + Warranties can be required on all work 	<ul style="list-style-type: none"> - Encompasses the other methods but scope may differ. Mixture of the others + Can be used to generate data for future rehab + In-house rehab can be used for job enrichment

TABLE 3.1 SUMMARY OF CHARACTERISTICS OF ALTERNATIVE REHABILITATION METHODS (CONTINUED)
 Symbols: +, advantage; -, disadvantage; o, indifference

Factors	In-House Method	Outside Contract Method	Mix of In-House and Outside Contract
Contracting Factors	o No formal contract	<ul style="list-style-type: none"> - Requires careful development of work statement - Requires careful selection of qualified bidders/contractors - Must conform to federal, state, and local regulation - Many pitfalls in work specification need consideration - May lead to contract disputes 	- Similar in general to pure outside contracting
Costing	o Costing must include G&A overhead, required startup costs, phase-out costs in addition to rehabilitation work itself	<ul style="list-style-type: none"> o Costs should be estimated by transit system for work scoping, budgeting o Costs need to be oriented toward required and optional work 	<ul style="list-style-type: none"> o Costs must include G&A overhead, startup, phase-out costs, etc., like in-house o Contract work should be scoped in cost for bid evaluation
Funding Options	o Basically same for all	o Basically same for all	o Basically same for all
Impact on Daily Transit System Operations	- Could be significant unless well planned & managed	+ Should be minimal	o- Could be significant if rehab resources are taken from daily operations resources
Total Time to Availability of Reworked Vehicles	<ul style="list-style-type: none"> - Potentially longest: subject to interruptions and depends on dedicated resources and division of work - Subject to interruptions 	<ul style="list-style-type: none"> o Influenced by need for comprehensive spec and contract development/selection process + Potentially shortest production schedule 	+o Can be reduced by proper mix of in-house to contract work

- Determine the number of bays needed and which can be devoted for full-time rehabilitation work. Bays should be approximately 20 feet x 50 feet to permit easy access to the bus for removing, storing, and installing major assemblies. One estimate calls for a minimum of one maintenance bay for every eight buses rehabilitated per year.
- Determine the needs for equipment (e.g., lifts, welders) and their availability. If purchases are necessary, determine the costs.
- Determine the type and quantity of components needed for the program and which ones are routinely being rebuilt in-house. Compare a list cost of the component with estimated manhours and material cost to rebuild each in-house. Determine if excess capability exists within the shop, or if additional capability could be acquired.
- Consider the alternatives of rebuilding certain components (i.e., engines and transmissions) in-house or contracting them out.
- Determine needs and availability of storage space for additional parts. As a rule of thumb, an additional 50 square feet of storage space for each bus in process will be required.
- Determine whether the rehabilitation activity can be isolated from routine maintenance (separate work area for both labor and management) as UMTA requires to qualify for federal grants. Even if federal money is not used, the idea of a separate area for this activity is good. The natural tendency of a manager is to use all resources available to meet the short-term demands; and this could hamper or destroy the rehabilitation effort.

3.1.2 Availability of Skills

The availability of the skilled personnel in sufficient numbers for the rehabilitation to be performed needs to be evaluated. Few transit systems will have sufficient rehabilitation work to justify production workers. Hence, the skills required of the maintenance shop workers will become more advanced and broad than those of a

production type worker. Therefore, it is necessary to determine the required investment in training and/or hiring of workers to obtain needed skills.

3.1.3 Start-Up and Shut-Down Consideration

An in-house rehabilitation program will involve start-up and shut-down costs. Depending on the magnitude of these costs and the number of buses to be rehabilitated, these costs could overshadow any savings in actual performance of the rehabilitation work. The following considerations are important:

- Start-up costs are the costs for additional resources, such as labor, facilities, and equipment, which are required for the rehabilitation program. A reasonable time frame for the program and a steady flow of buses into the program are needed to avoid excessive start-up costs. It is important in this context to analyze the time required to start the program, how fast the buses will be rehabilitated and put back into service, and if the time constraints will be acceptable to the operation. This presupposes federal funding (if used) will be available over the time span of the operations.
- The work flow must be stable, and this may impact the flexibility of the transit system. A set percentage of the transit fleet will be unavailable for service over an extended period. The transit services and regular maintenance program must be able to function with the remaining buses.

3.1.4 Labor Relations

The following labor issues can have an impact on the decision to perform in-house rehabilitation.

- Once the program is established, union contracts may prohibit future contracting of rehabilitation work
- The use of federal funds inevitably will mean obtaining 13(c) approval.

- Additional people and training which will be required
- The production environment of the rehabilitation program (essentially a Monday-through-Friday operation) may attract senior maintenance people away from other maintenance operations
- Termination of personnel at the end of the rehabilitation project may be difficult or lead to union problems.

3.1.5 Other Factors

Several other factors should be addressed in the process of evaluating the in-house rehabilitation option. These are listed below:

- Availability of funding over the life of the project
- Determination of whether the program will provide the same quality of buses at a reduced cost as compared to other options
- In-house work will have no warranties
- In-house rehabilitation may provide certain benefits for the transit system. For example:
 - Rehabilitating a small percentage of the fleet each year will spread the aging characteristics of the rehabilitated fleet over a wider spectrum
 - Allowing the maintenance personnel to work on all aspects of the bus from the inside out could improve their training level
 - Experience gained in the rehabilitation program could be used to improve specifications for future procurements or rehabilitation work.
- UMTA policy may impact funding support for in-house rehabilitation. For example, UMTA currently requires dedicated facilities, equipment, and work force.

3.1.6 Costing

After all the factors have been considered, detailed studies must be made to compare the estimated costs of doing an in-house rehabilitation project to doing the work with an outside contractor. This effort must consider:

- Direct cost of doing the rehabilitation in-house
- Cost of overhead and additional facilities
- Start-up costs such as recruiting, hiring, and training a labor force, ordering equipment, tools, and parts, developing detailed work procedures, and obtaining proper facilities
- Shut-down costs, including severance pay, and facility and equipment write off.

Appendix E provides a guide for estimating in-house rehabilitation costs.

3.2 Combination In-House and Contractural Bus Rehabilitation Method

The burdens of designing and managing a mixed method are significantly greater than using either the in-house or the contractual method alone. Also, UMTA policy may mitigate against a mixed method when federal funds are used. However, most larger transit systems are staffed, equipped, and have facilities to accommodate various aspects of major mechanical component rebuilding and other work associated with bus rehabilitation. The existence of these capabilities, especially if they are underutilized, provides the potential for performing a portion of the rehabilitation program in-house.

The combination method requires the buses to be rehabilitated to be divided into two sets. The first set is the buses to be done by a contractor. These typically would be those buses requiring the most extensive work. The second set is the buses to be rehabilitated in-house. These buses should be selected so that the amount and types of work to be done is consistent with available in-house resources.

3.3 Contracting Work to a Commercial Firm Method

Contracting work to a commercial firm is the method chosen by the majority of interviewed transit systems when doing rehabilitation work. There are some general advantages and disadvantages that can be associated with this approach. The following are the primary advantages mentioned during our interviews.

- The general consensus of experience to date is that the contractor approach is less expensive than the in-house approach when all relevant costs, including overhead costs, are included.

- The contract can be tailored and timed to meet exact requirements of individual transportation systems (no start-up or shut-down problems). One transit system interviewed during this study had its rehabilitation work done during a seasonal low period in their service requirements.
- Minimal investment is required in facilities, equipment, people, and parts.
- Rehabilitation of buses can start immediately with the only restriction being contracting work and processing the UMTA grant.
- Technical specifications warranties provide some assurance of quality of work.
- Competition is present which is currently constraining cost.
- Risks arising from changes in federal funding support or service requirements are lower because of shorter program duration.
- Depending on available in-house resources, this option may be less expensive than other options.

The disadvantages mentioned were:

- Contractor rehabilitation requires carefully prepared specifications and contracts. Most transit systems have limited experience in this area.
- Inspectors are required on-site.
- The possibility exists that the present facility and work force may continue to go underutilized.
- At the end of the program, the contractor has a trained labor pool instead of the transit system labor pool having gained the experience.
- If the rehabilitation effort is done out-of-state, this may cause increased transportation costs and the politically undesirable expenditure of state and/or local funds outside of the state.



4.0 PROCUREMENT ALTERNATIVES AND INSTRUMENTS

4.1 Overview

When the decision has been made to pursue a bus rehabilitation project by contracting work to a commercial firm, the next step is selection and preparation of the procurement option. If local funds are sufficient to finance the project there are various options (subject to local and state regulations) open to the transit system, such as:

- Sealed bids
- Negotiated procurements
- Sole source procurements.

However, most transit systems do not have the luxury of sufficient local funds and federal grants are their primary source of funding. If federal funds are used then a basic guide on selection and preparation of a contract option to meet federal standards is contained in UMTA Circular 4220.1A dated June 8, 1982.* This is a recent publication dealing with "Third Party Contracting Guidelines". Appendix F contains UMTA Circular 4220.1A. The circular implements Office of Management and Budget (OMB) Circular A-102, Attachment D, Uniform Standards Governing State and Local Grantee Procurements. If federal funds are to be used, the transit system is encouraged to discuss the project at an early stage with their UMTA Regional Office.

Procurement methods as outlined in this UMTA circular are:

- (a) small purchase procedure (which is probably not applicable to a rehabilitation program since most projects will exceed the \$10,000 limit)
- (b) competitive sealed bids
- (c) competitive negotiation
- (d) non-competitive negotiation (sole source)**
- (e) other unique methods may be acceptable, e.g., two-step procurements.

*UMTA is planning to conduct courses in the Spring of 1983 to familiarize transit systems with the guidelines as set forth in this circular.

**This method is probably not applicable in view of the existence of competition.

The grantee may choose the best method of procurement to satisfy his needs, but must exercise care in:

- Preparing the statement of requirements
- Clearly stating the basis for award
- Ensuring the procurement meets state and local requirements (these requirements may be tighter than those imposed by federal policies)
- Ensuring that the basis for the award is justifiable and provides for maximum open and free competition.

The more prevalent alternatives are discussed further below after the section on contractor qualifications.

4.1.1 Contractor Qualification

Successful rehabilitation requires the contractor to be qualified to perform the required work. In several historical instances, the low-bidder was not qualified to do the work. Since no provisions had been made for minimum bidder qualification, the low bidder received the contract and the result was unsatisfactory rehabilitation work.

Transit systems can protect themselves by incorporating minimum bidder qualification into the formal procurement process. A two-step bid process can be used. The first step can be bidder qualification, or bidder qualification and technical specifications. Bid prices are reserved for the second step. Use of the two-step bid process is allowed under UMTA Circular 4220.1A.

In all cases, the request for bids must state the qualification criteria to be used and the basis of the rejection criteria. The criteria must be justifiable and must not unfairly restrict competition. The qualification criteria should require the contractor to have on-hand or readily available:

- Appropriate facilities, tools, and equipment for the proposed rate of work
- Sufficient personnel with appropriate skills
- Financial capability
- Knowledge of bus rehabilitation.

Appendix G contains two examples of bidder qualification forms which have been successfully used.

4.1.2 Competitive sealed Bids

This has been the process used most frequently in contracting for rehabilitation work. However, many systems have reported problems regarding the ability of this method to ensure a proper quality of work. If this method is chosen, there are ways of increasing the assurance of a proper quality of work. Among these are:

- (1) Prepare a well defined statement of requirements: As outlined in the specifications, this is the most effective means of achieving quality work. The problem with specification preparation is that it is almost impossible to cover all eventualities. Even when a specification is very specific, so as to ensure a certain quality of work, it reduces the flexibility to adjust to an individual bus's requirement. This topic is dealt with in greater detail in Section 5 on technical specification preparation.
- (2) Take proper measures to award on basis of all factors impacting the transit system: A competitive sealed bid need not be awarded solely on low price. Citing UMTA Circular 4220.1A, this includes such situations as:
 - Where specified in the invitation for bid (IFB), factors such as transportation costs and life cycle costs may be considered in determining which bid is lower. The key point is that these factors must be specified in the IFB for them to be a valid basis for selection.
 - Where specified in the IFB, factors such as facilities, equipment, labor, and delivery schedule which reflect a contractor's ability to perform the rehabilitation effort may be considered in determining if a bid is responsive if it can be shown that the minimum requirements are rationally related to contract performance. Otherwise it may be construed as an improper attempt to convert an issue of responsibility into one of responsiveness. A transit system's contract office should be involved in establishment of minimum contractor qualifications.

- Any or all bids may be rejected when there are sound documented business reasons for doing so in the best interest of the program. One example of rejecting a bid under this procedure would be the elimination of a non-responsive bidder. An important point to consider with this option is that reasons for rejecting one bid must be due to finding of nonresponsiveness to the IFB or of nonresponsibility and be soundly documentable. The entire set of bids may be rejected for business reasons, even those unrelated to the IFB.

(3) Use of performance bonds: The general premises behind a performance bond are that:

- A non-responsive bidder should not be able to afford the bond
- If the bidder awarded the contract fails to fulfill his obligation, the transit system will be financially reimbursed.

The problem with this approach is that some responsible bidders may be forced out of the competition because they are less established and the increased cost for bonding would make them non-competitive. Moreover, if the bidder awarded the contract does not meet the expectation of the transit system, the issue of awarding damages will most likely be resolved in court. The implication is that the transit system would have to incur the legal fees and time involved to prove the contractor failed to meet requirements before gaining any financial compensation.

In summary, the advantages of the competitive sealed bid process are its ease of preparation, administration, and limited risk of bid failure. One caution is in order: Over-stipulation to ensure proper quality work can negate these advantages.

On the other hand, the disadvantages of the competitive sealed bid are its lack of flexibility to correct errors in the technical specifications and its difficulty to handle unanticipated work.

4.1.3 Competitive Negotiation

Competitive negotiation, if properly used, prevents non-responsive bidders as well as taking into consideration other significant evaluation factors. The main requirement is that all evaluation factors (including cost) be identified and their relative importance (most important to least important) be given in the request for proposal (RFP). The transit system must have a mechanism (i.e., weighted scales) for considering all the significant evaluation factors outlined in the RFP and this mechanism must be used for selecting the contract award.

An advantage of this contracting approach is that it enables the transit system to place the greatest emphasis on factors that are important to them (e.g., for a transit system that does not have enough buses to meet service demands, a rapid completion of the rehabilitation project may have an overriding weight in bidder selection). This method of contract award allows a selection based on the responsible offeror whose proposal will be most advantageous to the procuring party, price, and other factors considered. Appendix H provides an example of one approach to competitive negotiation.

Some disadvantages of the competitive negotiation are greater administrative effort, more detail and time for preparation of the RFP, and some increased risk of bidding problems.

4.1.4 Non-Competitive Negotiation

This option is better known as "sole source" procurement and consists of solicitation of a proposal from only one source. It can be used after solicitation of a number of sources determines that competition is inadequate. This would be a difficult, if not impossible, method to justify when using federal funds for bus rehabilitation.

4.1.5 Two-Step Bid Process

Most transit systems interviewed felt they achieved the best results at ensuring proper quality work through a two-step bid process involving prequalification of bidders or technical bid followed by the sealed cost bids. The motivation behind this approach is to eliminate any bidder that is deemed non-responsible prior to the opening of the sealed cost bids. Two examples of prequalification forms are included in Appendix G.

Transit systems liked this approach because there have been cases of bids coming in so low that it was doubtful whether proper quality work would be performed, but there did not appear to be a defensible means of disqualifying the bidder. The minimum conditions which must be met for successful use of this approach include clearly stating the basis of the rejection criteria, having justifiable criteria, and not unfairly restricting competition.

4.2 Options for Inclusion in the Contract

During the investigation leading to this manual, many options for incorporation into the rehabilitation contract were identified. The following is a brief discussion of some major options.

4.2.1 Partial Award of Contract

This option entails awarding portions of the contract to separate bidders (i.e., awarding the first part of the contract to the lowest bidder, up to the bidder's capabilities, and then rebidding the remaining portions). This option should be stated in the request for bids if it is used. One advantage to this approach is that it encourages competition by allowing small companies to bid for portions of a contract that would otherwise be too large for their scope of service. It could also provide shorter completion time for a large project by allowing more assets to be committed to the project than any one contractor could provide. The disadvantages of this approach are that it might make it more difficult to disqualify non-responsive bidders and increased administrative effort may be required.

4.2.2 Dividing the Contracts into Increments

This option would require the contractor to successfully complete one portion of the contract before being awarded subsequent portions. This has several advantages. If at any time the transit system becomes dissatisfied with the contractor's performance, subsequent portions of the contract could be discontinued. Also, if there is some possibility that additional rehabilitation work may be needed prior to the expiration of the contract, it could contain an option for additional buses at a stated price and eliminate the need for future bidding.

Among the disadvantages is that this approach would probably require a longer period of time for completion of the total rehabilitation effort. Also, if subsequent portions of the contract were not exercised, then the entire bidding process would have to be reinstated.

4.2.3 Performance Bonding

As previously stated, the general premise behind the performance bond is that it will discourage non-responsible bidders and ensure completion of the contract. The problem with this approach is that some responsible bidders may be forced out of the competition because they are less established and their increased cost for bonding would make them non-competitive. The other problem is that the issue of awarding damages, if the contract is not fulfilled must be resolved. Another point for consideration is the quality (responsibility) of the bonding agency. A bonding company with less than a AAAA rating (a bond industry rating) is not considered a viable bonding agent by many people.

4.3 Additional Considerations

In addition to the factors discussed above, the following points should be considered in structuring the contracting approach:

- It is virtually certain that the required rehabilitation work will be more extensive or in some ways different than originally anticipated. The contract should be structured to handle work contingencies. On a fixed-price contract, the transit system should be willing to consider add-on items if a technical need is determined during the program. The contractor should be fairly compensated for "over and above" items. On a cost-plus contract, the cost rate for various types of work can be included in the contract (and the bidding process). The actual price is then modified by the frequencies of the optional types of work.
- A contingency budget should be established. Such a budget will give a transit system flexibility to deal with work variations.

- Since the impact of additional cost items could exceed the contingency budget, a cap or ceiling on such work should be specified.
- The number of buses to be rehabilitated can be specified as a range rather than a fixed number. This approach can be used in applications for UMTA funding. Of course, a fixed number of buses should be used for the purpose of evaluating bids.
- The bid package should specify if a pre-award survey of the low bidder may be performed. This specification should identify the review factors which will be used.
- Under federal procurement regulations, the transit system has the right to perform pre-contract and post-contract audits. These mechanisms can be used by a transit system to ensure proper accounting of rehabilitation costs.





5.0 TECHNICAL SPECIFICATION PREPARATION

Technical specification preparation is undoubtedly the most important and time consuming portion of a proper rehabilitation procurement effort. This is the area that has the most impact on the ultimate price and quality of work done during the rehabilitation program. Bid specifications should clearly identify the required level of detail, whether repairs, refurbishing, or major structural remanufacturing. Contractors prefer not to bid on imprecise requests which are subject to wide interpretations.

The degree of precision in the technical specification must be carefully considered. A detailed and precise specification tends to reduce misinterpretation and result in a more effective bid (i.e., compare similar levels of work). However, too firm a specification may reduce flexibility within the program once the work has begun. Work identified as being needed may be neglected because it was not properly addressed in the specifications. Other work may be needlessly done because it was assumed that it would be needed when the specifications were prepared.

The actual level of work differs from one rehabilitation project to another because of such items as type of bus, local operating conditions, age and local maintenance practices. Because of this, each transit system needs to look at its individual need for rehabilitating buses based on present conditions of the buses, expected use, and funds available.

Appendix I contains two technical specification packets that have been used by transit systems. The first set of specifications uses a system of bidding costs for individual segments or a rehabilitated bus as well as a total contract price. This system allows the transit property some flexibility in adjusting the final scope of work to maximize their available funds.

The second set of specifications is similar to the first but has much greater detail. This degree of detail, along with a limited amount of "as required" work, reduces contract misinterpretation.

Both sets of specifications have inherent disadvantages as well as the advantages that have been mentioned. Each property should customize its technical specification packet to meet individual needs.

The following are some general considerations which apply to any level of rehabilitation effort:

- Specify all parts to be replaced after conducting your own detailed study of probable needs. Replacement of any low dollar items which have a substantial failure rate with new parts is recommended; higher priced items are more difficult to analyze. Consider the following points:
 - If an arbitrary decision to replace with all new parts is chosen, then some items not needing replacement may be removed which would result in waste and unwarranted extra expense. However, if normal access to some of these items is difficult, then it might be worthwhile to replace them with new during the rehabilitation.
 - If replacement as needed is used as a criterion, then some conflicts may arise. The contractor may have bid on one criterion for judging what was needed and on-site inspector for the transit system may be using another criterion. Spelling out all such criteria in the contract is almost impossible.
 - Specifying a number or percentage for the quantity of each part in the "replace as necessary" category is another option. This would provide for a uniform bid, allow the on-site inspector flexibility as to which parts need replacing on individual buses, but it would require a fairly accurate assessment of the number required. This type of information is not always easy to acquire because some areas of the bus can be inspected only after disassembly is initiated. One means of simplifying this process is to include price quotes for each repair function and use a change order process. If a repair is deleted, then the project is credited with that amount.
- If "repair as needed" is used in the specification, then the quality of repair and the cases under which it is applied should be defined.
- Attempt to standardize the fleet of buses, as much as possible, during the rehabilitation process. This might entail, for example, specifying a particular alternator for the rehabilitated buses because that style alternator is used on all the newer buses.

- Improve the bus during the rehabilitation process. Improvements may include such items as catching up on campaigns, as recommended by the manufacturer, and adding other government-supported items such as wheelchair lifts or safety bumpers. Another area, and a category which UMTA has not funded in the past, may be upgrading the bus by use of such items as power steering, brake adjusters, or different windows. These upgraded features should be looked at from the standpoint of improving the overall maintainability and performance of the bus.
- Clearly define the quality of work expected. The question of quality is critical and should be carefully discussed and understood by the transit system and prospective bidders.
- If a component is not replaced or rebuilt by decision of the transit system, then the contractor is not responsible for that component and no warranty applies.
- Warranty provisions should be included. They should be written and should contain minimum provisions, such as:
 - Contractor warrants all work performed by the contractor to be free from defects in material and workmanship under normal use and service. The contractor's obligation under the warranty typically is limited to repairing or replacing, at its option, any such material which shall, within six (6) months after installation, prove to be defective.
 - Some warranties are given by vendors to rehabilitation contractors for bus components or subsystems. If these warranties exceed the overall bus warranty, then they should be passed along to the transit system.



REHABILITATION PROJECT
MANAGEMENT





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6.0 MANAGEMENT OF A REHABILITATION PROJECT

With the important decisions made as discussed in the previous chapters, the management of the rehabilitation project is ready to proceed and should carefully follow the guidelines discussed below.

6.1 Engagement Plan

The engagement plan is a tool for managing the entire rehabilitation effort. The engagement plan outlines the rehabilitation program by assigning priorities and responsibilities, enumerating specific tasks, describing time frames, and committing resources. The following are the elements of a properly organized engagement plan.

6.1.1 Committed Resources

Because the commitment of resources is very extensive in a rehabilitation project, a careful analysis of these committed resources should be made. Likewise, everyone involved in the transit operation should be made aware of what resources will be committed so that plans can be made for adjusting operations accordingly. It should be stressed that while these resources are committed over a short time span the finished project will be affecting the operation for several years.

The following are some major resources which should be planned for:

- The total number of buses to be rehabilitated and the number of buses that will be unavailable for service at particular times should be known. The absence of these buses may necessitate the temporary reduction of service, the leasing of substitute buses, and/or adjustment in maintenance procedures.
- Once a bus has been scheduled for rehabilitation, any major maintenance work that is included in the planned rehabilitation and that can be deferred should be. There have been cases of a transit system installing items, such as a rebuilt engine, into a bus that has the same item removed and rebuilt months later as part of the rehabilitation program.

- All buses to be rehabilitated should be available prior to their scheduled inclusion date in the rehabilitation program. The rehabilitation program is similar to an assembly line operation: if buses are not available when expected, needless delays, expense, and possible litigation may arise.
- Capital expenditures necessary for the project should be known and expected. Depending on the procurement method and possible change orders, either the expenditures or total number of buses rehabilitated may fluctuate from original estimates. Information of this nature must be known and anticipated at the start of a rehabilitation effort to reduce the chances of an unsuccessful project resulting from misunderstandings.
- The number of personnel, their skills, and time commitments to the project should be properly analyzed. The commitment of a project manager, an adequate number of inspectors, and laborers (if the work is to be performed in-house) should be planned for. These personnel are essential for a proper rehabilitation program. Care should be taken that commitment of these resources does not detract from the regular maintenance program of the transit operation. Because of this, consideration should be given to hiring additional personnel, contracting out certain work, or reassigning work internally.
- Of primary importance is continuity of personnel. Frequent changeover of personnel only complicates the problem of controlling the project and heightens the chance of problems.

6.1.2 Timing

There should be a full understanding by all parties of the time frames involved. These time frames should include everything from the issuing of the bid document or Request for Proposal (RFP) to the return of the last rehabilitated bus. The following are a few time-related milestones which should be planned for in a rehabilitation project:

- Date the project starts
- Number of days from the "notice to proceed" to the return of the first rehabilitated bus (many systems think that 90 days is a minimum for a contractor to accomplish this)
- Date the last bus is expected from the rehabilitation contractor
- Identification of key intermediate milestones.

6.1.3 Progress Reviews

Progress reviews are essential for momentum and continuity of a rehabilitation project. These reviews should be on a periodic basis. They should assess the progress of the program and at key points in the program, such as the 75 percent completion stage, to decide on which ways to proceed. Items to consider during a progress review consist of the completion rate, budget, change orders, and unexpected problems. By keeping all parties abreast of the project on an on-going basis, the chances for confusion and misunderstandings are reduced.

All points of contact should be decided along with the proper flow of information before the start of the rehabilitation project. This will reduce confusion and wasted time.

6.2 Documentation

Because of its impact on the various departments of a transit operation, there will be a great deal of interest generated in a rehabilitation project by the Board of Directors, the general manager, and operations and maintenance departments. Proper documentation is required to keep all parties abreast of the happenings of the fast paced nature of a rehabilitation project. Documentation should also aid in the control of the project by tracking important milestones and recording important decisions. Finally, it should be a means of auditing the entire process to help resolve occasional interpretation problems that arise and to provide proper documentation for future audits. (All UMTA funded projects are subject to audit.)

The following documents should be maintained by the project manager during the rehabilitation project:

- Weekly inspection reports, including up-to-date status reports by individual buses.
- Actual performance status versus planned performance including justification for deviations.
- Change orders (all to be approved by project manager).
- Documentation of resolutions of issues between inspectors and rehabilitation contractor, including supporting materials such as photographs.
- Vehicle inspection checksheets (Obtain written certification of both the contractor's and customer's inspection, indicating any discrepancies found and the respective corrections as well as final approval and acceptance of delivery).
- Periodic budget reports.
- List of all resources (labor and materials) used in cost plus fixed-fee contracts.

The following information should be furnished by the contractor to the transit system:

- Curb weight, odometer reading, and all reports from drive-away service at time of delivery for each bus.
- Bus maintenance records on all buses when possible.
- Manufacturer's serial number of bus and those of the engine, transmission and differential if they exist.
- A complete list of all major parts used in reconditioning the bus, broken down by part numbers and vendors for same for each bus.
- A complete set of maintenance manuals for all new components installed; one complete set to be furnished for every five similar buses or fraction thereof.
- A complete set of wiring diagrams for each bus showing all changes made to original bus with color or number codes used.
- A complete schematic for the air system for each bus, showing the location of any new valves.
- Documentation of a road test or equivalent dynamometer tests confirming the proper operation, adjustment and performance of each bus in simulated service.

6.3 Key Personnel

In addition to all the items mentioned previously, a successful bus rehabilitation project requires a project manager and bus inspectors.

The project manager should be an individual designated by the transit authority to carry out the rehabilitation project. To accomplish this, the selected individual should have a technical background sufficient to allow for sound decisions regarding present work and how it relates to the cost effective future operation of the vehicle. The individual should also be familiar with the project goals, characteristics of the work to be done, general considerations of the buses involved, contract options, all points of contact, and their individual authority. Consequently, it is highly desirable that the project manager be an individual who has participated in the detailed preparation and decision-making leading up to the project.

The project manager needs to be assigned to the rehabilitation project on a time-committed basis that allows him to keep track of the effort and respond to problems in a timely manner. On a sizeable project, it is advisable to assign the project manager full time. Another aspect of commitment is the need to keep the same individual as project manager for the project's duration, if possible. If not, sufficient time overlap must be allowed to bring another qualified individual on board to ensure continuity. Few things can be as detrimental to the project's success as frequent turnover of project managers. It can lead to conflicting guidance being given to the project's team, and can lead to wasted effort and resources.

On-site quality inspectors need to be technically qualified individuals familiar with vehicle engineering and the work requirements. They should have knowledge of good industrial practices and be capable of making an on-the-spot assessment of the need for certain work to assure acceptable quality. The inspector should be familiar with the type of buses being rehabilitated, their peculiarities, and the unique nature of rehabilitating a bus compared to building a new one. The inspectors can be members of the transit authority's own maintenance organization, contract personnel, or a mix. They must, however, be responsible to the transit authority. Such inspectors are needed whether the work is done in-house or contracted.

Inspectors must be available on-site where the work is done on a timely basis in order to preclude holding up an agreed upon schedule. This may mean a full-time assignment for the duration of a rehabilitation project, if the workload is sufficiently high.

A key point is that the inspector's job is to examine the quality assurance process itself, not to conduct the inspection for the manufacturer. A pre-production quality review meeting between manufacturers and inspectors can be used to help this process by agreeing on exactly what items are important to each party involved.

Note that in the quality assurance process the inspector must be consistent in applying the monitoring technique. One of the things to avoid is changing or rotating inspectors because of the inherent inconsistency associated with such continued change. In addition, the whole monitoring process should be well documented. This includes completing daily or weekly inspection forms. A suggestion was made that the first bus be used as an example or model for mutual agreement by all parties as to what the final vehicles will look like. This could avoid numerous problems or disagreements later. Establishment of workmanship criteria is important to consider at the preproduction meeting with the plant inspector. Problem identification and the followup action must be documented and such documentation should remain with the bus. When delivering the bus, this documentation and records of any changes should be provided to the purchaser.

It should be noted that rehabilitation of a small number of buses may not justify the expense of a full-time inspector. A part-time inspector could be used if a person with appropriate knowledge is available in the contractor's vicinity. Alternatively, extra attention should be given to clearly defining the technical specifications.

6.4 Warranty

When the rehabilitation process is completed, the warranty period begins. The project manager should carefully check that all warranty provisions are in place and communicated to the maintenance staff. The project manager should ensure that anything done during rehabilitation or running repairs does not adversely affect the warranty provisions.

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APPENDIX A

BUS REHABILITATION WORKING GROUP MEMBERS

BUS REHABILITATION WORKING GROUP

May 6-7, 1982

W. J. (Skip) Parks	Central Ohio Transit Authority
John Jontig	Santa Clara County Transit
Lee Rung	New Orleans Public Service Inc.
Richard G. Long	Capital Dist. Transit Authority
Kalyan Ramakrishnau	SEMTA
P. K. Varma	The Blitz Corporation, Chicago
Bass Dyer	Pacific Bus Rebuilders
Patrick Jones	APTA
Frank J. Cihak	APTA
T. A. Norman	UMTA
John E. Ridgley	UMTA/Program Manager
George Izumi	UMTA/Program Manager
Rolland King	Battelle/Mgr., Transportation Systems
Michael S. Bridgman	Battelle/Principal Investigator
Kay Miller	Battelle
Bee Balzer	ATE Management & Service Co.
Alfred E. Savage	ATE Management & Service Co.
Pete Ward	ATE Management & Service Co.

BUS REHABILITATION WORKING GROUP

November 16-17, 1982

Charles Stalzer	WMATA
Charlie Creech	Grand Rapids Area Transit Authority
Greg Mitchell	Detroit DOT
Lee Rung	New Orleans Public Service, Inc.
John Jontig	Santa Clara County Transit
Bass Dyer	Pacific Bus Rebuilders
Carmont Blitz	Blitz Corporation
P. K. Varma	Blitz Corporation
Patrick Jones	APTA
Al Neumann	UMTA
R. D. King	Battelle
Mike Bridgman	Battelle
Hjalmar Sveinsson	Battelle
Bee Balzer	ATE
Bill Fowler	ATE
Alfred Savage	ATE
Debra Guinaw	Public Technology, Inc.





APPENDIX B

SITE VISIT CONTACTS, QUESTIONNAIRE, AND SUMMARIES

SITE VISIT CONTACTS

Alameda-Contra Costa Transit District
Oakland, CA
Tony Lucchesi

Capitol Area Transit Authority (CATA)
Lansing, MI
Gordon Szlachetka
Stan Wright

Detroit Department of Transportation (DDOT)
Detroit, MI
Richard Golembrewski
Greg Mitchell

Long Beach Transit Corporation
Long Beach, CA
Larry Jackson

Metropolitan Transit Authority
Houston, TX
Ms. Beverly Griesly

New Jersey Transit
Newark, NJ
Bill Collins
Bart Betz
Dick White

New Orleans Public Transit System (NOPSI)
New Orleans, LA
Leon Rung

Santa Clara County Transportation Agency
San Jose, CA
John Jontig

Southeastern Michigan Transportation Authority (SEMTA)
Detroit, MI
Thomas Okasinski
Kalyan Ramakrishman

Southeastern Pennsylvania Transit Authority (SEPTA)
Philadelphia, PA
Dave Feeley

Blitz Corporation
Chicago, IL
Carmont Blitz
P. K. Varma

SITE VISIT CONTACTS (Continued)

Midwest Bus Rebuilders
Owosso, MI
Dan Morrill

Pacific Bus Rebuilders
Milpitas, CA
Bass Dyer
Phil Dyer
Jerry Boster

NIMCO
Newark, NJ
Ben Baker

BUS REHABILITATION FIELD SURVEY

I. General

- A. How many buses has the property rehabilitated?
- B. How long has the property had rehabilitated buses in service?
- C. Is the property currently rehabilitating additional buses, or planning to do more rehab?
- D. How does the property calculate its requirements for buses?
- E. What is a desirable "average age" for the property's fleet?
 - o How does the property calculate it?
 - o Why is it important?

II. Rehabilitation vs. Buy Decision

- A. Why did the property consider rehabilitation?
- B. Did the property consider the following alternatives?
 - o Buy new buses
 - o Buy buses for rehabilitation
 - o Buy buses already rehabilitated
 - o Rehabilitate buses currently in inventory
- C. What levels of rehab were considered?
 - o How are these levels described (terms and definitions)?
 - o What items are specifically repaired or replaced in each level?
 - o What determined which level of rehab to select?
- D. Is there a minimum level of rehab required to justify rehab?
- E. Were buses inspected individually before writing specifications? Why or why not?
- F. Was funding source a major factor in the decision?
- G. How much time elapsed between the firm decision to rehab and the delivery of the first rehabilitated bus?

- H. What was the biggest element in the time span?
 - o Obtaining funding
 - o Contracting activities
 - o Rehab work itself
- I. How did the time to rehab compare with purchasing new buses?
How important was time?
- J. Was cash flow source a major factor in the decision?
- K. Was public reaction considered?
- L. How does the property calculate the age of its rehabilitated buses?
- M. What restrictions exist in rehabilitation programs?
- N. What types of buses did you consider for rehabilitation?
- O. How were candidates for rehabilitation selected from the existing inventory? Were buses already twelve years old, or would they be twelve by the time they were rehabilitated?
- P. What were the estimated life expectancies of a new and a rehabilitated bus?
- Q. Were spare ratios considered in the property's decision process?
- R. What factors were most important in the property's decision process?
(Rank from 1-7)
 - ___ Time to availability
 - ___ Life cycle cost
 - ___ Source of funds
 - ___ Public image
 - ___ Manpower availability
 - ___ Facility availability
 - ___ Other (Specify)
- S. Did the property use life cycle cost in its decision process?

III. Life Cycle Costing

A. Initial Capital Outlays

- o New bus acquisition cost
- o Rebuild cost
- o Transportation
- o Inspection
- o Leased vehicle cost (if required)
- o Special tools and equipment (for in-house rehab or new bus support)
- o Facility improvements
- o Inventory investment
- o Salvage values

B. Other Incidental Costs

- o Driver training
- o Mechanic training

C. Operating Costs

- o Fuel Consumption
 - a. What fuel economy estimates were used?
 - b. What fuel price was used?
 - c. What percentage of time is air conditioning operating?
 - d. What is the operating profile or duty cycle of the bus?
 1. Time in CBD (7 stops per mile)
 2. Time in arterial (2 stops per mile)
 3. Time in commuter (1 stop per mile)
 - e. What is the estimated curb weight of rebuilt bus?
 - f. What is the average load factor (percent of seating capacity) used?

- o Oil Consumption (added only)
 - a. What average MPQ is used?
 - b. What oil price is used?

D. Maintenance Costs

- o Brakes
 - a. Is there a policy to reline front and rear brakes at same time?
 - b. What factor was used to determine when brake drums should be turned upon relining?
 - c. Was vehicle weight considered?
- o Air Conditioning
- o Electrical
- o Differential
- o Preventive Maintenance
 - a. What is preventive maintenance (pm) schedule?
 - b. Were major pm's and intermediate pm's judged separately?
 - c. Were alternative schedules considered when evaluating new buses?

IV. In-House versus Contractor Rehabilitation Activity

- A. Did property consider both in-house and contractor rehabilitation?
 - 1. If yes:
 - a. How were the alternatives considered?
 - b. What aspects were considered?
 - c. Why did they select one alternative over another?
 - 2. If not, why were alternatives not considered?
 - 3. Was consideration given to a mix of the two alternatives?
How were these analyzed?

- B. What transportation arrangements were considered?
 - o Property delivered to and from contractor site
 - o Contractor pickup and delivery
- C. Who accepted liability during transportation?
- D. What inspection requirements were considered:
 - o Prior to development of specifications
 - o During rehab effort
 - o Acceptance of completed bus

V. Bidder's Qualification

- A. Did property have established criteria with which to evaluate bidders other than lowest bid?
- B. How were criteria evaluated?
 - o Minimum acceptable level
 - o Comparison of bidders
 - o Trade-offs between criteria (e.g., efficiency vs. space available)
- C. Did property list qualifications for bidders? What were these qualifications?
- D. Was a performance bond required of all bidders? If so, how much?
- E. Did transit system officials visit bidder's facility prior to awarding contract?
- F. What other investigations were made of bidder's ability to perform the work?
- G. Were financial statements required from bidders?

VI. Contracting Process

- A. Does rehab work qualify for a negotiated procurement? Why (or why not)?
- B. What contract process did the property use?
- C. How long did it take?

- D. What would the property do differently next time?
- E. Who managed the property's rehab program?
- F. Did the rehab program precipitate any significant changes in the property's organization?

VII. Contractual Instruments

- A. How were the specifications for the property's rehab work developed?
- B. How were they structured?
- C. What would the property do differently next time?
- D. Was the work completed according to the original contract?
- E. What changes took place during the contract?
 - o Additional work
 - o Less work
 - o Cost changes
- F. What restrictions were place on the contract by the Federal Government?
by the State?
- G. What was the property's biggest problem with the contract?

VIII. Documentation

Please indicate availability of any of the following documentation that you may have:

- A. List of items the property replaced on all buses, regardless of condition
- B. List of items replaced or repaired only as necessary
- C. Copies of specifications used
- D. Copies of criteria for qualifying bidders
- E. Copies of evaluation framework used with criteria
- F. Terms and definitions used in the property which refer particularly to rehab work, and which may vary from property to property

- G. Operational and maintenance data on rehabilitated buses versus other buses in fleet. Examples are:
 - o Initial cost
 - o Miles per gallon
 - o Miles per quart of oil
 - o Miles between road calls
 - o Other
- H. Surveys or information on changes in ridership or public reaction due to rehabilitated buses
- I. Current Fleet Description
 - o Bus types
 - o Models
 - o Routes
 - o Numbers.

FIELD SURVEYS OF REHABILITATION PROJECTSGeneral

During the course of this study, nine transit systems, one state department of transportation and four bus rebuilders were visited and interviewed. Tables 7-1 and 7-2 illustrate the general findings of these visits. A summary of the findings is presented below. A synopsis of each site visit is provided in section 7.4.

Transit Systems

Each of the transit operators had embarked or completed a bus rehabilitation project within the past five years. Although the project team chose properties located in different regions around the country and properties whose rehabilitation projects ranged from 15 to 156 buses, the general opinion of bus rehabilitation was similar.

Acquisition time was the most prevalent reason for choosing a rehabilitation project over the acquisition of Advanced Design Buses (ADB). The lead time for ADB's required 12 to 18 months in addition to the grant application time. The turn around time for a remanufactured bus ranged from 120 days to 9 months. When project funds were from state or local sources the time span was reduced again by the grant time involved. Another major consideration taken into the rehabilitation decision were the cost to maintain the vehicles. Although specific cost data were not readily available, several interviewees estimated that as much as 25 percent in direct operating and maintenance savings were realized over the original vehicle. This figure included fuel consumption which is a major operating cost factor. Several operators interviewed also mentioned the familiarity of their maintenance staff with a new look bus. Thus, the ease of maintenance is a consideration. Finally, capital costs influenced the decision process. A reliable vehicle could be placed on the street for a cost of \$40,000 to \$70,000 per bus while an ADB would cost approximately \$140,000 to \$150,000.

TABLE B-2. REHABILITATION PROJECTS OVERVIEW OF
TRANSIT PROPERTY SITE VISITS*

TRANSIT SYSTEM	Alameda-Contra Costa Transit District Oakland, CA	Capitol Area Transportation Authority Lansing, MI
DATE OF PROJECT	1975	1979-80
CONTRACTOR	In-house	Midwest Bus Rebuilders
SCOPE OF REBUILDS	Cosmetic	Complete rehabilitation
NUMBER OF REBUILDS		
PLANNED	N/A	0
COMPLETED	N/A	17
AVERAGE COST	\$2,400	\$55,000
FUNDING SOURCE	Local	State
PERSON CONTACTED	Tony Lucchesi	Gorden Szlachetka Stan Wright
COMMENTS	Minor cosmetic changes performed in house in 1974 and 1975. Favors rehabbed buses over ADBs due to maintenance staff familiarity.	Satisfied with performance. Provided cost information on parts, fuel and oil consumption rates. Still believes ADB's are better accepted by public.

*Site visits and interviews conducted by BCL/ATE project team June-July,
1982.

TABLE B-2. Continued

TRANSIT SYSTEM	Detroit Department of Transportation Detroit, MI	Long Beach Transit Corporation Long Beach, CA
DATE OF PROJECT	1979-80	1981
CONTRACTOR	Blitz	Transportation Design and Technology
SCOPE OF REBUILD	Phase I - Cosmetic Phase II - Cosmetic and as required on structure and drive lines	Complete
NUMBER OF REBUILDS		
PLANNED	0	15
COMPLETED	79 (Phase I) 30 (Phase II)	15
AVERAGE COST	\$20,000 (Phase I) \$35,000 (Phase II)	\$49,000
FUNDING SOURCE	Federal/state	Local
PERSON CONTACTED	Richard Golembrewski Greg Mitchell	Larry Jackson
COMMENTS	Two phases of rehab - Phase I mostly cosmetic. Phase II rebuild major components as necessary. Satisfied with rehab performance.	Rehab decision based primarily on acquisition of ADB's compared to rehabs. Major components rebuilt as needed. Recommended installed new engine and transmission in future.

TABLE B-2. Continued

TRANSIT SYSTEM	Metropolitan Transit Authority Houston, TX	New Jersey Transit Newark, NJ
DATE OF PROJECT	1980-81	1980-82
CONTRACTOR	Stage Coach Unlimited Pacific Bus Rebuilders Blitz	Nimco
SCOPE OF REBUILD	Complete rehabilitation	Complete rehabilitation
NUMBER OF REBUILDS		
PLANNED	60+	13
COMPLETED	79	49 (in-house) 105 (contracted)
AVERAGE COST	was \$85,000 presently \$65,000	\$20,000+ in-house \$50,000 contracted
FUNDING SOURCE	Local	Federal and State
PERSON CONTACTED	Ms. Beverly Grigsby	Bill Collins Bart Betz Dick White
COMMENTS	Chose rehabs to acquire reliable equipment in timely manner. In process of rebuilding 60 new look buses.	Rehabilitating was cheap way to upgrade fleet.

TABLE B-2. Continued

TRANSIT SYSTEM	New Orleans Public Transit System New Orleans, LA	Santa Clara County Transportation Agency San Jose, CA
DATE OF PROJECT	1978-79	1980-82
CONTRACTOR	Blitz	
SCOPE OF REBUILD	Complete rehabilitation	Various
NUMBER OF REBUILDS		
PLANNED	0	
COMPLETED	43	156 (over 4 efforts)
AVERAGE COST	\$53,000	\$60,000 (rehab + used bus)
FUNDING SOURCE	Local	Local
PERSON CONTACTED	Leon Rung	John Jontig
COMMENTS	Acquisition time deciding factor for rehab work. Reported seating capacity and maintenance staff familiarity with new looks to be major advantages of rehabs compared to ADB's.	Emphasized need for good specification plus marketing con- sideration when rehab buses. Bus should be attractive to the public (i.e. recognized as a new piece of equipment).

TABLE B-2. Continued

TRANSIT SYSTEM	Southeastern Michigan Transportation Authority Detroit, MI	Southeastern Pennsylvania Transit Authority Philadelphia, PA
DATE OF PROJECT	1979-81	1981-82
CONTRACTOR	Blitz	Nimco
SCOPE OF REBUILD	Phase I - Cosmetic, Level I Phase II - Cosmetic and as required on structure and drive lines	Complete rehabilitation
NUMBER OF REBUILDS		
PLANNED	0	
COMPLETED	21 (Phase I) 20 (Phase II)	157
AVERAGE COST	\$22,000 (Phase I) \$35,000 (Phase II)	\$51,000
FUNDING SOURCE	Federal/state	Federal
PERSON CONTACTED	Thomas Okasinski Kalyan Ramakrishnan	Dave Feeley
COMMENTS	Generally satisfied with rehabs because of operating and maintenance character- istics. Provided contract information.	Fast means of upgrading fleet and they felt that the rehabilitation buses would be cheaper to operate.

TABLE B-3. COMMERCIAL REBUILDERS VISITED BUS REHABILITATION

REBUILDING FIRM	PERSON CONTACTED	DATE OF CONTACT	COMMENTS
Blitz Corporation Chicago, IL	Carmont Blitz P. K. Varma	7/15/82	Discussed company's capabilities and approach to rebuilding. Toured rebuilding facilities.
Midwest Bus Rebuilders Owasso, MI	Dan Morrill	6/15/82	Discussed contract qualification procedures for bus rebuilders. Estimates rebuilding saves about 25 percent over the original vehicle in O&M costs.
Pacific Bus Rebuilders Milpitas, CA	Phil Dyer Jerry Boster	7/13/82	Focused discussion on bidder qualifications and in-house versus contract rehab work. Concern over quality of work being bid for rehab work and feel detailed specifications are needed.
NIMCO	Ben Baker	7/29/82	Discussed contracting and work specification issues.

The operators interviewed were pleased with their rehabilitated buses although several noted specific changes would be made or had been made in subsequent remanufacturing projects. The current life expectancy of a rehabilitated bus exceeds most original estimates by two to four years. Acceptance by the operators, mechanics and riding public was considered good, although most still felt the public prefers to ride a new bus. Methods were noted by some operators that enable the transit system to put forth a "new bus" image with a rehabbed vehicle. Some of these were paint schemes consistent with ADBs, darkened windows, new bumpers, and minor front and rear panel redesigning.

An array of ideas were put forth by the operators when discussing specifications and contracts. While some prefer tight specifications, with specific details of the work spelled out in advance, others felt a more cooperative attitude with the rebuilder could be developed if contract terms were more flexible. This flexibility worked to the advantage of both the transit system and the vendor. No conclusion could be drawn concerning the value of performance bonds. Operators agreed that measures were required to ensure performance and quality of work. Generally, those interviewed agreed that the scope of work should go beyond the cosmetic work and as-required repairs that were performed in the early stages of bus rehabilitation. Engines and transmissions should be rebuilt during the rehab process. One operator suggested that installing new components would result in an even more cost-effective project.

Remanufacturing Firms

Each of the individuals interviewed demonstrated confidence in the bus rebuilding industry. Tours of rebuilding facilities and the companies' philosophies were also expressed by the chief operating officers of these firms. Concerning contractor qualification procedures and standards, the rebuilders felt that most transit systems prefer to use established companies. Performance bonding requirements hamper smaller companies because of the cash flow implications. One concern expressed by bus rebuilders was the desire for clearer definition of the scope of work in bid specifications. It was felt

that loose specifications result in confusion both on the part of the transit system and the rebuilder and hampered an "apples to apples" comparison of bids. Examples of bid qualifications and specifications were obtained from these companies.

Synopsis of Field Survey Reports

AC Transit

AC Transit felt that older style buses should be rehabilitated because they were easier to maintain and operate. They also felt that in-house rehabilitation was not an effective approach because of the problems inherent with tooling up and tooling down from the work. They did feel that an on-site inspector for contractor rehabilitation work was a prerequisite.

AC Transit performed an in-house cosmetic program in 1974/75 on some buses at a cost of \$2,400 per bus. Because of the limited scope of this work, it cannot be considered a true rehabilitation program.

Capitol Area Transit Authority

The Capitol Area Transit Authority (CATA) rehabilitated 17 buses by Midwest Bus Rebuilders at a cost of \$55,000 per vehicle. The key rationale for the program was the ability to get the rehabilitated vehicles into service sooner than acquiring new advanced design buses (ADB). CATA has had the rebuilt buses back in service for over one year and they are satisfied with their performance. They feel the buses are well accepted by drivers, mechanics, and the public. Despite favorable reactions to the rehabilitated buses, CATA stated that they would still prefer new ADBs to rehabilitated buses because of rider acceptance.

Long Beach Public Transit

Long Beach Public Transit (LBPT) rehabilitated 15 GMC buses in 1980. Their decision to rehabilitate buses rather than purchase ADBs was based

primarily on the difference in acquisition time and the availability of local funds. It was believed the first rehabilitated buses could be received 120 days after startup with one bus following every two weeks thereafter. In actuality the startup time was 150 days because of the lead time required by the parts suppliers.

LBPT ruled out in-house performance of the rehabilitation effort because of limited facilities. The labor union's consent to contract out the work was necessary but not difficult to acquire because no similar work had ever been done by them.

Transportation Design and Technology (TDT) of San Diego was selected to perform the work. Since no federal funding was involved, LBPT was able to negotiate and develop specifications for the rehabilitation work directly with TDT. The scope of work performed on each bus included all basic work for \$32,500 plus add on work, on an as needed basis, at agreed on prices. The final average cost per bus was \$49,000.

LBPT originally expected to get a life extension of five years but now anticipates five to seven years. LBPT was generally pleased with the rehabilitated buses, and they are presently considering rehabilitating 15 more GMCs. This new effort will use federal funding and is being considered primarily because of the source of the funds and the life cycle cost consideration of the older GMCs. One thing which will probably be done differently on this rehabilitation effort will be the installation of all new engines rather than rebuilt engines.

Houston Metro

The Houston Metro has an extensive bus rehabilitation program. They have done business with Stage Coach Unlimited, Pacific Bus Rebuilders, and Blitz. They presently have rehabilitated over 70 buses and are in the process of rehabilitating 60 additional buses.

The first rehabilitated buses that Houston had performed cost approximately \$85,000 each, but the present rehabilitation work is running approximately \$65,000 each. Houston feels the reason for this reduction in cost is tighter control on the work being performed during the rehabilitation

effort. To achieve these results Houston recommends inspecting buses to determine what work is needed and developing a firm outline of the scope of work. Houston also felt that a prescreening of bidders was required to eliminate vendors not capable of providing adequate services.

To insure contractor compliance, Houston recommends a 100 percent performance bond and partial award of the contract with the full award of the contract only after successful completion of the partial award. Houston pointed out that they have greater flexibility in dealing with contractors because no federal money is involved.

Houston's primary reason for going into the rehabilitation effort was to acquire a proper quantity of reliable buses for use in their service operation. The time until the buses were available for service and manpower requirements were also a factor but to a lesser extent. They also felt that the older buses were easier to maintain and the mechanics were more comfortable working with them. Houston expects to realize five to eight years additional service from these rehabilitated buses. Life cycle costing was not a factor in selecting buses for rehabilitation, but Houston does feel that the older buses are cheaper to maintain.

New Jersey Transit

New Jersey Transit presently has 13 buses being rehabilitated by Nimco, an in-house rehabilitation program, and some rehabilitated buses that have been running approximately one year. In reference to the in-house rehabilitation work, New Jersey Transit stated that the buses were costing more than originally anticipated and were originally selected from the group that required less work. On contracted work, New Jersey Transit used a pre-qualification of bidders and 100 percent performance bond to insure a successful contract. They also performed inspections on individual buses before, during, and after the contracted work.

New Orleans Public Transit System

New Orleans Public Transit System (NOPSI) had rehabilitated 43 of their 84 1965 GMCs in the latter part of 1978 and the rehabilitated and non-

rehabilitated GMCs are still in service. NOPSI limited operation and maintenance expense records comparing similar fleets of rehabilitated and non-rehabilitated buses were the only ones found during our interviews.

Two major factors affecting NOPSI's decision to rehabilitate versus buying new buses in 1978 were the faster turnaround time and the lesser cost. The original cost for rehabilitation was estimated at \$46,000 per bus, but because of add ons the actual cost was approximately \$50,000 per bus.

NOPSI reported that the advantages of rehabilitated buses included more seating, less training for the maintenance staff, and reduced operating expenses. Originally, NOPSI had planned on extending the useful life of the GMCs by five years with the rehabilitation, but they presently think that a seven year extension is likely.

The rehabilitation program was relatively new in 1978. One problem NOPSI encountered was finding firms in the business of doing this particular type work. The decision was made to do the work externally because of logistical problems inherent with the one-time tooling up and tooling down. The decision as to which level of work would be performed was based primarily on a pre-inspection. As a result, the priority of work done during the rehabilitation effort was directed at drive line and under-construction. The control of the rehabilitation work was handled in a rough outline of the services to be performed.

The acceptance of the rehabilitated buses was good by mechanics, drivers, and the general public. The one thing reported by NOPSI that would be done differently, if done again, would be assigning on-site inspectors to insure the quality of the rehabilitation work.

Santa Clara County Transportation Agency

Santa Clara County Transportation Agency expressed many of the same thoughts on rehabilitating efforts that other systems have expressed in regard to contracts, bidding, etc. They have used a two-part bid process and were very pleased with the results. An innovative approach that Santa Clara system is considering would improve as well as recondition buses. Their innovative approach to the cosmetics of the bus, if successful, will make the

rehabilitated buses as aesthetically pleasing as ADBs while improving the original maintenance and operational aspects of the older GMCs.

Southeastern Michigan Transportation Authority

Southeastern Michigan Transportation Authority (SEMTA), as indicated previously, had contracted jointly with DDOT on the rehabilitation of 41 of their own vehicles. Of these, 21 were in the Phase I and 20 were in the Phase II of the rehabilitation effort. SEMTA expressed the same views as DDOT with their rehabilitated buses and indicated similar views and experiences in regard to the contracts.

Southeastern Pennsylvania Transit Authority

The Southeastern Pennsylvania Transit Authority (SEPTA) was presently in the middle of a rehabilitation effort for as many as 220 buses. The present contractor for this work is Nimco. The work was initially undertaken to quickly ungrade SEPTA's present fleet. SEPTA did feel that the rehabilitated buses are cheaper to operate than newer style buses.

Proper preparation for a bid was pointed out as a necessity by SEPTA. Among other things, they did a pilot rehabilitation program in-house to help develop the specs; they performed pre-, post- and in-process inspections on all buses; and they required performance bonds by the contractors. The total pre-bid preparation was estimated to have taken approximately one year.

Detroit Department of Transportation

The Detroit Department of Transportation (DDOT) joined with Southeastern Michigan Transportation Authority (SEMTA) in a bus rehabilitation effort totalling 150 buses of which 109 were for DDOT. The majority of the work done was by Blitz with SEMTA acting as the coordinator. DDOT provided their own on-site inspectors to oversee work on DDOT buses.

All buses in the program were 12 years of age or older, selected on an individual basis, and all possessed relatively good chassis. The contracts for both phases were for a total fixed price, with a cost per vehicle for Phase I of \$20,000 and for Phase II of \$35,000. Phase I (79 vehicles) was largely a cosmetic effort while Phase II (30 vehicles) included engine and transmission rebuild, and bulkhead replacement or repair on an as required basis. Each vehicle was treated on an individual basis with the DDOT inspector being the approving authority.

DDOT expressed satisfaction with the rebuilt buses, stating that the Phase II vehicles are more reliable than the Phase I, and that the rehabilitated buses currently out perform ADBs in reliability. DDOT also expressed the opinion that the five year life expansion (Phase II) buses are likely to last at least eight years and possibly more with normal maintenance.

Blitz

The Blitz Corporation expressed many of the same concerns in regard to bus rehabilitation as mentioned by others. They were particularly concerned that bus specifications should be prepared in such a manner as to reduce misinterpretation, insure competition among legitimate contractors and maintain the professional image of the industry.

Midwest Bus Rebuilders

Midwest Bus Rebuilders expressed concerns about contractor qualification procedures and standards. They claimed that the greatest advantage in rebuilding buses is the reduced O&M costs that result through improved reliability and fuel economy. They estimated these costs at approximately 25 percent in savings over the original vehicle.

Nimco

The Nimco plant expressed many of the same concerns expressed by others in regard to bus rehabilitation. They did feel that transit systems

considering contracting for work should carefully analyze their options concerning the contracts. They even suggested getting feedback from different contractors to assist in this very critical area.

Pacific Bus Rebuilders

Pacific Bus Rebuilders expressed a desire for clear definition of the scope of work and bid specifications. Tighter specs would clarify the interpretation of the work to be performed and result in more accurate comparison of bidders with less confusion on the scope of the work. A good approach to this problem was a sample bid specification outlining certain mandatory repairs and certain optional repairs. By fixing the prices of optional repairs before the contract is awarded, a safety factor is achieved. This allows the transit systems, through their on-site inspectors, to make individual decisions concerning the need and priority of repairs while the work is being conducted.

The use of performance bonding because of cash flow implications and the awarding of large contracts only as a whole was considered by Pac Bus to be restrictive on smaller companies. Pacific Bus Rebuilders also felt that in-house bus rehabilitation efforts by a transit system has several disadvantages. The transit system could overlook major costs in comparing in-house to contractor work. The in-house labor resources could possibly be absorbed by the regular maintenance program, and labor difficulties could even result from the work. They also felt that a successful in-house rehabilitation program requires the following: a large system size to maintain an even flow of buses, good internal support, sound technical knowledge, and a long-term commitment.



APPENDIX C

A GUIDE TO TYPE OF COMPONENT WORK RELATING
TO THREE ALTERNATIVE LEVELS OF BUS REHABILITATION

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A GUIDE TO TYPE OF COMPONENT WORK RELATING TO THREE
ALTERNATIVE LEVELS OF BUS REHABILITATION

The following is a generic breakout of the type of component work related to the three different levels of bus rehabilitation:

Component Areas	Level of Rehabilitation Desired		
	1	2	3
<u>Engine and Accessories</u>			
Engine (Optional and Conditional)	New IDA	Reman. IDA Specs.	Reman. as req.
Engine Mounts	New	New	New
Accessories (Hardware)	New or Reman.	New or Reman.	New or Reman. as req.
Engine Cradle	Reman. as req.	Reman. as req.	Reman. as req.
Air Cleaner Filter Elements	New	New	New
AZir Duct Tubes	Cleaned	Cleaned	Cleaned
<u>Transmission</u>			
Transmission	New IDA	Reman. IDA Specs.	Reman. as req.
Accessories	Reman. as req.	Reman. as req.	Reman. as req.
Fluid Filter Sock	New	New	New
U-Joint Assembly	New	New	New as req.
<u>Cooling System</u>			
Silicone Hoses	New	New	New
Hose Clamps	New	New	New
Radiator Core	New or Reman.	New or Reman.	New or Reman. as req.
Gaskets	New	New	New
Engine Thermostats	New	New	New
Engine Air Cooler Core	New	New	New as req.
Air Compressor Water Lines	New	New	New as req.
Transmission Water and Fluid Lines	New	New	New as req.
<u>Upper Structure</u>			
Body Posts	New as req.	New as req.	New as req.
Carlines	New as req.	New as req.	New as req.
Reinforcements	New as req.	New as req.	New as req.
Body Panel	New as req.	New as req.	New as req.
Strainer and Stiffener	New as req.	New as req.	New as req.
<u>Front Underframe</u>			
Brackets (Strut and Radius Rod)	New as req.	New as req.	New as req.

Component Areas	Level of Rehabilitation Desired		
	1	2	3
<u>Front Underframes (Con't.)</u>			
Reinforcement--Front and Rear Cross Assembly	New	New	New as req.
Angles	New	New	New as req.
Bulkhead	New	New	New as req.
Cross Member	New	New	New as req.
Beam Assembly	New as req.	New as req.	New as req.
Tube--Reinforcement	New	New	New as req.
Support Assembly	New	New	New as req.
Struts (Left and Right)	New as req.	New	New as req.
<u>Intermediate Underframe</u>			
Bulkhead Assemblies	New	New	New as req.
Stiffener	New	New	New as req.
Tanks and "U" Bolts (Wet & Dry)	New	New or Reman.	New as req.
Bracket Assembly	New	New	New as req.
Duct Assembly Main	Reman.	Reman.	Reman. as req.
Cross Member Assembly	New	New	New as req.
<u>Rear Underframe</u>			
Bulkhead Assemblies	New	New	New as req.
Angles	New	New	New as req.
Reinforcement Beam Assembly	New	New	New as req.
Beams	New	New as req.	New as req.
Support Assemblies	New	New	New as req.
Closure Panel	New	New as req.	New as req.
Longitudinal Plate	New	New	New as req.
Brackets	New as req.	New as req.	New as req.
Floor Reinforcement Bracket	New as req.	New as req.	New as req.
Engine Mounting Brackets	New as req.	New as req.	New as req.
Spacers Rear Cross Seat	New as req.	New as req.	New as req.
Complete Engine Bulkhead	New	New	New as req.
<u>Floor</u>			
CEM Equivalent 3/4" Thick 5 Ply Laminated Grads AC Plywood (Chemically Treated) From the Rear Axle Front Bulkhead to the Engine	New	New	New as req.

Component Areas	Level of Rehabilitation Desired		
	1	2	3
<u>Floor (Con't.)</u>			
Bulkhead and From the Front Bulkhead Forward to the Drivers Platform			
<u>Body</u>			
Bumpers (Front and Rear)	New	New	New as req.
Front End Lower Panels	New	New	New as req.
Front Grills	New	New	New as req.
Skirt Panels	New	New	New as req.
Windshield Panel Assembly	New as req.	New as req.	New as req.
Stepwells and Wheel Housings	New	New	New as req.
Rear End Closure Door	New	New	New as req.
Transmission Door (Reinforced)	New	New	New as req.
Radiator Door (With Screen)	New	New	New as req.
Service Access Doors	New	New	New as req.
Rubber Fenders	New	New	New as req.
Moldings	New	New	New as req.
Roof Rain Channels	New	New	New as req.
Window Body Panels and Window Frames	Repair as req.	Repair as req.	Repair as req.
Rear Window Channels	New	New	New as req.
Entrance and Exit Door Eng.	Reman.	Reman.	Reman. as req.
Entrance and Exit Doors Seals and Glass	Replace as req.	Replace as req.	Replace as req.
Emergency Door (if equip) Seals and Glass	Replace as req.	Replace as req.	Replace as req.
Windshield Wiper and Washer System	New or Reman.	New or Reman.	New or Reman. as req.
Interior Trim Panels	New as req.	New as req.	New as req.
Melamine Heading Panels	New as req.	New as req.	New as req.
Front Heater Compartment Panel and Molding	New	New	New
Modesty Panels	New as req.	New as req.	New as req.
Interior and Exterior Mirrors	New as req.	New as req.	New as req.
Bell Cord and Eyes	New as req.	New as req.	New as req.
Rubber Floor Covering and Platform Plate	New	New	New as req.
Stepwell Tread Nosing	New	New	New as req.
Ribbed Rubber Stepwell Treads	New	New	New as req.
Accelerator and Brakes Tread and Clip	New	New	New as req.

Component Areas	Level of Rehabilitation Desired		
	1	2	3
<u>Body (Con't.)</u>			
Seat Tracks and Inserts	New	New	New as req.
Seats (Including Drivers)	Recover	Recover	Recover as req.
Seat Frames	Recondition as req.	Recondition as req.	Recondition as req.
Channel and Filler for Windshield, Rear Windows, Transen Windows, and Destination Sign	New	New	New as req.
Side Window Seals and Channels	New	New	New as req.
Side Window Frames	New	New	New as req.
Glass	Replace as req.	Replace as req.	Replace as req.
Battery Tray	New	New	New as req.
<u>Front Axle</u>			
Steering Knuckle Kingpins	New	New	New as req.
Bushings	New	New	New as req.
Bearings--Kingpin	New	New	New as req.
Tie Rod Assemblies	New	New	New as req.
Front Axle Bumpers	New	New	New as req.
<u>Rear Axle</u>			
Gaskets and Seal Kit, Complete	New	New	New as req.
Rear Axle Bumpers	New	New	New as req.
Rear Axle Housing	New as req.	New as req.	New as req.
Differential and Carrier Assembly	Reman. as req.	Reman. as req.	Reman. as req.
<u>Wheels, Bearings</u>			
Wheels	New as eq.	New as req.	New as req.
Wheel Studs	Replace, stripped or broken	Replace, stripped or broken	Replace, stripped or broken
Cups and Cones	New	New	New as req.
Wipers, Seals, and Gaskets	New	New	New as req.

Component Areas	Level of Rehabilitation Desired		
	1	2	3
<u>Brakes</u>			
Brake Drum	Return to std.	Return to std.	Return to std.
Linings	Return to std.	Return to std.	Return to std.
Shoes	Return to std.	return to std.	Return to std.
Cam Shafts	New	New	New as req.
Slack Adjusters	New	New	New as req.
Anchor Pine	New	New	New as req.
Bushings	New	New	New as req.
Seals	New	New	New as req.
Brake Shoe Return Springs	New	New	New as req.
Brake Chamber Assemblies	New	New	New as req.
Parking Brake	Return to std.	Return to std.	Return to std.
Air Compressor and Governor	Reman.	Reman.	Reman. as req.
Air Lins Flex	New	New	New as req.
Air Filters and Strainers	New	New	New as req.
<u>Suspension (Front and Rear)</u>			
Radius Rod Bushings	New	New	New as req.
Lateral Rod Bushings	New	New	New as req.
Rear Upper Radius Rod Brackets	New	New	New as req.
Leveling Valves and Linkage	New	New	New as req.
Bellows and Piston Assembly	New	New	New as req.
Shock Absorber Assemblies	New	New	New as req.
<u>Steering System</u>			
Steering Gear	Reman.	Reman.	Reman. as req.
Power Steering Pump (If apply)	Reman.	Reman.	Reman. as req.
Booster Cylinder (If apply)	Reman.	Reman.	Reman. as req.
Hoses (Power Steering)	New	New	New as req.
Fittings	New	New	New as req.
Steering U-Joint Assembly	New	New	New as req.
Drag Link End Assemblies	New	New	New as req.
Drag Link Tube Assembly	New	New	New as req.
<u>Fuel System</u>			
Filters and Strainers	New	New	New
Fuel Tank	Clean--Repair as req.	Clean--Repair as req.	Clean--Repair as req.

Component Areas	Level of Rehabilitation Desired		
	1	2	3
<u>Exhaust System</u>			
Muffler	New	New	New as req.
Tailpipe	New	New	New as req.
Exhaust Pipe	New	New	New as req.
Gaskets	New	New	New as req.
Clamps	New	New	New as req.
<u>Electrical System</u>			
Lamp Assemblies	New as req.	New as req.	New as req.
Lenses	New as req.	New as req.	New as req.
Sealed Beamed Assemblies	New as req.	New as req.	New as req.
Relays	New as req.	New as req.	New as req.
Circuit Breakers	New as req.	New as req.	New as req.
Switches	New as req.	New as req.	New as req.
Amphenol Connectors	New as req.	New as req.	New as req.
Cables (Wiring)	New as req.	New as req.	New as req.
Gauges	New as req.	New as req.	New as req.
Solenoids	New as req.	New as req.	New as req.
Bulbs	New	New	New
Circuits and Components	Compliance to CEM specs.	Compliance to CEM Specs.	Compliance to CEM Specs
Starter	Reman.	Reman.	Reman. as req.
Alternator/Generator	Reman.	Reman.	Reman. as req.
Voltage Regulator	Reman.	Reman.	Reman. as req.
Batteries (CEM Specs.)	New as req.	New as req.	New as req.
<u>Heating System</u>			
Heater Core	Reconditioned	Reconditioned	Reconditioned as req.
Defroster Core	Reconditioned	Reconditioned	Reconditioned as req.
Valves	Reconditioned	Reconditioned	Reconditions as req.
Filters	New	New	New as req.
Seals	New	New	New as req.
Defroster Motor	Reman.	Reman.	Reman. as req.
Heater Motor	Reman.	Reman.	Reman. as req.
Blower Motor Assembly	Reman.	Reman.	Reman. as req.

Component Areas	Level of Rehabilitation Desired		
	1	2	3
<u>Air Conditioning</u>			
Compressor	New or reman.	New or reman.	Reman. as req.
Clutch	New	New	New as req.
Drive Shaft	New	New	New as req.
Brackets	New	New	New as req.
Filters	New	New	New as req.
Hoses and Fittings	New	New	New as req.
Expansion Valve	New	New	New as req.
Seals	New	New	New as req.
Alternator Assembly	Reman. or new	Reman. or new	Reman. or new as req.
Condensator--Fan Drive Motor	Reman. or new	Reman. or new	Reman. or new as req.
Evaporator Coil	New	Reconditioned	Reconditioned as req.
Condensator Coil	New	Reconditioned	Reconditioned as req.
<u>Interior and Exterior Paint</u>	To Customer Specs.	To Customer Specs.	To Customer Specs.

Source: ATE Management and Service Company, Inc., 1980.



APPENDIX D

LCC MODEL VARIATIONS



LCC MODEL VARIATIONS

Section 3.4 of this report presented a basic LCC model for comparison of new buses versus rehabilitated buses. This appendix presents three variations on the basic model. They are:

- (1) Compute annualized cost per bus-mile
- (2) Compute annualized cost per seat-mile
- (3) Incorporate discount and inflation factors.

In addition, a program of the LCC model for the TI-59 calculator is included.

Annualized Cost Per Bus-Mile

The annualized cost per bus-mile (ACBM) can be used to compare alternatives for which the number of buses and the miles per year per bus are different. The LCC for an alternative is computed as described in Section 2.4.3. Then

$$\text{ACBM} = \frac{\text{LCC}}{(\text{YRS} \cdot \text{NBUS} \cdot \text{MILES})}$$

where

YRS = bus life
 NBUS = number of buses
 MILES = miles per year per bus.

Annualized Cost Per Seat-Mile

If a system uses seat-miles rather than bus-miles to describe the level of service, then the annualized cost per seat-mile (ACSM) can be used to compare alternatives for which the number of miles per year per bus are different. The LCC for an alternative is computed as described in Section 2.4.3. Then

$$\text{ACSM} = \frac{\text{LCC}}{(\text{YRS} \cdot \text{SEATS} \cdot \text{MILES})}$$

where

YRS = bus life
 SEATS = number of seats for all buses
 NILES = miles per year per bus.

Discount and Inflation Factors

Discount and inflation factors can be incorporated into the LCC model by modifying the computation of LCC from Section 2.4.3. The formulas for computation of the annualized cost measures are unchanged.

Let year zero denote the year in which the capital costs are incurred. Let:

- I(J) = interest rate for year J, expressed as a decimal
 D(J) = discount rate for year J, expressed as a decimal
 AT(J) = annual O&M costs per year J expressed in year J
 (i.e., "then year") dollars
 AC(J) = annual O&M costs for year J expressed in year zero
 (i.e., constant) dollars.

The AT(J) values can be computed from AT(0) as follows:

$$AT(J) = AT(0) \cdot (1+I(1))(1+I(2)) \dots (1+I(J)).$$

The constant dollar (i.e., present value) expression for annual costs in year J is then:

$$AC(J) = \frac{AT(J)}{(1+D(1))(1+D(2)) \dots (1+D(J))}$$

Equivalently,

$$AC(J) = AT(0) \cdot \frac{1+I(1)}{1+D(1)} \frac{1+I(2)}{1+D(2)} \dots \frac{1+I(J)}{1+D(J)} .$$

If the inflation and discount rates do not vary from year to year, then the above equations can be simplified:

$$AT(J) = AT(0) (1+I)^J$$

$$AC(J) = \frac{AT(J)}{(1+D)^J} = AT(0) \left(\frac{1+I}{1+D} \right)^J .$$

The LCC of the alternative is then computed by summing the capital cost and all of the annual costs and subtracting discounted salvage value:

$$LCC = CAP + AC(1) + AC(2) + \dots + AC(YRS) - S/(1+D)^{YRS} .$$

TI-59 Calculator Program for LCC Model

The following program, BUSLCC, was written to perform the life cycle cost (LCC) computations in the LCC model from Chapter 2. The program is for use on the TI-59 programmable calculator. BUSLCC should be exercised for each alternative being considered.

If the number of buses, and hence the number of bus operators, for each alternative is identical, then the cost of the bus operators can be omitted. This can be accomplished by entering zero for NOPS and zero for WAGE.

Partitioning (Op 17) [2,3,9,2,9] Library Module --- Printer OPT. Cards Available
[719.29 - 239.89] for TI59

PROGRAM DESCRIPTION

This program performs three functions: (1) stores the necessary input parameters (listed below), (2) calculates the total life cycle cost for a system of like buses, and (3) computes the annual cost per bus.

USER INSTRUCTIONS

STEP	PROCEDURE	ENTER	PRESS		DISPLAY*
1.	Enter the number of buses	NBUS	A		NBUS
2.	Enter capital cost per bus (\$)	CBUS	R/S		CBUS
3.	Enter service life (yrs)	YRS	R/S		YRS
4.	Enter no. of miles operated/year	MPY	R/S		MPY
5.	Enter no. of operators per bus	NOPS	R/S		NOPS
6.	Enter annual wages & benefits per operator	WAGE	R/S		WAGE
7.	Enter fraction of total maintenance costs accounted for below	FMC	B		FMC
8.	For engine, enter MBMA	MBMA.1	R/S		MBMA.1
9.	For engine, enter CPMA	CPMA.1	R/S		CPMA.1
10.	For transmission, enter MBMA	MBMA.2	R/S		MBMA.2
11.	For transmission, enter CPMA	CPMA.2	R/S		CPMA.2
12.	For brakes, enter MBMA	MBMA.3	R/S		MBMA.3
13.	For brakes, enter CPMA	CPMA.3	R/S		CPMA.3
14.	For tires, enter MBMA	MBMA.4	R/S		MBMA.4
15.	For tires, enter CPMA	CPMA.4	R/S		CPMA.4
16.	For air conditioning, enter MBMA	MBMA.5	R/S		MBMA.5
17.	For air conditioning, enter CPMA	CPMA.5	R/S		CPMA.5
18.	Enter fuel consumption (mpg)	MPG	C		MPG
19.	Enter oil requirements (mi/qt)	MPQ	R/S		MPQ
20.	Enter fuel cost (\$/gal)	CFUEL	R/S		CFUEL
21.	Enter oil cost (\$/qt)	COIL	R/S		COIL
22.	Calculate total life cycle cost	--	D		LCC
23.	Calculate annual cost/bus	--	E		ACB

* The display is in engineering notation, fixed to two decimal places.

Partitioning (Op 17) [2, 3, 9, 2, 9] Library Module --- Printer OPT. Cards Available
[719.29 - 239.89] for TI59

MBMA - Miles between maintenance action

CPMA - Cost per maintenance action

M.A. - Maintenance actions

M.C. - Maintenance cost

The input sequences are modular. To correct an entry, begin reentering from the last step requiring a "user defined key". The input sequence may be abandoned once correction has been made. Also, once all variables have been initialized, subsequent analysis can be performed using the correction procedure (i.e., the entire input sequence need not be repeated).

USER DEFINED KEYS	DATA REGISTERS (INV 48)		
A First input seq.	00 No. of buses	10 Trans. CPMA	20 Oil cost (\$/qt)
B Second input seq.	01 Cost per bus	11 Brakes MBMA	21 Capital cost
C Third input seq.	02 Service life	12 Brakes CPMA	22 Annual operator cost
D Calculate tot. LCC	03 Milage per year	13 Tires MBMA	23 Annual fuel & oil cost
E Calculate ACB	04 No. operators/bus	14 Tires CPMA	24 Sum of major M.C.
A'	05 Annual pay/oper.	15 A/C MBMA	25 Annual maintenance cost
B'	06 Fraction M.A.	16 A/C CPMA	26 Life cycle cost (total)
C'	07 Engine MBMA	17 Fuel (mpg)	27 Annual cost per bus
D'	08 Engine CPMA	18 Oil (mpq)	8
E'	09 Trans. MBMA	19 Fuel cost (\$/gal)	9

Method:

$$\text{Capital cost: } CAP = CBUS \times NBUS$$

$$\text{Annual operator costs: } AOP = NOPS \times NBUS \times WAGE$$

$$\text{Annual fuel \& oil costs: } AFO = MPY \times NBUS \times \left(\frac{CFUEL}{MPG} + \frac{COIL}{MPQ} \right)$$

$$\text{Sum of major maintenance costs: } SMC = MPY \times NBUS \times \left(\sum_{n=1}^5 \frac{CPMA.(N)}{MBMA.(N)} \right)$$

$$\text{Annual maintenance cost: } AMC = \frac{SMC}{FMC}$$

$$\text{Life cycle cost: } LCC = CAP + YRS(AOP + AFO + AMC)$$

$$\text{Annual cost per bus: } ACB = \frac{LCC}{NBUS \times YRS}$$

LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS
000	76	LBL	Set display	055	42	STD	End of 2nd	110	43	RCL	
001	11	A	& begin 1st	056	16	16	input	111	00	00	NBUS
002	57	ENG	input	057	91	R/S	sequence.	112	65	x	x
003	58	FIX	sequence	058	76	LBL	Begin 3rd	113	43	RCL	MPY
004	02	02		059	13	C	input	114	03	03	
005	42	STD		060	42	STD	sequence	115	54)	=
006	00	00		061	17	17		116	42	STD	AFO
007	91	R/S		062	91	R/S		117	23	23	
008	42	STD		063	42	STD		118	53	(
009	01	01		064	18	18		119	53	(
010	91	R/S		065	91	R/S		120	53	((
011	42	STD		066	42	STD		121	43	RCL	
012	02	02		067	19	19		122	16	16	A/C CPMA
013	91	R/S		068	91	R/S		123	55	+	÷
014	42	STD		069	42	STD	End of 3rd	124	43	RCL	A/C MBMA
015	03	03		070	20	20	input	125	15	15	
016	91	R/S		071	91	R/S	sequence.	126	85	+	+
017	42	STD		072	76	LBL	Begin LCC	127	43	RCL	
018	04	04		073	14	D	calculation	128	14	14	Tire CPMA
019	91	R/S		074	53	(		129	55	+	÷
020	42	STD	End of 1st	075	43	RCL		130	43	RCL	Tire MBMA
021	05	05	input	076	01	01	CBUS	131	13	13	
022	91	R/S	sequence.	077	65	x	x	132	85	+	+
023	76	LBL	Begin 2nd	078	43	RCL	NBUS	133	43	RCL	Brake CPMA
024	12	B	input	079	00	00		134	12	12	
025	42	STD	sequence	080	54	)	=	135	55	+	÷
026	06	06		081	42	STD	CAP	136	43	RCL	Brake MBMA
027	91	R/S		082	21	21		137	11	11	
028	42	STD		083	53	(		138	85	+	+
029	07	07		084	43	RCL		139	43	RCL	Trans. CPMA
030	91	R/S		085	00	00	NBUS	140	10	10	
031	42	STD		086	65	x	x	141	55	+	÷
032	08	08		087	43	RCL	NOPS	142	43	RCL	Trans. MBMA
033	91	R/S		088	04	04		143	09	09	
034	42	STD		089	65	x	x	144	85	+	+
035	09	09		090	43	RCL	WAGE	145	43	RCL	Engine CPMA
036	91	R/S		091	05	05		146	08	08	
037	42	STD		092	54	)	=	147	55	+	÷
038	10	10		093	42	STD	AOP	148	43	RCL	Engine MBMA
039	91	R/S		094	22	22		149	07	07	
040	42	STD		095	53	(		150	54))
041	11	11		096	53	(		151	65	x	x
042	91	R/S		097	43	RCL		152	43	RCL	
043	42	STD		098	19	19	CFUEL	153	00	00	NBUS
044	12	12		099	55	+	÷	154	65	x	x
045	91	R/S		100	43	RCL	MPG	155	43	RCL	MPY
046	42	STD		101	17	17		156	03	03	
047	13	13		102	85	+	+	157	54)	=
048	91	R/S		103	43	RCL		158	42	STD	SMC
049	42	STD		104	20	20	COIL	159	24	24	
050	14	14		105	55	+	÷	160	55	+	÷
051	91	R/S		106	43	RCL	MPQ	161	43	RCL	
052	42	STD		107	18	18		162	06	06	FMC
053	15	15		108	54	)		163	54)	=
054	91	R/S		109	65	x	x	164	42	STD	AMC

LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS	LOC	CODE	KEY	COMMENTS
165	25	25									
166	53	(
167	53	(
168	43	RCL									
169	22	22	(AOP								
170	85	+	+								
171	43	RCL									
172	23	23	AFO								
173	85	+	+								
174	43	RCL									
175	25	25	AMC)								
176	54)									
177	65	x	x								
178	43	RCL	YRS								
179	02	02									
180	85	+	+								
181	43	RCL	CAP								
182	21	21									
183	54)	=								
184	42	STD	LCC								
185	26	26									
186	92	RTN									
187	76	LBL	Begin ACB								
188	15	E	calculation								
189	53	(
190	43	RCL									
191	26	26	(LCC								
192	55	+	÷								
193	43	RCL	NBUS)								
194	00	00									
195	55	-	÷								
196	43	RCL	YRS								
197	02	02									
198	54)	=								
199	42	STD	ACB								
200	27	27									
201	92	RTN									

MERGED CODES

62			72	STO		83	GTO	
63			73	RCL		84		
64			74	SUM		92	INV	SBR

TEXAS INSTRUMENTS
INCORPORATED

TEST CASE FOR BUSLCC MODEL.

This test case is for the BUSLCC model of bus life cycle costs for the TI-59 calculator. After the program has been entered into the calculator, this test case should be run to verify correct program execution and to ensure understanding of the mechanics. For each line in succession in the table below, enter the number shown and press the indicated key. After pressing each of keys D and E, compare your results with the numbers indicated below.

Enter *	Press	Variable
20.00 00	A	NBUS - No. of buses
180.00 03	R/S	CBUS - Cost per bus
10.00 00	R/S	YRS - Service life (years)
40.00 03	R/S	MPY - Miles operated per year
1.80 00	R/S	NOPS - No. of operators per bus
20.00 03	R/S	WAGE - pay and allowances per operator
830.00-03	B	FMC - Fraction of maintenance cost
3.00 03	R/S	MBMA(1) Engine
250.00 00	R/S	CPMA(1)
5.00 03	R/S	MBMA(2) Transmission
200.00 00	R/S	CPMA(2)
10.00 03	R/S	MBMA(3) Brakes
90.00 00	R/S	CPMA(3)
25.00 03	R/S	MBMA(4) Tires
1.40 03	R/S	CPMA(4)
2.50 03	R/S	MBMA(5) Air conditioning
50.00 00	R/S	CPMA(5)
3.00 00	C	MPG - Fuel consumption (mpg)
500.00 00	R/S	MPQ - Oil requirements (mi/qt)
1.00 00	R/S	CFUEL - Fuel cost (\$/gal)
900.00-03	R/S	COIL - Oil cost (\$/qt)
15.49 06	D	LCC - Life cycle cost of system
77.45 03	E	ACB - Annual cost per bus

* Entries need not be made in engineering notation; the printer converted the test case entries automatically.





APPENDIX E

SAMPLE COST ANALYSIS FOR IN-HOUSE REHABILITATION

In order to provide a comparison to contract rehabilitation, the in-house program has been costed on a per bus basis with a factor included to amortize start-up costs across 498 buses, which represents the rehabilitation program outlined. Each of the elements included in the cost computation is discussed below.

Start-up costs - It is estimated that six months of lead time will be required to design and establish the program. Activities such as recruiting, hiring, and training a labor force, ordering equipment and parts, and developing detailed work procedures, will be undertaken during this period. These activities will occupy the supervisory/management personnel identified for the program. It is also anticipated that the on-coach labor force will not achieve the level of proficiency desired (1140 labor hours/bus) until the third group of five buses is cycled through the program. Therefore, in addition to the overhead hours there will be start-up labor costs incurred. The assumption is made that only ten buses will be rehabilitated one year after the decision to undertake the program is made if one shift is utilized and 20 if two. It is further assumed that personnel devoted to component rebuild will not have to be added to the workforce until work on the third group of five buses is started.

Therefore, the start-up cost is derived by computing the total supervisory and labor cost for the first year of operation, and then subtracting the estimated standard cost for rehabilitating the 10 or 20 coaches. The difference between the total cost and the standard cost for the first year is then divided by the total number of buses to be

rehabilitated, to derive the start-up cost per rehabilitated bus. The calculations follow:

One Shift - 41 Buses/Year

Total First Year Personnel Costs

4 supervisory personnel @ \$32,000/year each	\$ 128,000	
25 direct labor personnel for 7 months @ \$16.53/hour	<u>501,700</u>	
		\$629,700

Standard Personnel Cost to Rehabilitate Ten Buses At Production
Rate of 41 Per Year

4 supervisors @ \$32,000 each, divided by 41 buses annual production, times 10 buses first years production.	\$ 31,220	
---	-----------	--

Standard labor hours of 1140 hours per bus X \$16.53 per hour X 10 buses (1st year's production).	188,442	
--	---------	--

Total Standard Cost		\$219,662
---------------------	--	-----------

Non-Allocated Personnel Cost For First Year

Total 1st year personnel cost	\$ 629,700	
Less standard cost to rehab ten buses:	<u>219,662</u>	

Non-Allocated Cost		\$410,338
--------------------	--	-----------

Start-Up Cost Per Bus

Non-Allocated cost divided by total number of buses in rehab project (249) equals start-up cost per bus (\$410,338 divided by 249 buses)	\$ 1,648	per bus
--	----------	---------

Direct labor is estimated at 1500 hours per bus. Labor cost has been estimates at \$16.53 per hour.

1500 hours @ \$16.53 = \$24,795 per bus

- Supervision - estimated at four personnel at an average annual salary of \$32,000 including fringes.

$\$32,000 \times 4$ divided by 41 buses/year = \$3,122 per bus

- Equipment - The equipment cost has been allocated to the 249 buses, to produce an equipment cost allocation of \$249 per bus.

$\$62,085$ divided by 249 buses = \$249 per bus

- Material Cost - \$23,726 in material cost is identified for the in-house program.
- Overhead - Personnel support, inventory carrying costs and indirect materials are estimated at 5 percent of direct labor plus parts.

$\$24,795 + \$23,726 = \$48,521 \times .05 + \$2,426$ per bus

- Facility - Establishing an in-house rehabilitation program will not affect building size or layout, and therefore, no facility cost has been included.

- Warranty - An in-house rehabilitation program places the burden of warranty work on the agency, and 10 percent of labor, material and overhead has been included as an estimate of the cost of direct repair.

$$24,795 + 23,726 + 2,426 = 50,947 \times .10 = \$5,095 \text{ per bus}$$

- Total Cost

Start-up	\$ 1,648
Labor	24,795
Supervision	3,122
Equipment	249
Material	23,726
Overhead	2,426
Warranty	<u>5,095</u>
TOTAL	\$61,061

MATERIAL COST

		<u>IN-HOUSE</u>
VI. <u>ELECTRICAL</u> (Continued)		
Horns	New as required	10
Solenoids	New as required	45
Bulbs New	20	
Circuits and Components	Compliance to OEM Specs.150	
Voltage Regulator	Remanufactured	41
Batteries (OEM Specs.)	New as required	176
Battery Cables & Ground Straps	New as required	<u>18</u>
		\$2,145
VII. <u>HEATING SYSTEM</u>		
Heater Core	Reconditioned	40
Defroster Core	Reconditioned	11
Valves	Reconditioned	25
Filters	New	10
Shutter & Control System	Remanufactured	35
Seals New	15	
Defroster Motor	Remanufactured	27
Circulating Pump	Remanufactured	22
Blower Motor Assembly	Remanufactured	163
Gradustat	New as required	<u>75</u>
		\$ 970

EQUIPMENT COST

<u>Quantity</u>	<u>Nomenclature</u>	<u>Unit Price</u>	<u>Total Price</u>
<u>Upholsterv Shop</u>			
Asst.	Pneumatic Tools & Storage Bins		<u>400</u>
TOTAL			\$ 400
<u>Metal and Wood Shop</u>			
Asst.	Hand Tools, Work Bench, and Storage Bins/Lockers		<u>1,000</u>
TOTAL			\$ 1,000
<u>Main Repair Work</u>			
2	Remote Control Jacks with Adaptors (Porta Power)	2,000	4,000
16	Jack Stands	60	960
3	Acetylene Torches	500	1,500
1	Electric Welder	3,400	3,400
1 Set	Frame Jigs	500	500
6	Work Benches with Vises	250	250
Asst.	Pneumatic Tools, Electrical Tools, Hand Body Tools		<u>5,000</u>
TOTAL			\$16,860
<u>Welding Shop</u>			
1	Electric Welder	3,400	3,400
1	Acetylene Torch	500	500
Asst.	Safety Equipment, Storage Lockers/Bins and Vises and Clamps		<u>1,500</u>
TOTAL			\$ 5,400
<u>Recruiting and Storage</u>			
1	Tow tractor		12,000
2	Hand Pallet Truck	350	<u>700</u>
TOTAL			\$17,700
TOTAL COST OF EQUIPMENT AND TOOLS			\$62,085





APPENDIX F

UMTA THIRD PARTY CONTRACTING GUIDELINES

U.S. Department of Transportation
Urban Mass Transportation Administration
Washington, D.C. 20590

CIRCULAR

UMTA C 4220.1A

June 8, 1982

SUBJECT: THIRD PARTY CONTRACTING GUIDELINES

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1. PURPOSE. This circular implements Office of Management and Budget (OMB) Circular A-102, Attachment O, Uniform Standards Governing State and Local Grantee Procurements; DOT Order 4600.9B, Change 1, Uniform Administrative Requirements for Grants-in-Aid to State and Local Governments; and UMTA requirements for third party contracts. This circular supersedes all previous UMTA regulations, orders, correspondence, etc., relative to third party contracts under UMTA grants.
 2. CANCELLATION.
 - a. Chapter III C of the UMTA External Operating Manual, dated March 11, 1974, is superseded by this circular.
 - b. UMTA C 4220.1, "Third Party Contracting Guidelines," dated April 15, 1982, is superseded by this circular.
 3. REFERENCES.
 - a. Office of Management and Budget (OMB) Circular A-102, "Uniform Requirements for Assistance to State and Local Governments," dated January 1981, Attachment O, "Procurement Standards."
 - b. DOT Order 4600.9B, "Uniform Administrative Requirements for Grants-in-Aid to State and Local Governments," dated February 22, 1980, Change 1, "Procurement Standards."
 4. APPLICABILITY. This attachment establishes standards and guidelines for the procurement of supplies, equipment, construction, and services for all UMTA assistance programs. These standards are furnished to ensure that such materials and services are obtained efficiently and economically and in compliance with the provisions of applicable Federal law and Executive orders.
 5. GRANTEE/GRANTOR RESPONSIBILITY.
 - a. These standards do not relieve the grantee of any contractual responsibilities under its contracts. The grantee is responsible, in accordance with good administrative practice and sound business judgment, for the settlement of all contractual and administrative issues arising out of procurements entered into in support of a grant. Although the grantee is primarily responsible for settling contract defaults, disputes, or breaches, this does not in any way affect UMTA's

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OPI: Office of Procurement and
Third Party Contract Review

monetary interest in such settlements, as set forth in the grant agreement. These include but are not limited to: source evaluation, protests, disputes, and claims. UMTA will not substitute its judgment for that of the grantee unless the matter is primarily a Federal concern. Violations of law are to be referred to the local, State, or Federal authority having proper jurisdiction.

- b. Grantees shall use their own procurement procedures which reflect applicable State and local laws and regulations, provided that procurements for Federal Assistance Programs conform to the standards set forth in this circular and applicable Federal law.

6. GRANTEE PROCUREMENT IMPROVEMENT. UMTA will provide grantees with technical assistance, training, publications, and other aid to assist them in improving their procurement capabilities. For guidance and assistance in meeting Federal requirements for third party contracts under UMTA grants, contact the appropriate UMTA Regional Office or the UMTA Headquarters Office of Third Party Contract Review, UAD-43.

7. PROCUREMENT SYSTEM REVIEWS.

- a. In accordance with paragraph 4 of Attachment O to OMB Circular A-102, UMTA may review a grantee's procurement system and procedures for the purpose of determining whether:

- (1) The grantee's procurement system and procedures meet the minimum standards set forth in this circular. If the grantee meets those standards, UMTA will certify the grantee, permitting it to award all contracts without preaward review by UMTA. If the grantee's procurement procedures fail to comply with one or more significant aspects of this circular, the grantee will be notified, in writing, and the review may provide a basis for determining whether the grantee's contracts and related procurement documents should be subject to UMTA's prior approval.

- (2) The certified grantee is complying with its approved procedures. If the grantee is in compliance, the certification shall continue. If not in compliance, the certification may be suspended or withdrawn. The grantee will be notified, in writing, of the deficiencies and informed of the necessary action to correct them. After correction, the grantee may apply for reinstatement of its certification. UMTA will then conduct a review of the grantee's procurement system to determine if the grantee should be recertified.

- b. UMTA reviews will generally be conducted in accordance with the procedures set forth in Attachment A to this circular, which attachment is incorporated herein by reference. Reviews by UMTA may consist of both desk and on-site reviews. Desk reviews may involve the submission of written information to UMTA. On-site reviews are conducted by personnel recognized by UMTA as qualified to make procurement system reviews. Reviews may be made in-depth or limited as deemed appropriate by UMTA.

8. PROTEST PROCEDURES. In accordance with OMB Circular A-102, Attachment O, UMTA has developed an administrative procedure to handle complaints or protests regarding grantee/contractor procurement actions. The procedure is set forth in Attachment B to this circular, which is incorporated herein by reference.
9. REVIEW OF PROPOSED CONTRACTS BY UMTA.
 - a. If a grantee's procurement system is certified by UMTA in accordance with paragraph 7 and Attachment A of this circular, the grantee may award all contracts without systematic preaward review by UMTA. Compliance reviews may be conducted periodically to determine whether the certification should remain in effect. Such compliance reviews should not normally be conducted more often than every two years.
 - b. Because of the large number of grantees and the infeasibility of detailed desk audits, it will be the policy of UMTA, barring information to the contrary, to assume that all grantees are complying with this circular upon their written assurance to this effect. As time permits, UMTA anticipates making compliance reviews even though there has been no information to indicate a grantee's non-compliance. Should any subsequent actions bring such assurance into question, UMTA will take further action to verify or deny that assurance. The letter of assurance should be signed by the senior official(s) in the grantee organization and sent to the appropriate UMTA Regional Offices. A sample letter of assurance is set forth as Attachment C to this circular, and is incorporated herein by reference.

Upon receipt of the letter of assurance (and until UMTA conducts a review of the grantee's procurement system pursuant to paragraph 7 and Attachment A of this circular), UMTA will limit submission of contracts for review to contracts under other than operating assistance grants which are:

- (1) single bid or offer, sole source, or brand name over \$10,000; or
- (2) proposed to be awarded to other than the apparent low bidder under a formally advertised procurement.

In the event a grantee does not provide assurance to UMTA that its procedures are in accordance with this circular, or when UMTA has other evidence which shows that the grantee's procedures and/or operations are not in compliance with the circular, then all contracts under other than operating assistance grants are subject to preaward review and approval by UMTA.

- c. All submissions of proposed contracts for UMTA preaward review shall contain the following:

6/8/82

- (1) A complete copy of the proposed contract. (To include a copy of bid/proposal of the awardee and in the case of an IFB, the bids of all those whose prices are lower than the awardee's.)
 - (2) A copy of the solicitation document.
 - (3) An explanation of the basis for selection of the contractor including the evaluation criteria, the technical evaluation, and when appropriate, the negotiation memorandum.
 - (4) A statement by the grantee that the price is fair and reasonable and the basis for that determination.
 - (5) The cost or price analysis used by the grantee as a basis for determining that the negotiated price is fair and reasonable.
 - (6) Under awards resulting from IFB's, a list of all bids received.
10. CODE OF CONDUCT. Grantees shall maintain a written code or standards of conduct which shall govern the performance of their officers, employees or agents engaged in the award and administration of contracts supported by Federal funds. No employee, officer or agent of the grantee shall participate in selection, or in the award or administration of a contract supported by Federal funds if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when:
- a. The employee, officer or agent;
 - b. Any member of his immediate family;
 - c. His or her partner; or
 - d. An organization which employs, or is about to employ, any of the above, has a financial or other interest in the firm selected for award.

The grantee's officers, employees or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from contractors, potential contractors, or parties to subagreements.

Grantees may set minimum rules where the financial interest is not substantial or the gift is an unsolicited item of nominal intrinsic value.

To the extent permitted by State or local law or regulations, such standards of conduct shall provide for penalties, sanctions, or other disciplinary actions for violations of such standards by the grantee's officers, employees, or agents, or by contractors or their agents.

11. PROCUREMENT PROCEDURES. The grantee shall establish procurement procedures which provide that proposed procurement actions shall be reviewed by grantee officials to avoid the purchase of unnecessary or duplicative items. Consideration should be given to consolidation or breaking out to obtain a more economical purchase. Where appropriate, an analysis shall be made of lease versus purchase alternatives, and any other appropriate analysis to determine which approach would be the most economical. To foster greater economy and efficiency, grantees are encouraged to enter into State and local intergovernmental agreements for procurement or use of common goods and services.

12. CONTRACTING WITH SMALL AND MINORITY FIRMS, WOMEN'S BUSINESS ENTERPRISE AND LABOR SURPLUS AREA FIRMS.
 - a. It is national policy to award a fair share of contracts to small and minority business firms. Accordingly, affirmative steps must be taken to assure that small and minority businesses are utilized when possible as sources of supplies, equipment, construction and services. Affirmative steps shall include the following:
 - (1) Including qualified small and minority businesses on solicitation lists.
 - (2) Assuring that small and minority businesses are solicited whenever they are potential sources.
 - (3) When economically feasible, dividing total requirements into smaller tasks or quantities so as to permit maximum small and minority business participation.
 - (4) Where the requirement permits, establishing delivery schedules which will encourage participation by small and minority business.
 - (5) Using the services and assistance of the Small Business Administration, the Office of Minority Business Enterprise of the Department of Commerce, or other appropriate agency, as required.
 - (6) If any subcontracts are to be let, requiring the prime contractor to take the affirmative steps in 1 through 5 above.
 - b. Grantees shall take similar appropriate affirmative action in support of women's business enterprises.
 - c. Grantees are encouraged to procure goods and services from labor surplus areas.
 - d. In addition to the above, grantees are required to follow Department of Transportation regulations set forth at 49 C.F.R. Part 23.

6/8/82

13. BUY AMERICA. Grantees shall comply with applicable Buy America requirements set forth in Section 401 of the Surface Transportation Assistance Act of 1978 (Public Law 95-599) and UMTA's Buy America regulations at 49 C.F.R. Part 660.
14. ADDITIONAL ROLLING STOCK REQUIREMENTS. Grantees shall comply with applicable requirements to consider or evaluate performance, standardization, life-cycle costs and other relevant factors in the procurement of rolling stock, including buses, as set forth in the DOT and Related Agencies Appropriations Act for Fiscal Year 1981 (Public Law 96-400) and DOT and Related Agencies Appropriations Act for Fiscal Year 1982 (Public Law 97-102) and guidelines at 47 Federal Register 7361-7364, February 18, 1982, and 47 Federal Register 9322, March 4, 1982.
15. CARGO PREFERENCE. Grantees are required to comply with the cargo preference requirements set forth in 46 U.S.C. 1241 and Maritime Administration regulations set forth in 46 C.F.R. Part 381.
16. SELECTION PROCEDURES.
 - a. All procurement transactions, regardless of whether by sealed bids or by negotiation and without regard to dollar value, shall be conducted in a manner that provides maximum open and free competition consistent with this circular. Procurement procedures shall not restrict or eliminate competition and UMTA will not fund procurements utilizing exclusionary or discriminatory specifications. Examples of what are considered to be restrictive of competition include, but are not limited to: (1) placing unreasonable requirements on firms in order for them to qualify to do business; (2) noncompetitive practices between firms; (3) organizational conflicts of interest; and (4) unnecessary experience and bonding requirements.
 - b. The grantee shall have written selection procedures which shall provide, as a minimum, the following procedural requirements:
 - (1) Solicitations of offers, whether by competitive sealed bids or competitive negotiation shall:
 - (a) Incorporate a clear and accurate description of the technical requirements for the material, product, or service to be procured. Such description shall not, in competitive procurements, contain features which unduly restrict competition. The description may include a statement of the qualitative nature of the material, product or service to be procured, and when necessary, shall set forth those minimum essential characteristics and standards to which it must conform if it is to satisfy its intended use. Detailed product specifications should be avoided if at all possible. When it is

impractical or uneconomical to make a clear and accurate description of the technical requirements, a "brand name or equal" description may be used as a means to define the performance or other salient requirements of a procurement. The specific features of the named brand which must be met by offerors shall be clearly stated. Some form of technical or engineering analysis must be performed in connection with every proposed procurement action.

(b) Clearly set forth all requirements which offerors must fulfill and all other factors to be used in evaluating bids or proposals.

(2) Awards shall be made only to responsible contractors that possess the potential ability to perform successfully under the terms and conditions of a proposed procurement. Consideration shall be given to such matters as contractors integrity, compliance with public policy, record of past performance, and financial and technical resources.

17. METHOD OF PROCUREMENT. Procurement under grants shall be made by one of the following methods, as described herein: (a) small purchase procedures; (b) competitive sealed bids (formal advertising); (c) competitive negotiation; or (d) noncompetitive negotiation.

a. Small purchase procedures are those relatively simple and informal procurement methods that are sound and appropriate for a procurement of services, supplies or other property, costing in the aggregate not more than \$10,000. Grantees shall comply with State or local small purchase dollar limits under \$10,000. If small purchase procedures are used for a procurement under a grant, price or rate quotations shall be obtained from an adequate number of qualified sources.

b. In competitive sealed bids (formal advertising), sealed bids are publicly solicited and a firm-fixed-price contract (lump sum or unit price) is awarded to the responsible bidder whose bid, conforming with all the material terms and conditions of the invitation for bids, is lowest in price.

(1) In order for formal advertising to be feasible, appropriate conditions must be present, including, as a minimum, the following:

(a) A complete, adequate and realistic specification or purchase description is available.

6/8/82

- (b) Two or more responsible suppliers are willing and able to compete effectively for the grantee's business.
 - (c) The procurement lends itself to a firm-fixed-price contract, and selection of the successful bidder can appropriately be made principally on the basis of price.
- (2) If formal advertising is used for a procurement under a grant, the following requirements shall apply:
- (a) A sufficient time prior to the date set for opening of bids, bids shall be solicited from an adequate number of known suppliers. In addition, the invitation shall be publicly advertised.
 - (b) The invitation for bids, including specifications and pertinent attachments, shall clearly define the items or services needed in order for the bidders to properly respond to the invitation.
 - (c) All bids shall be opened publicly at the time and place stated in the invitation for bids.
 - (d) A firm-fixed-price contract award shall be made by written notice to that responsible bidder whose bid, conforming to the invitation for bids, is lowest. Where specified in the bidding documents, factors such as discounts, transportation costs and life cycle costs shall be considered in determining which bid is lowest. Payment discounts may only be used to determine low bid when prior experience of the grantee indicates that such discounts are generally taken.
 - (e) Any or all bids may be rejected when there are sound documented business reasons in the best interest of the program.
- c. In competitive negotiation, proposals are requested from a number of sources and the Request for Proposal is publicized, negotiations are normally conducted with more than one of the sources submitting offers, and either a fixed-price or cost-reimbursable type contract is awarded, as appropriate. Competitive negotiation may be used if conditions are not appropriate for the use of formal advertising. If competitive negotiation is used for a procurement under a grant, the following requirements shall apply:

- (1) Proposals shall be solicited from an adequate number of qualified sources to permit reasonable competition consistent with the nature and requirements of the procurement. The Request for Proposal shall be publicized and reasonable requests by other sources to compete shall be honored to the maximum extent practicable.
 - (2) The Request for Proposal shall identify all significant evaluation factors, including price or cost where required and their relative importance.
 - (3) The grantee shall provide mechanisms for technical evaluation of the proposals received, determinations of responsible offerors for the purpose of written or oral discussions, and selection for contract award.
 - (4) Award may be made to the responsible offeror whose proposal will be most advantageous to the procuring party, price and other factors considered. Unsuccessful offerors should be notified promptly.
 - (5) Grantees may utilize competitive negotiation procedures for procurement of architectural/engineering professional services, whereby competitors' qualifications are evaluated and the most qualified competitors' are selected, subject to negotiation of fair and reasonable compensation.
- d. Noncompetitive negotiation is procurement through solicitation of a proposal from only one source, or after solicitation of a number of sources, competition is determined inadequate. Noncompetitive negotiation may be used when the award of a contract is infeasible under small purchase, competitive bidding (formal advertising) or competitive negotiation procedures. Circumstances under which a contract may be awarded by noncompetitive negotiation are limited to the following:
- (1) The item is available only from a single source;
 - (2) Public exigency or emergency when the urgency for the requirement will not permit a delay incident to competitive solicitation;
 - (3) UMTA authorizes noncompetitive negotiation; or
 - (4) After solicitation of a number of sources, competition is determined inadequate.

6/8/82

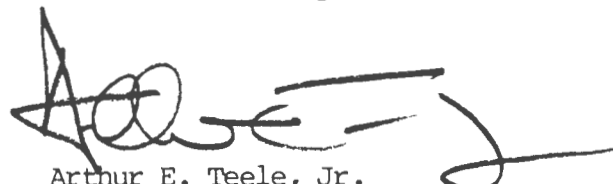
- e. Additional innovative procurement methods may be used by grantees with the approval of UMTA.
18. CONTRACT PRICING. The cost plus a percentage of cost and percentage of construction cost method of contracting shall not be used. Grantees shall perform some form of cost or price analysis in connection with every procurement action including contract modifications. Costs or prices based on estimated costs for contracts under grants shall be allowed only to the extent that costs incurred or cost estimates included in negotiated prices are consistent with Federal cost principles.
19. GRANTEE PROCUREMENT RECORDS. Grantees shall maintain records sufficient to detail the significant history of a procurement. These records shall include, but are not necessarily limited to, information pertinent to the following: rationale for the method of procurement, selection of contract type, contractor selection or rejection, and the basis for the cost or price.
20. CONTRACT PROVISION. In addition to provisions defining a sound and complete procurement contract, any recipient of Federal grant funds shall include the following contract provisions or conditions in all procurement contracts and subcontracts as required by the provision, Federal law or UMTA. Contract clauses meeting the following requirements are available upon request from UMTA.
- a. Contracts other than small purchase shall contain provisions or conditions which will allow for administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as may be appropriate.
 - b. All contracts in excess of \$10,000 shall contain suitable provisions for termination by the grantee including the manner by which it will be effected and the basis for settlement. In addition, such contracts shall describe conditions under which the contract may be terminated for default as well as conditions where the contract may be terminated because of circumstances beyond the control of the contractor.
 - c. All contracts awarded in excess of \$10,000 by grantees and their contractors or subgrantees shall contain a provision requiring compliance with Executive Order 11246, entitled "Equal Employment Opportunity," as amended by Executive Order 11375, and as supplemented in Department of Labor regulations (41 CFR Part 60).
 - d. All contracts and subgrants for construction or repair shall include a provision for compliance with the Copeland "Anti-Kickback" Act (18 USC 874) as supplemented in Department of Labor regulations (29 CFR, Part 3). This Act provides that each contractor or subgrantee shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he is otherwise entitled. The grantee shall report all suspected or reported violations to the grantor agency.

- e. All construction contracts in excess of \$2,000 awarded by grantees and subgrantees shall include a provision for compliance with the Davis-Bacon Act (40 USC 276a to a-7) as supplemented by Department of Labor regulations (29 CFR, Part 5). Under this Act, contractors shall be required to pay wages to laborers and mechanics at a rate not less than the minimum wages specified in a wage determination made by the Secretary of Labor. In addition, contractors shall be required to pay wages not less often than once a week. The grantee shall place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation and the award of a contract shall be conditioned upon the acceptance of the wage determination. The grantee shall report all suspected or reported violations to the grantor agency.
- f. Where applicable, all contracts awarded by grantees and subgrantees in excess of \$2,000 for construction contracts and in excess of \$2,500 for other contracts which involve the employment of mechanics or laborers shall include a provision for compliance with Sections 103 and 107 of the Contract Work Hours and Safety Standards Act (40 USC 327-330) as supplemented by Department of Labor regulations (29 CFR, Part 5). Under Section 103 of the Act, each contractor shall be required to compute the wages of every mechanic and laborer on the basis of a standard workday of 8 hours and a standard workweek of 40 hours. Work in excess of the standard workday or workweek is permissible provided that the worker is compensated at a rate of not less than 1-1/2 times the basic rate of pay for all hours worked in excess of 8 hours in any calendar day or 40 hours in the workweek. Section 107 of the Act is applicable to construction work and provides that no laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health and safety as determined under construction, safety and health standards promulgated by the Secretary of Labor. These requirements do not apply to the purchase of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.
- g. The contract shall include notice of UMTA requirements and regulations pertaining to reporting and patent rights under any contract involving research, developmental, experimental or demonstration work with respect to any discovery or invention which arises or is developed in the course of or under such contract, and of UMTA requirements and regulations pertaining to copyrights and rights in data.
- h. All negotiated contracts (except those awarded by small purchase procedures) awarded by grantees shall include a provision to the effect that the grantee, UMTA, the Comptroller General of the United States, or any of their duly authorized representatives, shall have access to any books, documents, papers, and records of the contractor which are directly pertinent to that specific contract, for the purpose of making audit, examination, excerpts, and transcriptions.

6/8/82

Grantees shall require contractors to maintain all required records for three years after grantees make final payments and all other pending matters are closed.

- i. All contracts for construction, reconstruction, or improvement of facilities and equipment, which are entered into under other than competitive bidding procedures, shall contain a provision that UMTA, the Comptroller General of the United States, or any of their duly authorized representatives shall, for the purpose of audit and examination, have access to any books, documents, papers and records of the contracting parties that are pertinent to the operations or activities under such contracts.
 - j. Contracts, subcontracts, and subgrants of amounts in excess of \$100,000 shall contain a provision which requires compliance with all applicable standards, orders, or requirements issued under Section 306 of the Clean Air Act (42 USC 1857(h)), Section 508 of the Clean Water Act (33 USC 1368), Executive Order 11738, and Environmental Protection Agency regulations (40 CFR, Part 15), which prohibit the use under non-exempt Federal contracts, grants or loans of facilities included on the EPA List of Violating Facilities. The provision shall require reporting of violations to UMTA and to the USEPA Assistant Administrator for Enforcement (EN-329).
 - k. Contracts shall recognize mandatory standards and policies relating to energy efficiency which are contained in the State energy conservation plan issued in compliance with the Energy Policy and Conservation Act (P.L. 94-163).
 - l. Grantees shall include in their contracts any clauses required by applicable minority business enterprise regulations.
 - m. Grantees shall include in their contracts any clauses required by applicable cargo preference regulations.
 - n. Grantees shall comply with the minimum insurance and bonding requirements of OMB Circular A-102, Attachment B, as set forth in the Grant Agreement.
21. CONTRACT ADMINISTRATION. Grantees shall maintain a contract administration system ensuring that contractors perform in accordance with the terms, conditions, and specifications of their contracts or purchase orders.



Arthur E. Teele, Jr.
Administrator

ATTACHMENT A

GRANTEE CERTIFICATION PROCEDURE

1. SCOPE. This attachment sets forth the procedures for obtaining certification in accordance with paragraph 4 of Attachment O to OMB Circular A-102 and outlines the standards the grantee must achieve and maintain to be certified.
2. PROCEDURES.
 - a. Eligibility. All grantees eligible for an UMTA grant may apply for certification.
 - b. Application. Request for certification must be submitted to the appropriate UMTA Regional Office.
 - c. Requirements for Submission. The grantee must set forth its complete system for processing third party contracts under Federal grants and should show in detail how each of the standards in this attachment are met. Each set of these documents should be in two parts, with one part addressing the procurement portion and the other part addressing the technical portion. The following is a list of certification documents that the grantee must submit to UMTA:
 - (1) Two complete sets of the grantee's procurement policies and procedures;
 - (2) An organization chart of the grantee's organization down to at least the first level of supervision;
 - (3) Function manuals, procurement instructions, procedures, etc.;
 - (4) Copies of all important procurement forms; and
 - (5) Two sets of any other documents that may be used to meet the minimum standards set forth in this attachment.
 - d. Onsite Review. The following is a list of actions UMTA will take in conducting onsite reviews:
 - (1) Upon satisfactory completion of the above (in-house) review, an onsite review will be conducted.
 - (2) A team of qualified procurement personnel will conduct the onsite review essentially as follows:

- (a) Contracts and related documents will be selected for onsite review.
- (b) Interviews will be conducted with grantee personnel from top management down to the operating level.
- (c) Minimum areas of coverage will be as follows:
 - 1 Advance procurement planning,
 - 2 Degree and type of competition obtained,
 - 3 Methods of evaluating contractor's responsibility,
 - 4 Completeness of contracts, including forms used, contract history of actions, etc.,
 - 5 Socio-economic programs,
 - 6 Evaluation of make or buy and lease versus purchase,
 - 7 Standards of conduct,
 - 8 Maintenance of records and files,
 - 9 System of contract administration,
 - 10 System for resolution of protests or disputes and the grantee's history of protests or disputes,
 - 11 Procurement policies and procedures,
 - 12 Contract clauses,
 - 13 Selection procedures of contractors for award,
 - 14 Bonding requirements, and
 - 15 Other procurement procedures necessary to ensure good and proper contracts.
- (d) The onsite review will also look into the technical and procurement standards as outlined in this attachment.

- e. Certification. If the UMTA review results in a determination that the grantee's system meets the minimum standards set forth herein, the grantee will receive a written certification, within specified limits, authorizing the grantee to manage its third party contract actions without preaward review by UMTA. If the grantee does not meet the minimum standards, it will be notified of the specific failures and the action required to correct them so that certification may be achieved.

3. GRANTEE TECHNICAL STANDARDS.

- a. To ensure that the grantee has the technical capability, certification review teams will include personnel qualified to determine the grantee's capabilities in accordance with the standards outlined in paragraph b. below.
- b. The grantee's project management staff should have free access to the grantee top management and should be consulted regularly in respect to matters relating to the domain of the staff expertise.

(1) The project manager is responsible for:

- (a) Examining and investigating alternate concepts to assure an end product with minimum life-cycle costs.
- (b) Assuring that contracts for equipment and construction contain performance schedules and that the contractor's performance is monitored on a routine and periodic basis. Management should be kept informed in a timely manner by means of a written report of the status of each contract.
- (c) Establishing and maintaining a process to routinely and periodically monitor the quality of a contractor's work. Written reports of these compliance reviews should be prepared and top management informed of significant deviations as they occur and corrective actions taken or proposed.
- (d) Reviewing all contract amendments, change orders, changes in scope of work, etc., and concurring in such actions prior to execution by the contracting officer.

(2) The grantee staff is responsible for:

- (a) Assuring the technical quality of all contract documents and for assuring that the documents do not contain exclusionary provisions that restrict free and open competitive bidding.

6/8/82

- (b) Assuring compliance with the UMTA guidelines.
- (c) Assuring compliance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 and implementing regulations. For guidance, refer to the Land Acquisition and Relocation Assistance Procedures Manual (UMTA 4530.1).
- (d) Assuring compliance with MBE regulations, 49 C.F.R., Part 23.
- (e) Reviewing contract documents to assure that they contain all the clauses and provisions required by Federal, State, and local governments and specifically OMB Circular A-102, Attachments B and O, and this circular.
- (f) Establishing performance schedules and conducting design/work progress and schedule performance reviews in professional, consultant and architectural/engineering service activities. These reviews should be coordinated, as necessary, with segments of the grantee organizations such as safety, operations, maintenance, quality, reliability, etc.

4. GRANTEE PROCUREMENT STANDARDS.

- a. Personnel. The grantee should have personnel with knowledge and experience in contracts and procurement that is commensurate with the level of contracting and procurement authority granted in the certification.
- b. Organization. The contracts and procurement function should be at a level in the grantee's organizational structure to ensure autonomy for the contract and procurement office. Personnel awarding contracts should not be subject to undue pressures from technical and other groups.
- c. Ethics. The grantee should have a written code or standards of conduct which will govern the performance of its officers, employees or agents engaged in the award and administration of contracts supported by Federal funds. The grantee's officers, employees or agents will neither solicit nor accept gratuities, favors or anything of monetary value from contractors or potential contractors. To the extent permissible by State or local law or regulations, such standards of conduct should provide for penalties, sanctions, or other disciplinary actions to be applied for violations of such standards by either the grantee's officers, employees, or agents, or by contractors or their agents.

In final form, it is not sufficient that the grantee be free from all conflict of interest situations; it should also be free from the appearance of conflict of interest.

d. Operations.

- (1) The grantee should have written procurement procedures that show how each procurement is to be processed from receipt of procurement request through award and administration of contract to closeout and retirement of the contract. The procedure should clearly show that the grantee has the capability and does the planning necessary to accomplish procurement at a level commensurate with the authority granted for local management. Included in the procedures should be detailed directions on how:
 - (a) procurements are to be planned, advertised, and solicited;
 - (b) bids/proposals are to be received and recorded;
 - (c) determinations of responsiveness/responsibility are made;
 - (d) how and by whom bid proposal evaluations will be done;
 - (e) how and on what basis determinations that negotiated costs/prices are fair and reasonable will be made;
 - (f) the successful bidder/proposer will be selected and the contract awarded; and
 - (g) contract administration and closeout will be handled.
- (2) Since each solicitation and contract action should be recorded, the written procurement procedure should also state how such documentation will be assured for the contract file.
- (3) The written procurement procedure should indicate that the grantee is fully aware of the requirement for open and free competition and how the grantee will ensure compliance.
- (4) The written procurement procedures should clearly indicate that the grantee understands and is in compliance with the requirements for involvement of Minority Business Enterprises as set forth in the Department's regulations.

e. Support. The grantee should have available, when necessary, the contract support tools such as:

- (1) Cost/Price Analysis,
- (2) Auditing,
- (3) Preaward Survey Teams, and
- (4) Technical Analysis.

- f. Contract and Solicitation Documents. The grantee should have the ability to properly construct a solicitation package and contract document that includes all the required contract clauses and otherwise meets the requirements of OMB Circular A-102, Attachment O, and this circular.

- g. Contract Files. The grantee should have a system of filing and maintaining contract files that ensures a complete and readily available record of all contract-related actions.

ATTACHMENT B

BID PROTEST PROCEDURES

1. PURPOSE. Filing of Protest

- a. Under certain limited circumstances (see paragraph 3a), an interested party may protest to UMTA the award of a contract pursuant to an UMTA grant. The purpose of this directive is to establish procedures for processing all such protests. This procedure permits review by UMTA provided that: (1) the protest is filed within the time limits specified in Section 4; and, (2) the protester has exhausted all administrative remedies available to him at the grantee level.

2. DEFINITIONS.

- a. The term "days" refers to working days of the Federal Government.
- b. The term "file" or "submit" refers to the date of receipt by UMTA.
- c. "Exhaustion of administrative remedies at the grantee level" means any action or inaction on the part of the grantee which is prejudicial to the position taken in a written protest filed with the grantee. It may include, but is not limited to:
 - (1) A final grantee decision on the merits of the protest.
 - (2) A procurement action such as the award of a contract or the rejection of a bid despite the pendency of the protest.
 - (3) Grantee acquiescence in and active support of continued and substantial contract performance despite the pendency of a protest.
- d. The term "interested party" includes all bidders on the contract or procurement. The term may also include a subcontractor or supplier at any tier who shows that he/she has a substantial economic interest in a provision of the Invitation for Bids (IFB) or the Request for Proposals (RFP), or in the interpretation of such a provision.

- e. Violation of Federal law or regulation is defined as the infringement of any valid requirement imposed by Federal statute or regulation which requirement governs the letting of contracts pursuant to a grant agreement. However, any protests involving a local matter and/or determinations that are clearly within the discretionary powers of the grantee should be resolved at the local level. Specific examples of determinations that are within the discretionary powers of the grantee include, but are not necessarily limited to, determinations of responsiveness and responsibility, the revision of specifications to incorporate the evaluation of life-cycle costing (LCC) factors in connection with any given procurement, and determinations regarding bonding requirements. In other words, the protester must be able to demonstrate or establish a clear violation by the grantee of a specific law or regulation, e.g., a violation of the prohibition against unduly exclusionary and restrictive specifications, or a violation of the Buy American requirements.
- f. The term "bid" as used herein also includes the term "offer" or "proposal" as used in the context of negotiated procurements.

3. GENERAL CONDITIONS.

- a. UMTA's review of any protest will be limited to:
 - (1) Violations of Federal law or regulations. Violations of State or local law shall be under the jurisdiction of State or local authorities.
 - (2) Violation of grantee's protest procedures or failure to review a complaint or protest.
- b. Protests must be filed with the grantee in accordance with the local procedures and requirements. Following an adverse decision by the grantee, the protester may file a protest with UMTA, in accordance with paragraph 4 below, if there has been a violation as described in paragraph 3.a.(1) or 3.a.(2) above. Protests should be filed with the appropriate UMTA Regional Office and concurrent copies sent to the grantee and UMTA Headquarters, Attention: UAD-43. To expedite handling within UMTA, the address should include "Attention: Bid Protest".
- c. The initial protest filed with UMTA shall:
 - (1) Include the name and address of the protester.
 - (2) Identify the grantee, project number, and the number of the solicitation contract.
 - (3) Contain a statement of the grounds for protest and any supporting documentation. (The grounds for protest filed with UMTA must be fully supported to the extent feasible. Additional materials in support of an initial protest will only be considered if filed within the time limits specified in paragraph 4.)

- (4) Include a copy of the protest filed with the grantee, and a copy of the grantee's decision, if any.
- (5) Indicate the ruling or relief desired from UMTA.
- d. UMTA will not consider any data that was not submitted to the grantee. If new data becomes available after the exhaustion of administrative remedies at the grantee level, that data should be filed with the grantee with a request for reconsideration. If the request is denied or if the protester's administrative remedies at the grantee level are again exhausted, the protester may then submit the new data to UMTA. UMTA will consider the data if filed as part of an initial protest within the time limits specified in paragraph 4, or as additional material filed within the time limits specified in paragraph 4.
- e. No formal briefs or other technical forms of pleading or motion are required, but a protest and other submission should be concise, logically arranged, and clear.

4. TIME FOR FILING.

- a. Protests shall be filed within the specified time limits set forth in the specifications which are the subject of the procurement and must adhere strictly to any procedures specified therein. The time period established for the filing of protests as set forth in all such specifications will be controlling and will take precedence over a time period established herein.
- b. Protests must be filed within the time limits set forth in this paragraph b. in order to be considered timely unless the specifications which are the subject of a particular procurement set forth a different period for filing a protest, in which case the provisions of paragraph a. above will apply. Protests based upon restrictive specifications or alleged improprieties in any type of solicitation, which are apparent prior to bid opening or the closing date for receipt of initial proposals, shall be filed not later than three (3) days prior to bid opening or the closing date for receipt of initial proposals.
- c. In cases other than those covered in the preceding paragraphs of this section, bid protests shall be filed not later than ten (10) days after the exhaustion of administrative remedies at the grantee level is known or should have been known, whichever is earlier.
- d. A protest may be considered, even if the initial filing is late, in the following circumstances:
 - (1) Good cause based on a compelling reason beyond the protester's control, whereby the lateness is due to the fault of UMTA or the grantee in the handling of his protest submission.

- (2) UMTA determines the protest raises issues significant to procurement practice or procedure.
- (3) A court of competent jurisdiction requests, expects, or otherwise expresses interest in UMTA's decision.

5. TIME FOR SUBMISSION OF ADDITIONAL INFORMATION.

Any additional information requested or required by UMTA from the protester, the grantee, or interested parties shall be submitted as expeditiously as possible but in no case later than five (5) days after the receipt of such request unless specifically excepted by UMTA.

6. NOTICE OF PROTEST, CONFIDENTIALITY, SUBMISSION OF GRANTEE REPORT, AND TIME FOR FILING COMMENTS ON REPORT.

- a. UMTA shall notify the grantee by telephone and in writing in a timely manner of the receipt of a protest, requesting the grantee to give notice of the protest to the contractor if award has been made or, if no award has been made, to all bidders or proposers who appear to have a substantial and reasonable prospect of receiving an award if the protest is denied. All who receive such notice shall be instructed that they may communicate further directly with UMTA.
- b. Material submitted by a protester will not be withheld from any interested party outside the Government or from any Government agency which may be involved in the protest, except to the extent that the withholding of information is permitted or required by law or regulation. If the protester considers that the protest contains proprietary material which should be withheld, a statement advising of this fact may be affixed to the front page of the protest document and the alleged proprietary information must be so identified wherever it appears.
- c. The grantee shall be requested to submit a complete report on the protest to UMTA, with a copy to the protester, as expeditiously as possible but not later than within twenty-five (25) working days of being notified by UMTA of the protest. The grantee report shall include:
 - (1) copies of all relevant bids;
 - (2) a copy of the Invitation for Bids or Request for Proposals, including pertinent provisions of the specifications;
 - (3) a copy of the abstract of bids;
 - (4) any other documents that pertain to the protest, including correspondence with the bidders; and
 - (5) a statement by the grantee explaining its actions and the reasons for them.

The protester must be informed that any comments must be submitted to UMTA within ten (10) days (see paragraph 6.d. below).

- d. Comments on the grantee report shall be filed by the protester with UMTA within ten (10) days after receipt of the report, with a copy to the grantee which furnished the report. The grantee's rebuttal to these comments shall be filed with UMTA within five (5) days after receipt of the comments to which the rebuttal is directed.
- e. The failure of a protester or of a grantee to comply with the time limits stated in this attachment may result in resolution of the protest without consideration of the comments untimely filed.

7. FURNISHING OF INFORMATION ON PROTESTS.

UMTA shall, upon request, make available to any interested party information bearing on the substance of the protest which has been submitted by the protester, interested parties or grantees, except to the extent that withholding of information is permitted or required by law or regulation. Any comments thereon shall be submitted within a maximum of ten (10) days.

8. WITHHOLDING OF AWARD.

When a protest has been filed before award, the grantee will not make an award prior to the resolution of the protest, and when a protest has been filed before the opening of bids, the grantee will not open bids prior to the resolution of the protest, unless the grantee determines that:

- a. The items to be procured are urgently required; or
- b. Delivery or performance will be unduly delayed by failure to make the award promptly; or
- c. Failure to make prompt award will otherwise cause undue harm to the grantee or the Federal Government.

In the event that the grantee determines that the award is to be made during the pendency of a protest, the grantee will notify UMTA prior to making such award. UMTA reserves the right not to participate in the funding of any contract awarded during the pendency of a protest to UMTA.

9. CONFERENCE.

- a. A conference on the merits of the protest with members of UMTA may be held at the request of the protester or the grantee. Request for a conference should be made in a timely manner so as not to interfere with the resolution of the protest and not later than the expiration of the time period allowed for filing comments on the grantee report as specified in Section 5(d). Except in unusual circumstances, requests for conferences after such time will not be honored.

- b. Conferences normally will be held prior to the expiration of the period allowed for filing comments on the grantee report. Interested parties may request, and in UMTA's discretion may be invited to attend the conference.

10. REQUEST FOR RECONSIDERATION.

- a. Reconsideration of a decision of UMTA may be requested by the protester or any grantee involved in the protest. The request for reconsideration shall contain a detailed statement of the factual and legal grounds upon which reversal or modification is deemed warranted, specifying any errors of law made or information not previously considered.
- b. Request for reconsideration of a decision of UMTA shall be filed not later than ten (10) days after the initial written decision, and shall be filed with the office which issued the decision being appealed. The protest shall not be considered pending during the 10-day period specified in this paragraph.
- c. A request for reconsideration shall be subject to these bid protest procedures, consistent with the need for prompt resolution of the matter.

11. EFFECT OF JUDICIAL PROCEEDINGS.

UMTA may refuse to decide any protest where the matter involved is the subject of litigation before a court of competent jurisdiction, or has been decided on the merits by such a court. The foregoing shall not apply where the court requests, expects, or otherwise expresses interest in UMTA's decision.



APPENDIX G

SAMPLE APPROACHES FOR SCREENING BIDDERS

EXAMPLE 1

Re: Pre-qualification of Bus Remanufacturers

To Whom It May Concern:

To aid _____ evaluation of the non-financial ability of a bus remanufacturer, the attached questionnaire will be made a part of the pre-qualification package. Prospective contractors, prior to bidding on capital improvement projects, must be pre-qualified as to their character and amount of work for which they are permitted to submit bids. The pre-qualification package and non-financial questionnaire must be returned to

_____ at least 15 days prior to the bid opening.

All information provided to _____ will be kept strictly confidential and will be used only to prequalify your particular firm.

Your attention to this matter is appreciated.

Sincerely,

Non-Financial Questionnaire

Vehicle Type: Transit _____ Commuter _____
Articulated _____ Streetcar _____ Other _____

1. Describe the firms remanufacturing experience including previous customers, number and type of buses rehabed, customer's engines, scheduled production and schedule adherence. List type of services provided.

2. Describe remanufacturing . plant size layout and stages of manufacturing.

3. Describe the quality assurance approach.

4. Provide copies of quality assurance inspection points and the specific checks performed.

5. Describe subassemblys and quality inspections performed on subassemblys.

6. Describe checkoff used to determine that bus is ready for customer.

7. Identify suppliers of following components:

- air compressor
- air dryer
- brakes
- tanks
- retarder
- transmission
- engine
- axles
- air conditioning compressor
- radiator and heating system
- bulkheads
- alternator
- starter

8. Describe warranty provisions and claim procedures.

9. Provide details on vehicle testing facilities and standard checks (dynamometer).

Firm

Address

Phone

Contact:

For ^{TABLE 1} Use Only

Review Finding

___ Acceptable ___ Conditional Acceptance ___ Unacceptable

Exceptions

EXAMPLE 2

Proposer's Qualifications. Before a proposal is considered for award, the proposer will be required to submit Pre-Award Evaluation Data showing his previous experience in performing comparable work, his business and technical organization, his financial resources, and the plant available for performing this contract work.

Particular evaluation shall be made of the proposer's experience and expertise in the performance of bus rehabilitation. In addition, all proposers shall submit, with its proposal, a list on the form (page PF-6) provided of bus rehabilitation contracts which the proposer has successfully completed. Offers will not be accepted from any proposer who has not rehabilitated or rebuilt at least one-hundred (100) transit or intercity type buses within the last three (3) years or who has been acknowledged by those transit or intercity bus companies as having performed the work in an unsatisfactory and non-acceptable or untimely manner. Proposers must be able to show they can accomplish the delivery schedule.

Doubt as to technical ability, productive capacity, or financial strength which cannot be resolved affirmatively shall require a determination of non-responsibility by the Contracting Officer.

Pre-Award Evaluation Data

(Request for Proposal)

Project Description:

Invitation No:

1. Name of Firm _____

2. Legal Address _____

3. Individual _____ Partnership _____ Corporation _____ Joint Venture _____
4. Date Organized _____ State in which incorporated _____
5. Names and addresses of officers or partners:
 - (a) _____
 - (b) _____
 - (c) _____
 - (d) _____
 - (e) _____
 - (f) _____
6. How long has your firm been in business under its present name? _____
7. Attach as Schedule 7 a list of current contracts with contract amount, owner, architect-engineer, character or type of work, and percentage complete. Also include those projects on which you are apparently low bidder but have not received an award of contract.
8. Attach as Schedule 8 a list of contracts with contract amount, owner, architect-engineer, and character or type of work, for contracts completed in the past (5) years.
9. What is estimated work placement value required per year to complete work described in Schedule 7?
 1981 _____ 1982 _____ 1983 _____ 1984 _____
10. Have you ever been denied an award on which you were low bidder? _____
 If answer is YES, attach as Schedule 10 the full particulars regarding each occurrence.

11. Have you ever failed to complete any contract, other than current, on which you were low bidder?
If answer is YES, attach as Schedule 11, the full particulars regarding each occurrence.
12. Have you ever been assessed liquidated damages or actual damages for late completion within the last five (5) years?
If answer is YES, attach as Schedule 12 the full particulars regarding each occurrence.
13. Financial resources available as working capital for this contract.
 - (a) Cash on hand _____ Date _____
 - (b) Sources of credit _____
14. Attach as Schedule 14 certified financial statements and letters from banks regarding credit as required by paragraph 14 of the invitation for Bid.
15. Attach as Schedule 15 the construction experience of each officer and principal individual of your organization including present position, years of construction experience, magnitude and type of work, and in what capacity.
16. What percentage of the work (contract amount) do you intend performing with your own personnel? _____
17. Attach as Schedule 17 a list of all principal subcontractors and the percentage and character of work (contract amount) which each will perform. Principal items of work shall include, but not be limited to, those items listed in paragraph 14 of the Invitation for Bid.
18. Attach as Exhibits: completed PRE-AWARD EVALUATION DATA forms for each of subcontractors named in Schedule 17, above.
19. If contractor or subcontractor is a joint venture, submit PRE-AWARD EVALUATION DATA forms for each member of the joint venture.

The above information is confidential and will not be divulged to any unauthorized person or persons.

The signatory of this questionnaire certifies to the truth and accuracy of all statements and answers.

FOR: _____
Name of Firm

SIGNED: _____

Title

DATED: _____

LOCATION: _____

Pre-Award Information. (a) In accordance with the provisions of Paragraph 3 herein, the Contracting Officer will conduct a pre-award survey to determine if the proposer eligible for award is responsible both financially and technically and has the capability to perform the bus rehabilitation work in accordance with the requirements of the plans and specifications and within the specified time or times.

(b) Accordingly, a proposer being considered for award shall be required to furnish within 5 calendar days after notification by the Authority, pre-award data as required by Paragraph 3 and as follows:

(1) A detailed, narrative description of how the proposer proposes to accomplish each of the following features of the work: Overhaul of the engine, transmission, air system, electrical system, heating and ventilating system, body, fuel system, wheels, hubs and bearings; the painting and graphics, and the reupholstering of seats. Each description shall include the names of fabricators, coordinators, subcontractors and suppliers of all components of each of the stated features. A copy of the contractor's inspection procedures, test procedures and Quality Assurance manual shall also be provided.

(2) A statement of the proposer's experience record, type of contract work previously performed, list of Governmental agencies or private concerns for which the work was performed, statement by the financial institution with which the proposer conducts business, and a list of contracts, if any, on which failure to complete within the specified time resulted in assessment of liquidated damages. Also complete financial statements for the last three years, including Statement of Financial Position (Balance Sheet), Results of Operations (Income Statement), Statement of Changes in Financial Position (Net Change in Resources), Statement of Current and Retained Earnings. These Statements shall be certified indicating disclosure of all facts which could impair or affect the statements presented.

(3) A statement for approval of the Contracting Officer detailing the proposer's proposed Quality Assurance Program.

(4) Complete and comprehensive Affirmative Action Program in accordance with the General Provisions Article "Equal Employment Opportunity - Revised Order No. 4", 41 CFR 60-2, and Executive Order 11246 (with special attention directed to Sections 202 and 203). The program shall contain but not necessarily be limited to the following:

- a. Program for equal employment policy in all personnel actions.
- b. Program for internal and external dissemination of Contractor's policy.
- c. Establishment of responsibilities for implementation of the Contractor's program.
- d. Identification of problem areas (deficiencies) by organizational units and job groups.
- e. Development and execution of action-oriented programs designed to eliminate problems and increase the level of participation by minorities, women, vietnam-era veterans, and the handicapped.
- f. Active support of local and national community action programs and community service programs designed to improve the employment opportunities of minorities, women, vietnam-era veterans and the handicapped.
- g. The program shall also be subject to the requirements pursuant to Title VI and VII of the Civil Rights Act of 1964; Section 402 of the Vietnam-era Veterans Re-adjustment Assistance of 1974 and Sections 503 and 504 of the Rehabilitation Action of 1973; and requirements of relevant rules, and non-discriminatory policies of the Authority.

(c) If the prospective Contractor is a joint venture, each joint venture member will be required to submit the above data as applicable or required to clearly establish the Contractor's capability to perform the work.

(d) All requests for submittal of pre-award data or clarification of data submitted will be made by telephone call and the proposer agrees to transmit the data requested so that it will be on hand in the Office of Contract Administration within 5 calendar days after the date of request.



APPENDIX H

SAMPLE APPROACH TO COMPETITIVE NEGOTIATION

Competitive Negotiation(a) General

This procurement will be conducted utilizing the procedures of competitive negotiation of technical and price proposals. Under these procedures, full evaluation shall be performed on every offeror's proposal, including any revisions by the Authority.

Proposers shall submit one (1) copy of their Technical Proposal and one copy of their Cost Proposal. The technical volume of the proposal shall contain no pricing information, and shall be maintained and evaluated separately from the cost proposal.

- (b) Negotiations - After receipt of initial proposals, written or oral discussions may be conducted with all responsive offerors who submit proposals within a competitive range, price and other factors (including technical quality) considered to the extent necessary to resolve uncertainties relating to the technical requirements. Basic questions will not be left for later agreement during price revisions or other supplemental proceedings. When negotiations are conducted with more than one offeror, the relative price positions shall not be revealed. If negotiations are conducted with several offerors whether successively or not, all offerors selected to participate in negotiations will be offered an equal opportunity to submit cost, technical or other revisions as required. Complete agreement on all basic requirements shall be the objective of these negotiations.
- (c) Best and Final Offer - If negotiations are conducted, all offerors will be informed of the specified time and date to submit their Best and Final Offer. This Best and Final Offer shall be each contractor's most favorable price proposal for the technical proposal which had been clarified and agreed to during negotiations.

Requirements of the Technical Proposal. Each proposer shall cover all of the requirements of the work as given in the Technical Specification, the General Provisions, the Special Provisions and the other contract documents, and provide sufficient specific information to effectively demonstrate the proposer's technical capability to perform all of the work required under these specifications. The proposer shall submit information to enable the Authority to ascertain how the proposal will meet the specifications contained herein and in accordance with the Evaluation Criteria.

Unnecessarily elaborate brochures or other presentations beyond that sufficient to present a complete and effective proposal are not desired and may be construed as an indication of the offeror's lack of cost consciousness. Elaborate art work, expensive paper and bindings and expensive visual and other presentation aids are neither necessary nor wanted.

Requirements of the Cost Proposal(a) Cost and Pricing Data and Schedule of Unit PricesData to be Submitted and Format

- (i) The proposers shall submit complete cost and pricing information in accordance with the attached WMATA pricing form, Exhibit "A", which is to be completely filled out. All supporting data shall be attached to this form.

- (ii) The proposers shall specify each labor category to be utilized, the applicable wage rate, and the amount of time proposed for each category. All miscellaneous expenses shall be specifically detailed.
- (iii) The proposers shall also submit with its cost proposal the Schedule of Unit Prices (pages PF-7 and PF-8).

(b) Cost Proposal Evaluation

The cost proposal shall be evaluated on the basis of all proposers being technically acceptable. Essentially, cost proposals will be evaluated on the amount, depth and utility of the information supplied to determine which proposal presents the most favorable overall cost parameters.

Offerors are advised that WMATA will evaluate all proposals on an "all or none basis" for the quantities and items stipulated in the Schedule of Unit Prices. Any proposal submitted for quantities or items less than those stated in the Schedule may be considered as non-responsive and may be rejected.

Furthermore, any proposal which is materially unbalanced as to prices for base items and or additives may be rejected as non-responsive. An unbalanced proposal is one which is based on prices significantly less than cost for some work and prices which are significantly overstated for other work.

Technical Evaluation Criteria

The technical proposals will be evaluated in accordance with the evaluation criteria listed below.

The relative weight of importance of the items has been predetermined and is known only to the Authority.

The criteria are as follows:

- Delivery Schedule

All proposals must meet or improve upon the prescribed delivery schedule shown on PF-10 in the Request for Proposal. The proposal will be considered non-responsive if the prescribed delivery schedule can not be met.

- Production Plan

Prospective proposers must document that they have rehabilitated or built at least one hundred (100) buses in the last three years, and have done so within cost, schedule and the performance specification. The previous rehabilitation contracts must have been comparable in scope of work to this proposed work. If a joint

venture is utilized, all companies forming the joint venture must document the above experience and past performance.

° Minority Business Enterprise - (MBE)

Prospective proposers must be able to meet an MBE goal of 3% of the total contract price as outlined in Appendix B in the General Provisions.

- Basis for Award

The contract shall be awarded to that proposer submitting the most favorable technical and business/cost proposal as determined through the evaluation procedures established for this procurement. Cost will be a major factor in the award decision, although the award may not necessarily be made to that proposer submitting the lowest total price. Likewise, award will not necessarily be made for technical capabilities that would appear to exceed those needed for successful performance of the work.



APPENDIX I

SAMPLE TECHNICAL SPECIFICATIONS

EXAMPLE 1

PROPOSAL FOR THE REHABILITATION OF BUSES

BIDDER IDENTIFICATION NUMBER: _____

UMTA JOB CODE NUMBER: _____

<u>I. DESCRIPTION OF WORK</u>	<u>UNIT PRICE</u>	<u>EXTENDED PRICE</u>
A. Cooling System		
1. Rebuild radiator with new gaskets, clamps and silicone hoses.	\$ _____	\$ _____
B. Electrical System		
1. Replace all lenses with new lenses and replace any inoperable bulbs.	\$ _____	\$ _____
2. Remanufacture starter	\$ _____	\$ _____
3. Remanufacture alternator	\$ _____	\$ _____
4. Remanufacture voltage regulator	\$ _____	\$ _____
5. Convert internal lighting power pack with individual ballasts.	\$ _____	\$ _____
6. Replace the following harness with new crosslink polyethylene insulated wires: engine compartment, rear engine door, engine and transmission. Check and correct front and rear apparatus boxes for proper function.	\$ _____	\$ _____
7. Install emergency signals	\$ _____	\$ _____
C. Power Module		
1. Remanufacture 6VA-71N/8VA-71N engine and fluidfan drive as per DDA reliabilt specifications. Install new hoses and filter elements. Reinstall engine with new engine mounts submit dynamometer test report.	\$ _____	\$ _____
2. Remanufacture transmission as per OEM reliabilt specifications. Rebuild oil cooler. Install new hoses. Submit dynamometer test report.	\$ _____	\$ _____

PROPOSAL FOR THE REHABILITATION OF BUSES

BIDDER IDENTIFICATION
NUMBER: _____

UMTA JOB CODE NUMBER:

<u>DESCRIPTION OF WORK</u>	<u>UNIT PRICE</u>	<u>EXTENDED PRICE</u>
D. Frame		
Install front Firestone HELP bumper on approved equal.	\$ _____	\$ _____
E. Air Intake System		
Clean air intake duct system. Clean oil bath elements and cup complete.	\$ _____	\$ _____
F. Suspension: Front and Rear Axle		
Install new radius rod bushings. Install new lateral rod bushings. Install new levelling valves and linkages. Install new bellow assemblies. Install new shock absorber assemblies.	\$ _____	\$ _____
G. Drive Shaft		
Rebuild drive shaft with new U-joints.	\$ _____	\$ _____
H. Steering		
New steering U-joint assemblies, new drag link end assemblies, new drag link tube assembly.	\$ _____	\$ _____
L. Body: Front End		
1. Replace new front lower panel with front end ventilators and license plate mounting bracket.	\$ _____	\$ _____
Sides		
2. Replace new RHS skirt panels, rub rails, end caps and angle reinforcements, mouldings, and fenders.	\$ _____	\$ _____
3. Replace new LHS skirt panels, rub rails, end caps and angle reinforcements, mouldings, and fenders.	\$ _____	\$ _____

PROPOSAL FOR THE REHABILITATION OF BUSES

BIDDER IDENTIFICATION
NUMBER: _____

UMTA JOB CODE NUMBER:

<u>DESCRIPTION OF WORK</u>	<u>UNIT PRICE</u>	<u>EXTENDED PRICE</u>
4. Replace with new battery door, A/C compressor door, fuel fill door, voltage regulator door, A/C heat exchanger door, and radiator fill door.	\$ _____	\$ _____
Rear End		
5. Replace new transmission door and install new gas spring kit.	\$ _____	\$ _____
6. Replace new radiator door and install new gas spring kit.	\$ _____	\$ _____
7. Replace new rear end closure door and install new gas spring kit (5307 type).	\$ _____	\$ _____
General		
8. Replace new front plywood floor, drivers floor, drivers floor board.	\$ _____	\$ _____
9. Replace new floor covering at front plywood floor area, drivers platform and front step treads with white nosing.	\$ _____	\$ _____
10. Install new front fiberglass stepwell.	\$ _____	\$ _____
11. Install new rear fiberglass stepwell.	\$ _____	\$ _____
12. Install in side wall new heat duct above the floor insulation panels.	\$ _____	\$ _____
13. Install new engine bulkhead with new engine mounting brackets.	\$ _____	\$ _____

PROPOSAL FOR THE REHABILITATION OF BUSES

BIDDER IDENTIFICATION
NUMBER: _____

UMTA JOB CODE NUMBER:

<u>DESCRIPTION OF WORK</u>	<u>UNIT PRICE</u>	<u>EXTENDED PRICE</u>
14. Install new LH and RH longitudinal bulkheads.	\$ _____	\$ _____
15. Install new rear axle rear bulkhead.	\$ _____	\$ _____
16. Install new rear reinforcing plate and plywood (plate ties together the bulkhead rearwall of the rear axle and the engine bulkhead).	\$ _____	\$ _____
17. Install new rubber flooring over the new plywood covering the rear reinforcing plate.	\$ _____	\$ _____
18. Install new front axle front bulkhead.	\$ _____	\$ _____
19. Install new front axle rear X-member.	\$ _____	\$ _____
20. Install new front entrance door bearings, bushings, seals retainer and filler. Repair door panels.	\$ _____	\$ _____
21. Install new rear exit door bearings, bushings, seals, retainer and filler. Repair door panels.	\$ _____	\$ _____
22. Undercoat with Tectyl 165G complete bus under structure.	\$ _____	\$ _____
23. Repair and paint seat frames. Reupholster seats with new covers, including drivers seat.	\$ _____	\$ _____
24. Replace with new rubber harness: windshield, rear window, transom window, destination sign, tear drop window.	\$ _____	\$ _____
25. Rebuild side windows, intermediate window, drivers window, with new seals.	\$ _____	\$ _____

PROPOSAL FOR THE REHABILITATION OF BUSES

BIDDER IDENTIFICATION NUMBER: _____

UMTA JOB CODE NUMBER:

<u>DESCRIPTION OF WORK</u>	<u>UNIT PRICE</u>	<u>EXTENDED PRICE</u>
26. Rebuild heating system with rebuilt heater cores, with new hoses and rebuild heater blower motors.	\$ _____	\$ _____
27. Rebuild heater compartment doors and install new seals.	\$ _____	\$ _____
28. Rebuild defroster motor, defroster core and housing.	\$ _____	\$ _____
29. Paint exterior 4 colors, paint interior 2 colors and paint wheels all per TNJ color scheme.	\$ _____	\$ _____
30. Install priority seating sign.	\$ _____	\$ _____
31. Install handrails.	\$ _____	\$ _____
32. Install doorway lighting.	\$ _____	\$ _____
33. Install Four Digit Run Box	\$ _____	\$ _____
TOTAL PRICE		\$ _____

PRICING FOR ADDITIONAL WORK

Each bidder must respond to the preceding pricing pages. Each bidder must also provide the following detailed information:

- i. The labor rate used in the bid which will be in effect for the contract period.
Effective labor rate _____
- ii. A breakdown of the labor rate into direct labor cost, indirect cost, overhead and profit.
Direct Labor _____
Indirect Labor _____
Overhead _____
Profit _____
- iii. The criteria used in pricing the material component of the bid.
Criteria _____

PRICING FOR OPTION

The bidder shall restate the average total unit price to indicate willingness to rehabilitate an additional 105 buses during the fiscal year beginning July 1, 1982 in the space below.

OPTION PRICE _____

The undersigned is (an Individual)
(a Partnership) under the laws of
(a Corporation)

the State of _____ having
office at _____

(Contractor) _____
(Signature) _____
(Title) _____
(Date) _____

PRICING SCHEDULE FOR COMPONENTS

Each bidder must respond to the preceding pricing pages. Each bidder must also provide the following detailed information:

- i. The criteria used in pricing the material component of the bid.

Criteria

Each bidder will quote a price to be used if a complete replacement is required for the items listed below. These prices will be used in lieu of "Pricing For Additional Work" which will be used for miscellaneous items. Prices quoted should include all labor and shall be net of any credit for other work that will not be performed.

<u>Component</u>	<u>Complete Replacement in Lieu of Item #</u>	<u>Credit From Deleted Item</u>	<u>Cost of Component</u>	<u>Net Cost of Compo</u>
Complete Seat Cushion	10.3			
Engine Black	C1			
Cylinder Head	C1			
Transmission Casing	C2			
Crank Shaft	C1			
Radiator Core	I41			
Defroster Core	I28			
Heater Core	I27			

PRICING FOR ADDITIONAL WORK IN PLACE PROVIDED

Each bidder shall quote the number of labor hours and rate used to prepare the bid. The rate will be used in evaluating proposed charge orders and will be maximum permitted rate for any additional work authorized.

<u>Hours of Labor</u>	<u>\$</u>	<u>\$</u>
	<u>Rate of Labor</u>	<u>Amount in bid to be expended in labor</u>

**NEW JERSEY TRANSIT CORPORATION
SPECIFICATION FOR REHABILITATION OF
40' TRANSIT AND COMMUTER COACHES**

1.1 SCOPE OF WORK

The New Jersey Transit Corporation (NJ TRANSIT) intends to rehabilitate 105 transit and commuter buses listed in Schedule 1. Upon written notice, NJ TRANSIT may add and delete buses from the list provided. Buses listed represent the buses to be rehabilitated. It is expected that all work described on pages four through nine of the Proposal will be completed for each bus. However, the Contractor shall not permit any work to be performed without the specific approval of NJ TRANSIT's resident inspector. Such approval shall be registered on forms to be provided by NJ TRANSIT for each and every bus individually. At the discretion of NJ TRANSIT's inspector, parts removed from buses will be returned to Transport of New Jersey, Newark Shops, 703 Ferry Street, Newark, New Jersey 07105.

2.1 COMPONENTS, MATERIALS, WORKMANSHIP, AND COMPLETENESS

These specifications reflect preference as to materials, and major components. However, the bidder shall not omit any parts or detail which goes to make the vehicle complete and ready for service, even though such parts and detail are not mentioned in these specifications.

All replacement units or parts not specified shall be of a grade which meets or exceeds the original equipment, and shall conform in material, design or workmanship to the best practice known in transit bus industry. All replacement parts shall be new, and in no case will used or obsolete parts be accepted. Reconditioned or rebuilt parts may be used with the approval of Contract Administrator or his designated representative. Equipment throughout shall be so installed that it will be interchangeable among the vehicles specified herein.

The price to be quoted in any Proposal submitted shall include all items of labor, material, tools, equipment, and other cost necessary to fully complete the rehabilitation and delivery of the buses pursuant to these specifications. It is the intent of these specifications to provide and require a complete vehicle of the type prescribed ready for operation.

It should be understood that specifying a brand name, components and/or equipment in this specification shall not relieve the supplier from his responsibility to produce the product in accordance with the performance warranty and contractual requirements. The supplier is responsible for notifying Contract Administrator of any inappropriate brand name, component and/or equipment that may be called for in the specification, and to propose a suitable substitute for consideration.

3.0 TECHNICAL SPECIFICATIONS

A. Cooling System

1. The radiator shall be disassembled, cleaned, inspected, repaired as necessary, rebuilt and pressure checked. Core repair must not remove more than 10 percent of the original cooling capacity from use. Cleaning effort should also be directed to the tube interiors.
2. All connecting hoses shall be replaced with new silicone hoses, new clamps and new gaskets.
3. Radiator tank and fittings to be cast iron or brass.

B. Electrical System

1. Replace all interior passenger light lenses with new lenses. Replace any inoperable bulbs.
2. The engine starter shall be remanufactured to manufacturers specifications.
3. The alternator shall be remanufactured to manufacturers specifications.
4. The voltage regulator shall be remanufactured to manufacturers specifications.
5. Convert all internal lighting power packs with individual ballasts.
6. Wiring harness replacements shall use new crosslink polyethylene insulation. All harnesses will be covered with vinyl tape and routed for protection from the elements.
7. The manufacturer shall install a foot operated switch that will cause marker lights to flash on and off. The switch shall be located to be easily activated in an emergency but shall not interfere with normal bus operation. The switch shall be silent when activated.

C. Power Module

The power module is to be removed from the bus. All units are to be disassembled, inspected, and rebuilt to Detroit Diesel Allison specifications using O.E.M. parts or approved equal. Contractor must rebuild the power module supplied with the bus.

1. The engine shall be serviced to the minimum level specified in Attachment "A".
2. After rebuilding the engine, it shall be dynamometer run-in according to D.D.A. specifications.

3. The transmission shall be disassembled, cleaned, inspected and rebuilt according to Allison specifications.
4. The oil-cooled generator shall be disassembled, cleaned, inspected and rebuilt according to Delco-Remy specifications. Unit shall be tested under full load after rebuilt.

D. Frame

1. Install the Firestone HELP bumper to the bus front. Specific approval of equals is required.

E. Air Intake System

1. The Contractor will clean the air intake duct system, oil both elements and cup complete.

F. Suspension: Front and Rear Axle

1. The Contractor will install new radius rod and lateral rod bushings.
2. The Contractor will install new levelling valves and linkages.
3. The Contractor will install new bellows assemblies and new shock absorber assemblies.

G. Drive Shaft

1. The Contractor will rebuild the drive shaft using new U-joints.

H. Steering

1. The Contractor will rebuild the steering assembly as follows:
 - a. New U-joint assemblies
 - b. New drag link end assemblies
 - c. New drag link tube assembly

I. Body Panels

1. Front End

- a. The Contractor will replace with new the front lower panel complete with front end ventilators and license plate mounting bracket.

2. Sides

- a. Replace with new the right hand side skirt panels, rub rails, end caps, angle reinforcements, mouldings and fenders.
- b. Replace with new the left hand side skirt panels, rub rails, end caps, angle reinforcements, mouldings and fenders.
- c. Replace with new the following access doors: battery compartment, A/C compressor, fuel fill, voltage regulator, A/C heat exchanger and radiator fill.

3. Rear End

- a. Replace with new the transmission door and install suitable gas spring.
- b. Replace with new the radiator door and install suitable gas spring.
- c. Replace with new the rear closure door and install suitable gas spring.

4. Flooring and Covering

- a. Replace with new 3/4" thick 7-ply resin waterproof board laminated fir, #1 grade AC or better, treated to be rot resistant the following floor areas; #1, drivers floor, drivers floor board and #5 in the passenger compartment.
- b. Replace with new the floor covering as follows: 1/8" smooth under seats, 3/16" ribbed in aisle and on drivers platform, 3/16" ribbed front standee area and 5/16" ribbed in entrance and standee line area including step treads.
- c. Integrally molded white nosings to be furnished on all step edges.
- d. A white line of matching material will be provided across the aisle just rearward of the drivers seat.
- e. Except as noted, flooring to be black.

5. Stepwells

- a. New fiberglass front and rear stepwells will be installed.
- b. Stepwell covering is to be as described in 4. **Flooring and Covering.**

6. Heating System

- a. Install in the side walls above floor level new ROYALITE combination heat duct and insulation panels. Equals will require specific approval.

- b. Rebuild the heating system using rebuilt heater cores, new connecting hoses and a rebuilt heater blower motor.
- c. Rebuild heater compartment doors and install new seals.
- d. Rebuild the defroster motor, core and housing.

7. Bulkhead

- a. Install a new engine bulkhead with new engine mounting brackets.
- b. Install new left and right hand longitudinal bulkheads.
- c. Install new rear axle bulkhead.
- d. Install new rear reinforcing plate. Plate shall be 14 gauge cold rear reinforcing rolled steel approximately 94" x 48" in size.
- e. Install new front axle bulkhead.
- f. Install new front axle rear cross member.

8. Passenger Doors

- a. Install on the front passenger entrance door, new door bearings, bushings, seals, retainer and filler. Repair door panels.
- b. Install on the rear exit door new door bearings, bushings, seals, retainer and filler. Repair door panels.

9. Windows

- a. Rebuild all side windows, intermediate window and drivers window with new seals.
- b. Replace with new the rubber harness on the windshield, rear window, transom window, destination signs and tear drop window.

10. Repair and Reupholstery of Bus Seast

1. Transit, Suburban, and Driver's seats and backs are to be reupholstered in the style and arrangement of the original manufacturer.

2. All seats and backs shall be completely stripped of old coverings and covered with new material. Old material shall not be used in any area. Colors shall be specified by Director of Maintenance. The covering materials and self Welt Cord shall be furnished as follows:

- a. Transit, Driver's Seats and Backs: A minimum of 42 oz. Timkote or approved equal, similar to the material used by the original manufacturer of these seats and backs.

- b. Suburban Seats and Backs: Center inserts shall be 42 oz. Timkote Vinyl, balance of upholstery shall be corresponding vinyl, as designated by Director of Maintenance. Coverings shall be fabricated as per original manufacture including arrangement of upholstery and attachments.
 - c. All covering materials for Transit, Driver and Suburban seats shall be fire-retardant, treated in accordance with Federal Specification CCC-A-680 (a), latest issue, Treatment A-1.
 - d. All material shall be directly interchangeable with Transport of New Jersey reupholstery practices. Material interchangeability with color and texture according to Transport of New Jersey practice must be assured.
3. Vandalized foam shall be repaired in the following manner and the cost of this repair shall be included in any quoted prices listed on the accompanying Inquiry.
- a. The vandalized area shall be "squared off" with a fabricated foam insert installed to assure smooth and concise repair of damaged area.
 - b. Existing foam, if damaged or worn beyond repair, shall be replaced by a totally new unit of the same configuration as the original foam. Cost to supply new foam units shall be quoted separately. Replacement foam shall meet Federal, State, and Industry Fire-Retardant Requirements.
 - c. All seating materials used in the work shall meet ASTM Specification E162-7 and FAA Air Worthiness Standards, Transportation Category Air Worthiness Part 25, Paragraph 25.853 and Paragraph 25.1359, Compartment Interiors.
4. Heavy Duty Nylon Sewing Thread - Minimum size F (Belding or equal) shall be utilized in the fabrication of all coverings.

All original hardware including clips, or brackets shall be reinstalled or replaced, if required, to restore the repaired seats to a "new" condition. This cost shall be included in quoted prices. Seat plywood boards and metal backrest panels, when required, shall be replaced with approval of Director of Maintenance.

5. All bidders must submit a list of previous or present commercial firms for which they have done reupholstery work. This clause will not be used to disqualify new contractors from bidding, but in the absence of this list, adequate proof (as prescribed by New Jersey Transit) of the ability to complete the job properly, may be required.

11. Finish and Color

- a. Repaint exterior in four (4) colors per NJ TRANSIT Graphics Standards.

- b. Repaint interior as follows:

Commuter - Top of dash and inner face of entrance door - Non-reflective paint to match Du Pont Dulux Blue #83-1855.

Lower Body Front - Du Pont Dulux Blue #83-1855.

Ceiling and Window Post Area - Du Pont Dulux Light Blue #83-83558

Lower Interior Trim - Standard leather patterned aluminum.

Transit - Top of dash and inner face of entrance door - Non-reflective paint to match Du Pont Dulux Enamel #83-77903H.

Lower Body Front - Du Pont Dulux Enamel #83-77903H.

Ceiling and Window Post Area - Du Pont Dulux Enamel #83-77902.

Lower Interior Trim - Standard leather patterned aluminum.

Center Ceiling Panels - Aqua Fantasy No. 10-5524.

- c. Reinstall all bus numbers, decals and passenger information removed as per NJ TRANSIT graphic standards.

12. Undercoating

- a. Complete bus understructure to be undercoated with Tectyl 165G or approved equal.

J. Accessibility

Requirements for people who can use steps:

- 1. Install priority seating signs over forwardmost seat set, a sign that reads "Please offer these seats to the elderly." To be supplied by TNJ. Photocopy of the plastic sign is attached. Actual sign is approximately as thick as a credit card.

2. Install a handrail on the front door and on the front and rear modesty panels as per the following :
 - a. Install on each half of the two part front door a handrail mounted $21\frac{1}{4}$ " on the seal side of the door and mounted $50\frac{3}{4}$ " on the hinged side of the door. Measurements from the bottom of the door frame.
 - b. Install on the front modesty panel a handrail, mounted 10" from the side wall, and $6\frac{1}{4}$ " from the floor and mounted $1\frac{3}{4}$ " from the front modesty panel stanchion.
 - c. Install on the rear modesty panel a handrail extending from below the upper grabrail of the rear modesty panel to the top of the lower grabrail of the rear modesty panel. The handrail is to be located parallel to and from 2" from the center of the rear modesty panel stanchion. A reinforcing panel of 16 guage aluminum 7" x 29" shall be fixed to the modesty panel flush with the rear modesty panel stanchion.
 - d. All handrails are to be fabricated from 1" O.D Stainless steel tubing flattened on each end for at least 2". The ends shall be finished with a radius of equal to the width of the flat area.
 - e. All handrails will be securely mounted on each end with a bolt and washer.

3. Install an exterior doorway lighting system as follows:

Lamps at the front and rear doors shall activate only when the doors open and shall illuminate the street surface to a level of no less than 1 footcandle for a distance of 3 feet outward from the lowest step tread edge. The lights shall be positioned below the lower daylight opening of the windows and shall be shielded to protect passengers' eyes from glare.

A stepwell lighting system shall be illuminated when the master switch is in RUN and NITE/RUN, except the front stepwell lamps which shall be extinguished when the doors are closed. The system shall provide no less than 2 footcandles of illumination on the entry and exit step treads with the doors open. These lights shall be shielded to protect passengers' eyes from glare. Light fixtures shall be totally enclosed, splashproof, designed to provide ease of cleaning as well as lamp and housing removal, and shall not be easily removable by passengers. Stepwell lights shall be protected from damage caused by passengers kicking lenses or fixtures and shall not be a hazard to passengers.

K. Run Numbers

An illuminated run number sign box with four characters, 4 inches high, shall be mounted on the dash panel to the right of center of the coach. The sign shall be mounted with a built-in appearance to eliminate glare and reflections in the windshield and shall minimize obstruction of the driver's view. Manual adjustment of the run number sign entry shall be provided from inside the coach with provision for reading the sign during the adjustment operation. Illumination of the sign shall be concurrent with the market lights. The list of required sign readings is defined in attachments to Part II: Technical Specifications.

Each character location shall be individually controlled, with each location containing the numbers, 0 through 9, a blank indicator and the letter X.

4.0 WARRANTY & TESTING

Warranty for all work to be performed will be submitted prior to award of bid.

This warranty should consist of:

- a. Warranty on body and paint. (Section 3.1)
- b. Warranty on electrical system. (Section 4.1)
- c. Warranty on mechanical. (Section 5.1)
- d. Warranty on other items specified in Exhibit B-1.

Warranty provisions are subject to final approval by the Authority.

A. Durability of Workmanship and Materials

The design parameters during rebuilding, shall be with a view to increase the service life of the vehicles by 5 years.

B. Work not Specified

In rehabilitation work, it is not feasible to define the scope of work, totally. During actual performance of work or inspection of sample for evaluation, if the contractor considers that additional work needs to be carried out beyond the specifications, he should undertake such work only with the written concurrence of the Authority's on-site representative.

C. POST-DELIVERY TESTS

The New Jersey Transit Corporation may conduct acceptance tests on each delivered coach. These tests shall be completed within 15 days after coach delivery and shall be conducted in accordance with written test plans. The purpose of these tests is to identify defects that have become apparent

between the time of coach release and delivery to the New Jersey Transit. The post-delivery tests shall include visual inspection and coach operations.

Coaches that fail to pass the post-delivery tests are subject to nonacceptance. The New Jersey Transit Corporation shall record details of all defects on the appropriate test forms and shall notify the Contractor of nonacceptance of each coach within 5 days after completion of the tests. The defects detected during these tests shall be repaired according to procedures defined in Section 5.

C.1 VISUAL INSPECTION

The post-delivery inspection is similar to the inspection at the Contractor's plant and shall be conducted with the coach in a static condition. Any visual delivery damage shall be identified and recorded during the visual inspection of each coach.

C.2 COACH OPERATION

The road tests for total coach operation are similar to those conducted at the Contractor's plant. Operational deficiencies of each coach shall be identified and recorded.

C.3 WATER TEST PROCEDURES

Buses which have had structural components, body panels, windows, passenger doors and rubber seals replaced must be subjected to a water test. This test must be witnessed and approved, in writing, if passed by the NJ TRANSIT designated representative. The test will consist of a heavy spray of water from a pressurized hose. If the vehicle fails to pass this test, the vehicle must have corrective action taken and test must be repeated. Exceptions due to any reason whatsoever shall have the written approval of the on-site inspector.

C.4 ROAD TEST

All rehabilitated buses shall be road tested for a minimum of 15 miles distance to determine adequacy and quality of repairs. The test must be witnessed and approved, in writing, if passed by the NJ TRANSIT designated representative. Exceptions, if any, should have written approval of the on-site inspector.

EXAMPLE 2

REHABILITATION OF GMC BUSESSchedule of Bid PricesI. BASE BID (BID ITEM NOS. 1 Through 17)

<u>em No.</u>	<u>Description</u>	<u>Applicable Spec. Section</u>	<u>Estimated No. of Bus Units</u>	<u>Unit Price</u>	<u>Total P</u>
1	Overhaul of Front Axle Group	_____	161	_____	_____
2	Overhaul of Rear Axle Group	_____	161	_____	_____
3	Overhaul of Steering Group	_____	161	_____	_____
4	Overhaul of Air Brake System	_____	161	_____	_____
5	Overhaul of Engine and Drive Train System	_____	161	_____	_____
6	Overhaul of Electrical System	_____	161	_____	_____
7	Overhaul of Fuel System	_____	161	_____	_____
8	Overhaul of Exhaust System	_____	161	_____	_____
9	Overhaul of Heating, Ventilating and Air Conditioning Systems	_____	161	_____	_____
10	Overhaul of Body	_____	161	_____	_____
11	Pickup & Delivery of Bus	_____	161	_____	_____
12	Furnish & Install Air Starter	_____	161	_____	_____
13	Furnish & Install Automatic Slack Adjuster	_____	161	_____	_____
14	Furnish & Install Teflon Oil Hoses	_____	161	_____	_____
15	Furnish & Install Silicon Water Hoses	_____	161	_____	_____
16	Furnish & Install Emco-Wheaton Fuel System	_____	161	_____	_____
17	Furnish & Install Speakers & Jack	_____	161	_____	_____
<u>TOTAL BASE BID (BID ITEM NOS. 1 Through 17)</u>			_____	_____	_____

II. ADDITIVES

All bidders are required to submit bid prices for the following additives. One more of the following additives, if elected by the Authority, will be elected at time of award of the contract. The elections, if any, shall be made in priority order, A-1 through A-39 and then B through J, with A-1 being the highest priority additive and J being the lowest priority additive.

Additives A-1 through A-39 inclusive are overhaul of individually identified collision-damaged buses. For each such collision-damaged bus the work to be accomplished includes repair of the collision damage and all of the following:

<u>Description</u>	<u>Applicable Spec. Section</u>
Overhaul of Front Axle Group	_____
Overhaul of Rear Axle Group	_____
Overhaul of Steering Group	_____
Overhaul of Air Brake System	_____
Overhaul of Engine and Drive Train System	_____
Overhaul of Electrical System	_____
Overhaul of Fuel System	_____
Overhaul of Exhaust System	_____
Overhaul of Heating, Ventilating and Air Conditioning Systems	_____
Overhaul of Body	_____
Pickup & Delivery of Bus	<u>See Bid Form Section on Pickup & Delivery</u>
Furnish & Install Air Starter	_____
Furnish & Install Automatic Slack Adjuster	_____
Furnish & Install Teflon Oil Hoses	_____
Furnish & Install Silicon Water Hoses	_____
Furnish & Install Emco-Wheaton Hoses	_____
Furnish & Install Speakers & Jack	_____

<u>ADDITIVE ITEM</u>	<u>DESCRIPTION (OVERHAUL OF BUS NO.)</u>	<u>NO. OF BUS UNITS</u>	<u>UNIT PRICE</u>	<u>TOTAL PRICE</u>
A-1		1		
A-2		1		
A-3		1		
A-4		1		
A-5		1		
A-6		1		
A-7		1		
A-8		1		
A-9		1		
A-10		1		
A-11		1		
A-12		1		
A-13		1		
A-14		1		
A-15		1		
A-16		1		
A-17		1		
A-18		1		
A-19		1		
A-20		1		
A-21		1		
A-22		1		
A-23		1		
A-24		1		
A-25		1		
A-26		1		

<u>ADDITIVE ITEM</u>	<u>DESCRIPTION (OVERHAUL OF BUS NO.)</u>	<u>NO. OF BUS UNITS</u>	<u>UNIT PRICE</u>	<u>TOTAL PRICE</u>
A-27	_____	1	_____	_____
A-28	_____	1	_____	_____
A-29	_____	1	_____	_____
A-30	_____	1	_____	_____
A-31	_____	1	_____	_____
A-32	_____	1	_____	_____
A-33	_____	1	_____	_____
A-34	_____	1	_____	_____
A-35	_____	1	_____	_____
A-36	_____	1	_____	_____
A-37	_____	1	_____	_____
A-38	_____	1	_____	_____
A-39	_____	1	_____	_____

<u>ADDITIVE ITEMS (Cont.)</u>	<u>DESCRIPTION</u>	<u>APPLICABLE SPEC. SECTION</u>	<u>ESTIMATED NO OF BUS UNITS</u>	<u>UNIT PRICE</u>	<u>TOTAL PRICE</u>
B	Furnish & Install AD'2 Air Dryer	_____	200	_____	_____
C	Furnish & Install "HELP" Bumpers (Front and Rear)	_____	200	_____	_____
D	Furnish & Install AC Screw-On Type Oil Filters	_____	200	_____	_____
E	Furnish & Install AC Screw-On Type Fuel Filters	_____	200	_____	_____
F	Furnish & Install DD-3 Type Parking Brake System	_____	200	_____	_____
G	Furnish & Install Electro- Lube Oil Filter-Refiner	_____	200	_____	_____
H	Furnish & Install Electronic Destination Signs	_____	200	_____	_____
I	Furnish & Install Koni Shocks	_____	200	_____	_____
J	Furnish & Install Mobile Page #407C P.A. System	_____	200	_____	_____

TECHNICAL SPECIFICATIONS
FOR
REBUILDING TRANSIT BUS SUBSYSTEMS

1.0 GENERAL

The following article identifies the manner and type of those areas of the bus which shall be directly involved in the rehabilitation, including the description of most options.

2.0 DETAIL REQUIREMENTS

2.1 Axle and Suspension, Front

2.1.1 Specific parts and equipment requirements are identified in Paragraph 3.0, Pages 11 through 18.

2.1.2 All wheel bearing cups and cones shall be removed, cleaned, and inspected for general condition including discoloration, pits, scratches, scoring, etc., and shall be replaced if required. All brake drums shall be cleaned and inspected for cracks, scoring, and out of roundness. Drums with wear or deep grooves exceeding sixty thousandths of one inch (.060") on the radius shall be replaced with new drums. Drums on the same axle shall be of the same diameter. All front bellows supports shall be inspected and repaired as required, or replaced if necessary.

2.1.3 New Item: The Existing manual slack adjuster will be replaced by a SAB Automatic Slack Adjuster.

2.1.3.1 The Slack Adjuster part numbers are 409-10027 & 409-10028, with two Bracket Assemblies, number 427-10130.

2.1.4 Options: Paragraph 3.0, Page 17 calls for replacement of the existing shock absorber. The specification includes an option, which if exercised, will require the replacement of the existing shock absorber by a "Koni" Shock Absorber for a GMC Bus.

2.2 Axle and Suspension, Rear

2.2.1 Specific parts and equipment requirements are identified in Paragraph 3.0, Pages 19 through 29.

2.2.2 All wheel bearing cups and cones shall be removed, cleaned, and inspected for general conditions including discoloration, pits, scratches, scoring, etc., and shall be replaced if required. All brake drums shall be cleaned and inspected for cracks, scoring, and out of roundness. Drums with wear or deep grooves exceeding sixty thousandths of an inch (.060") on the radius shall be replaced with new drums. Drums on the same axle shall be of the same diameter. Axle shafts shall be removed and inspected. Twisted, cracked, or otherwise damaged axle shafts shall be replaced with new axle shafts. All rear bellow supports shall be inspected and repaired as required, or replaced if necessary.

2.2.3 New Item: The existing manual slack adjuster will be replaced by a SAB Automatic Slack Adjuster.

2.2.3.1 The Slack Adjuster Part numbers are 409-10023 & 409-10024, with two Bracket Assemblies number 427-10256.

2.2.4 Options:

2.2.4.1 Paragraph 3.0, Page 24 calls for replacement of the existing shock absorbers. The specification includes an option which, if exercised, will require the replacement of the existing shock absorber with a "Koni" Shock Absorber for a GMC Bus.

2.2.4.2 Paragraph 3.0, Page 26 outlines the requirements for rehabilitation of the parking brake. The specification includes an option which, if exercised, will require the replacement of the existing parking brake with a DD3 Type Parking Brake System.

2.3 Steering System

2.3.1 Specific parts and equipment requirements are identified in Paragraph 3.0, Pages 30 through 31.

2.3.2 Four new mounting bolts, which are not identified in Paragraph 3.0, Page 30, shall be installed, attaching the Steering Gear Housing to the front axle.

2.4 Air Systems

2.4.1 Specific parts and equipment requirements are identified in Paragraph 3.0.

2.4.2 The air systems shall be purged of all foreign material, dirt, water, etc. The Air Compressor shall be a remanufactured B-W TuFlo 700 size with ball bearing crankshaft. The Air Compressor Governors shall be relocated on the L.H. Hanger Supprt and shall be preset for 135 P.S.I.

2.4.3 New Item: An Ingersol-Rand/Air Starter #150BMPE83-LH-11 and kit #150M-BK50-1 with 60 gallon aluminum tanks and brackets, will be supplied in place of the existing electrical starter.

2.4.4 Options:

2.4.4.1 Bendix Westinghouse DD3 Type Parking Brake System, see 2.2.4.2, above.

2.4.4.2 The specification includes an option, which if exercised, will require the installation of a Bendix Westinghouse AD-2 Air Dryer equipped with a heater coil in the drain valve.

2.5 Engine and Drive Train Systems

2.5.1 The specific parts and equipment requirements are identified in Paragraph 3.0, Pages 32 through 36.

2.5.2 The Engine and Transmission shall be rebuilt by a Detroit Diesel Allison Distributor to the specifications outlined in Sections III and IV. The rebuilt Engines and Transmissions shall carry a six (6) month unconditional warranty. 6V-71 engines shall be equipped with C-60 injectors and 8V-71 engines with C-55 injectors.

2.5.3 New Items:

2.5.3.1 All engines shall be protected against low oil pressure and high water temperature with a Motor Guard Engine Shut Down System.

2.5.3.2 All oil hoses shall be Strato-Flex Teflon No. 246 and all water hoses shall be Strato-Flex Silicon No. 4214 with two (2) clamps at each connection.

2.5.4 Options:

2.5.4.1 The specification includes an option which, if exercised, will require the installation of screw-on type fuel and oil filters.

2.5.4.2 The specification includes an option which, if exercised, will require the supply and installation of Electro-Lube Oil Filter-Refiner.

2.6 Electrical Systems

2.6.1 Specific parts and equipment requirements are identified in Paragraph 3.0.

2.6.2 Replace all existing wiring with new wiring looms and harnesses. Replace existing battery cable with new 4/0 size battery cable.

2.6.3 New Items:

2.6.3.1 Install individual Nycal Fluorescent Ballast.

2.6.3.2 Install and wire six (6) speakers, Mobil Page No. 603B/65FP or 603B/65 to junction box with plug for use with WMATA owned portable PA System. Interface plugs; Amphenol Plug No. 16-95R & Amphenol Shell No. MS 3106A16-95(C).

2.6.4 Option: The Specification includes an option which, if exercised, will require the installation of a complete Mobile Page #407C PA System.

2.7 Fuel System

2.7.1 Specific parts and equipment requirements are identified in Paragraph 3.0.

2.7.2 All fuel lines shall be inspected for crimping, chafing, or other damaged and replace if necessary.

2.7.3 New Item: An Emco-Wheaton Fueling System consisting of the following parts shall be installed.

2.7.3.1 1 each G35-004, 2" Fueling filler neck with hardware

2.7.3.2 1 each J1201, Dustcover

2.7.3.3 1 each G-30, Omni Vent

2.7.3.4 1 each G-31, Lever Control

2.7.3.5 1 each G2257-001, 1" Whistle

2.7.3.6 1 each 491825, Anti-Spill valve

2.7.4 Option: The Specification includes an option which, if exercised, will require the installation of screw-on type fuel filters.

2.8 Exhaust System

2.8.1 Specific parts and equipment requirements are identified in Paragraph 3.0, Pages 37 through 38.

2.8.2 All gaskets, seals, connectors, and hangers shall be replaced by new ones.

2.9 Heating, Ventilating and Air Conditioning

2.9.1 Specific parts and equipment requirements are identified in Paragraph 3.0, Pages 39 through 41.

2.9.2 The Heating and Ventilating Circulating Pump shall be relocated to the engine compartment.

2.9.3 New Item: Install Vapor mercury single tube temperature controls for the Air Conditioning system.

2.10 Body Interior, Exterior Structure, Windows and Miscellaneous Items

2.10.1 Specific parts and equipment requirements are identified in Paragraph 3.0, Pages 42 through 89.

2.10.2 The passenger and driver's seats shall be removed, cleaned, and inspected. Seat frames shall be repaired as required and all seats shall be repadded with Toyad LS200 Low Smoke Neoprene Foam. Passenger seats shall be recovered with Transpo American Beauty Red No. T348 (54 oz.) vinyl material. The driver's seat shall be recovered with Transpo Blue No. T374 (54 oz.) vinyl covering, and the seat cushion shall be perforated.

2.10.3 Remove and replace all front and side destination signs. All front and side signs shall be replaced with Transign models similar to those originally installed.

2.10.3.1 Block Number Signs shall be removed, inspected, and repaired as required, but not replaced if missing.

2.10.3.2 Front destination signs shall have three (3) digit positions for alpha/numeric run numbers and shall have provisions for a 30" destination curtain. This curtain will be provided and installed by the Authority.

- 2.10.3.3 Side destination signs shall have three (3) digit positions for alpha/numeric run numbers and shall have provisions for a 26" destination curtain. This curtain shall be provided and installed by the Authority.
- 2.10.3.4 The Contractor shall provide and install a Special Event Sign, on the dash, next to the Block Number Sign. This two roller sign shall be approximately 19" x 6" x 4.5".
- 2.10.4 Flooring requiring replacement shall be replaced with 3/4" Plywood, exterior grade or better. The floor shall be entirely recovered with RCA TR-932 Blue. Floor covering 1/8" smooth underneath the seats, 3/16" ribbed in aisles and 5/16" ribbed flooring with 6" wide stainless steel backing shall be used at entrance, exit, and standee line area. All standee lines and stair nosings shall be white and 2" wide.
- 2.10.5 All welding must be performed by a competent and qualified welder and shall be approved by the WMATA inspector.
- 2.10.6 All dissimilar materials shall be primed with zinc chromate and an insulator tape inserted to prevent contact between dissimilar metals.
- 2.10.7 Before the bus is refinished in final colors, all metal surfaces shall be repaired or replaced, sanded, cleaned, and primed after body repairs are completed. All surface preparations and paint applications shall be in accordance with the procedures recommended by the paint supplier.
 - 2.10.7.1 The entire bus shall be painted DuPont DeLux #93-508 White Enamel with a DuPont DeLux #253-27216 Charcoal Gray Enamel skirt, as shown on the Contract Drawing. The wheels shall be painted DuPont DuLux #99 Black. Ditzler equivalent colors and types may be substituted, subject to the approval of the Authority.
 - 2.10.7.1 The interior shall be painted #522 64 GMC Trk Gray & 1947 White Trk Dark Gray, or approved equals.

2.10.8 Striping shall be 3M Scotchlite Ruby Red #508-82 engineer grade and Scotchlite Blue #3275 engineer grade. Each stripe shall be 2 3/4" wide and placed over the White enamel body paint, making a red, white, and blue (from bottom to top) band 8 1/4" wide, running across the back and along each side, to the front sliding sash, where it ascends between the sash and oval fixed window, at an angle up to and over the roof. Each red, white, and blue Scotchlite stripe through the angle shall be 2 1/8" wide for a total width of angle stripes of 6 3/8". There shall also be a red, white and blue Scotchlite band across the front of the bus just under the windshield. All Decals shall be made according to 3M Scotchlite specifications and shall be engineer grade (see Drawing #MTB-1-3GM).

2.10.8.1 There shall be a set of four (4) bus numeral decals, indicating the bus number, installed on the roof, facing toward the rear, and measuring 24" high, with 2" wide marking, which shall be Scotchlite #3275, Reflective Blue. These shall be located in a line, running over the top, at the rear of the front door opening.

2.10.8.2 The successful bidder shall be furnished one (1) complete set of interior decals and numbers, to be used as a sample. The Contractor shall furnish and install all decals as shown on Drawing #M-97-5.

2.10.9 Ceiling panels shall be cleaned. Damaged ceiling panels, or panels that cannot be cleaned, shall be replaced with a new panel of the same style, color and pattern.

2.10.10 All front and rear bumpers shall be repaired as necessary and shall be rechromed.

2.10.11 All polycarbonate and/or acrylic windows will be replaced with 1/4" safety glass that has a 60% gray tint.

2.10.12 New Item: A Lexan shield shall be installed behind the operator, downward from the aluminum panel. This shield shall be 40" long and shall extend from the wall to the stanchion. There shall be a hand-hold cutout, approximately 30" long and 4" wide on the side adjacent to the stanchion, and the edges of this cutout shall be beveled to give a smooth and rounded appearance. The cutout corners shall have a radius of no less than 1/2".

2.10.13 Options:

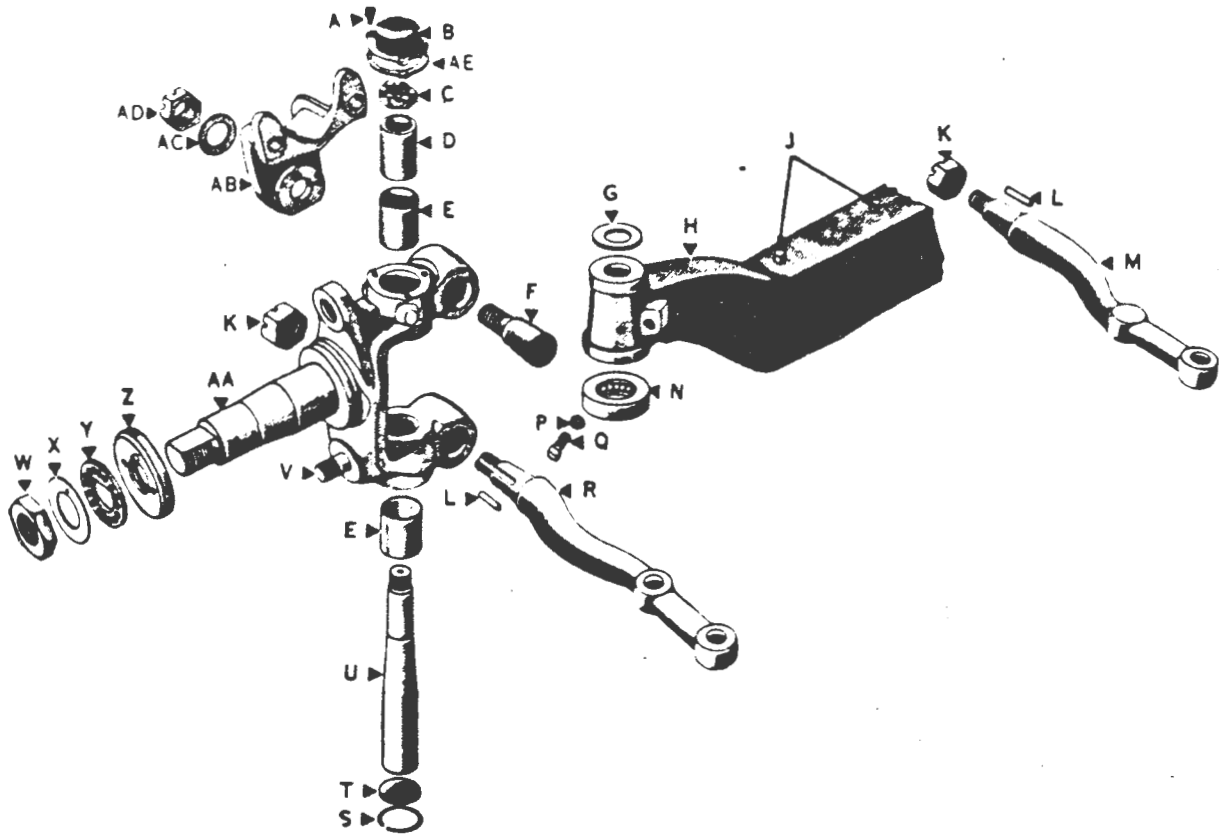
2.10.13.1 The specification includes an option which, if exercised, will require the installation of HELP Bumpers, Front and Rear.

2.10.13.2 The specifications include an option which, if exercised, will require the installation of new electronic route and destination signs in the front, side and rear (see Article 6, Pages 1 through 7.

3.0 HANDLING OF SPECIFIC PARTS

3.1 Parts Requirements

3.1.1 The specification identifies all components and indicates how these components shall be handled in this contract. Those Parts identified by "N" must be replaced by a new part; those parts identified by "R" must be replaced by a remanufactured part; and those parts identified by "AR" shall be replaced by a new or remanufactured part, if required on the basis of condition, as determined by the Contractor and approved by the WMATA inspector.



FRONT AXLE HUB

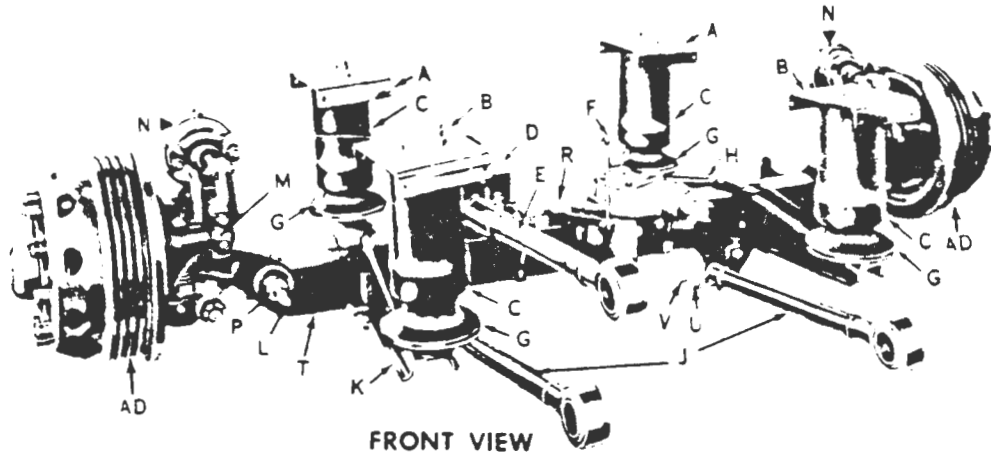
KEY	PART NO	DESCRIPTION	GROUP	PART DESIGNATION
A	-	SCREW		N
B	2237499	CAP	1-10	N
C	2311251	NUT	1-10	N
D	2253220	BUSHING	1-10	AR
E	2265810	BUSHING	1-06	AR
F	2298274	STUD	4-15	AR
G	-	WASHER - spacing	1-08	N
H	2434703	CENTER ASSY	1-04	AR
J	2421495	PIN	1-04	AR
K	249127	NUT	1-14	N
L	2357978	KEY	1-14	N
M	2404822	ARM	1-14	AR
N	445655	BEARING	1-08	AR
P	120378	NUT	20.0460	N
Q	182931	SCREW - set	20.0710	N
R	2404823	ARM	1-14	AR
S	274867	RING	1-06	N
T	2270709	PLUG	1-06	N
U	2253219	PIN-king	1-10	AR
V	2279082	STUD	4-03	AR
W	694782	NUT-jam	19-06	N
X	694780	LOCK	19-06	N
Y	694781	RING	19-06	N
Z	2257993	NUT ASSY - adj.	19-06	N
AA	2404831	KNUCKLE ASSY - RH	1-06	AR
AA	2404832	KNUCKLE ASSY - LH	1-06	AR
AB	-	BRACKET	4-15	N
AC	2053010	WASHER	4-15	N
AD	2298267	NUT	4-15	N
AE	2303371	GASKET	1-10	N

N - NEW R - REMANUFACTURED AR - AS REQUIRED

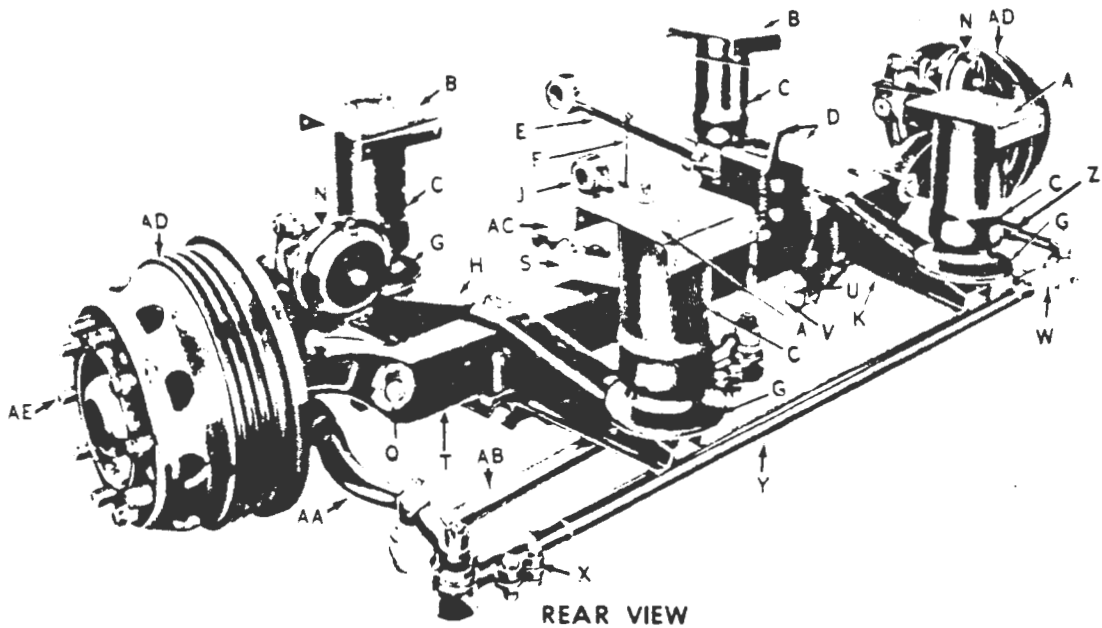
FRONT BRAKE SHOE AND LININGS

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	-	LINING (anchor end)	4-05	AR
B	-	LINING (cam end)	4-05	AR
C	2356110	BOLT	4-05	N
D	2046751	PLUG	4-05	N
E	2471533	BUSHING		AR
F	2428105	SHOE (steel)	4-05	AR
G	2356115	ROLLER	4-05	AR
H	2377712	SPRING	4-09	AR
J	2363519	PIN	4-09	AR
K	2298271	CAMSHAFT (RH)	4-11	AR
K	2298270	CAMSHAFT (LH)	4-11	AR
L	2030115	PIN	4-07	AR
M	2012242	WASHER	4-11	N
N	244531	SEAL - oil	4-11	N
P	2473988	BUSHING	4-03	AR
Q	2434698	SPIDER - RH	4-03	AR
Q	2434699	SPIDER - LH	4-03	AR
R	2275647	SLEEVE	4-03	N
S	305579	LOCK	4-07	N
U	2473351	ADJUSTER - slack, RH	4-13	AR
U	2473352	ADJUSTER - slack, LH	4-13	AR
V	658049	WASHER	4-13	N
W	9413403	RING - snap	4-13	N
X	-	NUT	20.0470	N
Y	-	BRACKET	4-15	AR
Z	2030121	PIN - dowel	4-15	N
AA	2398363	YOKE	4-15	N
AB	2052020	PIN - yoke	4-15	N
AC	2431548	CHAMBER - brake -diaphragm	4-15	N

N - NEW R - REMANUFACTURED AR - AS REQUIRED



FRONT VIEW



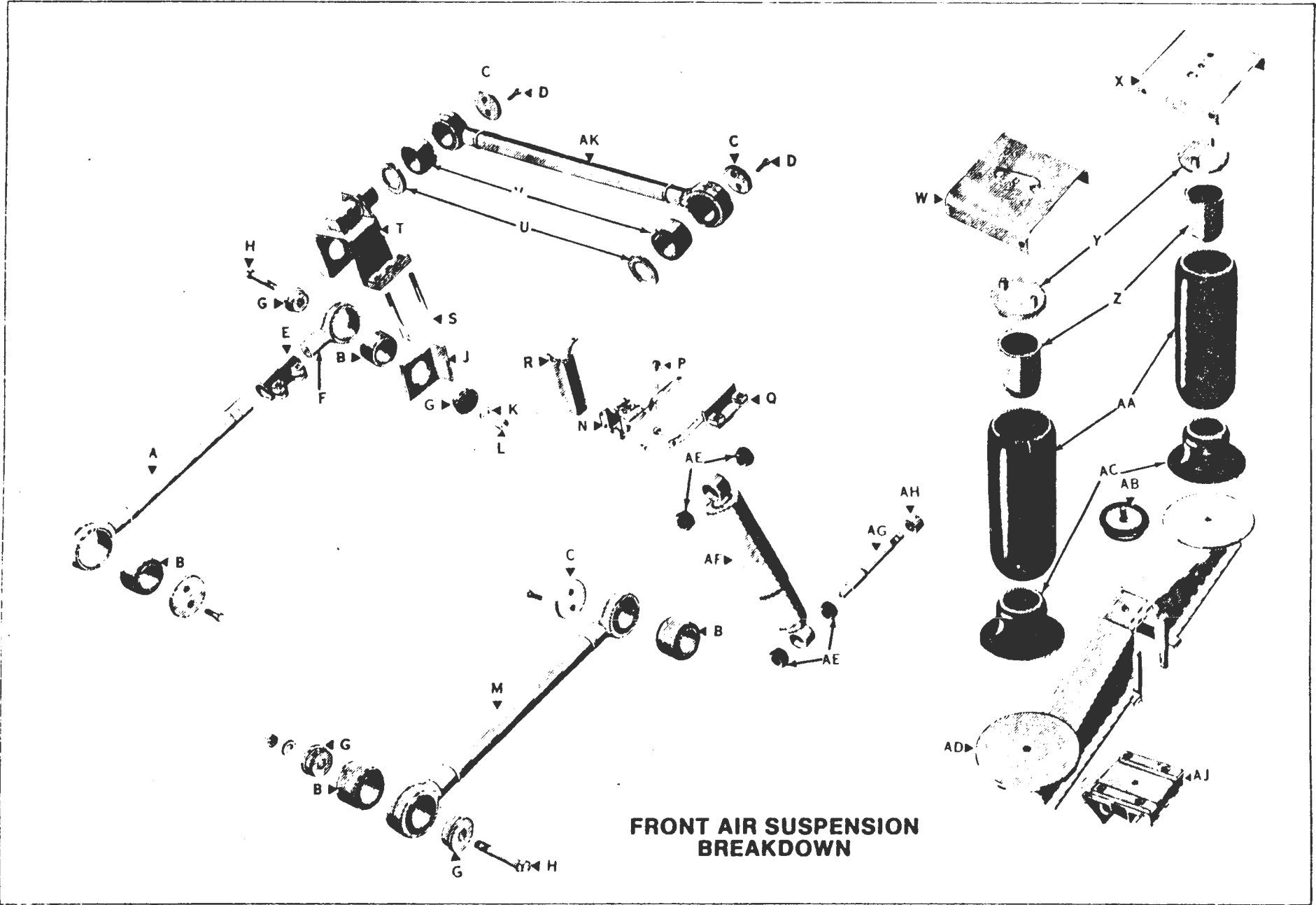
REAR VIEW

FRONT AIR SUSPENSION

FRONT AIR SUSPENSION

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	2499182	PLATE - mtg. frt	14-04	AR
B	2499183	PLATE - mtg. rear	14-04	AR
C	8875031	BELLOWS	14-04	N
D	2380644	BRACKET - upper. rad rod	14-22	AR
E	2387336	ROD - rad. frt upper	14-20	AR
F	3178670	LINK	14-08C	N
G	8869813	PISTON	14-04	N
H	2373412	SUPPORT - LH	14-04	AR
J	2375131	ROD - frt	14-20	N
K	2373413	SUPPORT - RH	14-04	AR
L	2376423	PIN - lower	14-10	N
M	2473351	ADJUSTER - slack, RH	4-13	N
N	2431548	CHAMBER - frt brake, RH	4-15	N
P	2376874	BUSHING	14-10	N
Q	2276286	WASHER	14-10	N
R	2380639	SUPPORT - RH	16-26	AR
S	2244568	SUPPORT - LH	16-26	AR
T	2434703	CENTER	1-04	AR
U	2373471	WASHER - lat rod bshg	14-20	N
V	443162	BOLT - lat rod	14-20	N
W	2404820	END - RH	1-18	N
X	2404821	END - LH	1-18	N
Y	2404821	TUBE - tie	1-16	AR
Z	2404823	ARM - LH	1-14	AR
AA	2404822	ARM - RH	1-14	AR
AB	2422037	TUBE - drag link	16-28	N
AC	5689463	GEAR - strg. lower	16-02	R
AD	2214945	DRUM - frt brake	19-08	AR
AE	2217615	STUD - frt wheel	19-06	N

N - NEW R - REMANUFACTURED AR - AS REQUIRED



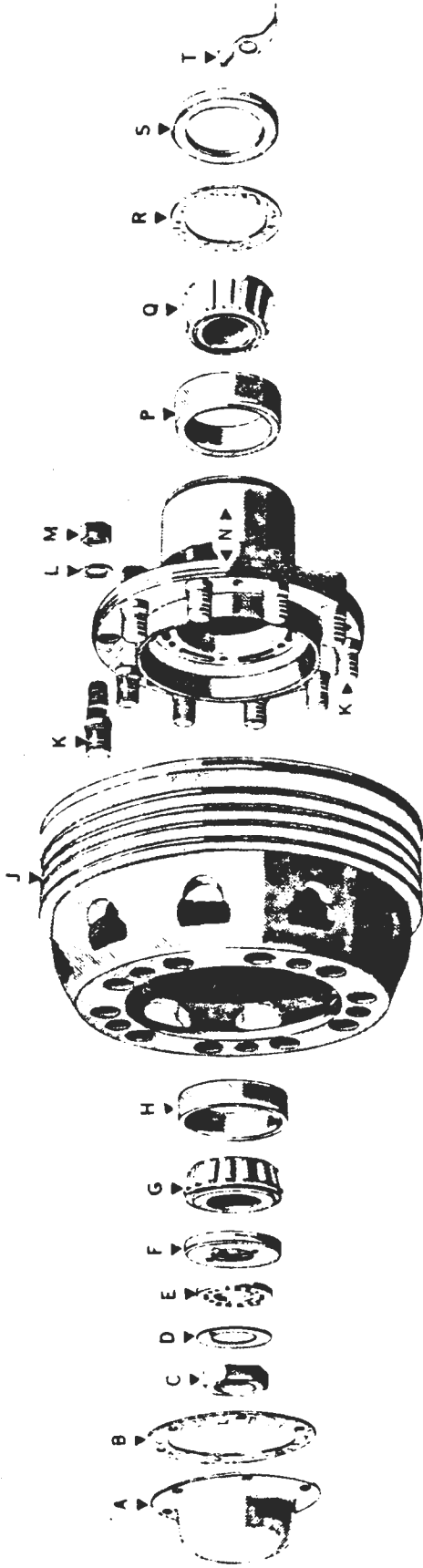
**FRONT AIR SUSPENSION
BREAKDOWN**

FRONT AIR SUSPENSION BREAKDOWN

KEY	PART NO	DESCRIPTION	GROUP	PART DESIGNATION
A	-	ROD ASSY - front upper	14-20	AR
B	-	BUSHING - front and front upper radius rod	14-20	N
C	-	WASHER - retaining, radius and bushing	14-20	N
D	-	BOLT - front lateral and front radius rod	14-20	N
E	-	CLAMP - adj.	14-20	AR
F	-	END - adj.	14-20	AR
G	-	WASHER	14-20	AR
H	-	BOLT	N.S	N
J	-	ANGLE - anchor	14-20	AR
K	-	WASHER - anchor bolt	14-20	N
L	-	NUT	-	N
M	-	ROD ASSY - radius, front	14-20	AR
N	-	VALVE ASSY - leveling, front	14-20	N
P	-	LINK ASSY - leveling valve	14-20	N
Q	-	SUPPORT ASSY	16-26	AR
R	-	BRACKET ASSY	14-08	AR
S	-	U-BOLT - front upper radius rod	14-20	N
T	-	BRACKET ASSY - front upper radius rod	14-20	AR
U	-	WASHER - spring, front lateral rod	14-20	N
V	-	BUSHING - front lateral radius rod	14-20	N
W	-	PLATE - mounting, bellows, front	14-04	N
X	-	PLATE - mounting, bellows, rear	14-04	N
Y	-	COVER ASSY - bellows, upper	14-04	N
Z	-	RETAINER - bellows, lower	14-04	N
AA	-	BELLOWS ASSY	14-04	N
AB	-	BUMPER ASSY - front axle	11-10	N
AC	-	PISTON - bellows	14-04	N
AD	-	SUPPORT ASSY - bellows	14-04	AR
AE	-	GROMMET - pivot	14-10	N
*AF	-	ABSORBER ASSY - shock, front	14-10	N
AG	-	PIN - front shock absorber	14-10	AR
AH	-	BUSHING - spacing, pin	14-10	N
AJ	-	BRACKET ASSY - front radius rod	14-20	AR
AK	-	ROD ASSY - lateral	12-20	AR

N - NEW R - REMANUFACTURED AR - AS REQUIRED

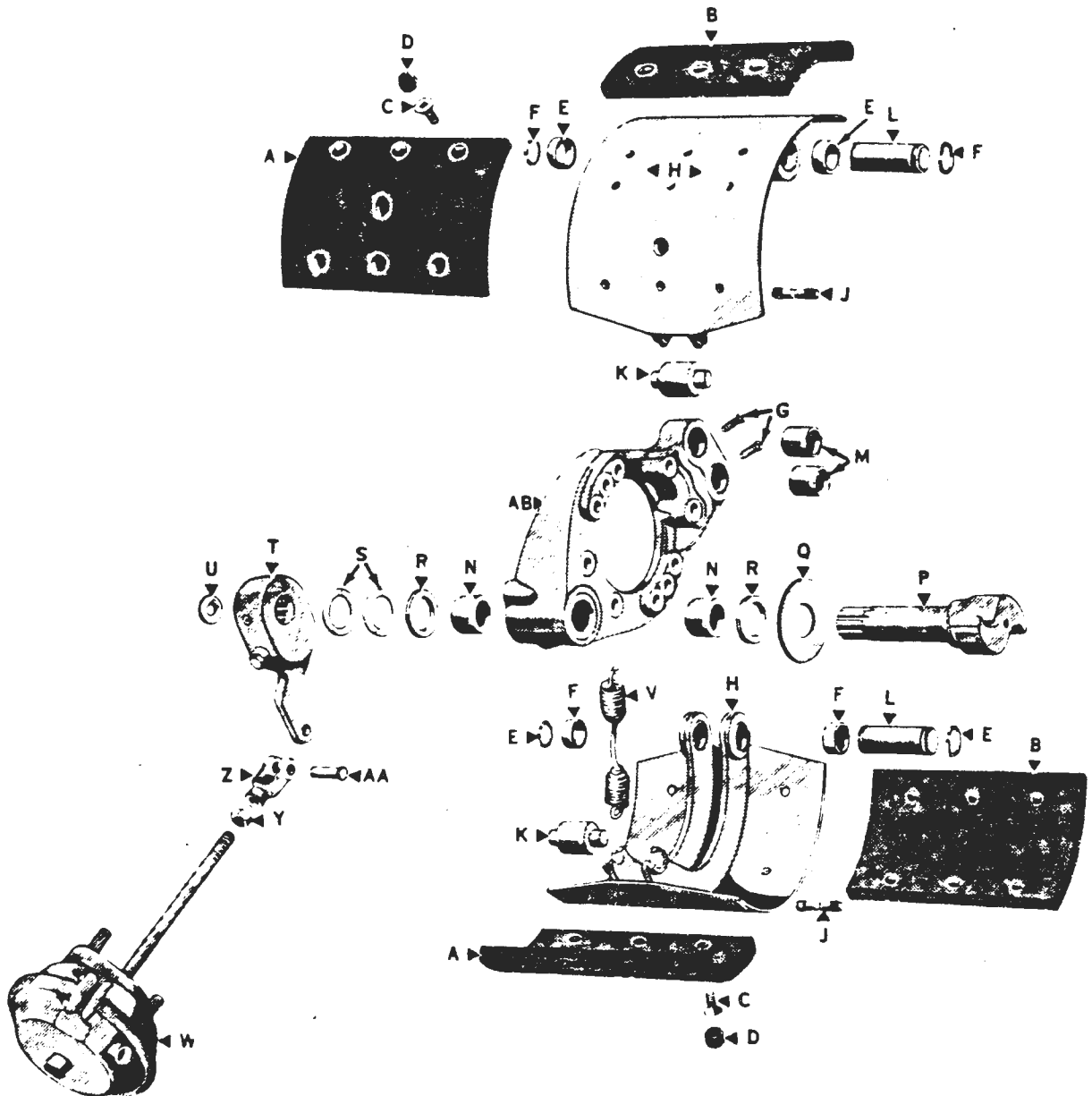
*SEE OPTIONS



FRONT HUB, DRUM AND BEARINGS

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION	KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	2091955	CAP	19-06	AR	K	2217615	STUD - hub to wheel	19-06	N
B	2306427	GASKET	19-06	N	L	2306427	WASHER - stud nut	19-06	N
C	694782	NUT	19-06	N	M	9422310	NUT - stud	19-06	N
D	694780	LOCK - adj. nut	19-06	N	N	2359668	HUB	19-06	AR
E	694781	RING	19-06	N	P	118588	CUP (inner)	19-06	AR
F	2253903	NUT - adj. inner	19-06	AR	O	118587	CONE (inner)	19-06	AR
G	131750	CONE (outer)	19-06	N	R	2133236	WASHER - oil seal	19-06	AR
H	120413	CUP (outer)	19-06	N	S	2074449	SEAL - oil	19-06	///
I	2214945	DRUM	19-08	AR	T	2040109	FLINGER	19-06	///

N - NEW R - REMANUFACTURED AR - AS REQUIRED



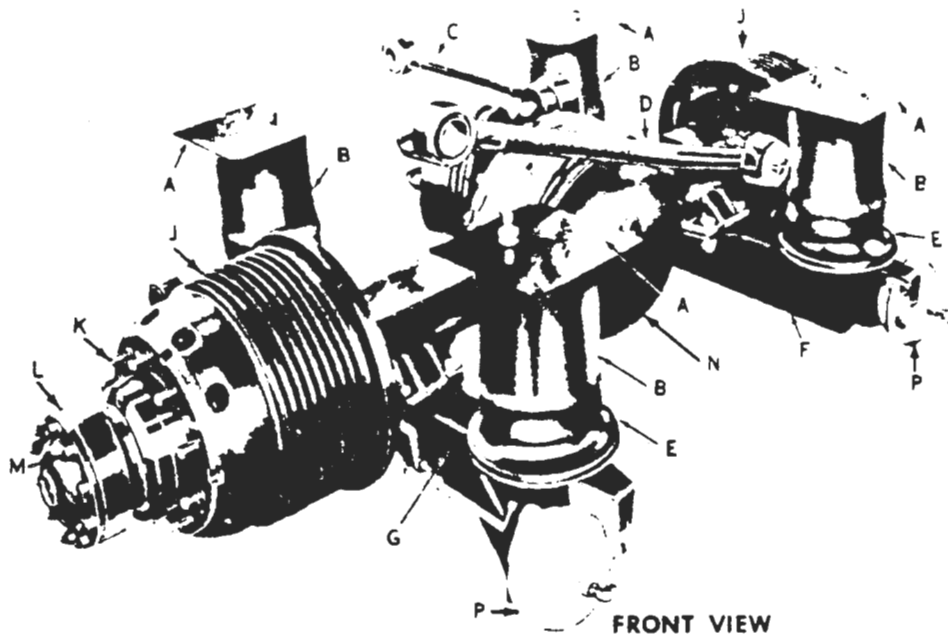
REAR BRAKE SHOE AND LININGS

REAR BRAKE SHOE AND LININGS

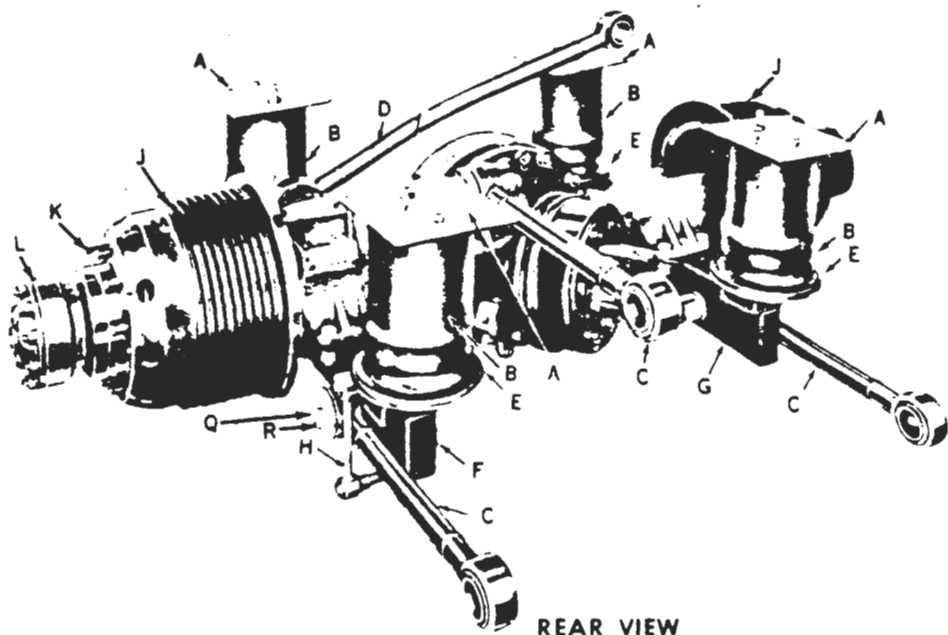
KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	-	LINING (cam end)	4-06	AR
B	-	LINING (anchor end)	4-06	AR
C	-	BOLT - rear brake lining	4-06	N
D	2046751	PLUG	4-06	N
E	2382493	BUSHING	4-06	N
F	677112	LOCK	4-08	N
G	2415058	BOLT	4-08	AR
H	2471544	SHOE	4-06	AR
J	2374444	PIN	4-10	N
K	2396542	ROLLER	4-06	N
L	2411895	KIT - anchor pin	4-08	N
M	2396539	BUSHING (to anchor pin)	4-04	N
N	2473988	BUSHING (to camshaft)	4-04	N
P	2451183	CAMSHAFT - RH	4-12	AR
P	2451184	CAMSHAFT - LH	4-12	AR
Q	2012242	WASHER	4-12	N
R	244531	SEAL	4-12	N
S	2101123	WASHER	4-12	N
*T	2473362	ADJUSTER - slack, RH	4-14	N
*T	2473361	ADJUSTER - slack, LH	4-14	N
U	2220873	WASHER	4-14	N
V	2371499	SPRING	4-10	N
W	2428704	CHAMBER - rear brake	4-16	N
Y	-	NUT	20.0470	N
Z	2119029	YOKE	4-16	N
AA	2380233	PIN	4-16	N
AB	2396505	SPIDER - RH	4-04	N
AB	2396506	SPIDER - LH	4-04	N

N - NEW R - REMANUFACTURED AR - AS REQUIRED

*Automatic Slack
Adjusters



FRONT VIEW



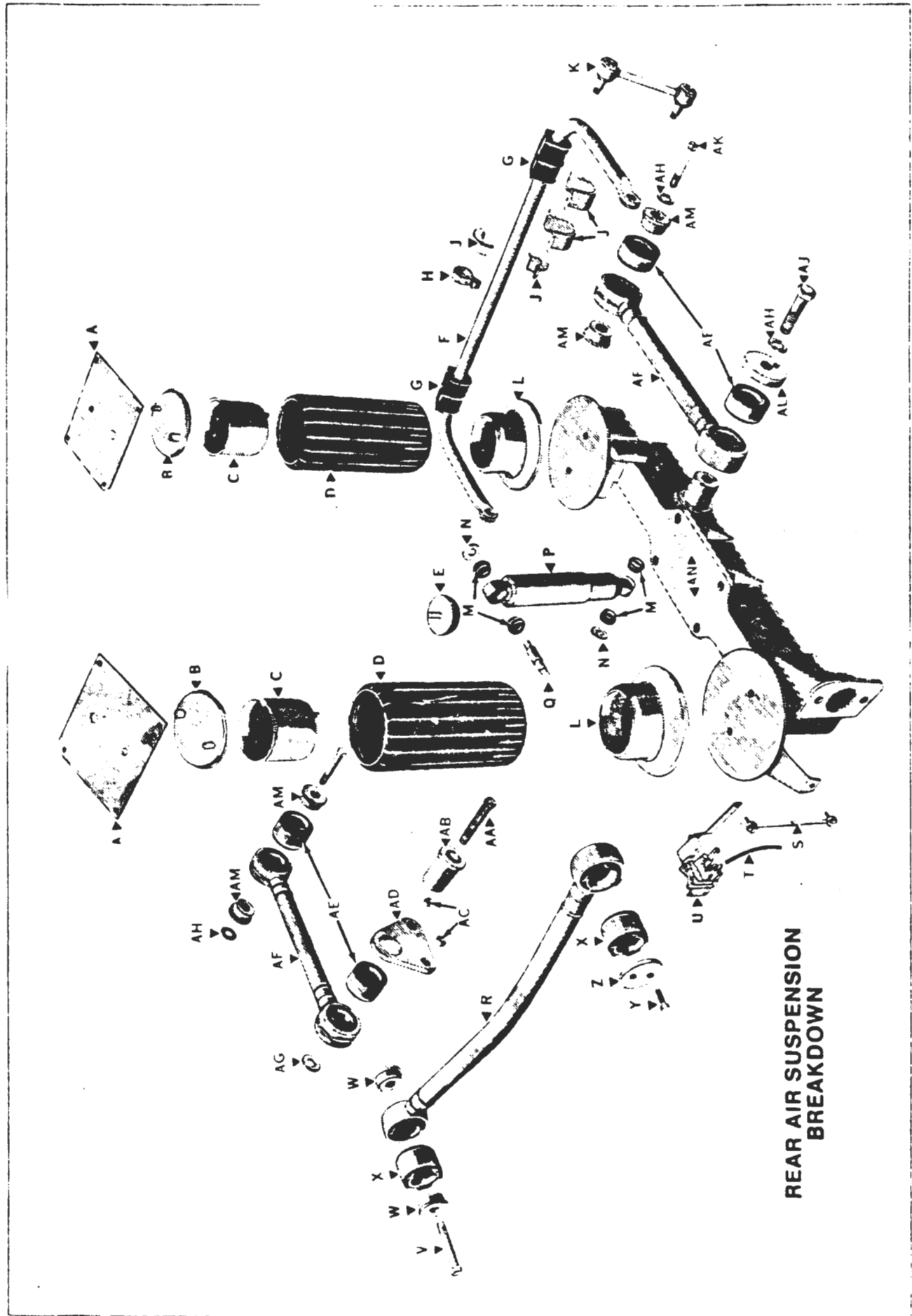
REAR VIEW

REAR AIR SUSPENSION

REAR AIR SUSPENSION

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	2388407	PLATE - adapter	14-04	AR
B	8875032	BELLOWS		N
C	2367620	ROD - radius	14-21	N
D	2385480	ROD - lat	14-21	AR
E	8875033	PISTON	14-04	N
F	2422610	SUPPORT - bellows. RH	14-04	AR
G	2422611	SUPPORT - bellows. LH	14-04	AR
H	3192035	LINK	14-24	N
J	2369827	DRUM	19-12	AR
K	2217873	STUD	19-10	N
L	2302128	HUB	19-10	AR
M	8867392	STUD	2-06	N
N	-	HOUSING	2-04	N
P	2426704	CHAMBER - rear brake dia-	4-16	N
Q	2424073	WASHER phram	14-21	N
R	2429518	BOLT	14-21	N

N - NEW R - REMANUFACTURED AR - AS REQUIRED

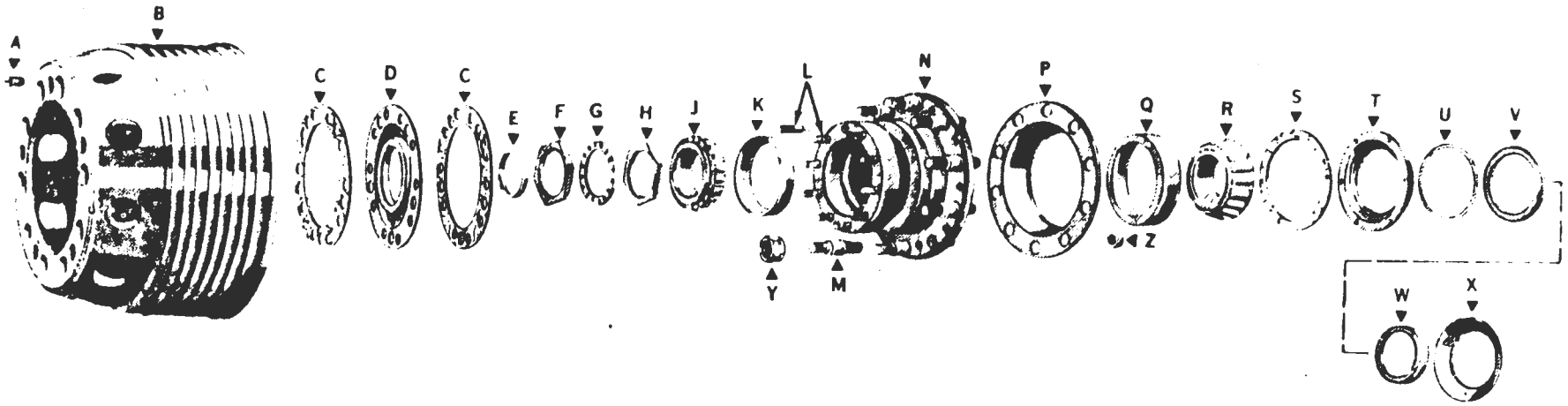


REAR AIR SUSPENSION
BREAKDOWN

REAR AIR SUSPENSION BREAKDOWN

KEY	PART NO	DESCRIPTION	GROUP	PART DESIGNATION
A	-	PLATE - adapter	14-04	AR
B	-	COVER ASSY - upper	14-04	N
C	-	RETAINER ASSY - bellows, lower	14-04	N
D	-	BELLOWS ASSY	14-04	N
E	-	BUMPER ASSY - rear axle	14-10	N
F	-	BAR ASSY - stabilizer	14-24	AR
G	-	BUSHING	14-24	N
H	-	CLAMP	14-24	N
J	-	RETAINER ASSY	14-24	AR
K	-	LINK ASSY	14-24	N
L	-	PISTON ASSY - rear bellows	14-24	N
M	-	GROMMET	14-12	N
N	-	WASHER	14-12	N
P	-	ABSORBER ASSY - shock, rear	14-12	N
Q	-	PIN - shock, upper	14-12	N
R	-	ROD ASSY - lateral	14-20	AR
S	-	LINK ASSY - leveling valve	14-08	N
T	-	HOSE - exhaust	14-08	N
U	-	VALVE ASSY - leveling, rear	14-08	N
V	-	BOLT - rear lateral rod	14-20	N
W	-	WASHER - anchor, lateral rod	14-20	N
X	-	BUSHING - lateral rod	14-20	N
Y	-	BOLT - lateral rod	14-20	N
Z	-	WASHER - anchor, lateral rod	14-20	N
AA	-	BOLT	14-20	N
AB	-	PIN	14-20	AR
AC	-	PIN - dowel	14-20	N
AD	-	PLATE - anchor	14-20	AR
AE	-	BUSHING	14-20	N
AF	-	ROD - radius, rear	14-20	AR
AG	-	WASHER	14-20	N
AH	-	WASHER	14-20	N
AJ	-	BOLT	14-20	N
AK	-	BOLT	14-20	N
AL	-	WASHER	14-20	N
AM	-	WASHER	14-20	AR
AN	-	SUPPORT ASSY	14-04	AR

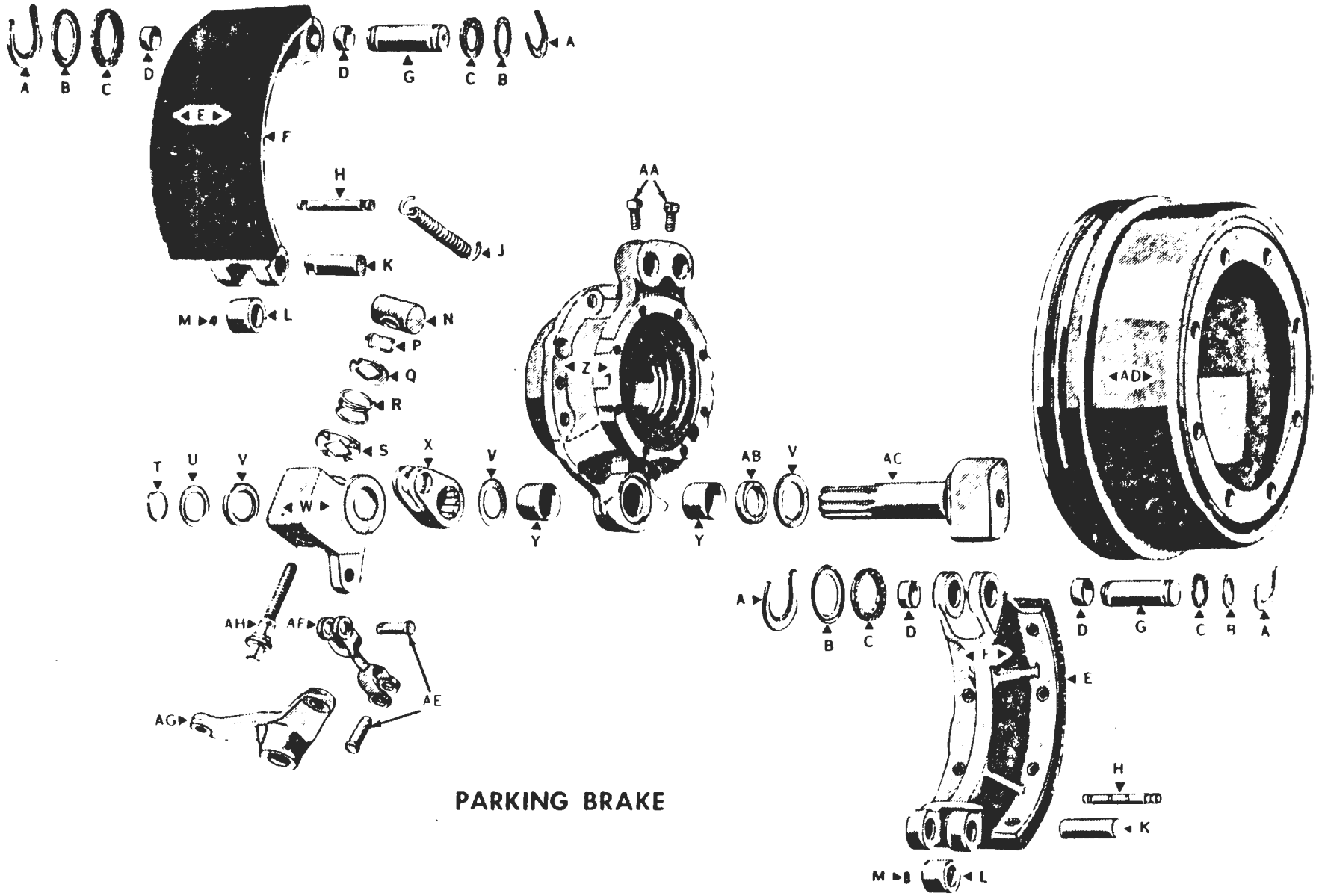
N - NEW R - REMANUFACTURED AR - AS REQUIRED



REAR HUB, DRUM AND BEARINGS

KEY	PART NO	DESCRIPTION	GROUP	PART DESIGNATION	KEY	PART NO	DESCRIPTION	GROUP	PART DESIGNATION
A		SCREW	20.0020	N	N	2302128	HUB	19.10	AR
B	2369827	DRUM	19.12	AR	P	2254960	SHIELD	19.12	AR
C	2322610	GASKET	2.06	N	Q		CUP - inner	19.10	AR
D	2298288	SEAL - outer	10.10	N	R		CONE - outer	19.10	AR
F	2353318	WIPER - outer	19.10	N	S	2302132	GASKET	19.10	N
I	2221220	NUT - jam	19.10	N	T	2123114	RETAINER	19.10	N
G	2220869	WASHER - adj. nut	19.10	N	U	2302140	WASHER (oil seal)	19.10	N
H	2405945	NUT - adj	19.10	N	V	2435718	SEAL - inner	19.10	N
J		CONE - outer	19.10	AR	W	2302130	WIPER	19.10	N
K		CUP - outer	19.10	AR	X	2302131	SLINGER	19.10	N
L	8867392	STUD	2.06	N	Y	082918	NUT	19.02	AR
M	2217873	STUD	19.10	N	Z		NUT	20.0430	AR

N - NEW R - REMANUFACTURED AR - AS REQUIRED



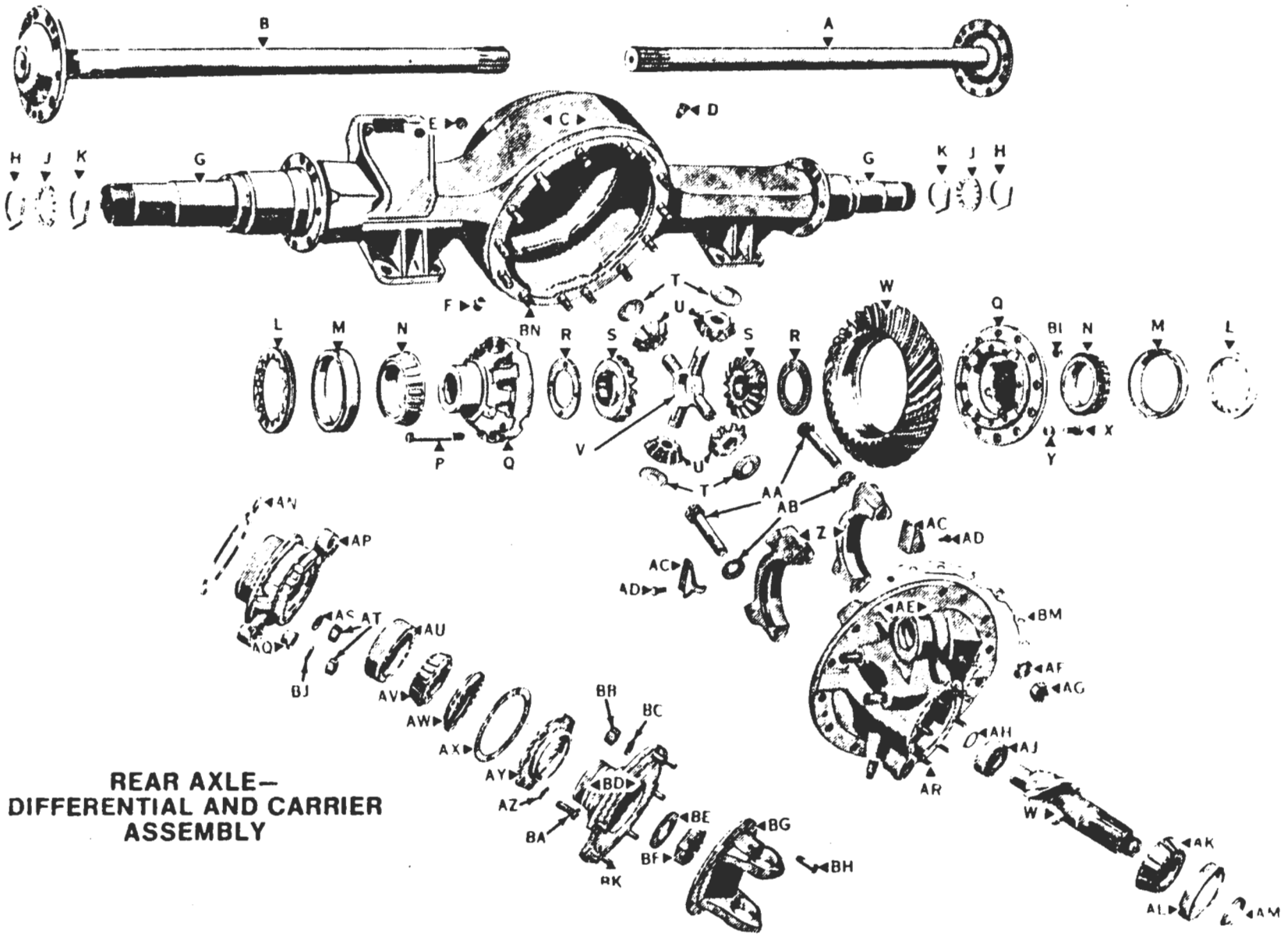
PARKING BRAKE

PARKING BRAKE *

IF REQUIRED

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	687740	LOCK	4-74	N
B	2122667	RETAINER	4-74	N
C	2122666	WASHER - seal	4-74	N
D	2122680	BUSHING - brake shoe	4-73	N
E	2313142	LINING - brake shoe	4-73	N
F	2122746	SHOE	4-73	AR
G	2122665	PIN - anchor	4-74	N
H	2476911	PIN- return spring	4-74	N
J	235754	SPRING - return	4-74	N
K	2009343	PIN - roller	4-73	N
L	2009342	ROLLER	4-73	N
M	-	SCREW - set	20.0700	N
N	092086	PIN	4-77	N
P	2026335	LOCK	4-77	N
Q	092082	WASHER - locking	4-77	N
R	092083	SPRING	4-77	N
S	092084	WASHER - spring	4-77	N
T	274932	RING SNAP	4-76	N
U	2221222	WASHER - snap ring	4-76	N
V	2385277	WASHER - spacing	4-71	N
W	2396520	BODY	4-77	AR
X	2221230	LEVER- slack adjuster	4-77	AR
Y	234951	BUSHING	4-76	N
Z	-	CAGE	2-20	AR
AA	2130193	SCREW - lock	4-74	N
AB	2220883	SEAL - oil	4-76	N
AC	2220894	CAMSHAFT	4-76	N
AD	2221229	DRUM	4-73	AR
AE	284810	PIN - head, link	4-75	N
AF	2396537	LINK	4-75	N
AG	2396515	LEVER	4-75	N
AH	092081	BOLT	4-77	AR

N - NEW R - RE MANUFACTURED AR - AS REQUIRED *See Options



**REAR AXLE—
DIFFERENTIAL AND CARRIER
ASSEMBLY**

REAR AXLE - DIFFERENTIAL AND CARRIER ASSEMBLY

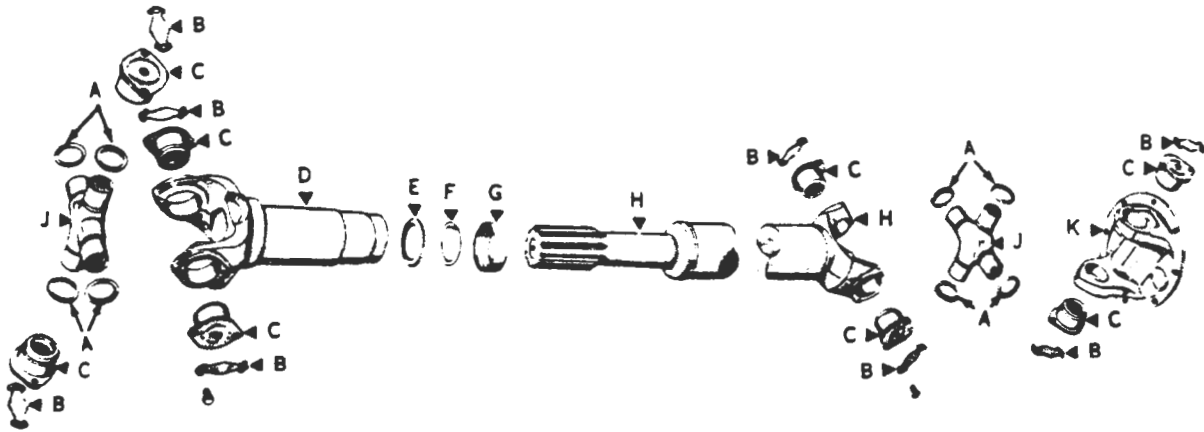
KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	2452828	SHAFT-RH	2-06	AR
B	2452829	SHAFT-LH	2-06	AR
C	2473986	HOUSING	2-04	AR
D	2257165	BREATHER	2-04	AR
E	2309473	PLUG - Filter	2-04	AR
F	2309473	PLUG - Drain	2-04	AR
G	2302138	SLEEVE	2-04	AR
H	2221220	NUT - Jam (outer)	19-10	AR
J	2220869	WASHER - adj. nut	19-10	AR
K	2405945	NUT - adj. (inner)	19-10	AR
L	2030173	ADJUSTER	2-16	AR
M	106701	CUP	2-16	N
N	144489	CONE	2-16	N
P	2277311	BOLT	2-14	AR
Q	2415093	CASE	2-10	AR
R	2306496	WASHER - side gr	2-10	AR
S	2356118	GEAR	2-14	AR
T	2208991	WASHER - pinion	2-14	N
U	2208990	PINION	2-14	AR
V	2208989	SPIDER	2-14	AR
W	-	GEAR ASSY - dr.	2-18	AR
X	2356117	BOLT	2-18	N
Y	2392314	WASHER	2-18	N
Z	-	CAP	-	AR
AA	2406000	BOLT	2-10	AR
AB	2400298	WASHER - cap bolt	2-10	N
AC	2166092	LOCK	2-16	AR
AD	301257	BOLT	2-16	AR
AE	2451852	CARRIER	2-10	AR
AF	-	WASHER	20.0820	N
AG	-	NUT	20.0460	AR
AH	2303305	RING	2-20	N
AJ	7450004	RING	2-20	N
AK	451985	CONE - inner	2-20	N
AL	451984	CUP - inner	2-20	N
AM	-	SPACER	2-20	N
AN	-	SHIM	2-20	N

N - NEW R - REMANUFACTURED AR - AS REQUIRED

REAR AXLE - DIFFERENTIAL AND CARRIER ASSEMBLY
(Continued)

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
AP	2396513	CAGE	2-20	AR
AQ	2232462	WEDGE	2-20	AR
AR	2230675	STUD	2-20	AR
AS	-	WASHER	20.0820	N
AT	-	NUT	20.0460	AR
AU	457091	CUP (outer)	2-20	N
AV	457129	CONE (outer)	2-20	N
AW	2317696	SEAL - oil	2-20	N
AX	2315527	GASKET	2-20	N
AY	2315526	SLINGER - oil	2-20	AR
AZ	-	WASHER	20.0820	N
BA	-	BOLT	20.0050	AR
BB	068904	NUT	18-08	AR
BC	-	WASHER	20.0820	N
BD	2221228	FLANGE	18-08	AR
BE	2257971	WASHER	2-18	N
BF	2257970	NUT	2-18	AR
BG	2366105	YOKE	18-08	AR
BH	2110683	BOLT	18-08	AR
BJ	-	WASHER		N
BK	2476912	STUD	4-73	AR
BL	-	NUT	20.0520	AR
BM	2396526	GASKET	2-10	N
BN	-	STUD - carrier to hsg.	2-10	AR

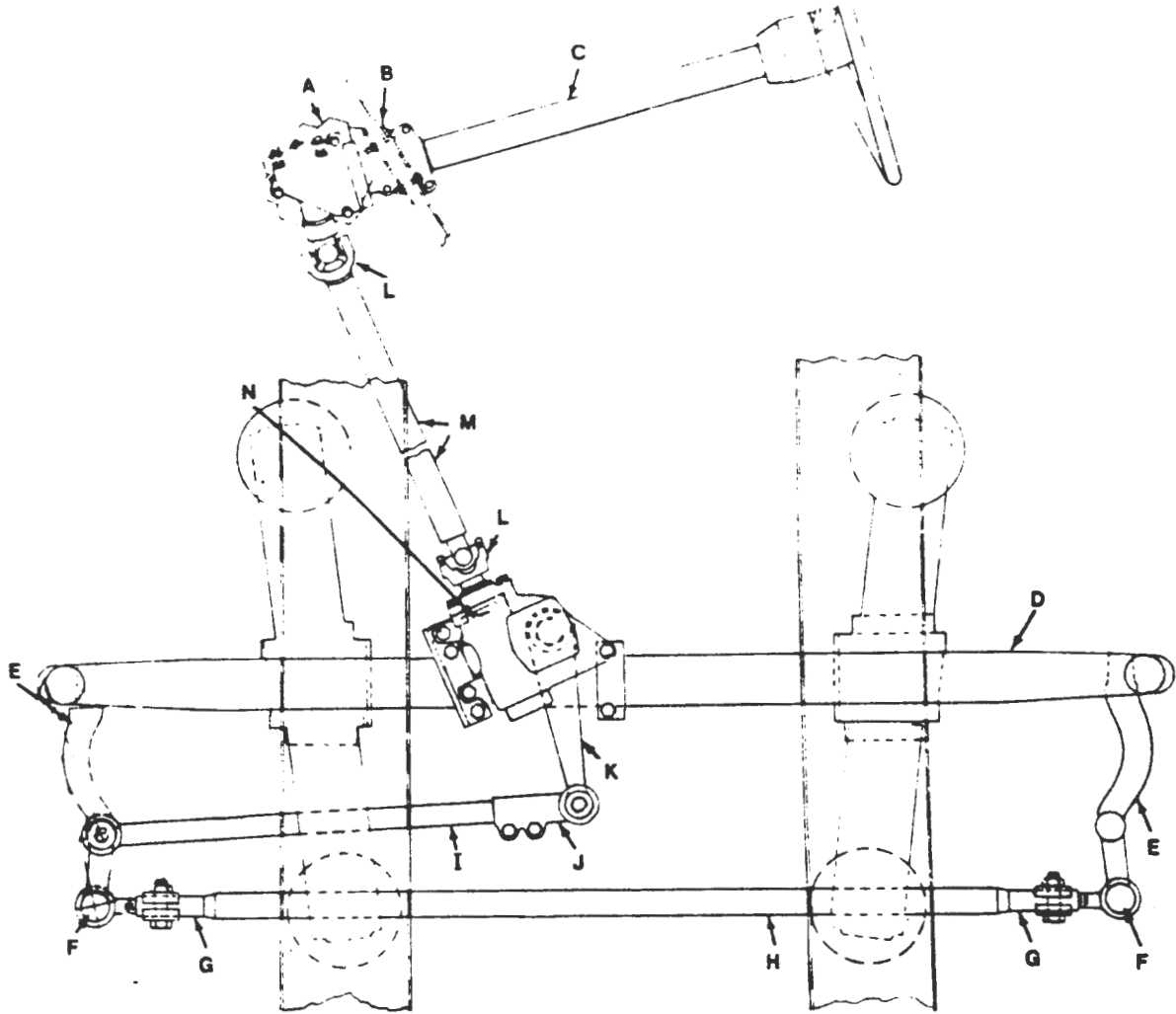
N - NEW R - REMANUFACTURED AR - AS REQUIRED



PROPELLER SHAFT

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	2438086	SEAL	18-06	N
B	2366106	STRAP	18-06	N
C	2366104	BEARING	18-06	N
D	2378766	YOKE ASSY - slip	18-08	AR
E	085989	WASHER - (steel)	18-08	N
F	085987	WASHER - (cork)	18-08	N
G	085986	CAP - dust	18-08	AR
H	-	TUBE ASSY	18-04	AR
J	2366108	KIT - journal	18-06	N
K	2366105	YOKE - (at axle)	18-08	AR

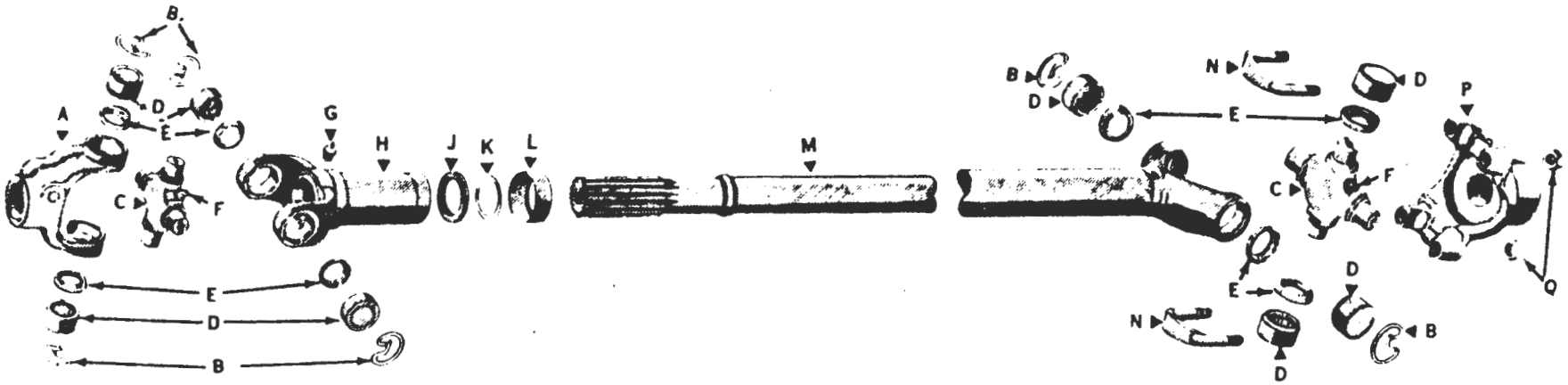
N - NEW R - REMANUFACTURED AR - AS REQUIRED



STEERING MECHANISM

KEY	DESCRIPTION	PART DESIGNATION
A	UPPER GEAR	R
B	SUPPORT FLANGE	AR
C	STEERING COLUMN	AR
D	AXLE BEAM	AR
E	STEERING ARM	AR
F	TIE ROD TO END STUD NUT	N
G	TIE ROD END	N
H	TIE ROD	AR
I	DRAG LINK	AR
J	DRAG LINK END	N
K	PITMAN ARM	AR
L	UNIVERSAL JOINT	AR
M	PROPELLER SHAFT	AR
N	STEERING GEAR	R

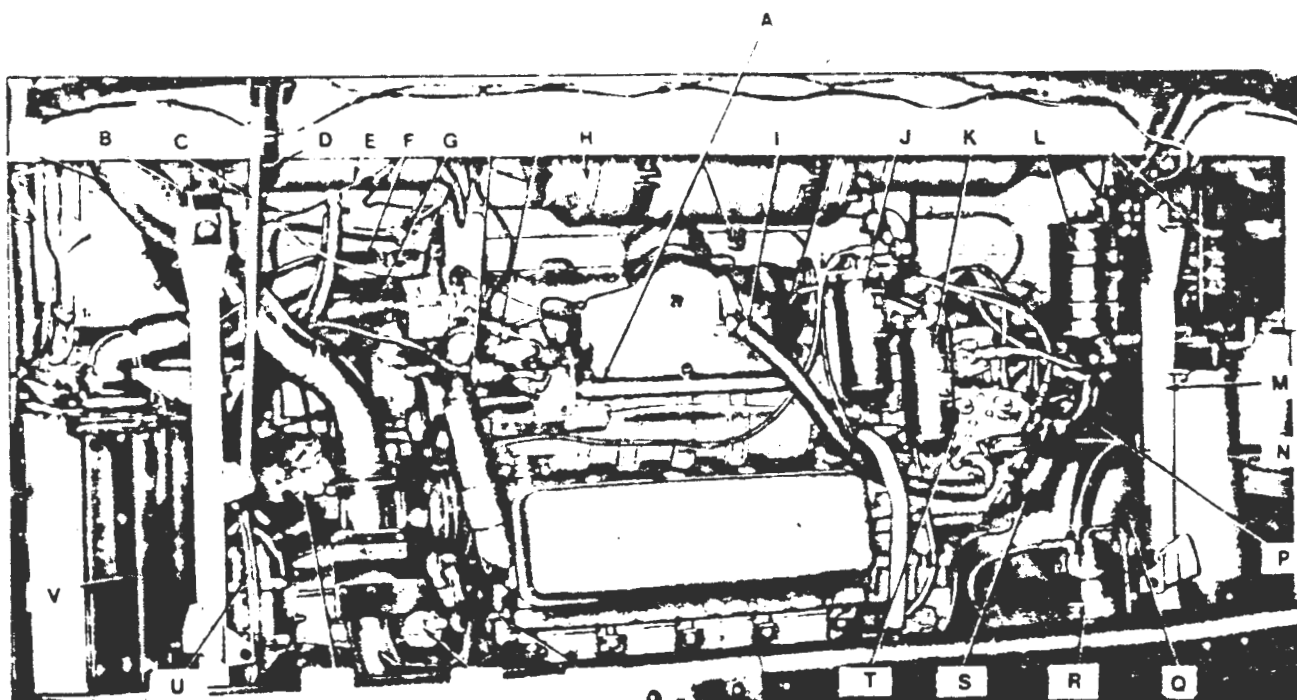
N - NEW R - REMANUFACTURED AR - AS REQUIRED



STEERING PROPELLER SHAFT

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	2384326	YOKE - end	16-22	AR
B	403909	RING - snap	16-18	N
C	-	JOURNAL		AR
D	2368970	BEARING	16-18	N
E	3774326	SEAL	16-18	N
F	271287	FITTING	16-18	N
G	191758	FITTING	16-18	N
H	2495231	YOKE - sleeve	16-22	AR
J	240803	WASHER - (steel)	16-18	N
K	080386	WASHER - (cork)	16-18	N
L	240804	CAP - dust	16-18	AR
M	2384325	SHAFT	16-16	AR
N	1358938	U-BOLT	16-22	AR
P	5672941	YOKE - end	16-08	AR
Q	-	NUT	20.0430	N

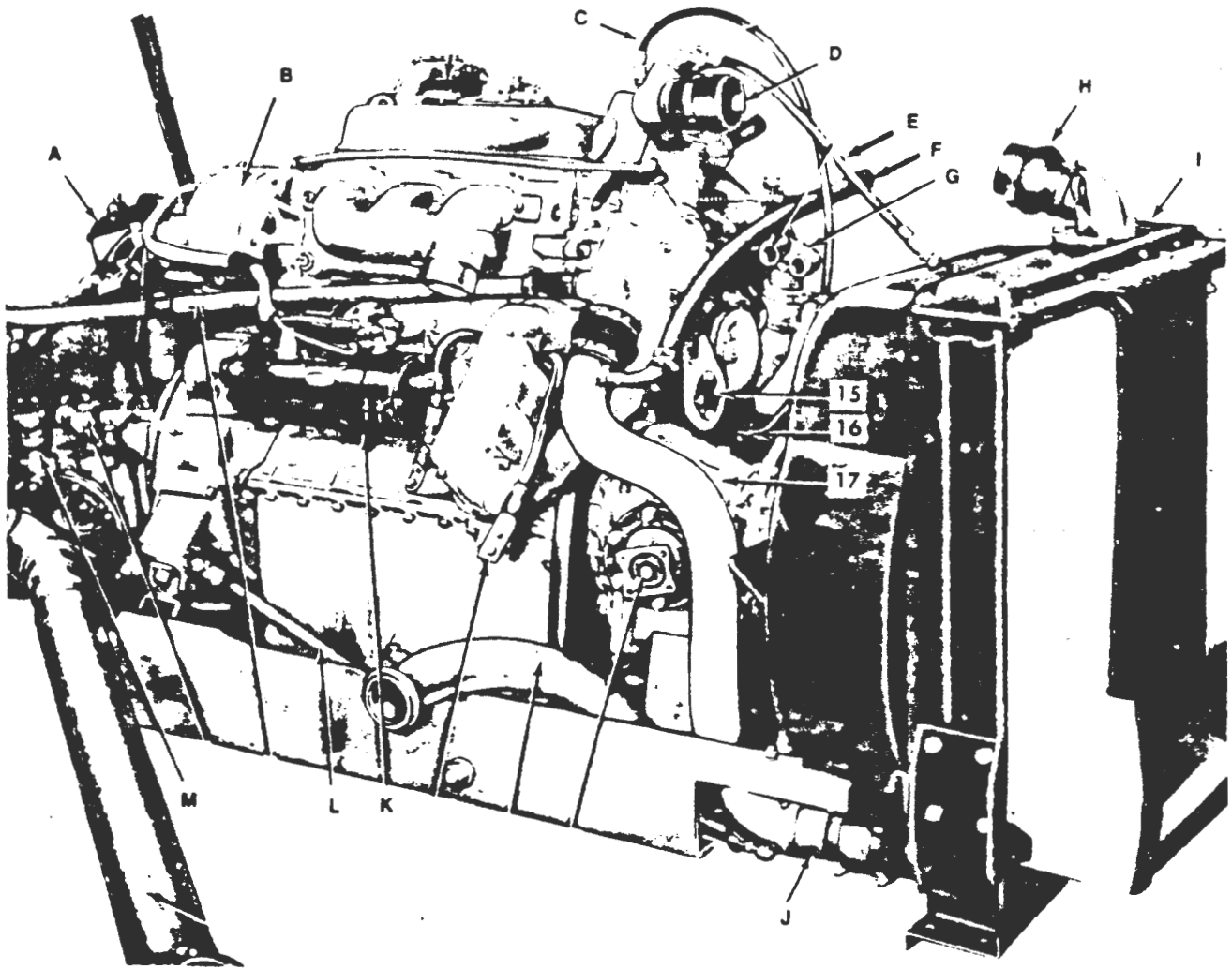
N - NEW R - REMANUFACTURED AR - AS REQUIRED



ENGINE AND ACCESSORIES

KEY	DESCRIPTION	PART DESIGNATION
A	ENGINE	R
B	HANGER SUPPORT	AR
C	DOOR SUPPORT-Air Spring	N
D	DOOR HINGE	N
E	SURGE TANK	N
F	HEATER LINE HOSE	N
G	HEATER RETURN LINE HOSE	N
H	AIR CLEANER-New if not dry type	N
I	COMPRESSOR SUPPLY LINE	N
J	PRIMARY FUEL FILTER - Screw-on type	N
K	SECONDARY FUEL FILTER-Screw-on type	N
L	(DELETED)	
M	CRADLE HANGER	AR
N	ENGINE BY-PASS OIL FILTER	N (Screw-on Type)
P	COMPRESSOR DISCHARGE LINE	N
Q	TRANSMISSION -See Trans. Spec.	R
R	TRANSMISSION FLUID FILTER -Screw-on Type	N
S	COMPRESSOR GOVERNOR-Set to 135PSI	R
T	AIR COMPRESSOR -TU FLO 700	R
U	FLUID FAN DRIVE	R
V	RADIATOR	R

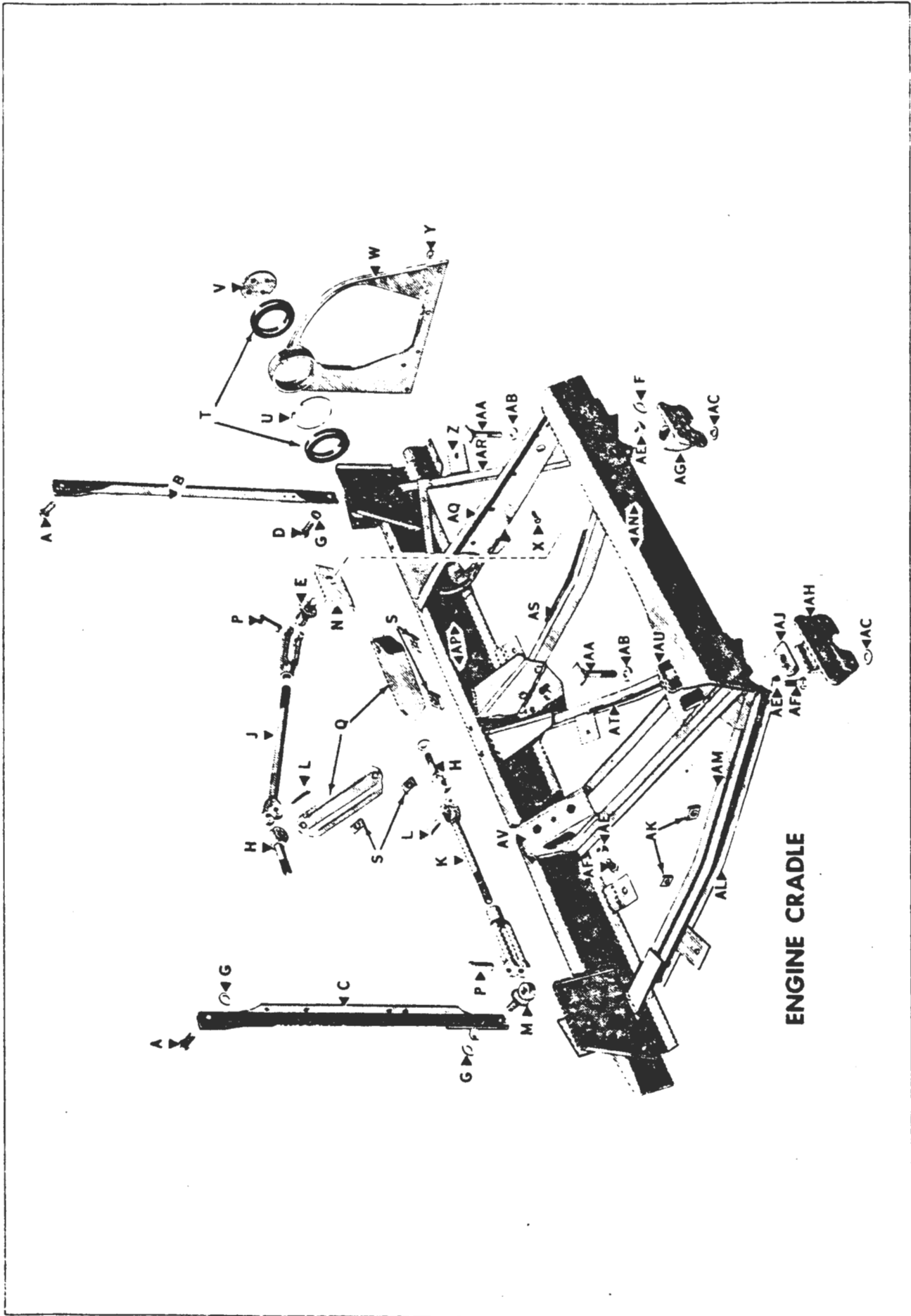
N - NEW R - REMANUFACTURED AR - AS REQUIRED



ENGINE AND TRANSMISSION

KEY	DESCRIPTION	PART DESIGNATION
A	OIL FILTER - Screw on type	N
B	ALTERNATOR	R
C	COOLING SYSTEM VENT LINE	N
D	LINE TO TOP OF RADIATOR	N
E	RADIATOR VENT LINE	N
F	SURGE TANK TO COOLING SYSTEM LINE	N
G	HEATER SUPPLY LINE	N
H	RADIATOR TOP HOSE - Silicon	N
I	RADIATOR	R
J	RADIATOR HOSE - Silicon	N
K	STARTER- IR Air Starter	R
L	ENGINE - See Engine Rebuild Spec.	R
M	TRANSMISSION - See Trans. Rebuild Spec.	R

N - NEW R - REMANUFACTURED AB - ASSIGNED



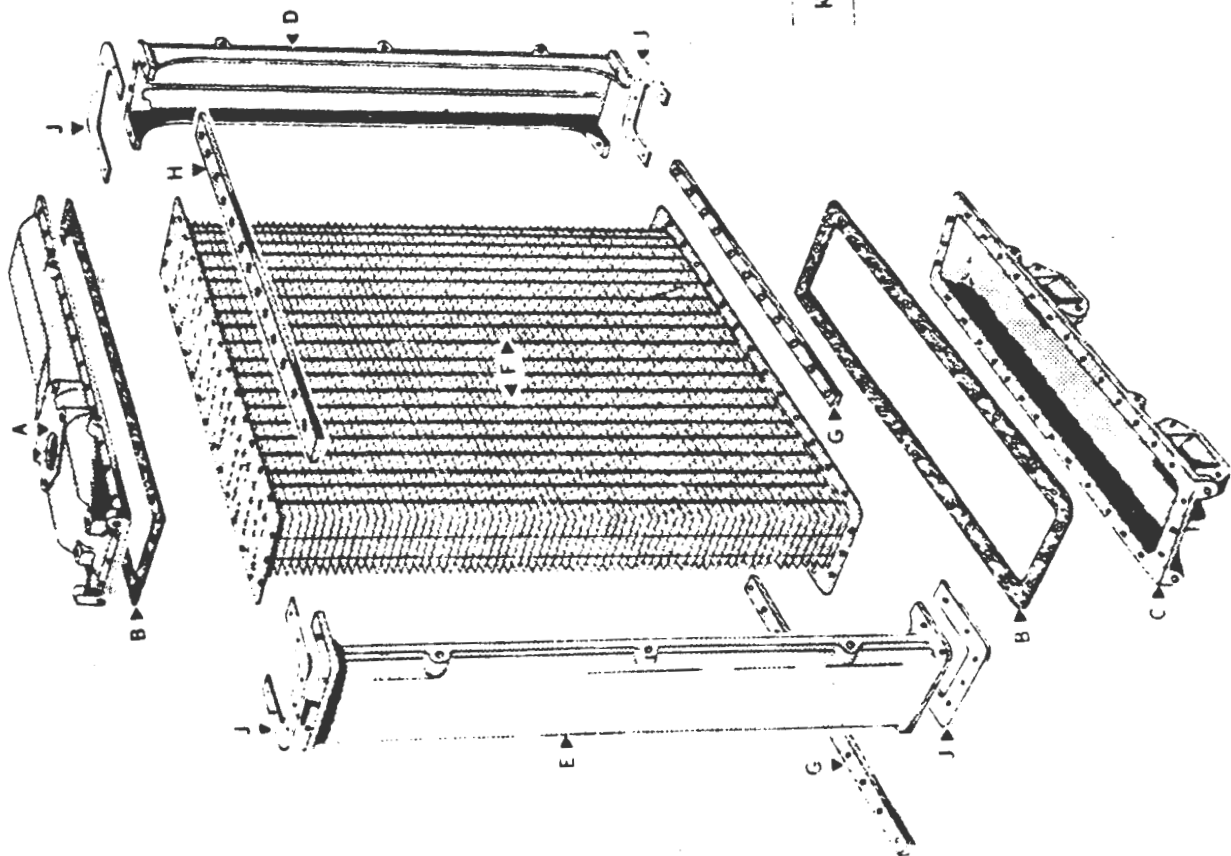
ENGINE CRADLE

ENGINE CRADLE

KEY	PART NO	DESCRIPTION	GROUP	PART DESIGNATION
A	2390956	BOLT	8-90	
B	-	HANGER - LH	8-90	AR
C	-	HANGER - RH	8-90	AR
D	2390955	BOLT - LH	8-90	N
E	2365505	BOLT ASSY - eye, LH	8-90A	N
F	2436169	WASHER - eye bolt	8-90A	N
G	2436168	WASHER - hanger bolt	8-90A	N
H	2267158	BOLT - eye, tube	8-90A	N
J	2267152	TUBE ASSY - frt	8-90A	AR
K	2269916	TUBE ASSY - rear	8-90A	N
L	-	PIN	8-90A	N
M	2392095	BOLT - eye, RH	8-90A	N
N	2467155	REINFORCEMENT	8-90	AR
P	138146	PIN	8-90A	N
Q	757501	INSULATOR ASSY	8-90A	N
R	144252	YOKE	8-90A	AR
S	5177146	SPACER	8-90A	AR
T	2438253	BUSHING	8-90A	N
U	2305715	RING - snap	8-90A	N
V	2105445	RETAINER	8-90A	AR
W	2418839	SUPPORT ASSY - frt	8-90A	AR
X	2352590	BOLT - frt supt	8-90A	N
Y	2421809	WASHER	8-90A	N
Y	2431208	SUPPORT	8-90	AR
AA	2394231	BOLT	8-90	N
AB	2456192	WASHER	8-90	N
AC	2436167	WASHER	8-90	N
AE	2264683	WASHER - locating	8-90A	N
AF	2231826	BOLT - insulator	8-90A	N
AG	2363450	BLOCK - LH	8-90	N
AH	2363408	BLOCK - RH	8-90	N
AJ	063782	SPACER - (rear mbr)	8-90	AR
AK	077189	SPACER - RH	8-90	AR
AL	2419410	STRUT - RH center	8-90	AR
AM	2383906	STRUT - RH inner	8-90	AR
AN	2384235	MEMBER - frt	8-90	AR
AP	-	MEMBER - rear	8-90	AR
AQ	SN-9812	MEMBER - frt supt	8-90	AR
AR	2383987	STRUT - LH	8-90	AR
AS	2431220	STRUT - LH center	8-90	AR
AT	2431221	STRUT - RH center	8-90	AR
AU	2383913	BRACKET - support	8-90	AR
AV	2383908	BRACKET - support	8-90	AR

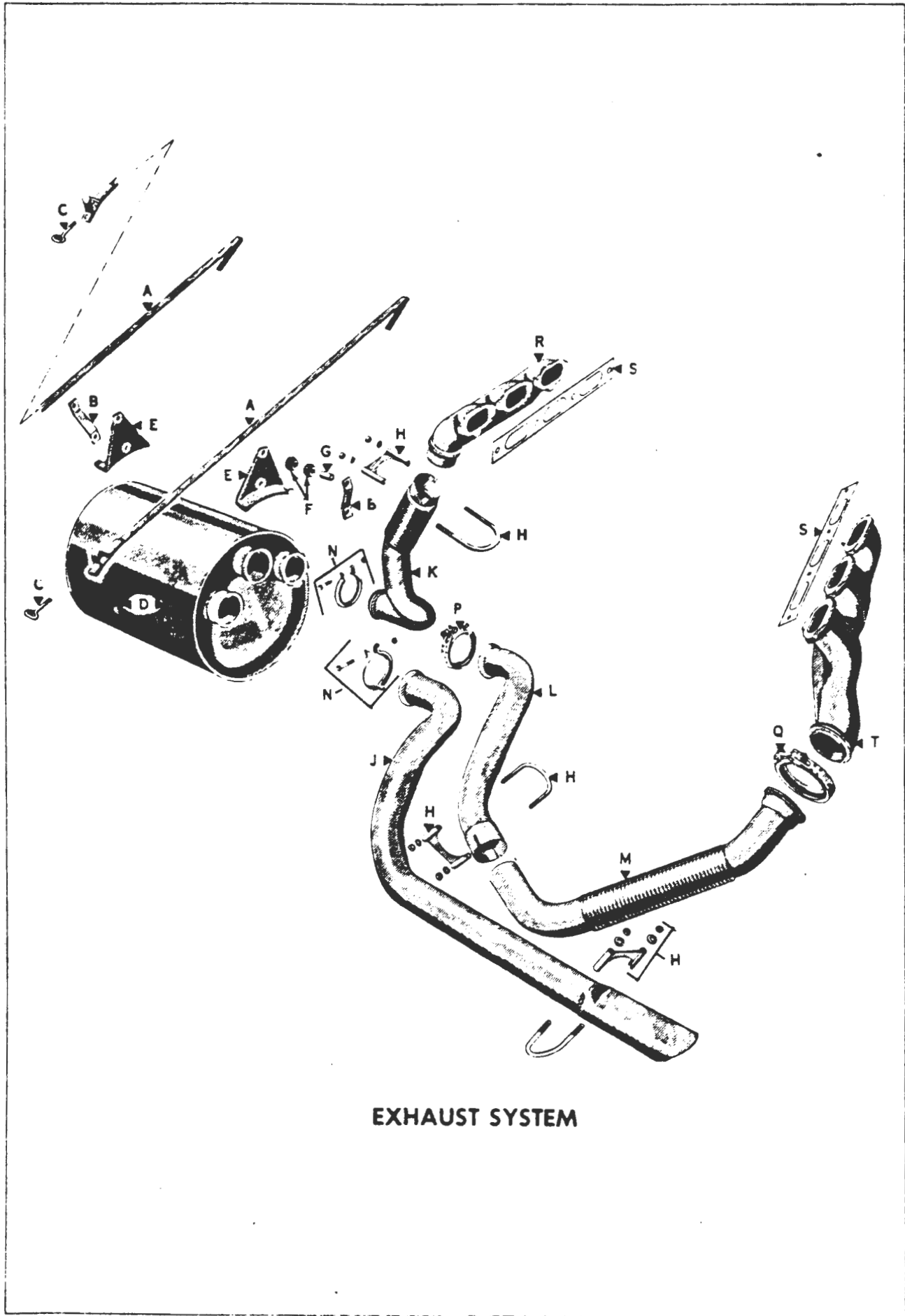
N - NEW R - REMANUFACTURED AR - AS REQUIRED

RADIATOR ASSEMBLY



KEY	PART NO	DESCRIPTION	GROUP	PART DESIGNATION
A	2461761	TANK - top	6-02	R
B	2387074	GASKET	6-02	R
C	2455116	TANK - bottom	6-02	AR
D	2405577	SIDEMEMBER - RH	6-02	AR
E	2405578	SIDEMEMBER - LH	6-02	R
F	2387080	CORE	6-02	R
G	2255200	STRIP - bottom	6-02	R
H	2387081	STRIP - top	6-02	AR
J	8874870	SIDE	6-02	AR

N - NEW R - REMANUFACTURED AR - AS REQUIRED

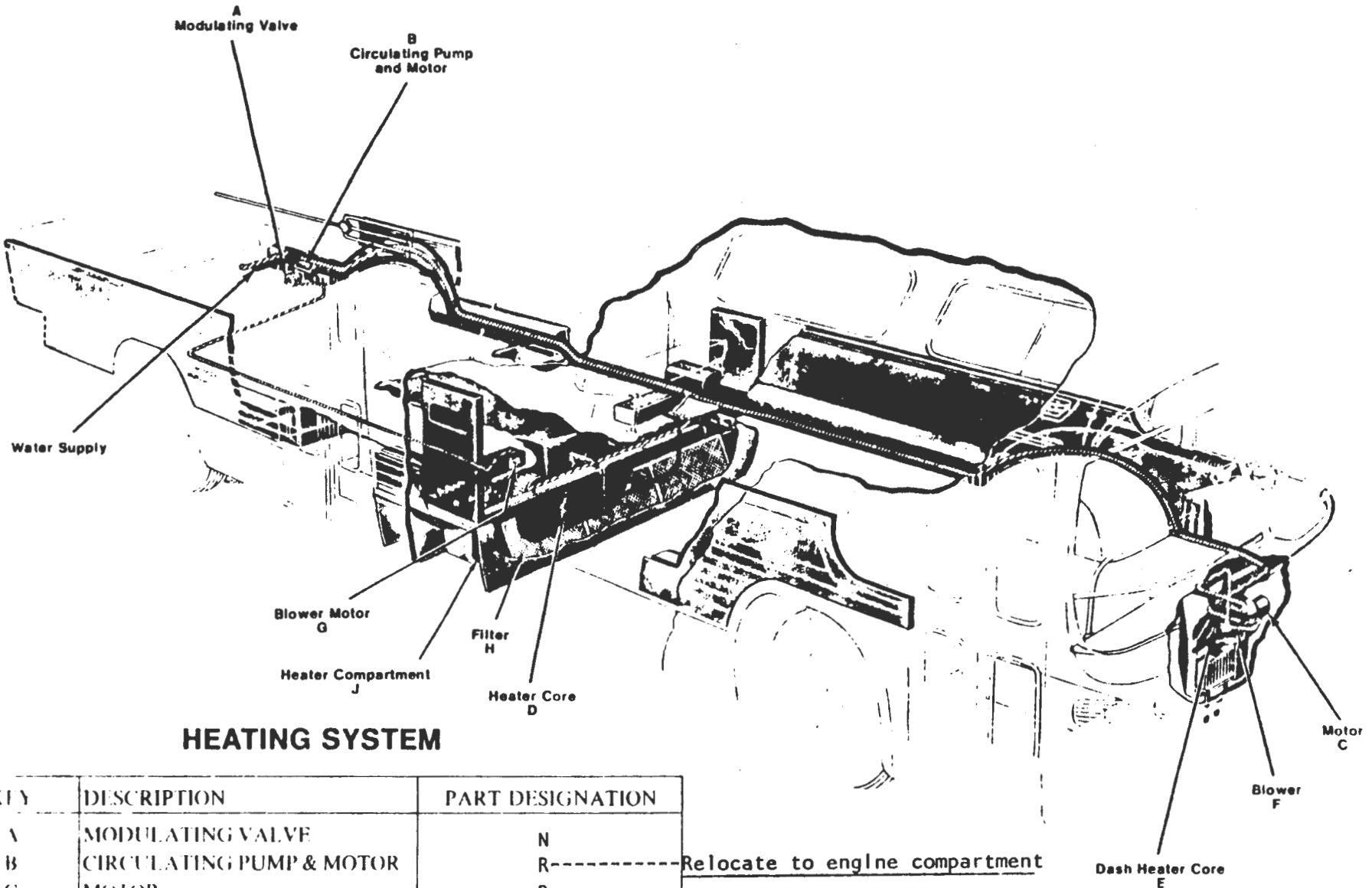


EXHAUST SYSTEM

EXHAUST SYSTEM

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	2440228	STRAP - muffler	12-32	N
B	2454397	STRAP - bracket	12-32	AR
C	3745928	BOLT - strap	12-32	N
D	2440813	MUFFLER	12-32	N
E	2454398	BRACKET - support	12-32	AR
F	3735334	GROMMET	12-32	N
G	2446056	SPACER	12-32	N
H	2378617	CLAMP KIT	12-32	N
J	2440241	PIPE - tail	12-32	N
K	2463305	PIPE - RH exhaust	12-32	N
L	2440236	PIPE - LH upper	12-32	N
M	2463306	PIPE - LH lower	12-32	N
N	2439895	CLAMP - RH exhaust & tail pipes	12-32	N
P	2340301	CLAMP - LH exhaust	12-32	N
Q	2387401	CLAMP - exhaust (at manifold)	12-32	N
R	5130632	MANIFOLD - RH bank	8-89	AR
S	5122866	GASKET - manifold	8-89	N
T	5123210	MANIFOLD - LH bank	8-89	AR

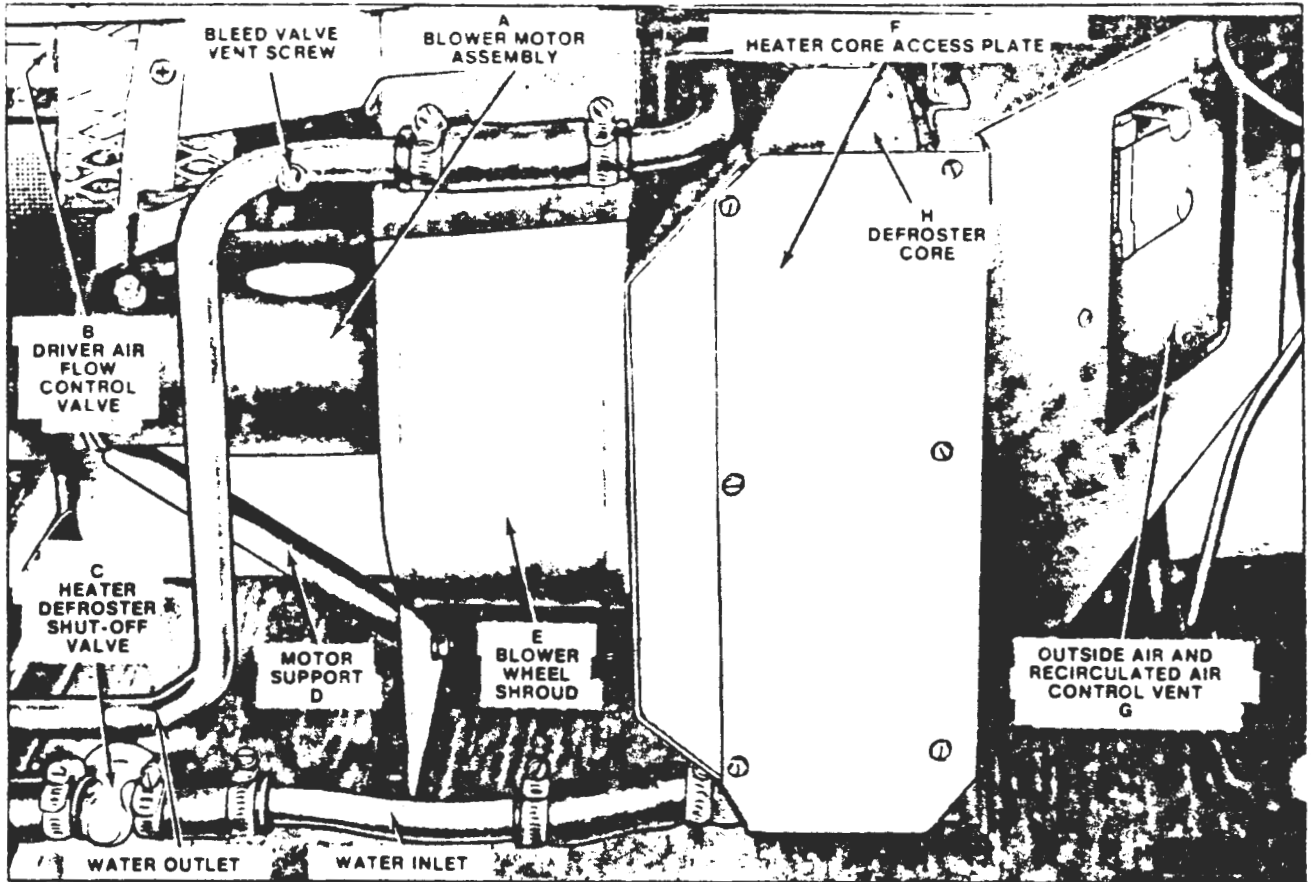
N - NEW R - REMANUFACTURED AR - AS REQUIRED



HEATING SYSTEM

KEY	DESCRIPTION	PART DESIGNATION
A	MODULATING VALVE	N
B	CIRCULATING PUMP & MOTOR	R-----Relocate to engine compartment
C	MOTOR	R
D	HEATER CORE	R
E	DASH HEATER CORE	R
F	BLOWER	AR
G	BLOWER MOTOR	R
H	FILTER	N
J	HEATER COMPARTMENT	AR

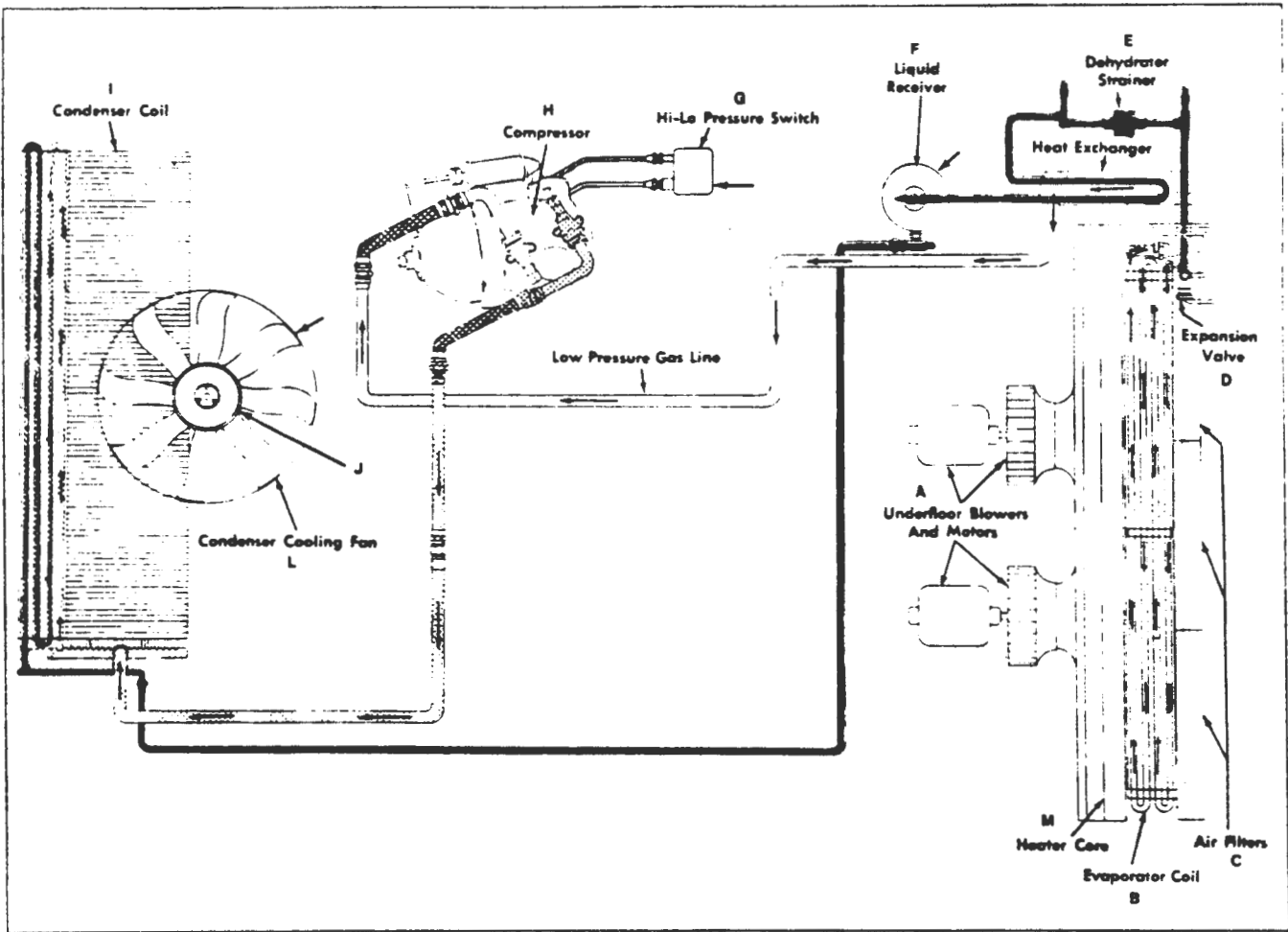
N - NEW R - REMANUFACTURED AR - AS REQUIRED



WINDSHIELD DEFROSTER HEATER UNIT

KEY	DESCRIPTION	PART DESIGNATION
A	BLOWER MOTOR ASSEMBLY	R
B	FLOW CONTROL VALVE	N
C	SHUT OFF VALVE	N
D	MOTOR SUPPORT	AR
E	SHROUD	AR
F	ACCESS PLATE	AR
G	VENT	AR
H	DEFROSTER CORE	R

N - NEW R - REMANUFACTURED AR - AS REQUIRED



AIR CONDITIONING SYSTEM

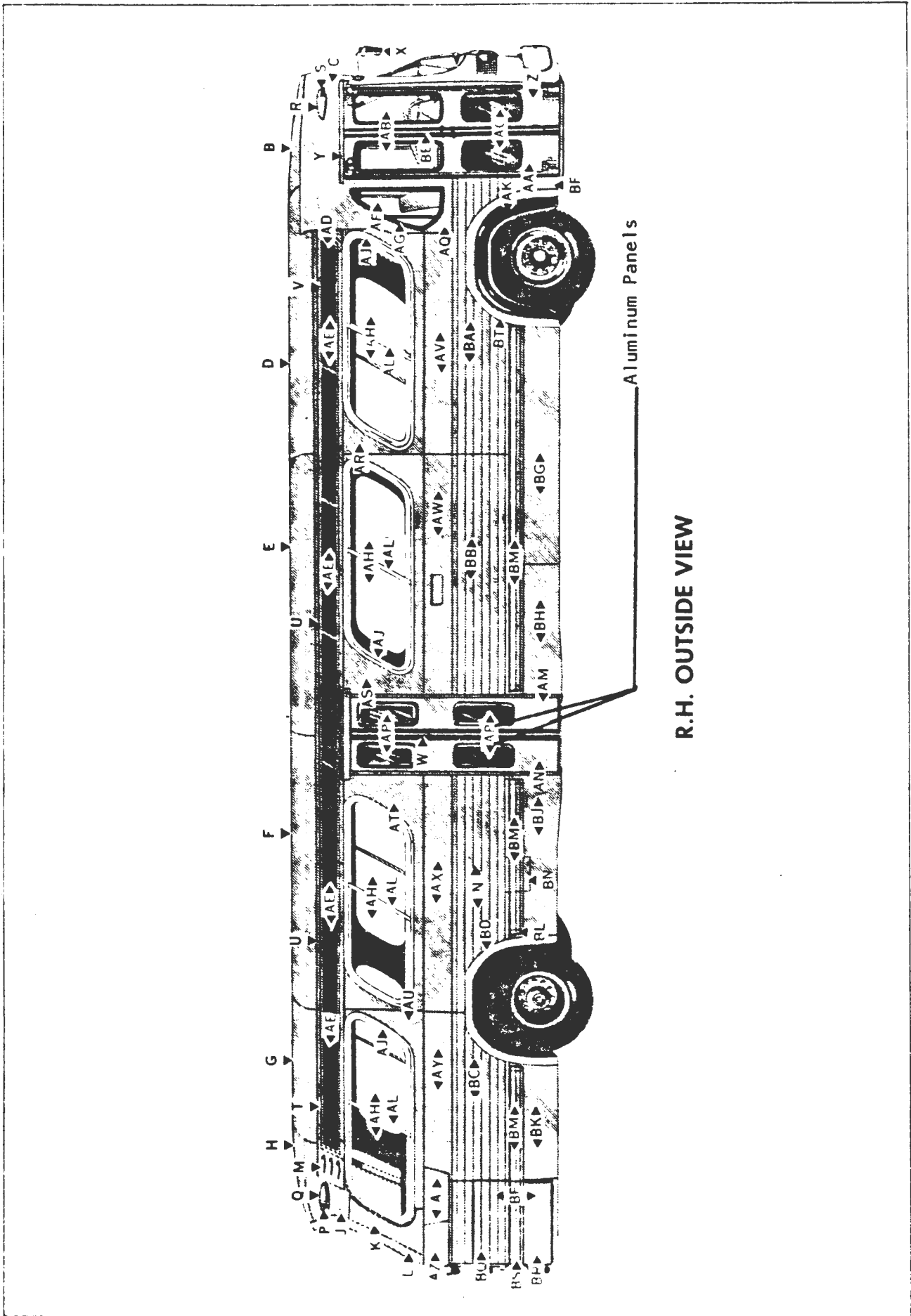
KEY	DESCRIPTION	PART DESIGNATION
A	BLOWER MOTOR	R
B	EVAPORATOR COIL-Relocate to Engine Compartment.	R
C	AIR FILTERS	N
D	EXPANSION VALVE	N
E	DEHYDRATOR	N
F	LIQUID RECEIVER	R
G	HIGH LOW PRESSURE SWITCH	N
H	COMPRESSOR	R
I	CONDENSOR COIL	R
J	CONDENSOR MOTOR	R
K	CONDENSOR PUMP (NOT SHOWN)	R
L	CONDENSOR FAN	R
M	HEATER COIL	R

N - NEW R - REMANUFACTURED AR - AS REQUIRED

FRONT END OUTSIDE VIEW CONT'D

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
G	2388259	RETAINER	24-33	N
H	2489461	MIRROR - (LH)	24-95	N
J	2457655	ARM	24-95	AR
K	-	STUD - ball	24-95	AR
L	-	MIRROR - (RH)		N
M	-	ARM		AR
N	-	STUD		AR
P	2380708	GLASS	24-58	AR
Q	2380710	GLASS	24-58	AR
R	2373438	GLASS	24-55	AR
S	2373439	GLASS	24-55	AR
T	2380713	GLASS	24-55	AR
U	2380714	GLASS	24-55	AR
V	2369165	CHANNEL	24-55	N
W	8867659	BLADE	24-91	AR
X	8867658	ARM - drive	24-91	AR
Y	2387624	BRACKET	24-06	AR
Z	2388752	GRILLE - RH	24-32	AR
AA	2388753	GRILLE - LH	24-32	AR
AB	8884869	PANEL	24-03	AR
AC	2370820	PANEL	24-03	N
AD	-	PANEL - skirt, RH	24-03	N
AE	-	PANEL - skirt, LH	24-03	N
AF	2387353	BRACKET - tow eye	11-06	AR
AG	-	BUMPER - frt	11-06	N
AH	2384608	BAR - impact	11-06	AR
AJ	2447577	EMBLEM	24-03	N
AK	2396301	GRILLE - RH	24-03	N
AL	2396085	GRILLE - LH	24-03	N
AM	R-35627	CHANNEL - rubber	7-01	N
AN	5956001	BEAM - inner	7-01	AR
AP	5956005	BEAM - outer	7-01	AR
AQ	2391109	BEZEL - RH	7-01	N
AR	2391110	BEZEL - LH	7-01	N
AS	2386603	LAMP - RH	7-08	AR
AT	2386602	LAMP - LH	7-08	AR

N - NEW R - REMANUFACTURED AR - AS REQUIRED



Aluminum Panels

R.H. OUTSIDE VIEW

R.H. OUTSIDE VIEW

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	2448441	PANEL	24-19E	AR
B	2380749	PANEL	24-30A	AR
C	2449126	REINFORCEMENT	24-30B	AR
D	2368178	PANEL	24-30	AR
E	2368180	PANEL	24-30	AR
F	2368182	PANEL	24-30	AR
G	2368184	PANEL	24-30	AR
H	2380704	PANEL	24-30A	AR
J	2402408	PANEL	24-30A	AR
K	2380702	PANEL	24-30A	AR
L	2380705	PANEL	24-62	AR
M	2448656	PANEL - (louvered)	12-21	AR
N	2369847	PANEL	24-19	AR
P	2111411	LENS	7-07	N
Q	2261413	HOUSING - front	7-07	AR
R	2261413	HOUSING - rear	7-07	AR
S	2111410	LENS	7-07	N
T	2448632	CHANNEL - rear	24-58	N
U	2371661	CHANNEL - inner	24-58	N
V	2448617	CHANNEL - front	24-58	N
W	2301961	SEAL	24-50	N
X	-	MIRROR - RH		AR
Y	2427730	HEADER	24-34	AR
Z	-	DOOR - front section	24-46	AR
AA	-	DOOR - rear section	24-46	AR
AB	-	GLASS		AR
AC	-	GLASS		AR
AD	2448622	GLASS	24-58	AR
AE	2371668	GLASS	24-58	AR
AF	-	GLASS	24-58	N
AG	2371248	CHANNEL	24-57	N
AH	-	GLASS		AR
AJ	2455433	FRAME - RH	24-57	N
AK	8876527	FENDER	24-23	AR
AL	2403362	CHANNEL - RH		
		front frame	24-57	AR
AM	-	DOOR - front section	24-50	AR

N - NEW R - REMANUFACTURED AR - AS REQUIRED

R.H. OUTSIDE VIEW

(Continued)

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
AN	-	DOOR - rear section	24-50	AR
AP	-	GLASS		AR
AQ	2382815	PANEL - (#1)	24-62	AR
AR	2368890	PANEL - (#2)	24-62	AR
AS	2368892	PANEL - (#3)	24-62	AR
AT	2368894	PANEL - (#4)	24-62	AR
AU	2368896	PANEL - (#5)	24-62	AR
AV	2416082	PANEL - (w/crease)	24-19E	AR
AW	2416082	PANEL - (w/crease)	24-19E	AR
AX	2416082	PANEL - (w/crease)	24-19E	AR
AY	2416082	PANEL - (w/crease)	24-19E	AR
AZ	2381715	PANEL - RH rear	24-11	AR
BA	2369846	PANEL - (fluted)	24-19	AR
BB	2412763	PANEL - (fluted)	24-19	AR
BC	2369841	PANEL - (fluted)	24-19	AR
BD	2414097	MOULDING	24-23	N
BE	2369602	SEAL - inner	24-46	N
BF	2369699	PANEL - skirt	24-19	N
BG	2416084	PANEL - skirt	24-19	N
BH	2411321	PANEL - skirt	24-19	N
BJ	2411320	PANEL - skirt	24-19	N
BK	2411323	PANEL - skirt	24-19	N
BL	2380170	CAP - end	24-22	N
BM	2378643	RAIL	24-22	N
BN	2370876	DOOR	24-24	N
BP	2434940	DOOR	24-15	N
BQ	2370874	PANEL - fluted	24-15	N
BR	2378188	PANEL - lower	24-15	N
BS	2373247	RAIL - RH door	24-22	N
BT	2445455	MOULDING - RH front	24-23	N

N - NEW R - REMANUFACTURED AR - AS REQUIRED

REPLACE ALL ACRYLIC WINDOWS WITH TINTED GREY SAFETY GLASS

L.H. OUTSIDE VIEW

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	2378643	RAIL	24-22	N
B	2380749	PANEL	24-30A	AR
C	2380751	PANEL	24-30A	AR
D	2368179	PANEL	24-30	AR
E	2368181	PANEL	24-30	AR
F	2368183	PANEL	24-30	AR
G	2368185	PANEL	24-30	AR
H	2380704	PANEL	24-30A	AR
J	2402409	PANEL - (used w/drain tubes)	24-30A	AR
K	2380703	PANEL	24-30A	AR
L	2380705	PANEL (w/o A/C)	24-62	AR
M	2448690	PANEL - (louvered)	12-21	AR
N	2445453	MOULDING	24-23	N
P	2111411	LENS - (red)	7-07	N
Q	2261413	HOUSING	7-07	AR
R	2414097	MOULDING	24-23	N
S	2261413	HOUSING	7-07	AR
T	2111140	LENS - (amber)	7-07	N
U	2448633	CHANNEL	24-58	N
V	2371662	CHANNEL	24-58	N
W	2448618	CHANNEL	24-58	N
X	2448441	PANEL - belt	24-19E	AR
Z	-	GLASS		AR
AA	2385541	RAIL - end	24-56	AR
AB	2385542	RAIL - center	24-56	AR
AC	2385540	RAIL - horizontal	24-56	AR
AD	2373928	PANEL - drivers	24-62	AR
AE	2371249	CHANNEL - (#1 LH)	24-57	N
AF	-	GLASS		AR
AG	2382816	PANEL - (#1)	24-62	AR
AH	2448622	GLASS - (#1 LH)	24-58	AR
AJ	2371668	GLASS	24-58	AR
AK	-	GLASS		AR
AL	2455434	FRAME - outer	24-57	AR
AM	2403363	CHANNEL - front frame	24-57	AR

N - NEW R - REMANUFACTURED AR - AS REQUIRED

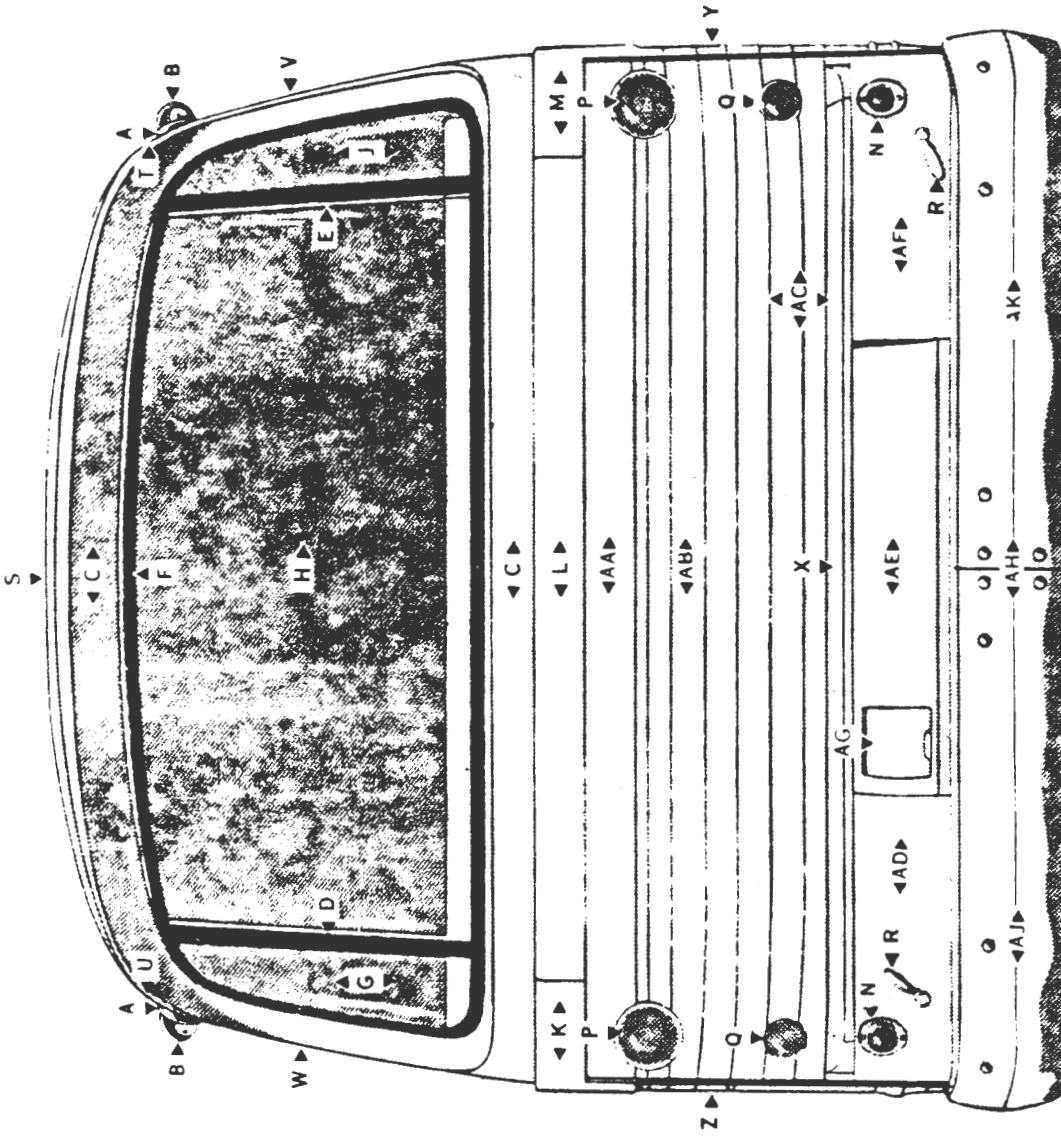
REPLACE ALL ACRYLIC WINDOWS WITH TINTED GREY SAFETY GLASS

L.H. OUTSIDE VIEW
(Continued)

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
AN	-	GLASS	24-54	N
AP	2370660	RETAINER	24-54	N
AQ	2416082	PANEL	24-19E	AR
AR	2416082	PANEL	24-19E	AR
AS	2416082	PANEL	24-19E	AR
AT	2416082	PANEL	24-19E	AR
AU	2455825	PANEL	24-19E	AR
AV	2381716	PANEL - LH	24-11	AR
AW	2368891	PANEL - (#2)	24-62	AR
AX	2368893	PANEL - (#3)	24-62	AR
AY	-	PANEL - safety door		AR
AZ	2369857	DOOR	24-54	AR
BA	2368895	PANEL - (#4)	24-62	AR
BB	2368897	PANEL - (#5)	24-62	AR
BC	2380777	PANEL - fluted	24-19	N
BD	2369837	PANEL - fluted	24-19	AR
BE	2412763	PANEL - fluted	24-19	AR
BF	2369839	PANEL - fluted	24-19	AR
BG	2369883	PANEL - fluted	24-19	AR
BH	2369840	PANEL - fluted	24-19	AR
BJ	2472587	PANEL	24-15A	N
BK	2369842	PANEL - fluted	24-19	AR
BL	2372930	PANEL - fluted	24-10	AR
BM	2471795	PANEL - upper	24-15A	N
BN	2378189	PANEL	24-15A	N
BP	2378379	SCREEN	24-15A	N
BQ	2411323	PANEL - skirt	24-19	N
BR	2422130	DOOR ASSEMBLY	24-28	N
BS	2411321	PANEL - skirt	24-19	N
BT	2372011	DOOR ASSEMBLY	24-25A	N
BU	2416084	PANEL - skirt	24-19	N
BV	2416084	PANEL - skirt	24-19	N
BW	2445456	PANEL - skirt	24-19	N
BX	2489461	MIRROR	24-95	N
BY	2423667	CHANNEL - (curved)	24-57	AR
BZ	2373601	PANEL - rear	24-15A	N

N - NEW R - REMANUFACTURED AR - AS REQUIRED

REPLACE ALL ACRYLIC WINDOWS WITH TINTED GRAY SAFETY GLASS

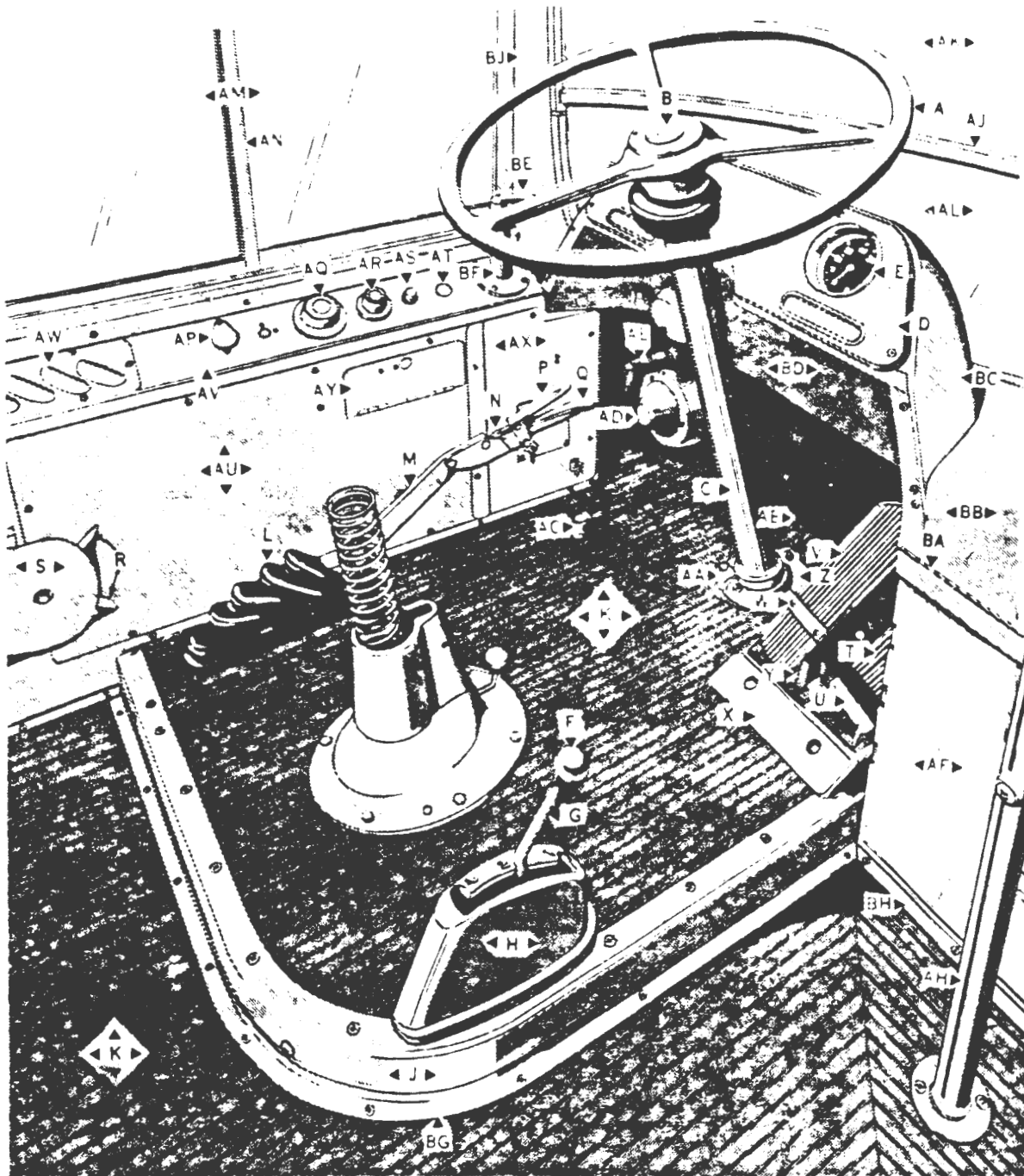


REAR END OUTSIDE VIEW

REAR END OUTSIDE VIEW

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	2261413	HOUSING	7-07	AR
B	2111411	LENS - (red)	7-07	N
C	-	PANEL - rr wdw	24-62	AR
D	2391257	REINFORCEMENT	24-60	AR
E	2391256	REINFORCEMENT	24-60	AR
F	2390991	CHANNEL	24-60	N
G	2449631	GLASS - LH	24-60	AR
H	2449636	GLASS	24-60	AR
J	2449630	GLASS	24-60	AR
K	2381716	PANEL - belt, LH	24-11	AR
L	2381706	PANEL - belt, ctr	24-11	AR
M	2381715	PANEL - belt, RH	24-11	AR
N	2233801	REFLECTOR - red	7-03	AR
P	2449796	LENS - stop & direct	7-03	AR
Q	2389779	LENS - tail lamp	7-03	AR
R	2383916	BUMPER		AR
S	2380704	PANEL	24-30A	AR
T	2402408	PANEL	24-30A	AR
U	2402409	PANEL	24-30A	AR
V	2380702	PANEL - RH lower	24-30A	AR
W	2380703	PANEL	24-30A	AR
X	2385186	HOOD	24-30A	N
Y	2434940	DOOR	24-15	N
Z	2378940	DOOR	24-15A	N
AA	2448683	PANEL - belt	24-16	N
AB	2448679	PANEL	24-16	N
AC	2449117	DOOR	24-16	N
AD	2448644	PANEL	24-16	N
AE	2383570	PANEL	24-16	N
AF	2448643	PANEL	24-16	N
AG	2386439	DOOR ASSY - oil insp	24-16	N
AH	2383539	BAR	11-08	AR
AJ	2383538	BAR	11-08	AR

N - NEW R - REMANUFACTURED AR - AS REQUIRED



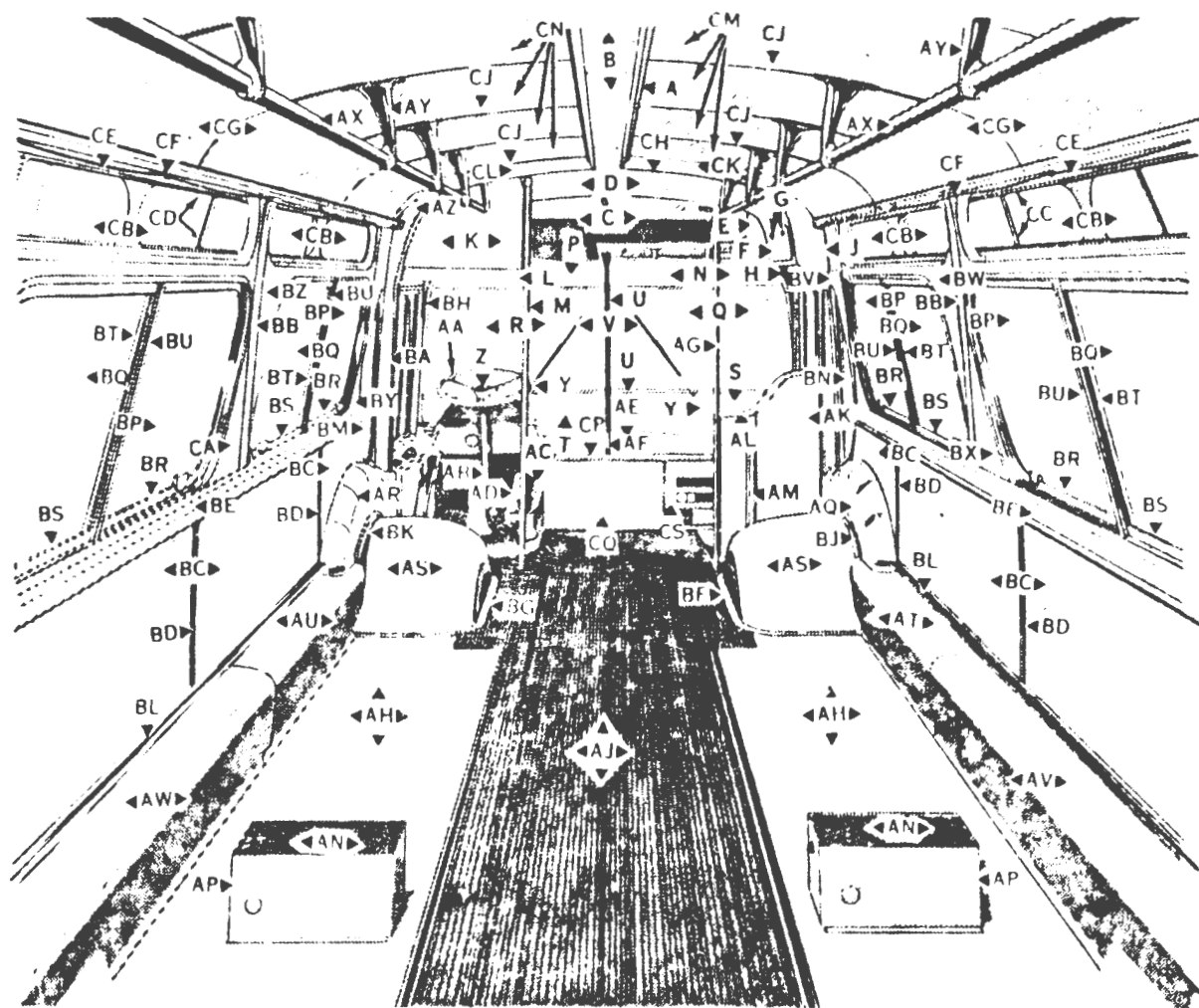
DRIVER'S COMPARTMENT (INSIDE VIEW)

DRIVER'S COMPARTMENT (INSIDE VIEW)

KEY	PART NO	DESCRIPTION	GROUP	PART DESIGNATION
A	-	WHEEL	16-24	AR
B	2394488	CAP	7-76	N
C	2473629	JACKET	16-06	AR
D	6407096	CLUSTER	7-38	AR
F	1587607	SPEEDOMETER	7-43	N
F	098322	BALL	17-47	AR
G	2376980	HANDLE	17-47	AR
H	2376900	HOUSING	17-47	AR
J	-	RISER - driver's flr	24-37	N
K	-	COVERING - flr	24-38	N
*L	2384624	BOOT	4-70	N
*M	2417586	LEVER	4-70	AR
*N	798028	ROD - latch	4-70	AR
*P	552490	HANDLE - latch	4-70	AR
*Q	2396003	HANDLE - parking	4-70	AR
R	2400678	DAMPER	24-72	AR
S	-	DUCT - air outlet	24-72	AR
T	663364	TREAD - accel pedal	8-91	N
U	055390	CLIP	8-91	N
V	663364	TREAD - brake pedal	4-61	N
W	055390	CLIP	4-61	N
X	2376920	REST	8-91	AR
Y	2364462	PLATE - mtg	4-61	AR
Z	2378120	FLANGE - (rh)	16-26	AR
AA	2378121	FLANGE - (lh)	16-26	AR
AB	2224980	LINE	4-51	AR
AC	1997014	SWITCH - dimmer	7-71	N
AD	2386602	LAMP - directional (lh)	7-08	AR
AE	-	HARNES - wiring (hdip)	7-90	N
AF	2451438	PANEL	24-08	N
AH	2392012	STANCHION - frt door	24-88	AR
AJ	2369165	CHANNEL	24-55	N
AK	-	GLASS - (lh cntr)	24-55	N
AL	-	GLASS - (lh lower)	24-55	N
AM	-	GLASS		N
AN	2447045	CHANNEL	24-56	AR
AP	1996090	SWITCH - (emer stop)	7-72	AR
AQ	1998743	SWITCH - master, dr	7-74C	AR
AR	1998720	SWITCH - (defroster)	7-74A	AR
AS	1996060	SWITCH - (starter)	7-72	AR
AT	-	PLUG		AR
AU	2436211	PANEL - control, dr.	7-38	AR
AV	2420045	COVER	7-38	AR
AW	2390947	LOUVRE	24-72	AR
AX	2420582	COVER - valve compt	24-81	AR
AY	2420044	BRACKET - mtg. switch	7-74H	AR
BA	2387993	SUPPORT - w/s ledge cover	24-03	AR
BB	2384640	COVER - rh	24-03	AR
BC	2388318	COVER - lh	24-03	AR
BD	2385473	HOUSING	24-03	AR
BE	2336400	HANDLE	24-49	AR
BF	2409054	SHAFT	24-49	AR
BG	2403109	MOULDING - curved	24-37B	N
BH	2378702	MOULDING - at dash pnl	24-37B	N
BJ	8884868	PANEL - w/s	24-03	AR

N - NEW R - RE MANUFACTURED AR - AS REQUIRED

*SEE OPTIONS



INTERIOR TRIM (FRONT VIEW)

T5 2-54

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INTERIOR TRIM (FRONT VIEW)

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	2389750	BASE	7-14	AR
B	2423036	LENS	7-14	AR
C	-	DOOR	24-33	AR
D	2385067	PANEL - crown, front center upper	24-82	AR
E	2390615	PANEL - crown, corner, upper (RH)	24-82	AR
F	-	DOOR - front door mech	24-86	AR
G	2248612	KNOB	24-86	AR
H	2440286	PANEL	24-86	AR
J	2384264	CAP - end	24-86	AR
K	2449666	PANEL	24-93	AR
L	2391691	COVER	24-93	AR
M	2392498	STANCHION - driver's curtain	24-88	AR
N	2380709	GLASS - (w/s RH front)	24-58	N
P	2380710	GLASS - (w/s LH front)	24-58	N
Q	-	GLASS - RH center	24-55	N
R	-	GLASS - LH center	24-55	N
S	-	GLASS - RH lower	24-55	N
T	-	GLASS - LH lower	24-55	N
U	2369165	CHANNEL	24-55	N
V	8867659	BLADE	24-91	N
Y	8867658	ARM - w/s wiper	24-91	N
Z	2394488	CAP	7-76	N
AA	-	WHEEL	16-24	AR
AB	2376590	JACKET	16-06	AR
AC	2379022	PEDAL - accel	8-91	AR
AD	2385470	PEDAL - brake	4-61	AR
AE	2384640	COVER - RH	24-03	AR
AF	2391322	MOULDING - trim	24-03	AR
AG	2388786	STANCHION - front modesty panel	24-88	AR
AH	R37000	COVERING - (underseats)	24-38	N
AJ	R36505	COVERING - (aisle & toe board)	24-38	N
AK	2389120	PANEL - front	24-84	AR
AL	2450170	RAIL - front modesty panel	24-89	AR

N - NEW R - REMANUFACTURED AR - AS REQUIRED

INTERIOR TRIM (FRONT VIEW)
(Continued)

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
AM	2459027	REINFORCEMENT	24-84	AR
AN	2383984	SCREEN	24-71	AR
AP	2383943	DUCT - recir air	24-71	AR
AQ	-	DUCT - front RH (over w/h)	24-72	AR
AR	-	DUCT - front RH (over w/h)	24-72	AR
AS	2368494	WHEELHOUSE - front	24-20	AR
AT	-	DUCT - air, front (RH)	24-72	AR
AU	-	DUCT - air, front (LH)	24-72	AR
AV	-	DUCT - air (RH inter)	24-72	AR
AW	-	DUCT - air (LH inter)	24-72	AR
AX	2387681	RAIL - grab, pass	24-89	AR
AY	2456196	BRACKET - rail in ceiling	24-89	AR
AZ	2456198	CAP	24-89	AR
BA	2387615	COVER - vertical wiring duct	24-82	AR
BB	2378694	COVER - upper post (straight)	24-82	AR
BC	2416143	PANEL - lower side	24-81	AR
BD	2388295	MOULDING - (between panels)	24-81	AR
BE	2378708	MOULDING - (belt rail)	24-81	AR
BF	2382348	MOULDING - w/h, RH	24-81	N
BG	2382349	MOULDING - w/h, RH	24-81	N
BH	2425765	END - front, upper	24-01	AR
BJ	-	MOULDING - (bowed, RH)	24-81	AR
BK	-	MOULDING - (bowed, LH)	24-81	AR
BL	2378657	RAIL - seat	24-64	AR
BM	-	GLASS		N
BN	-	GLASS		N
BP	-	GLASS - front		N
BQ	-	GLASS - rear		N
BR	2423667	CHANNEL - front (curved)	24-57	AR
BS	2423667	CHANNEL - rear (curved)	24-57	AR
BT	-	CHANNEL - rear (straight)	24-57	AR
BU	-	CHANNEL - front (straight)	24-57	AR

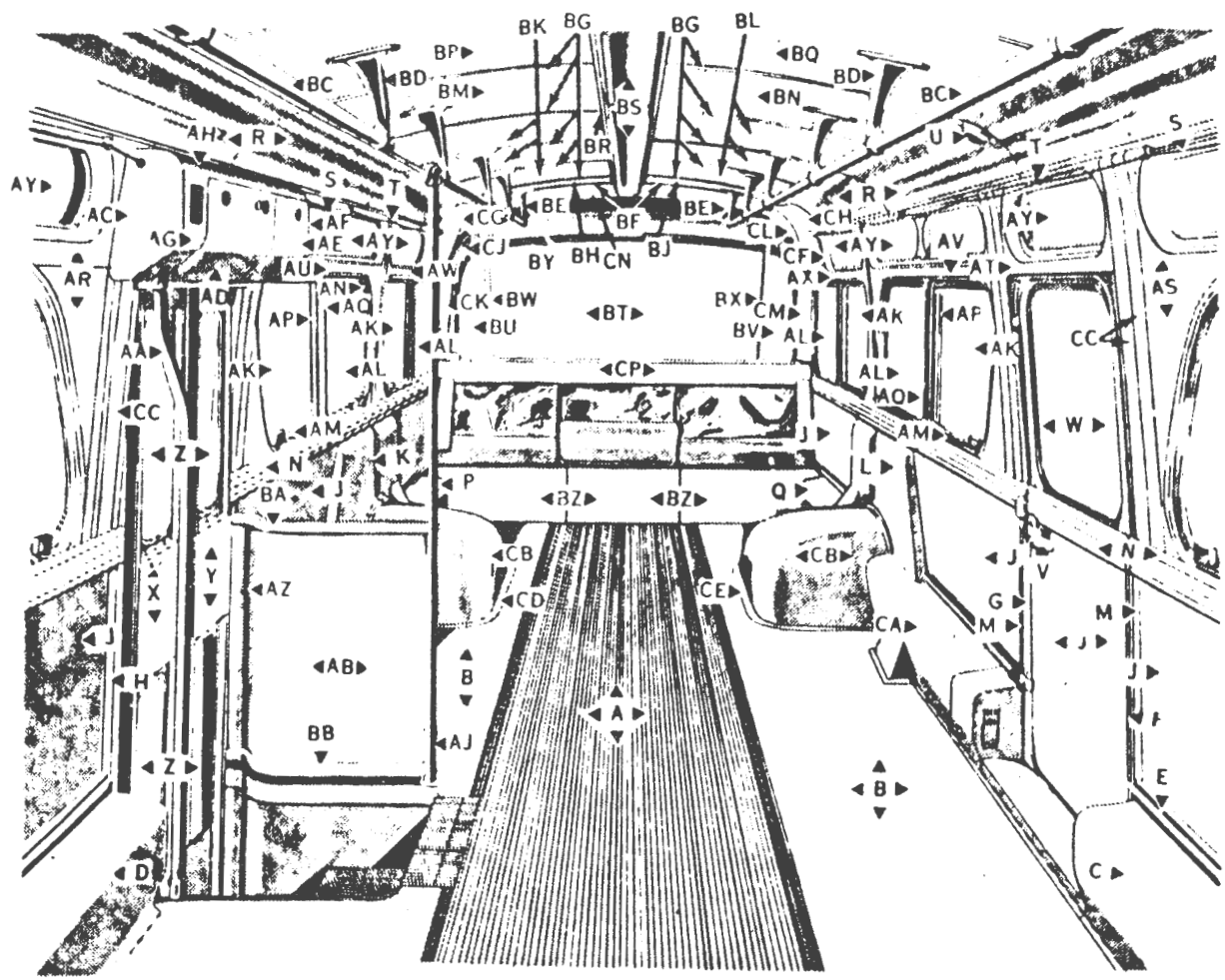
N - NEW R - REMANUFACTURED AR - AS REQUIRED

INTERIOR TRIM (FRONT VIEW)
(Continued)

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
BV	2382815	PANEL - (#1 RH)	24-62	AR
BW	2368890	PANEL - (#2 RH)	24-62	AR
BX	2368892	PANEL - (#3 RH)	24-62	AR
BY	2382816	PANEL - (#1 LH)	24-62	AR
BZ	2368891	PANEL - (#2 LH)	24-62	AR
CA	2368893	PANEL - (#3 LH)	24-62	AR
CB	2371668	GLASS	24-58	AR
CC	2371661	CHANNEL - (RH inter)	24-58	N
CD	2371662	CHANNEL - (RH inter)	24-58	N
CE	2367486	CORD - pass. signal	7-77	N
CF	2048840	BRACKET - guide	7-77	AR
CG	2416056	PANEL - adv. card	24-82	AR
CH	2224881	MOULDING - trim	24-82	AR
CJ	2467154	MOULDING - trim	24-82	AR
*CK	-	PANEL - (#1 RH upper)	24-82	AR
*CL	-	PANEL - (#1 LH upper)	24-82	AR
*CM	-	PANEL - (#2,3,4,5 RH upper)	24-82	AR
*CN	-	PANEL - (#2,3,4,5 LH upper)	24-82	AR
CP	2387993	SUPPORT - w/s ledge	24-03	AR
CQ	2451438	PANEL - front heater compartment	24-08	N
CS	-	DOOR	24-09	AR

N - NEW R - REMANUFACTURED AR - AS REQUIRED

*SEE GENERAL SPECIFICATIONS



INTERIOR TRIM (REAR VIEW)

INTERIOR TRIM (REAR VIEW)

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	R36505	COVERING + (aisle)	24-38	N
B	R37000	COVERING - (underseats)	24-38	N
C	-	DUCT - front of safety door	24-72	AR
D	-	DUCT - front of rear door	24-72	AR
E	2378658	RAIL - seat	24-64	AR
F	2385137	PANEL - (RH)	24-81	AR
G	2385136	PANEL - (LH)	24-81	AR
H	2390081	PANEL - rear door frame	24-81	AR
J	2416143	PANEL - lower side	24-81	AR
K	-	DUCT - over w/h (RH)	24-72	AR
L	-	DUCT - over w/h (LH)	24-72	AR
M	2378708	MOULDING - end	24-81	AR
N	2389708	MOULDING - belt rl	24-81	AR
P	-	DUCT - rr of rr w/h (RH)	24-72	AR
Q	-	DUCT - rr of rr w/h (LH)	24-72	AR
R	2416057	PANEL - adv	24-82	AR
S	2467486	CORD - signal	7-77	AR
T	2048840	BRACKET - guide	7-77	AR
U	-	LAMP - over safety door		AR
V	2378103	HANDLE	24-54	AR
W	-	GLASS		N
X	-	DOOR - rr (front sect)	24-50	AR
Y	-	DOOR - rr (rear sect)	24-50	AR
Z	-	GLASS		AR
AA	2424540	STANCHION - rear door	24-88	AR
AB	2459024	PANEL	24-85	AR
AC	2383060	CAP - closure, rear door eng. compartment (LH)	24-86	AR
AD	2383056	DOOR - eng compt front	24-86	AR
AE	2383055	DOOR - eng compt rear	24-86	AR
AF	2383059	CAP - rear door eng. compartment (RH)	24-86	AR
AG	2394531	PANEL - front	24-86	AR
AH	2383058	PANEL - header	24-82	AR
AJ	2389921	STANCHION - rear modesty panel	24-88	AR

N - NEW R - REMANUFACTURED AR - AS REQUIRED

INTERIOR TRIM (REAR VIEW)
(Continued)

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
AK	-	GLASS - sash, front		N
AL	-	GLASS - sash, rear		N
AM	-	CHANNEL - (curved)	24-57	AR
AN	-	CHANNEL - (curved)	24-57	AR
AP	-	CHANNEL - (straight)	24-57	AR
AQ	-	CHANNEL - (straight)	24-57	AR
AR	2368892	PANEL - (#3 RH)	24-62	AR
AS	2368891	PANEL - (#3 RH)	24-62	AR
AT	2368898	PANEL - (oversafety door)	24-62	AR
AU	2368894	PANEL - (#4 RH)	24-62	AR
AV	2368895	PANEL - (#4 RH)	24-62	AR
AW	2368896	PANEL - (#5 RH)	24-62	AR
AX	2368897	PANEL - (#5 RH)	24-62	AR
AY	2371668	GLASS - transom	24-58	N
AZ	2389922	CHANNEL	24-85	AR
BA	2389920	RAIL - grab, upper	24-89	AR
BB	2389918	RAIL - grab, lower	24-89	AR
BC	2387681	RAIL - grab, pass	24-89	AR
BD	2456196	BRACKET - rail	24-89	AR
BE	2456197	BRACKET - anchor	24-89	AR
BF	2224881	MOULDING - trim	24-82	AR
BG	2467154	MOULDING - trim	24-82	AR
BH	-	PANEL - upper (#11 RH)	24-82	AR
BJ	-	PANEL - upper (#11 LH)	24-82	AR
BK	-	PANEL - UPPER (#8,9,10 RH)	24-82	AR*
BL	-	PANEL - upper (#8,9,10 LH)	24-82	AR*
BM	-	PANEL - upper (#7 RH)	24-82	AR*
BN	-	PANEL - upper (#7 LH)	24-82	AR*
BP	-	PANEL - upper (#6 RH)	24-82	AR
BQ	-	PANEL - upper (#6 LH)	24-82	AR
BR	2390072	BASE - (49.028 lg)	7-14	AR
BS	2423036	LENS	7-14	AR
BT	-	GLASS - center	24-60	N
BU	2449630	GLASS - RH	24-60	N
BV	2449631	GLASS - LH	24-60	N

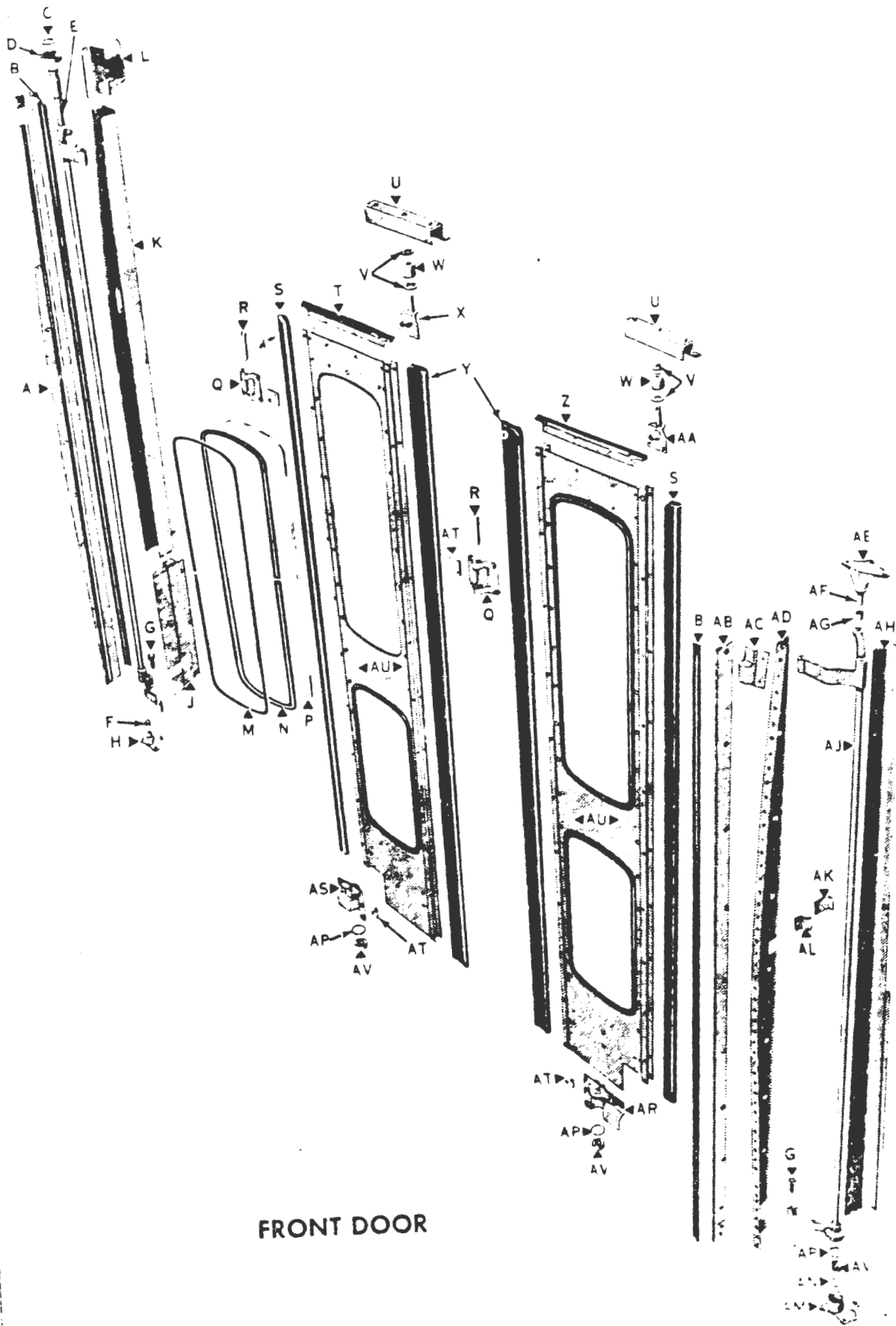
N - NEW R - REMANUFACTURED AR - AS REQUIRED

*SEE GENERAL SPECIFICATIONS

INTERIOR TRIM (REAR VIEW)
(Continued)

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
BW	-	STRAINER - rear window (RH)	24-30B	AR
BX	-	STRAINER - rear window (LH)	24-30B	AR
BY	-	PANEL - rear window	24-62	AR
BZ	2416065	PANEL - heelboard	24-13	AR
CA	2401256	DUCT - front of LH rear w/h		AR
CB	2468494	WHEELHOUSE - rear	24-30	AR
CC	2378694	COVER - trim upper post	24-82	AR
CD	-	MOULDING - w/h (RH)	24-81	N
CE	-	MOULDING - w/h (LH)	24-81	N
CF	-	PANEL - (rear of rear transom window)	24-82	AR
CG	-	PANEL - engine air intake (RH)	24-82	AR
CH	-	PANEL - engine air intake (LH)	24-82	AR
CJ	-	PANEL - rear RH corner crn, lwr	24-82	AR
CK	-	PANEL - rear RH corner crn, upr	24-82	AR
CL	-	PANEL - rear LH corner crn, upr	24-82	AR
CM	-	PANEL - rear LH corner crn, lwr	24-82	AR
CN	-	PANEL - rear center crown	24-82	AR
CP	-	PANEL - rear cross seat, upper	24-13	AR

N - NEW R - REMANUFACTURED AR - AS REQUIRED

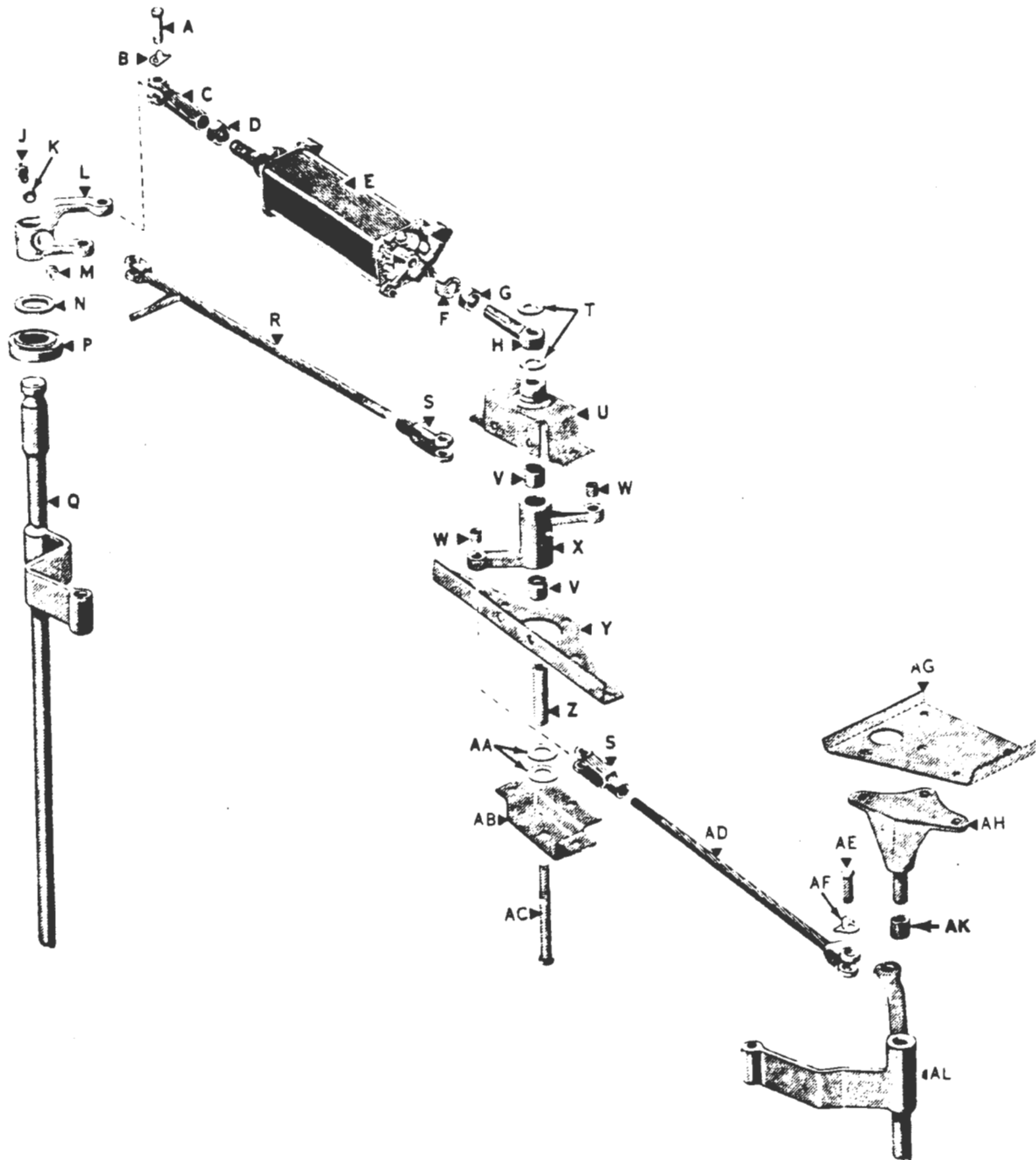


FRONT DOOR

FRONT DOOR

KEY	PART NO	DESCRIPTION	GROUP	PART DESIGNATION
A	2371604	RETAINER - rr seal	24-46	
B	2391562	SEAL - upr & lwr	24-46A	N
C	713097	SHIM - upr brg	24-46A	N
D	9415248	BEARING - upper	24-46A	N
E	2469188	SHAFT - hinge (rr)	24-46A	AR
F	148404	BEARING - hinge shaft	24-46A	N
G	2438570	PIN - lwr brg	24-46A	N
H	2369615	BRACKET - lwr	24-46A	N
J	2387312	CAPPING - lwr #1rh	24-46B	AR
K	2390902	CAPPING - upr #1rh	24-46B	AR
L	2411627	COVER - hge arm	24-46B	AR
M	2378738	FILLER - glass	24-46	N
N	2366912	RETAINER - glass	24-46	N
P	-	GLASS - door		AR
Q	2369825	BRACKET - upr hinge	24-46	N
R	2469185	PIN - drive upr hinge	24-46A	N
S	-	SEAL - door edge, outer	24-46	N
T	2371604	RETAINER - upr seal	24-46	AR
U	2440245	TRACK - upr roller	24-46A	AR
V	2455795	WASHER - upr roller	24-46A	N
W	2440266	ROLLER - upper	24-46A	N
X	2440271	BRACKET - upr roller	24-46A	AR
Y	-	SEAL - door edge, inr	24-46	N
Z	2371604	RETAINER - upr seal	24-46	AR
AA	2440273	BRACKET - upr roller	24-46A	AR
AB	2386443	RETAINER - frt seal	24-46A	AR
AC	2386444	SHIELD - (rh corner post)	24-46A	AR
AD	2386419	CAPPING - outer rn	24-46B	AR
AE	2369825	BRACKET - hinge, upr	24-46	AR
AF	-	PIN - upr hinge brkt		AR
AG	2469186	BUSHINGS - hinge shaft	24-46A	N
AH	2386445	CAPPING - inner rh	24-46B	AR
AJ	2469187	SHAFT - hinge (frt)	24-46A	AR
AK	2391714	SUPPORT - center, inr	24-46A	AR
AL	2391716	SUPPORT - center, otr	24-46A	AR
AM	2438578	BRACKET - shaft, lwr	24-46A	AR
AN	2370693	SHIM - lower brkt	24-46A	N
AP	1929959	CLAMP	24-46A	N
AR	2438580	BRACKET - lwr hge (frt)	24-46	AR
AS	2438579	BRACKET - lwr hge (rr)	24-46	AR
AT	-	SHIM - bumper		AR
AU	-	PANEL - door		AR
AV	907396	BEARING - hge to door	24-46A	N

N - NEW R - REMANUFACTURED AR - AS REQUIRED



FRONT DOOR MECHANISM

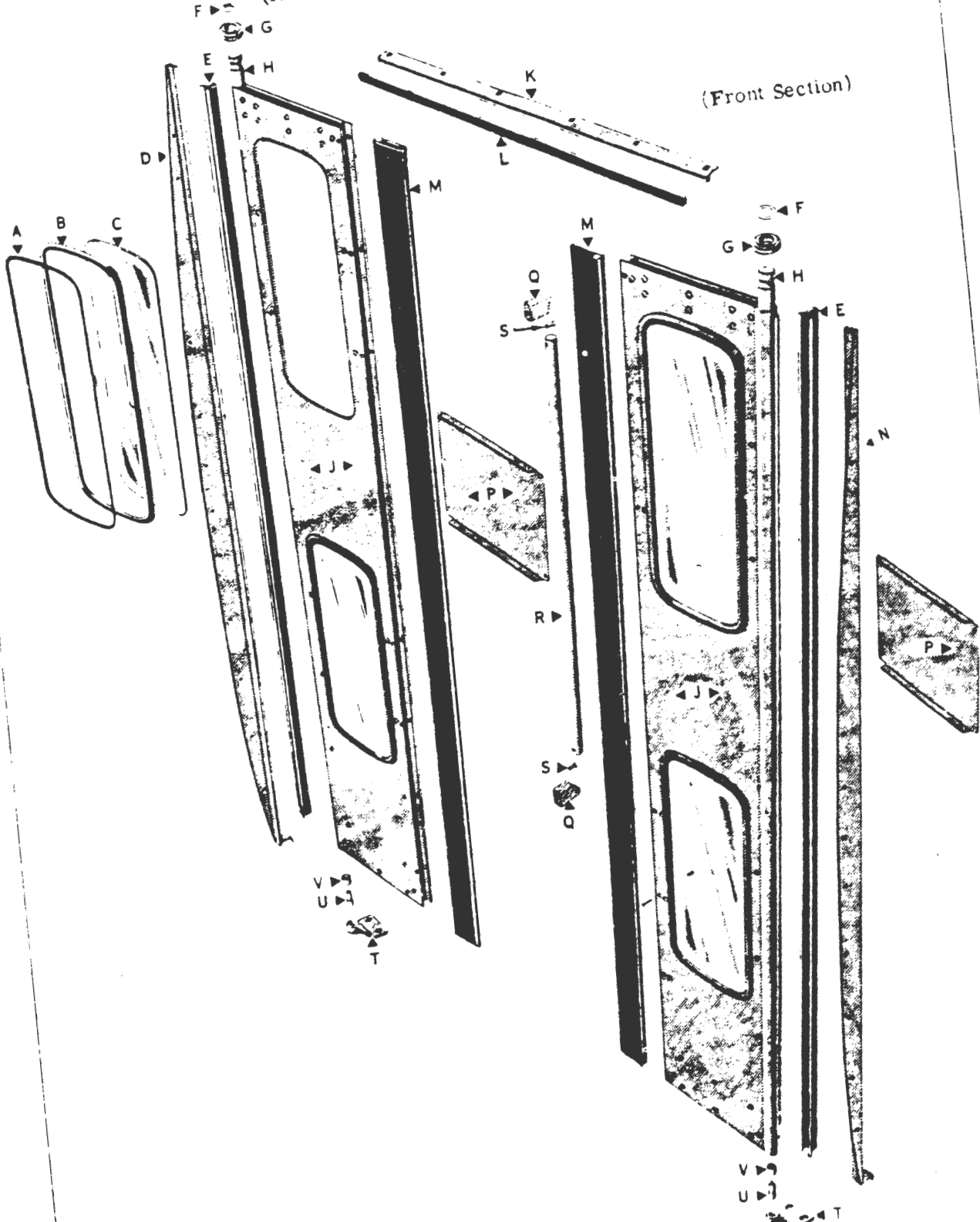
FRONT DOOR MECHANISM

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	2332989	PIN - yoke	24-48	N
B	2332992	RETAINER - yoke pin	24-48	N
C	2411099	YOKE	24-48	AR
D	-	NUT	20.0470	AR
E	2395953	ENGINE	24-48	R
F	2287908	LOCK	24-48	AR
G	-	NUT	20.0470	AR
H	2395954	BOLT - eye	24-48	AR
J	2371193	BOLT - clamp	24-47	AR
K	2332990	WEDGE - clamp bolt	24-47	N
L	2421869	LEVER - ctrl, rr	24-47	AR
M	2332991	NUT - clamp bolt	24-47	N
N	713097	SHIM - hinge, upr brg	24-46A	N
P	9415248	BEARING - hinge, upr	24-46A	N
Q	2469188	SHAFT - hinge, rr	24-46A	AR
R	2369244	ROD - control, rr	24-47	AR
S	144244	YOKE - rod	24-47	AR
T	2369694	WASHER - idler lvr, inr	24-47	N
U	2368904	BRACKET - idler lvr, upr	24-47	AR
V	456382	BEARING - idler lever	24-47	AR
W	2360330	BUSHING - idler lever	24-47	AR
X	2369605	LEVER - idler	24-47	AR
Y	2379016	PLATE - support	24-48	AR
Z	2369626	SLEEVE - idler lever	24-47	AR
AA	120395	WASHER - idler lvr, lwr	24-47	AR
AB	2369607	BRACKET - idler lvr, lwr	24-47	AR
AC	2369627	PIN - rod to lever	24-47	AR
AD	2440839	ROD - control, frt	24-47	AR
AE	2332989	PIN - rod to lvr	24-47	N
AF	2332992	RETAINER - pin	24-47	N
AG	2379012	REINFORCEMENT	24-46A	AR
AH	2369825	BRACKET - hinge, upr	24-46	AR
AJ	-	PIN - brkt, upr		N
AK	-	BEARING	24-46A	N
AL	2469187	SHAFT - hinge (frt sect)	24-46A	AR

N - NEW R - REMANUFACTURED AR - AS REQUIRED

(Rear Section)

(Front Section)

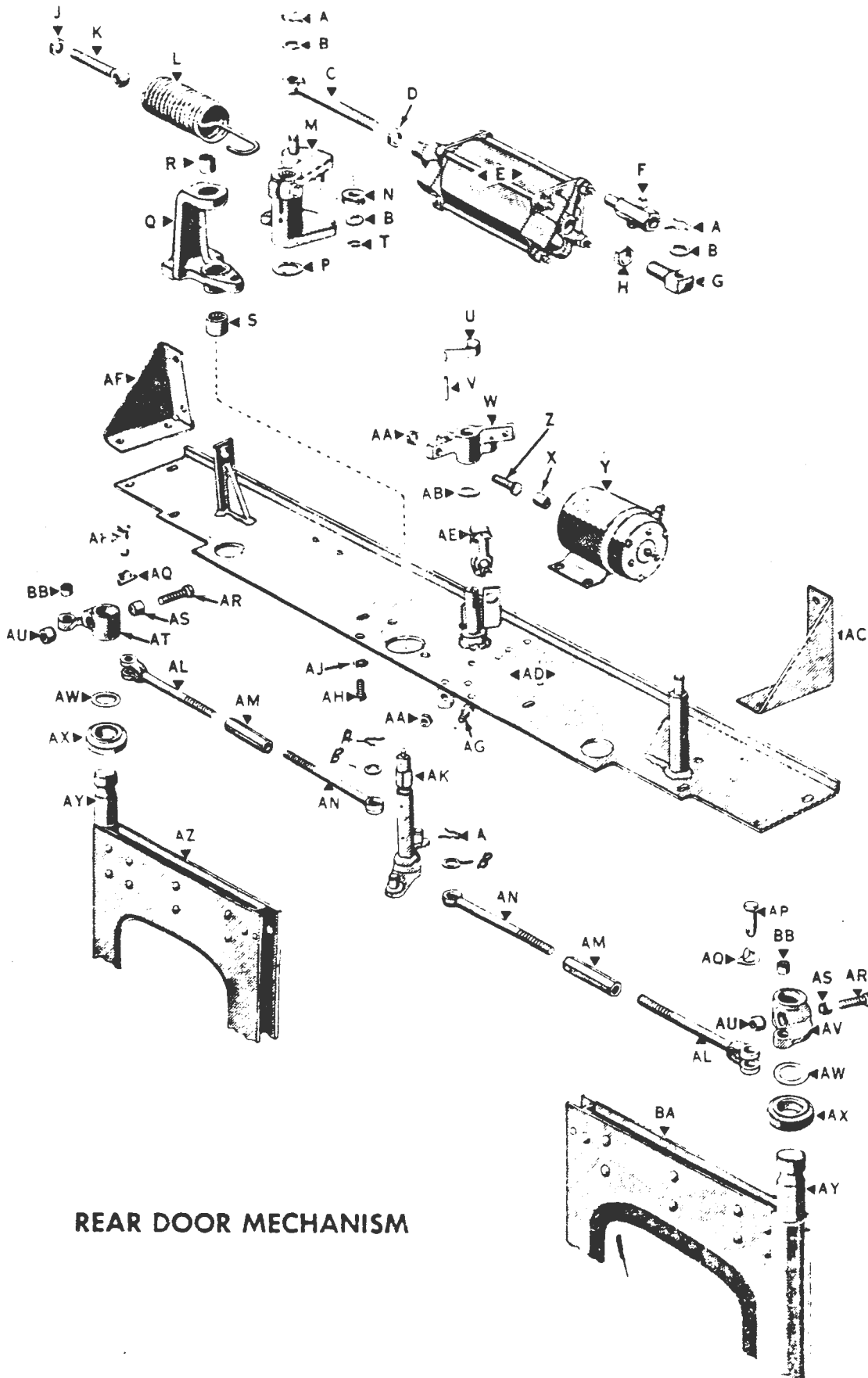


REAR DOOR

REAR DOOR

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	2378738	FILLER - glass	24-50	N
B	2366912	RETAINER - glass	24-50	N
C	-	GLASS		AR
D	2438530	CAPPING - end, rr	24-18	AR
E	2438528	SEAL - hinge	24-50	N
F	713097	SHIM - vpr shaft brg	24-50	N
G	9415248	BEARING - upr shaft	24-50	N
H	2497769	SHAFT - end	24-50	AR
J	-	PANEL - door		AR
K	2365542	RETAINER - seal, upr	24-50	AR
L	2366434	SEAL - door, upr	24-50	N
M	-	SEAL - door edge	24-50	N
N	2438529	CAPPING - end, frt	24-18	AR
P	2366440	PANEL - center, inner	24-50	AR
Q	2447501	BRACKET - assist rail	24-50	AR
R	2446950	RAIL - assist	24-50	AR
S	-	SCREW		AR
T	2366443	BRACKET - hinge, lwr	24-50	AR
U	2365594	PIN - hinge, lwr brkt	24-50	N
V	2367063	BEARING - lwr	24-50	N

N - NEW R - REMANUFACTURED AR - AS REQUIRED

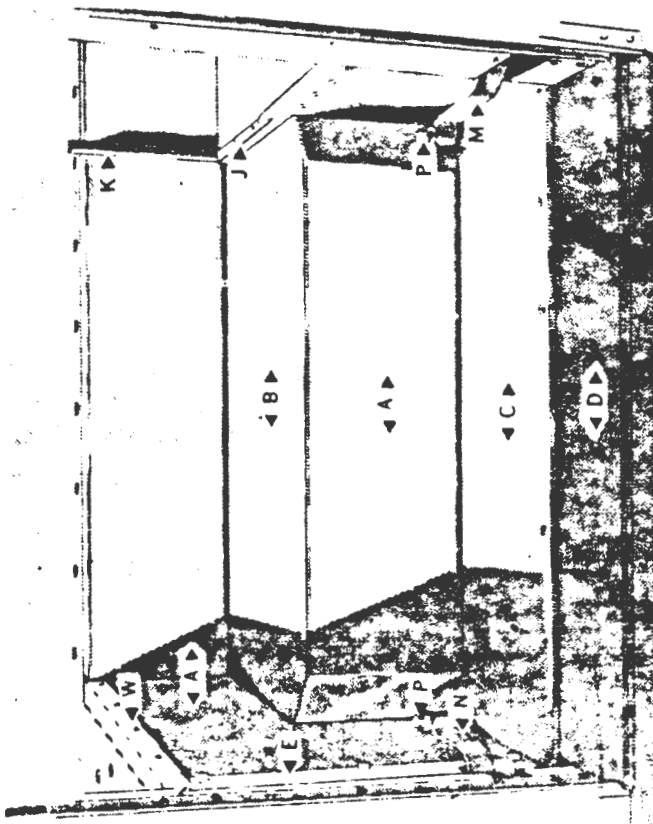
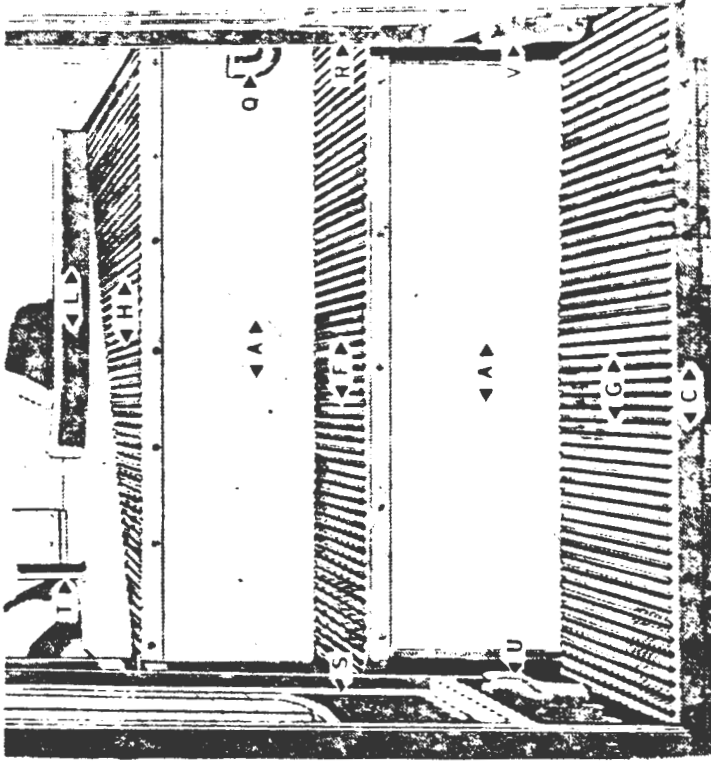


REAR DOOR MECHANISM

REAR DOOR MECHANISM

KEY	PART NO	DESCRIPTION	GROUP	PART DESIGNATION
A	-	SPRING - rein	20.0735	N
B	2390313	WASHER - lever to pin	24-51	N
C	2402215	ROD - eye	24-53	AR
D	-	NUT	20.0470	AR
E	2467749	CYLINDER	24-53	R
F	2460882	VALVE - speed	24-53	AR
G	2399413	ROD - eye	24-53	AR
H	-	NUT	20.0470	AR
J	-	NUT	20.0470	AR
K	2383837	ROD - eye, base	24-51	AR
L	2392514	SPRING - closure	24-51	N
M	2399403	LEVER - cam	24-51	AR
N	2399408	BEARING - spring	24-51	AR
P	2399407	WASHER - cam lever	24-51	AR
Q	2399404	SUPPORT - cam lever	24-51	AR
R	148406	BEARING - idler lvr	24-51	AR
S	148410	BEARING - idler lvr	24-51	AR
T	9414841	RING - snap	24-51	N
U	2399406	SPRING - door latch	24-51	AR
V	455481	PIN - anchor	24-51	AR
W	2399402	LEVER - latch	24-51	AR
X	2396067	CAP - solenoid shaft	7-54	AR
Y	1119921	SOLENOID	7-54	N
Z	2355863	BOLT - rear doorlock	24-51	AR
AA	-	NUT	20.0460	AR
AB	2401497	WASHER - latch lever	24-51	AR
AC	2373191	BRACKET - base plate, frt	24-51	AR
AD	2399401	PLATE - base	24-51	AR
AE	2380651	SWITCH - stepwell	7-71	AR
AF	2373192	BRACKET - base plate	24-51	AR
AG	-	BOLT	20.0050	AR
AH	-	BOLT	20.0050	AR
AJ	-	WASHER	20.0820	AR
AK	2399405	SHAFT - (Incl lever)	24-51	AR
AL	2417744	YOKE - control eye rod	24-51	AR
AM	2417746	COUPLING	24-51	AR
AN	2417745	ROD - eye	24-51	AR
AP	2332989	PIN - rod to lvr	24-51	N
AQ	2332992	RETAINER - pin	24-51	N
AR	2371193	BOLT - clamp	24-51	N
AS	2332990	WEDGE	24-51	N
AT	2395230	LEVER - pivot (rr sect)	24-51	AR
AU	2332991	NUT - clamp bolt	24-51	AR
AV	2392516	LEVER - pivot (frt sect)	24-51	AR
AW	713097	SHIM - brg. upr shaft	24-50	N
AX	9415248	BEARING - upr shaft	24-50	N
AY	2366444	SHAFT - end (Incl plate)	24-50	AR
AZ	-	DOOR - rr sect	24-50	AR
BA	-	DOOR - frt sect	24-50	AR
BB	2335996	BU SHING - pilot lever	24-50	AR

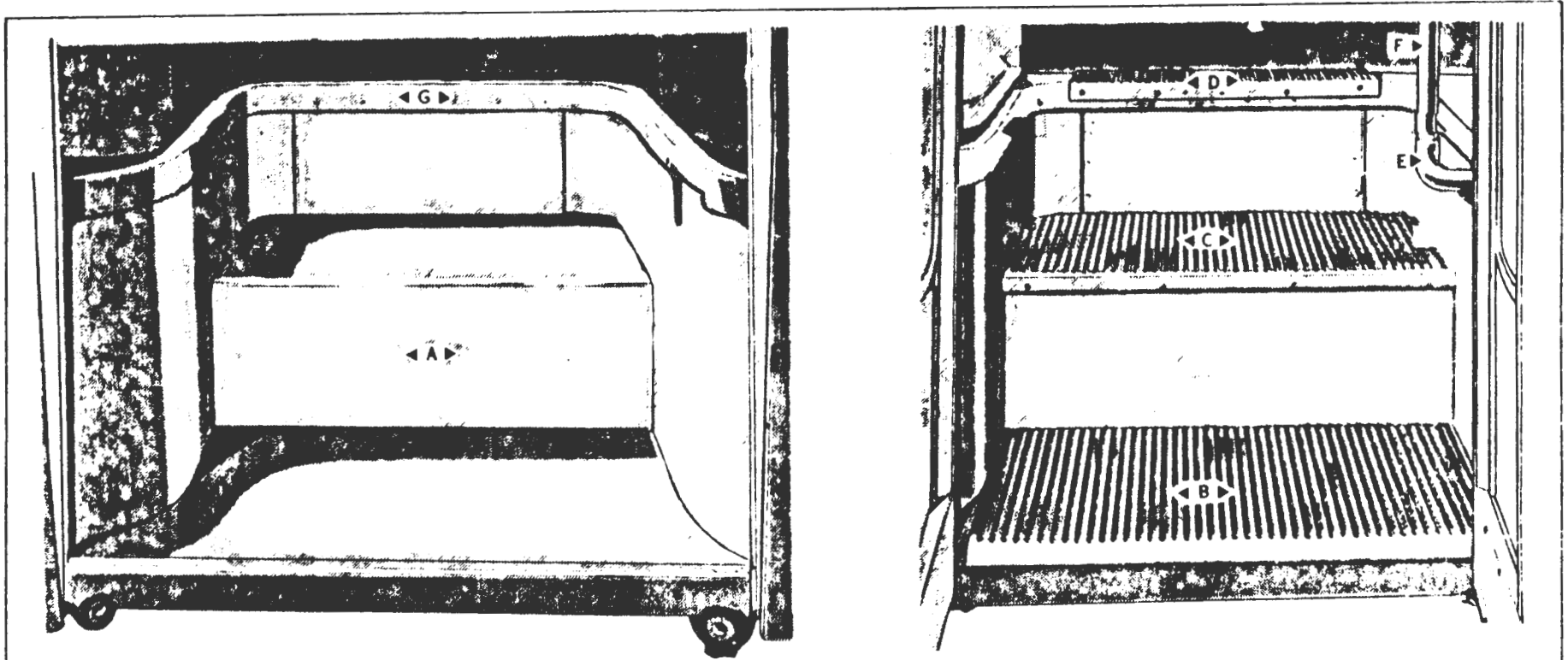
N - NEW R - REMANUFACTURED AR - AS REQUIRED



FRONT STEPWELL

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION	KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
V	2450337	STEPWELL - (fiberglass)	24 39	N	L	2469187	RISER - dr. dr.	24 37A	N
B	2480436	SUPPORT - (to bulkhead)	24 39	AR	M	2469188	SHAFT - frt. sec.	24 46A	AR
C	2472528	SUPPORT - panel to angle	24 39	AR	N	2438570	SHAFT - rear sec.	24 46A	AR
D	2449134	PLATE - tread, upper	24 39	N	P	2492010	PIN - hinge shaft	24 89	N
E	2449135	PLATE - tread, lower	24 39	N	Q	2492010	RAIL - grab (curved)	24 46	AR
F	2491111	PLATE - tread, frt. dr. area	24 38	N	R		DOOR - frt. sec.	24 46	AR
G		ANGLE - frt. area	24 37	N	S		DOOR - rear sec.	24 46	AR
H		ANGLE - safety equip	24 37	N	T		STANCHION - dr. curtain	24 88	AR
J				N	U	2411627	COVER	24 46B	AR
K				N	V	2386444	SHIELD	24 46A	AR
				N	W	B 110030	BAND - scuff		N
				N	X		FLOORBOARD		AR

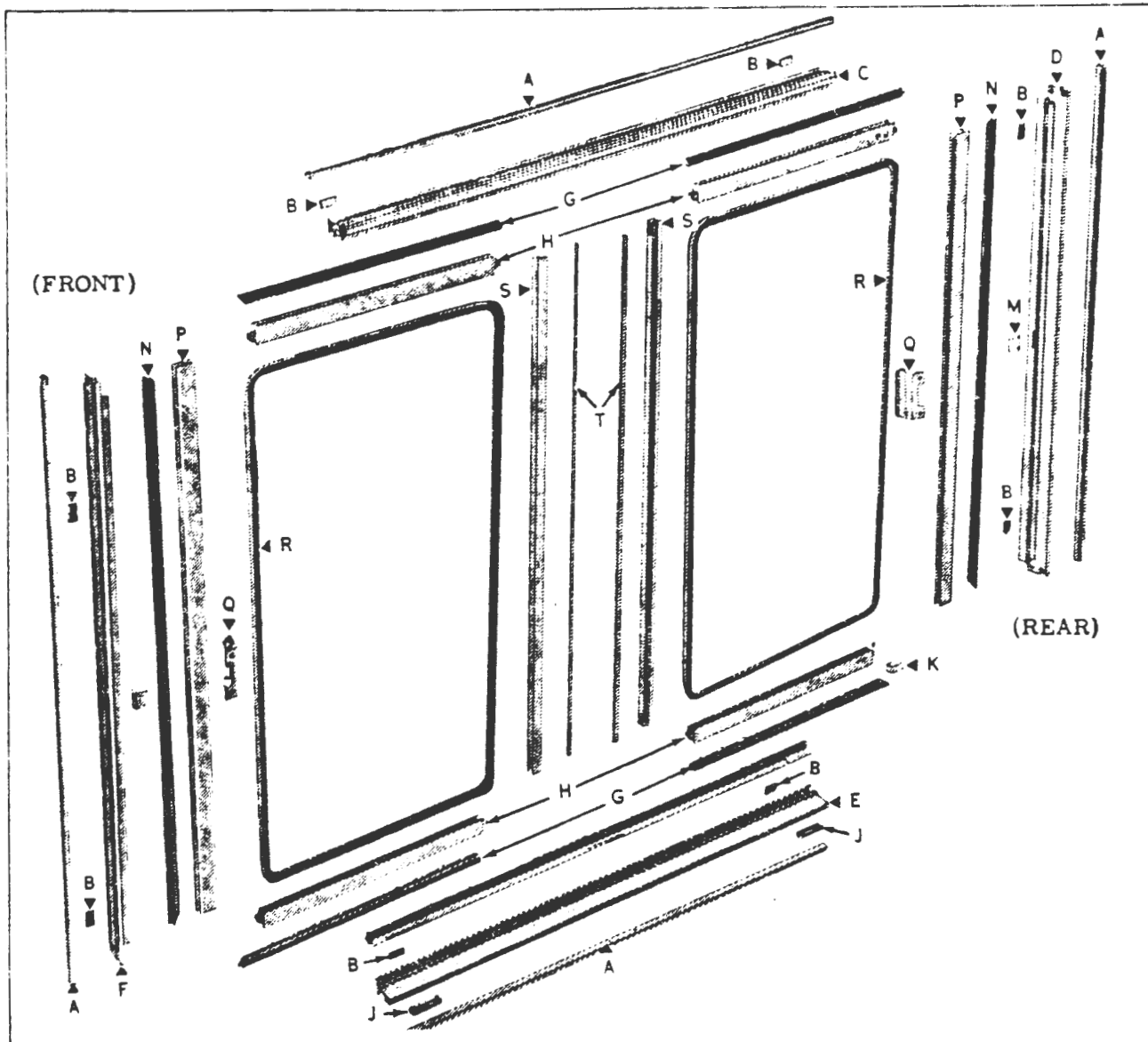
N - NEW R - REMANUFACTURED AR - AS REQUIRED



REAR STEPWELL

KEY	DESCRIPTION	PART DESIGNATION
A	STEPWELL	N
B	PLATE TREAD-LOWER	N
C	PLATE TREAD-UPPER	N
D	PLATE TREAD	N
E	STANCHION ELBOW	AR
F	STANCHION	AR
G	BAND	N

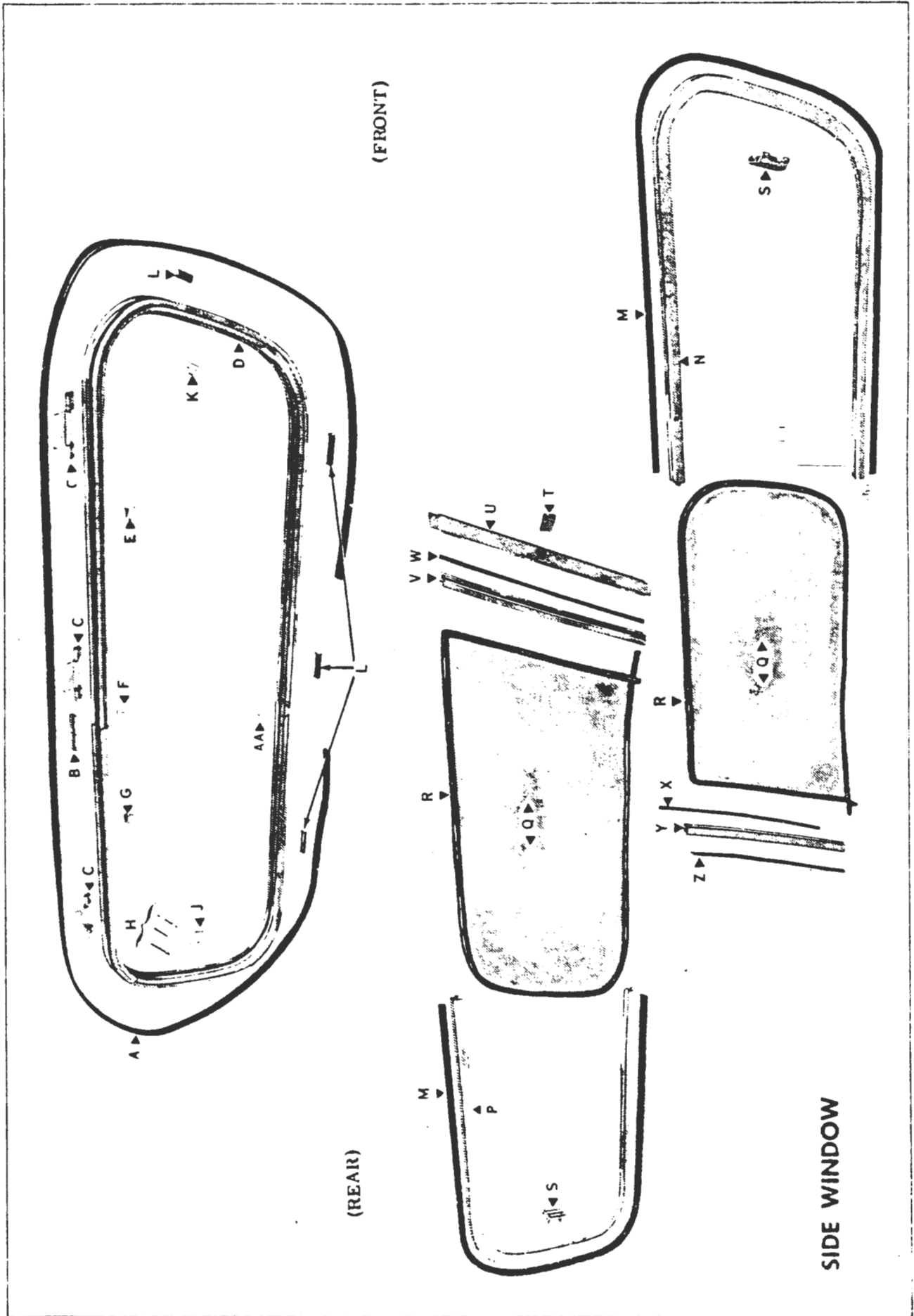
N - NEW R - REMANUFACTURED AR - AS REQUIRED



DRIVER'S WINDOW

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	2447046	SEAL - weather	24-56	N
B	-	INSULATOR		N
C	2385534	RAIL - outer frame, upr	24-56	AR
D	2385537	RAIL - outer frame, rr	24-56	AR
E	2385535	RAIL - outer frame, lwr	24-56	AR
F	2417563	RAIL - outer frame, frt	24-56	AR
G	2401751	CHANNEL - horizontal		N
H	2385540	RAIL - horizontal	24-56	AR
J	2385531	BAR - position	24-56	N
K	2422343	STOP	24-56	AR
M	2385529	KEEPER - lock, rr	24-56	AR
N	2386077	CHANNEL - run	24-56	N
P	2385541	RAIL - end	24-56	AR
Q	2381886	LOCK	24-56	AR
R	2447045	CHANNEL - glass	24-56	N
S	2385542	RAIL - center	24-56	AR
T	2385532	SEAL - rail (vert)	24-56	N

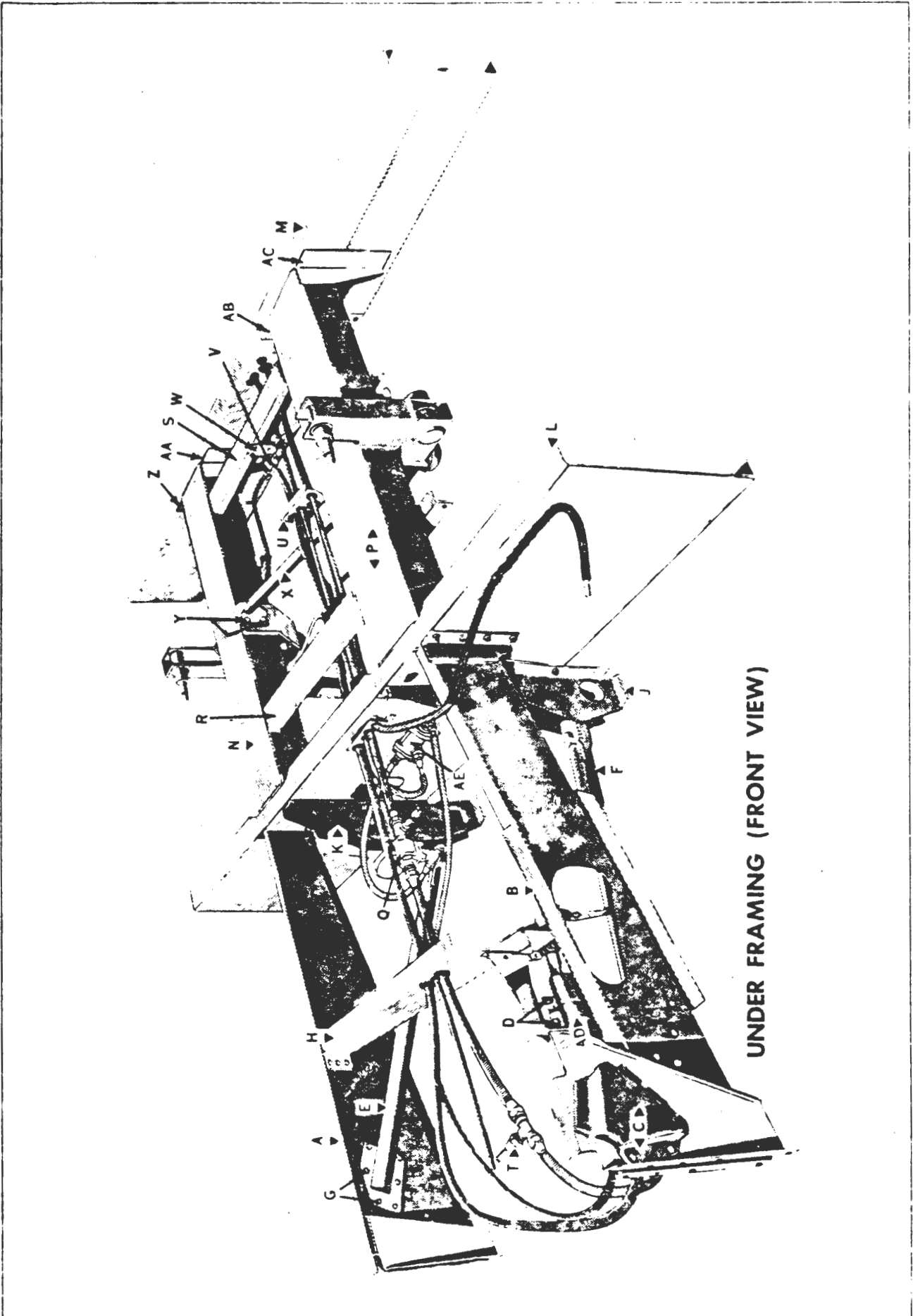
N - NEW R - REMANUFACTURED AR - AS REQUIRED



SIDE WINDOW

KEY	PART NO	DESCRIPTION	GROUP	PART DESIGNATION
A	2416067	SEAL - frame otr	24-57	N
B	2379036	CHANNEL	24-57A	AR
C	-	HINGE	24-57A	AR
D	-	FRAME - sash	24-57	AR
E	2385507	STOP - frt	24-57	N
F	2397804	ESCUTCHEON	24-57	N
G	2381443	STOP - rear	24-57	N
H	-	SCREW		N
J	2409106	KEEPER - rear	24-57A	N
K	2383017	KEEPER - front	24-57A	N
K	2415378	KEEPER - bottom of sash	24-57A	N
L	2379037	BAR - position	24-57	N
M	-	CHANNEL - run	24-57	N
N	2423667	CHANNEL - frt	24-57	AR
P	2423667	CHANNEL - rr (curved)	24-57	AR
Q	-	GLASS		N
R	2447040	CHANNEL - glass	24-57	N
S	-	LOCK	24-57A	Install New Storm-Tite Locks
T	-	CUSHION		AR
U	-	BAR - tie	24-57A	AR
V	-	CHANNEL - rr (straight)	24-57	AR
W	2379035	SEAL - divider, rr	24-57	N
X	2382843	SEAL - divider, frt (rh)	24-57	N
Y	-	CHANNEL - frt (straight)	24-57	AR
Z	-	SEAL - frt and rear	24-57	N
AA	-	SEAL - lower		N

N - NEW R - REMANUFACTURED AR - AS REQUIRED

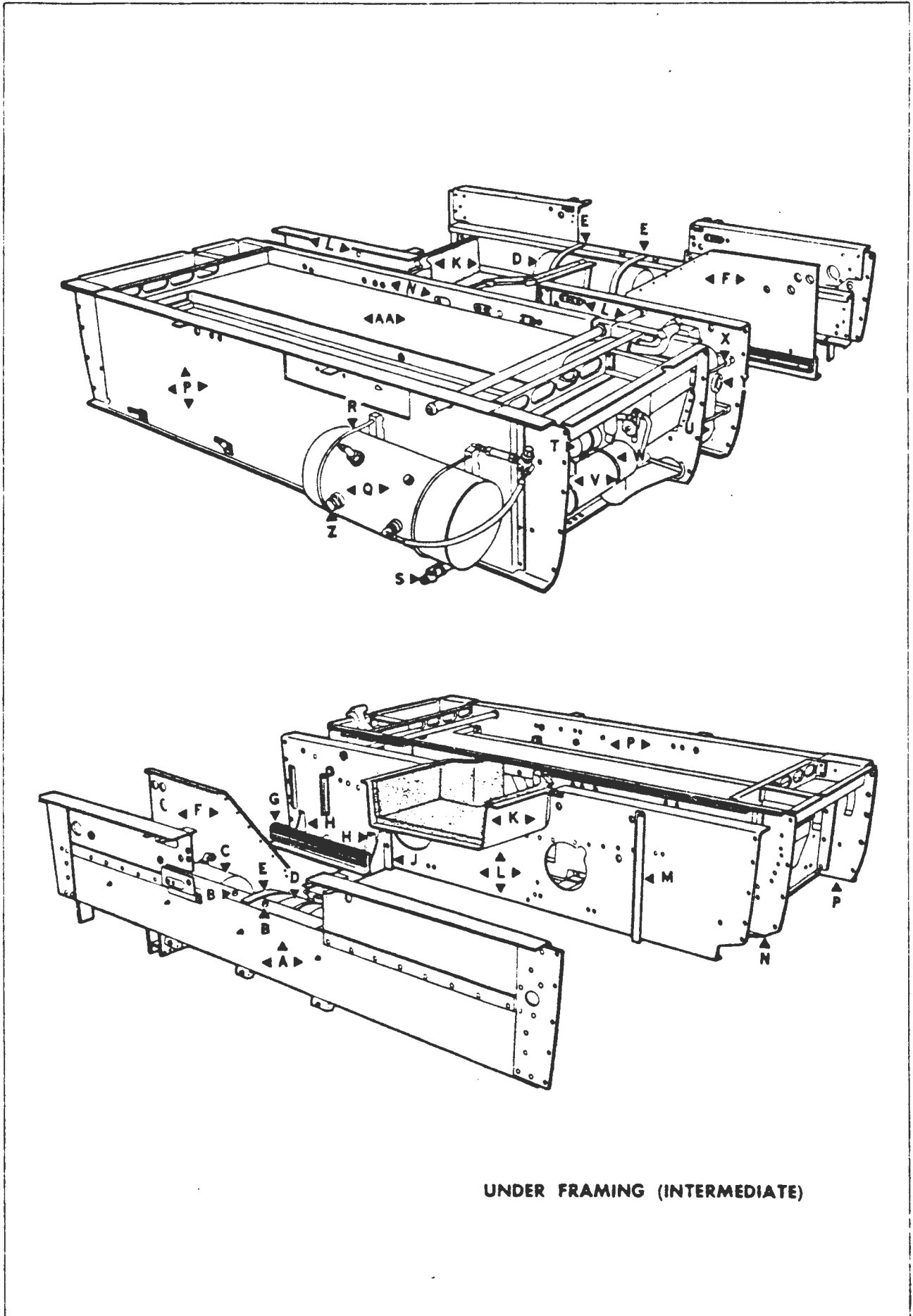


UNDER FRAMING (FRONT VIEW)

UNDER FRAMING (FRONT VIEW)

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	-	EXTENSION - RH	14-02	AR
B	-	EXTENSION - LH	14-02	AR
C	2378334	BRACKET - mtg	16-26	AR
D	2239396	BOLT	16-26	N
E	2375058	STRUT - RH	14-22	AR
F	2375042	STRUT - LH	14-22	AR
G	2239396	BOLT	14-22	N
H	2382089	REINFORCEMENT	24-37	AR
J	2373498	BRACKET - LH (at blkhd)	14-22	AR
K	2450139	BRACKET - RH (at blkhd)	14-22	AR
L	2373408	BULKHEAD	24-44	N
M	2450833	CROSSMEMBER	24-43	AR
N	-	BEAM ASSY - RH	14-02	AR
P	-	BEAM ASSY - LH	14-02	AR
Q	-	VALVE - aux. brake		N
R	2383102	SUPPORT	14-08C	N
S	2379721	REINFORCEMENT	14-37	N
T	2227413	TEE	4-58B	AR
U	2402499	BRACKET	4-58C	N
V	2246608	TEE	4-58B	AR
W	-	SUPPORT - frt brake tee		N
X	2382090	TUBE - reinf (102)	14-02	N
Y	453719	BOLT - (to RH beam)	14-02	N
Z	2375026	ANGLE	14-02	N
AA	2380633	ANGLE	14-02	N
AB	2375026	ANGLE	14-02	N
AC	2380633	ANGLE	14-02	N
AD	-	CYLINDER - air, aux. interlock		N
AE	-	VALVE - check. aux. interlock		N

N - NEW R - REMANUFACTURED AR - AS REQUIRED

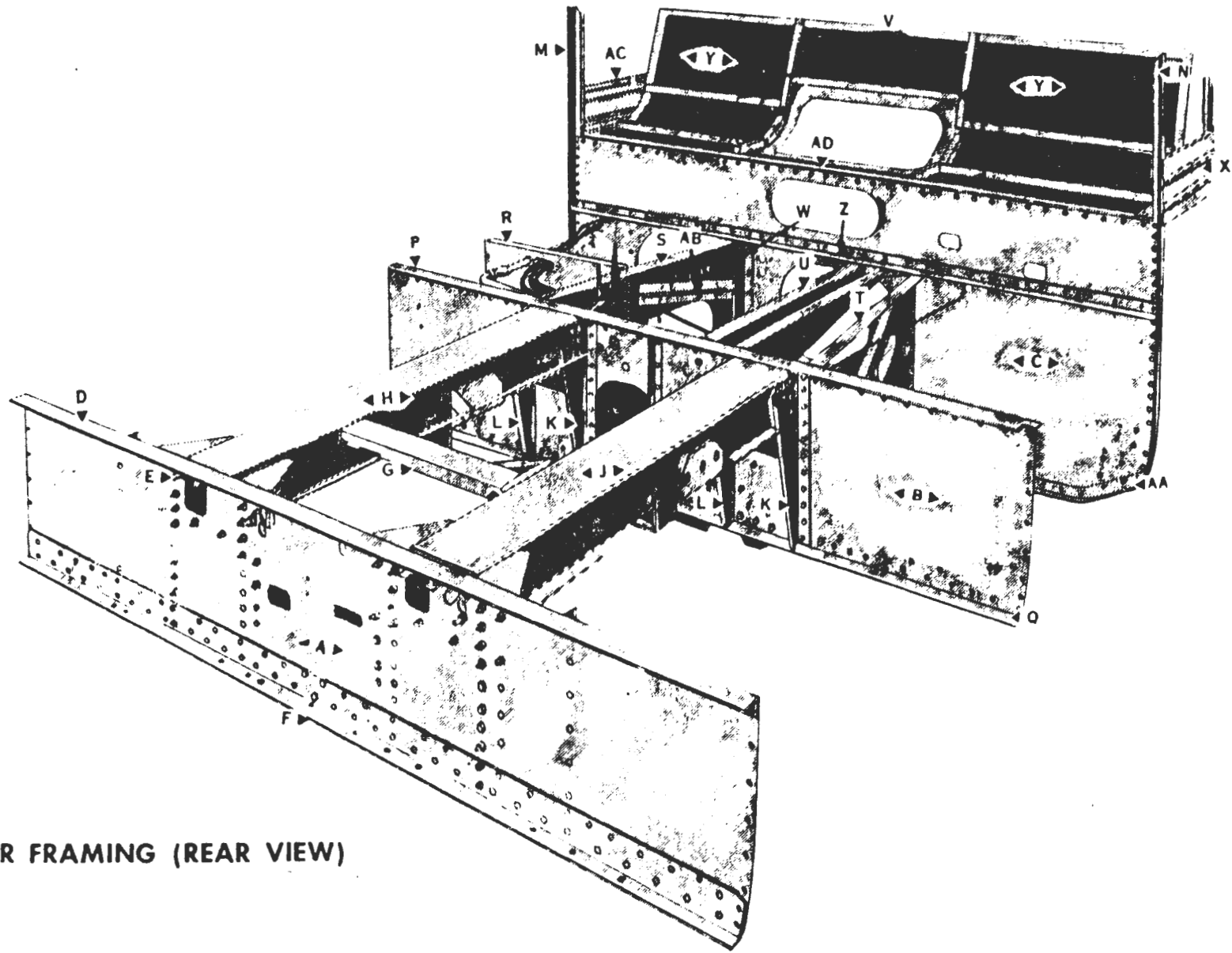


UNDER FRAMING (INTERMEDIATE)

UNDER FRAMING (INTERMEDIATE)

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	—	CROSSMEMBER ASSY	24-43	N
B	2023785	BUMPER	24-43	N
C	2424278	TANK ASSY-wet	4-42	N
D	2424278	TANK ASSY-dry	4-42	N
E	2381699	STRAP ASSY	4-42	N
F	—	SHIELD	24-25	N
G	669323	SLIDE ASSY	24-25	AR
H	—	BRACKET-LH	24-25	N
J	—	BRACKET-RH	24-25	N
K	—	DUCT ASSY-main	24-71	R
L	—	BULKHEAD ASSY	24-44K	N
M	2224900	STIFFENER	24-44K	N
N	—	BULKHEAD ASSY-frt.	24-44J	AR
P	—	BULKHEAD ASSY-rear	24-44J	AR
Q	2424278	TANK ASSY-suspension	4-42	N
R	2404739	U-BOLT	4-42	N
S	2429626	COCK ASSY-drain	4-42	N
T	669351	DRIER ASSY	26-30	N
U	2454934	RECEIVER ASSY	26-30	N
V	2372653	EXCHANGER ASSY	26-28	N
W	2373933	U-BOLT	26-28	N
X	2454925	U-BOLT	26-30	N
Y	2388877	GLASS ASSY	26-30	N
Z	444638	PLUG	4-42	N
AA	2390544	PANEL ASSY	26-10	AR

N — NEW R — REMANUFACTURED AR — AS REQUIRED



UNDER FRAMING (REAR VIEW)

UNDER FRAMING (REAR VIEW)

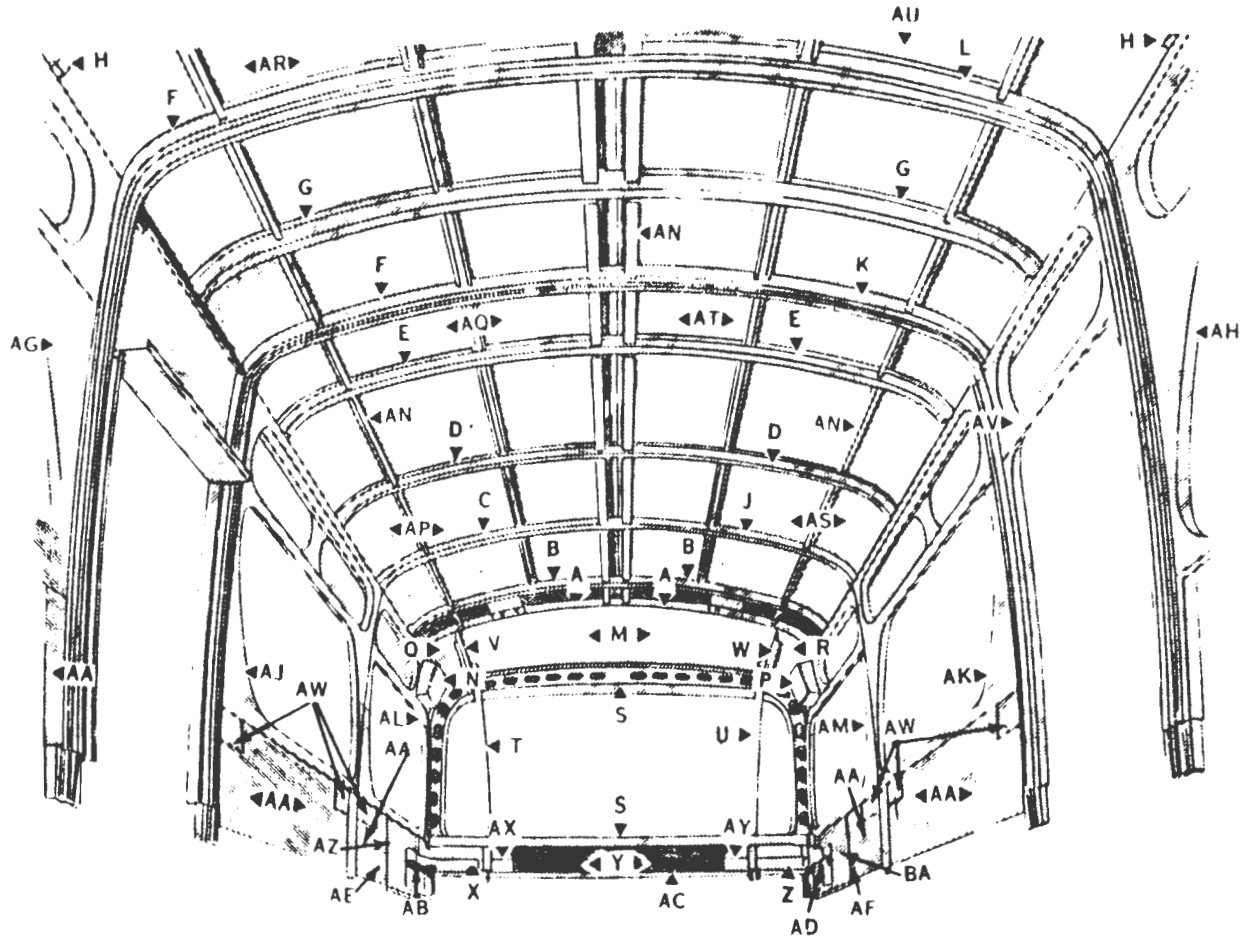
KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	2371244	BULKHEAD	24-44L	AR
B	-	BULKHEAD - Rear	24-44L	AR
C	2448458	BULKHEAD	24-44M	N
D	2371255	ANGLE	24-44L	N
E	-	CLIP		N
F	2434549	ANGLE	24-44L	N
G	2379720	REINFORCEMENT	24-37	N
H	2434980	BEAM - RH	14-03	AR
J	2434978	BEAM - LH	14-03	AR
K	2428890	SUPPORT - LH rear	14-03	AR
L	242889	SUPPORT - RH rear	14-03	AR
M	2436299	ANGLE - RH	24-44M	N
N	2436300	ANGLE - LH	24-44M	N
P	S-10231	SUPPORT	24-44L	N
Q	2477350	ANGLE	24-44L	N
R	2395436	PANEL - closure	24-14	N
S	-	PLATE - long, RH	24-44R	N
T	-	PLATE - long, LH	24-44R	N
U	2454394	BRACKET	14-22	AR
V	-	SPACER - (rear cross seat)		AR
W	2421075	ANGLE	24-44R	N
X	2372930	PANEL - LH	24-10	AR
Y	-	PANEL - lower	24-13	AR
Z	-	ANGLE - seat riser supt		N
AA	2383589	ANGLE	24-44M	N
AB	-	REINFORCEMENT - trans anchor brkt		N
AC	2372553	PANEL - RH	24-10	AR
AD	-	ANGLE - floor	24-44M	N

N - NEW R - REMANUFACTURED AR - AS REQUIRED

ROOF AND UPPER POST (FRONT VIEW)

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	2372004	POST	24-29	AR
B	2387608	POST	24-29	AR
C	—	CARLINE	24-29A	AR
D	2382305	CARLINE	24-29A	AR
E	—	POST	24-29	AR
F	2382305	CARLINE	24-29A	AR
G	2366926	CARLINE	24-29A	AR
H	2366928	CARLINE	24-29A	AR
J	2366926	CARLINE	24-29A	AR
K	2379197	POST	24-29	AR
L	2387613	POST	24-29	AR
M	2416071	PANEL-belt	24-19E	AR
P	—	POST	24-29	AR
Q	2382680	POST-RH upper	24-02	AR
R	2382053	POST-LH upper	24-02	AR
S	2366885	POST	24-29	AR
T	2427730	HEADER	24-34	AR
U	2380753	PANEL-reveal	24-30B	AR
V	2380750	PANEL-RH cnr	24-30A	AR
W	2380751	PANEL-LH-cnr	24-30A	AR
X	8884868	PANEL-w/s	24-03	AR
Y	—	STIFFENER	24-30	AR
Z	2380749	PANEL	24-30A	AR
AA	2385120	STRAINER-center	24-30B	AR
AB	2387375	STRAINER-RH cnr	24-30B	AR
AC	2388809	STRAINER-LH cnr	24-30B	AR
AD	2385115	STRAINER-cross	24-30B	AR
AE	—	PANEL-RH frt	24-30	AR
AF	—	PANEL-LH frt	24-30	AR
AG	—	PANEL-RH frt inter	24-30	AR
AH	—	PANEL-LH frt inter	24-30	AR
AJ	—	PANEL-RH rear inter	24-30	AR
AK	—	PANEL-LH rear inter	24-30	AR
AL	2368890	PANEL	24-62	AR
AM	2368891	PANEL	24-62	AR
AN	2368892	PANEL	24-62	AR
AP	2368993	PANEL	24-62	AR
AQ	2368898	PANEL	24-62	AR
AR	2387700	POST	24-18	AR
AS	2458200	REINFORCEMENT-RH	24-62	AR
AT	2424013	REINFORCEMENT-LH	24-62	AR

N — NEW R — REMANUFACTURED AR — AS REQUIRED

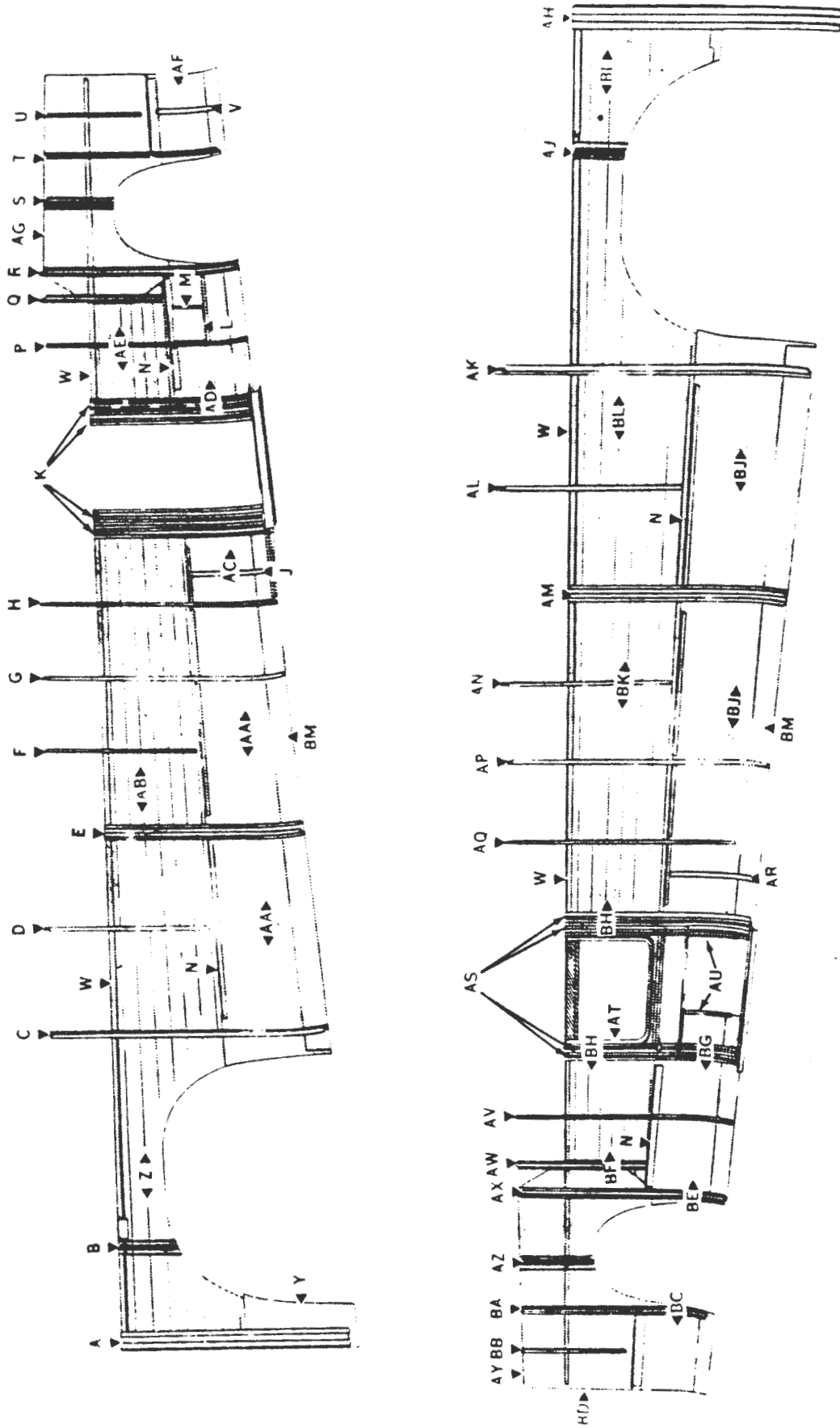


ROOF AND UPPER POST (REAR VIEW)

ROOF AND UPPER POST (REAR VIEW)

KEY	PART NO	DESCRIPTION	GROUP	PART DESIGNATION
A	—	CARLINE	24-29A	AR
B	—	CARLINE	24-29A	AR
C	—	POST	24-29	AR
D	2382305	CARLINE	24-29A	AR
E	2366926	CARLINE	24-29A	AR
F	2362772	POST	24-29	AR
G	2366928	CARLINE	24-29A	AR
H	2366926	CARLINE	24-29A	AR
J	—	POST	24-29	AR
K	2366888	POST	24-29	AR
L	2366885	POST	24-29	AR
M	2380704	PANEL-rear ctr	24-30A	AR
N	2385124	PAN-RH	12-20	AR
P	2385491	PAN-LH	12-20	AR
Q	2402408	PANEL-RH upper	24-30A	AR
R	2402409	PANEL-LH upper	24-30A	AR
S	2380721	PANEL	24-62	AR
T	—	STRAINER-rr RH wdw	24-30B	AR
U	—	STRAINER-rr LH wdw	24-30B	AR
V	2384627	STRAINER-rr RH cnr	24-30B	AR
W	2384628	STRAINER-rr LH cnr	24-30B	AR
X	2381715	PANEL-belt, RH	24-11	AR
Y	2381706	PANEL-belt, ctr	24-11	AR
Z	2381716	PANEL-belt, LH	24-11	AR
AA	2416071	PANEL-belt	24-19E	AR
AB	—	RAIL-belt, RH	24-11	AR
AC	—	RAIL-belt, ctr	24-11	AR
AD	—	RAIL-belt, LH	24-11	AR
AE	2448441	PANEL-belt	24-19E	AR
AF	2448441	PANEL-belt	24-19E	AR
AG	2368892	PANEL	24-62	AR
AH	2368893	PANEL	24-62	AR
AJ	2368894	PANEL	24-62	AR
AK	2368895	PANEL	24-62	AR
AL	2368896	PANEL	34-62	AR
AM	2368897	PANEL	24-62	AR
AN	—	STIFFENER-roof	24-30	AR
AP	—	PANEL-RH rear	24-30	AR
AQ	—	PANEL-RH rr inter	24-30	AR
AR	—	PANEL-RH frt inter	24-30	AR
AS	—	PANEL-LH rear	24-30	AR
AT	—	PANEL-LH rr inter	24-30	AR
AU	—	PANEL-LH frt inter	24-30	AR
AV	2368898	PANEL	24-62	AR
AW	—	REINFORCEMENT	24-62	AR
AX	2423012	REINFORCEMENT	24-11	AR
AY	2423013	REINFORCEMENT	24-11	AR
AZ	2448449	REINFORCEMENT	24-11	AR
BA	2448447	REINFORCEMENT	24-11	AR

N — NEW R — REMANUFACTURED AR — AS REQUIRED

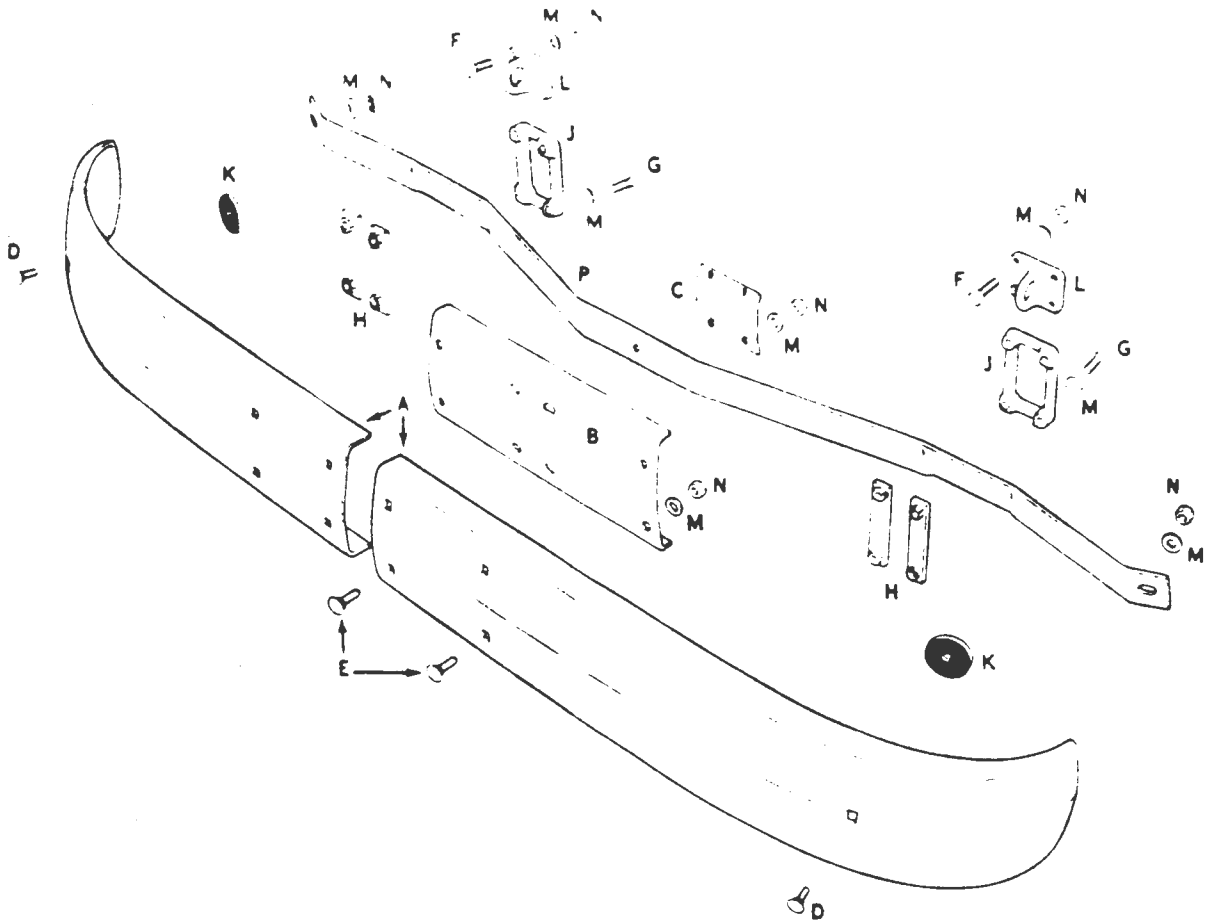


LOWER SIDE POST AND PANEL

LOWER SIDE POST AND PANEL

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGN-NATION	KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGN-NATION
A	2367656	POST	24-18	AR	AH	2373178	POST	24-18	AR
B	2387700	POST	24-18	AR	AJ	2387700	POST	24-18	AR
C	2394549	STIFFENER	24-19C	AR	AK	2394550	STIFFENER	24-19C	AR
D	2366948	STIFFENER	24-19C	AR	AL	2366949	STIFFENER	24-19C	AR
E	2394551	POST	24-18	AR	AM	2361405	POST	24-18	AR
F	2366948	STIFFENER	24-19C	AR	AN	2366949	STIFFENER	24-18	AR
G	2391981	STIFFENER	24-19C	AR	AP	2393897	STIFFENER	—	AR
H	2370688	STIFFENER	24-19C	AR	AQ	2370689	STIFFENER	24-19C	AR
J	2386792	REINFORCEMENT	24-19A	N	AR	2386793	REINFORCEMENT	24-19A	N
K	2360579	POST	24-18	AR	AS	610902	POST	24-18	AR
L	—	STOP-fuel filler door	—	AR	AT	2369864	FRAME	24-54	AR
M	—	STOP-fuel filler door	—	AR	AU	2496978	STOP	24-25A	AR
N	—	ANGLE-supt. floor	24-37	N	AV	2395031	STIFFENER	24-19C	AR
P	2395030	STIFFENER	24-19C	AR	AW	2381440	STIFFENER	24-19C	AR
Q	2381441	STIFFENER	24-19C	AR	AX	2436291	STIFFENER	24-19C	AR
R	2436290	STIFFENER	24-19C	AR	AY	2420186	PANEL-reinforcement	24-19D	AR
S	2395072	POST	24-18	AR	AZ	2395073	POST	24-18	AR
T	2437222	STIFFENER	24-19C	AR	BA	2437223	STIFFENER	24-19C	AR
U	S-10011	STIFFENER	24-19C	AR	BB	—	STIFFENER	24-19C	AR
V	2386792	REINFORCEMENT	24-19A	N	BC	2411323	PANEL-LH (skirt)	24-19	N
W	2378647	STIFFENER-belt	24-19C	AR	BD	2369842	PANEL-LH (fluted)	24-19	AR
W	2368249	STIFFENER-belt	24-19C	AR	BE	2411323	PANEL-LH (skirt)	24-19	N
Y	2369699	PANEL-RH (skirt)	24-19	N	BF	2369840	PANEL-LH (fluted)	24-19	AR
Z	2369846	PANEL-RH (fluted)	24-19	AR	BG	2416084	PANEL-LH (skirt)	24-19	N
AA	2416084	PANEL-RH (skirt)	24-19	N	BH	2369839	PANEL-LH (fluted)	24-19	AR
AB	2412763	PANEL-RH (fluted)	24-19	AR	BJ	2416084	PANEL-LH (skirt)	24-19	N
AC	2411321	PANEL-RH (skirt)	24-19	N	BK	2412763	PANEL-LH (fluted)	24-19	AR
AD	2411320	PANEL-RH (skirt)	24-19	N	BL	2369837	PANEL-LH (fluted)	24-19	AR
AE	2369847	PANEL-RH (fluted)	24-19	AR	BM	—	ANGLE-reinforcement	24-19B	AR
AF	2411323	PANEL-RH (skirt)	24-19	N					
AG	2420186	PANEL-reinforcement	24-19D	AR					

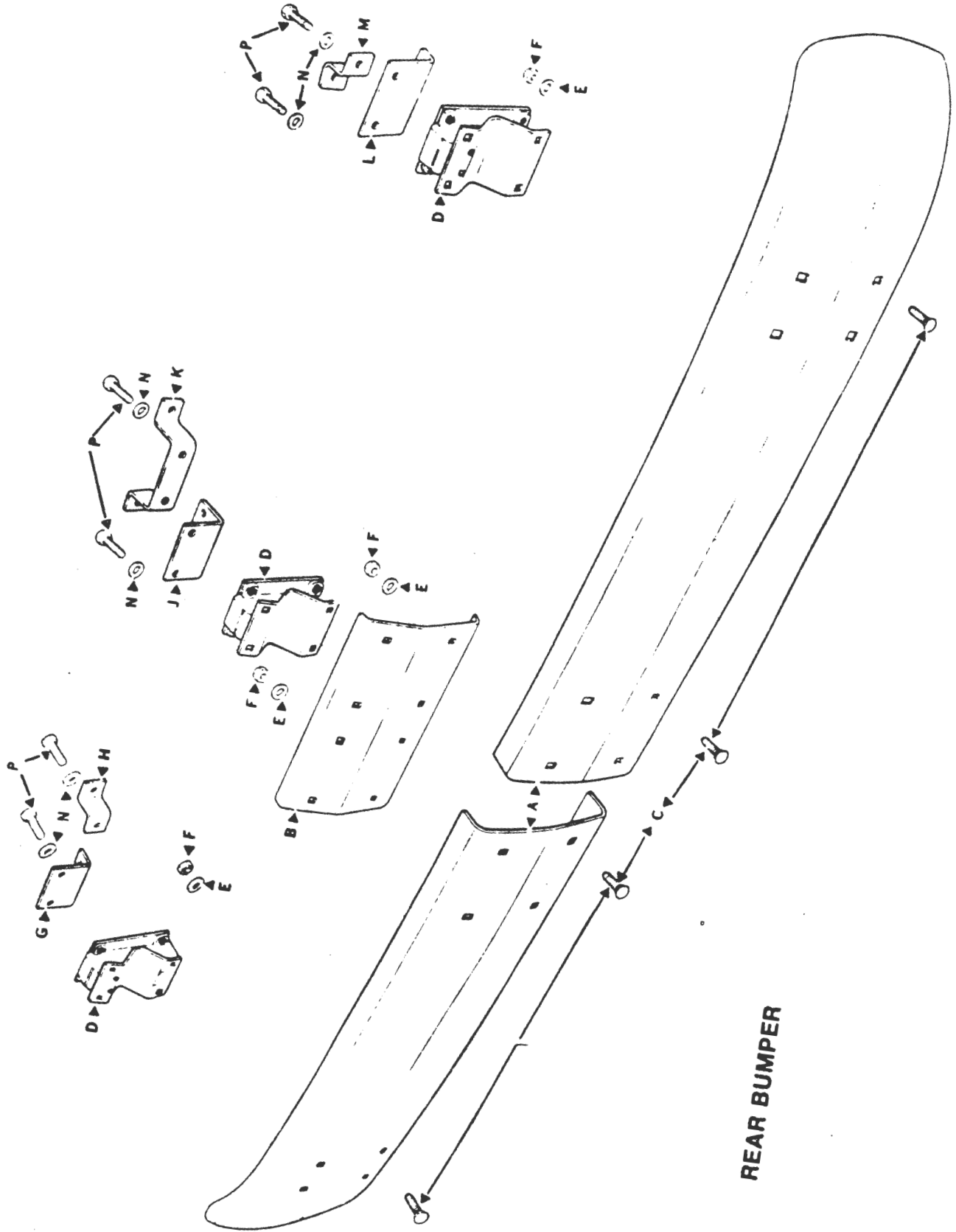
N — NEW R — REMANUFACTURED AR — AS REQUIRED



FRONT BUMPER

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	662778	BAR-impact	11-06	R
B	2384613	REINFORCEMENT	11-06	AR
C	2384612	PLATE-clamp	11-06	AR
D	664420	BOLT	11-06	AR
E	3751718	BOLT	11-06	N
F	9419101	BOLT	20.0050	N
G	9418838	BOLT	20.0050	N
H	2453736	BRACKET	11-06	AR
J	2453738	SPACER	11-06	AR
K	2448403	SPACER	11-06	AR
I	2387353	BRACKET-tow-eye	11-06	AR
M	2436165	WASHER	11-06	N
N	9422281	NUT	-	AR
P	2384607	BAR-back (102)	11-06	AR

N - NEW R - REMANUFACTURED AR - AS REQUIRED



REAR BUMPER

REAR BUMPER

KEY	PART NO.	DESCRIPTION	GROUP	PART DESIGNATION
A	657742	BAR-impact	11-08	R
B	643795	PLATE	11-08	AR
C	3751718	BOLT	11-08	N
D	2460697	CUSHION ASSY.	11-08	AR
E	131101	WASHER	20.0820	N
F	9418828	NUT	-	N
G	643790	BRACKET-LH upper outer	11-08	AR
H	643792	BRACKET-LH lower inner	11-08	AR
J	643788	BRACKET-upper center	11-08	AR
K	612477	BRACKET-lower center	11-08	AR
L	643789	BRACKET-RH upper outer	11-08	AR
M	643791	BRACKET-RH lower inner	11-08	AR
N	2436165	WASHER	11-08	N
P	9419099	BOLT	20.0050	N

N — NEW R — REMANUFACTURED AR — AS REQUIRED