

INTRODUCTION	XVIII
STUDY OBJECTIVES	XVIII
SCOPE AND FORMAT	XVIII
METHODOLOGY	XIX
CONTRIBUTION OF THE STUDY	XIX
ANALYSTS CREDENTIALS	XX
RELATED PUBLICATIONS	XX
BCC ONLINE SERVICES	XX
DISCLAIMER	XXI
SUMMARY	XXII
<i>SUMMARY TABLE U.S. DEMAND FOR EMI/RFI SHIELDING OPTIONS BY TYPE,</i> <i>THROUGH 2008 (MILLIONS)</i>	<i>XXII</i>
<i>SUMMARY FIGURE U.S. DEMAND FOR EMI/RFI SHIELDING OPTIONS BY TYPE,</i> <i>2002, 2003, AND 2008 (\$ MILLIONS)</i>	<i>XXIII</i>
PRINCIPLES OF ELECTROMAGNETISM	1
SYMBOLS AND TERMINOLOGY	1
<i>TABLE 1 SI UNITS AND THEIR SYMBOLS</i>	<i>1</i>
<i>TABLE 2 SI PREFIXES AND THEIR SYMBOLS</i>	<i>2</i>
ELECTROMAGNETIC ENERGY	2
RADIATION	3
CONDUCTION	3
IMPEDANCE	3
ELECTROSTATIC DISCHARGE	4
ELECTROMAGNETIC FIELDS	5
<i>TABLE 3 FREQUENCY LEVELS AND BAND NAMES</i>	<i>5</i>
ELECTROMAGNETIC INTERFERENCE AND RADIO FREQUENCY INTERFERENCE	5
<i>TABLE 4 EMI TRANSMITTERS AND RECEIVERS</i>	<i>6</i>
SOME DEFINITIONS	6
MECHANISMS OF SHIELDING	7
BACKGROUND	7
OVERVIEW OF EMI SHIELDING	7
SHIELDING EFFECTIVENESS	7
<i>TABLE 5 GENERAL RATINGS OF SHIELDING EFFECTIVENESS</i>	<i>8</i>
ATTENUATION	8
ELECTROMAGNETIC COMPATIBILITY	8
EMC CONTROL	9
SHIELDING PERFORMANCE	10
OVERVIEW	10
ABSORPTION	10
REFLECTANCE	11
PERMEABILITY	11
<i>TABLE 6 TYPICAL MATERIALS FOR LOW FREQUENCY MAGNETIC SHIELDING</i>	<i>12</i>

GALVANIC CORROSION AND METALS COMPATIBILITY	12
TABLE 7 ANODIC INDICES FOR METALS.....	13
RELATIONSHIP BETWEEN CONDUCTIVITY AND RESISTIVITY	14
EFFECTS OF EMI, RFI AND STATIC ELECTRICITY	14
BACKGROUND	14
THE IMPORTANCE OF SHIELDING	15
CONTROLLING EMI/RFI.....	15
Background.....	15
Technical Overview	16
Use of Thermoplastics	17
EMI Shielding Compounds Versus Coatings	18
TABLE 8 COMPARISON BETWEEN EMI SHIELDING COMPOUNDS AND CONDUCTIVE COATINGS.....	18
SHIELDING TECHNOLOGIES AND MATERIALS.....	19
COST AND PERFORMANCE CHARACTERISTICS OF THE SHIELDING OPTIONS.....	19
COST COMPARISONS.....	19
TABLE 9 TOTAL RAW MATERIAL AND LABOR COSTS ASSOCIATED WITH THE MAJOR SHIELDING OPTIONS (\$/SQ. FT.).....	20
PERFORMANCE COMPARISONS	20
TABLE 10 SUMMARY OF STRENGTHS AND WEAKNESSES OF EMI SHIELDING OPTIONS.....	21
TABLE 11 QUALITATIVE RATINGS OF THE MAJOR SHIELDING OPTIONS	22
CONDUCTIVE PLASTICS.....	22
BACKGROUND	22
FUNCTIONS	23
RECENT DEVELOPMENTS	23
CONDUCTIVE ADDITIVE SELECTION.....	23
TABLE 12 SURFACE RESISTIVITY FOR ELECTRONIC DEVICE SUBSTRATES (OHMS/SQ.).....	24
CONDUCTIVITY TESTS.....	24
ADVANTAGES AND DISADVANTAGES	25
COMPOUNDING CONDUCTIVE PLASTICS	26
INHERENTLY CONDUCTIVE POLYMERS	26
Inherently Conductive Polymers (Continued).....	27
INHERENTLY DISSIPATIVE POLYMERS	28
COMMERCIAL PRODUCTS EMPLOYING ICPs AND IDPs.....	28
RTP Co./Panipol.....	28
Noveon.....	29
LNP Engineering Plastics, Inc.....	29
Others.....	29
CONDUCTIVE FILMS	29
CARBON FIBERS AND POWDERS	30
OVERVIEW	30
CARBON NANOTUBES—A RECENT DEVELOPMENT.....	30

COMPUTER APPLICATIONS	31
POTENTIAL AUTOMOTIVE APPLICATIONS	32
SUPPLIERS	32
OTHER NEW PRODUCTS	32
RTP Co.	32
LNP Plastics Engineering, Inc.	33
Ticona	33
Conoco Cevolution	33
Cabot Corp.	33
Bayer AG.....	34
GE Plastics.....	34
METAL FIBERS	34
OVERVIEW	34
ADVANTAGES.....	34
METAL FIBER CONDUCTIVITY	35
METALLIZED GLASS FIBERS	35
NICKEL-COATED GRAPHITE FIBERS.....	36
Background	36
Advantages	36
STAINLESS STEEL FIBERS.....	37
Overview	37
Technology	37
Effect on Processing.....	38
Fiber Forms.....	38
Advantages and Disadvantages.....	39
TABLE 13 ADVANTAGES AND DISADVANTAGES OF STAINLESS STEEL FIBERS	39
LNP New Products	40
COPPER FIBERS.....	40
METALLIZED FOIL LAMINATES AND TAPES.....	40
OVERVIEW	40
FLEXIBLE FOIL LAMINATES	41
ADHESIVE METAL TAPES	41
FABRIC TAPES	42
CONDUCTIVE ELASTOMERS	43
TABLE 14 SHIELDING EFFECTIVENESS OF CONDUCTIVE ELASTOMERS (SHIELDING EFFECTIVENESS, IN DB).....	44
TABLE 15 COMPARATIVE TESTING OF CONDUCTIVE ELASTOMERS FOR GALVANIC CORROSION	44
CONDUCTIVE COATINGS	45
BACKGROUND	45
OVERVIEW	45
PERFORMANCE OF ALTERNATE CONDUCTIVE COATINGS	46
ADVANTAGES AND DISADVANTAGES	46
TABLE 16 ADVANTAGES AND DISADVANTAGES OF CONDUCTIVE COATINGS FOR EMI SHIELDING	46
COATING BINDERS	47

SOLVENT-BASED VERSUS WATERBORNE CONDUCTIVE COATINGS.....	47
COPPER AND NICKEL	48
Advantages of Copper vs. Nickel	48
Advantages of Nickel vs. Copper	48
Silver	49
ELECTROLESS PLATING	49
Overview	49
Advantages and Disadvantages.....	50
<i>TABLE 17 ADVANTAGES AND DISADVANTAGES OF ELECTROLESS PLATING FOR EMI SHIELDING</i>	<i>50</i>
Applications	50
<i>TABLE 18 SELECTED APPLICATIONS USING ELECTROLESS PLATING FOR EMI SHIELDING.....</i>	<i>51</i>
Multilayers.....	51
<i>TABLE 19 SEQUENCE OF STEPS FOR ELECTROLESS PLATING OF PLASTICS</i>	<i>51</i>
<i>TABLE 19 (CONTINUED)</i>	<i>52</i>
Measuring Shielding Effectiveness.....	52
<i>TABLE 20 RELATIVE CONDUCTIVITY OF SHIELDING METALS</i>	<i>53</i>
Direct Plate	54
VACUUM METALLIZATION	54
Background	54
Technology	55
Advantages and Disadvantages.....	55
<i>TABLE 21 ADVANTAGES AND DISADVANTAGES OF VACUUM METALLIZATION FOR EMI SHIELDING</i>	<i>56</i>
Vacuum Metallization Processes	56
Direct Thermal Evaporation	56
Electron Beam Coatings	57
Cathode Sputtering.....	57
CONDUCTIVE PAINTS	57
Overview	57
Conductive Paint Cost Comparisons	58
Recent Developments Related to Conductive Coatings	59
THERMAL (ARC) SPRAY	60
OVERVIEW	60
ADVANTAGES AND DISADVANTAGES	60
<i>TABLE 22 ADVANTAGES AND DISADVANTAGES OF ZINC ARC SPRAY FOR EMI SHIELDING.....</i>	<i>61</i>
IMPROVEMENTS IN TECHNOLOGY	61
SOFT FERRITES.....	62
BACKGROUND	62
PROPERTIES.....	63
CHOOSING FERRITES FOR EMI SUPPRESSION.....	63
<i>TABLE 23 PARAMETERS FOR FERRITE SELECTION.....</i>	<i>64</i>
TYPES OF FERRITE SHAPES AND APPLICATIONS	64
<i>TABLE 24 SHAPE OF FERRITE APPLICATIONS.....</i>	<i>65</i>

SHIELDING COMPONENTS.....	66
GASKETS.....	66
BACKGROUND	66
PROPERTIES.....	66
SELECTING GASKET TYPES	67
GASKET TYPES BY MATERIAL	67
Background	67
Fabric-Clad Foam Gaskets.....	67
Stamped and Formed Metal Gaskets	68
Wire Mesh Gaskets.....	68
Some Technical and Commercial Considerations	69
INSTALLATION COST	69
SHIELDING GASKETS FOR HIGHER FREQUENCIES	69
NEW PRODUCTS	70
Leader-Tech Offers New EMI Shielding Gaskets	70
New Chomerics Gaskets.....	70
Vanguard Products.....	70
TESTING.....	71
FILTERS	71
OVERVIEW	71
Low-pass Filter Networks	72
NEW PRODUCTS	72
CONNECTORS AND CABLES.....	73
WINDOWS	73
BACKGROUND	73
SHIELDING PERFORMANCE.....	74
MATERIAL ADVANTAGES AND DISADVANTAGES	74
<i>TABLE 25 COMPARISON OF WINDOW SHIELDING MATERIALS.....</i>	<i>74</i>
MAINTENANCE AND PERFORMANCE ISSUES.....	74
ENCLOSURES.....	75
BACKGROUND	75
AESTHETICS.....	76
EMI LEAKAGE	77
COST CONSIDERATIONS	78
Raw Materials.....	78
Shielding	78
<i>TABLE 26 RELATIVE COST STRUCTURE OF VARIOUS SHIELDING OPTIONS.....</i>	<i>79</i>
METAL CABINETS.....	79
BACKGROUND	79
ADVANTAGES AND DISADVANTAGES	80
<i>TABLE 27 ADVANTAGES AND DISADVANTAGES OF METAL CABINETS FOR EMI</i>	
<i>SHIELDING.....</i>	<i>81</i>
CABINET DESIGN	81
SHIELDING OF APERTURES	82
ARCHITECTURAL SHIELDING	82

BACKGROUND	82
Background (Continued)	83
MAGNETIC SHIELDING VERSUS EMI/RFI SHIELDING	84
SHIELDED ROOM CONSTRUCTION TYPES	84
COMPONENTS	85
OTHER SHIELDING COMPONENTS	86
BRAIDS	86
ADHESIVES	86
ELECTROSTATIC DISSIPATION	87
INTRODUCTION	87
STATIC ELECTRICITY CREATES CHARGE	87
TECHNOLOGY ASPECTS	87
<i>TABLE 28 TRIBOELECTRIC SERIES FOR SELECTED MATERIALS</i>	88
DEVICE FAILURES DUE TO ESD DAMAGE	88
HOW MUCH STATIC PROTECTION IS NEEDED?	89
SUMMING UP THE ESD SCENARIO	89
ESD CONTROLS	89
BACKGROUND	89
CONDUCTIVE MATERIALS FOR ESD CONTROL	90
Background	90
Chemical Additives	90
Technology	91
Conductive Fillers	91
Coated Sheets	92
Inherently Conductive Polymers	92
Inherently Dissipative Polymers	93
IDP Alloys	93
NEW DEVELOPMENTS	93
Permanent Antistats	93
Carbon Nanotubes for Static Dissipation	94
More Automotive Products for ESD Protection	94
DuPont	94
GE Plastics	94
Nova Chemicals	94
RTP Co.	95
Ticona	95
EMI SHIELDING MARKETS	96
BACKGROUND	96
SHIELDING TYPE OVERVIEW	96
REDESIGNING CIRCUITRY	97
EMI SHIELDING TECHNOLOGY MARKET OVERVIEW	98
QUANTITATIVE EMI MARKET ASPECTS	99

TABLE 29 U.S. VALUE OF EMI/RFI SHIELDING MARKET, BY METHOD, THROUGH 2008 (\$ MILLIONS).....	100
TABLE 30 U.S. VALUE OF CONDUCTIVE COATING EMI/RFI SHIELDING MARKET, THROUGH 2008 (\$ MILLIONS).....	101
FIGURE 1 U.S. VALUE OF CONDUCTIVE COATING EMI/RFI SHIELDING MARKET, 2002, 2003, AND 2008 (\$ MILLIONS).....	101
TABLE 31 MARKET SHARES OF SHIELDING OPTIONS BASED ON VALUE, 2002, 2003 AND 2008 (%).....	102
TABLE 32 MARKET SHARES OF CONDUCTIVE COATING SHIELDING OPTIONS BASED ON VALUE, 2002, 2003 AND 2008 (%).....	102
TABLE 33 VOLUME OF THE EMI/RFI SHIELDING MARKET, BY METHOD, THROUGH 2008 (MILLION SQUARE FEET).....	103
TABLE 34 VOLUME OF THE CONDUCTIVE COATING EMI/RFI SHIELDING MARKET, THROUGH 2008 (MILLION SQUARE FEET).....	103
TABLE 35 SHARES OF SHIELDING OPTIONS BASED ON VOLUME, 2002, 2003 AND 2008 (%).....	104
TABLE 36 SHARES OF CONDUCTIVE COATING SHIELDING OPTIONS BASED ON VOLUME, 2002, 2003 AND 2008 (%).....	104
METAL CABINETS.....	104
TABLE 37 U.S. DEMAND FOR METAL CABINETS IN EMI/RFI SHIELDING, THROUGH 2008 (MILLIONS).....	105
FIGURE 2 U.S. DEMAND FOR METAL CABINETS IN EMI/RFI SHIELDING, 2002, 2003, AND 2008 (\$ MILLIONS).....	106
CONDUCTIVE COATINGS.....	106
TABLE 38 U.S. DEMAND FOR CONDUCTIVE COATINGS IN EMI SHIELDING, THROUGH 2008 (MILLIONS).....	107
ELECTROLESS PLATING.....	108
TABLE 39 U.S. DEMAND FOR ELECTROLESS PLATING IN EMI SHIELDING, THROUGH 2008 (MILLIONS).....	108
VACUUM METALLIZATION.....	108
TABLE 40 U.S. DEMAND FOR VACUUM METALLIZATION IN EMI SHIELDING, THROUGH 2008 (MILLIONS).....	109
FIGURE 3 U.S. DEMAND FOR VACUUM METALLIZATION IN EMI SHIELDING, 2002, 2003, AND 2008 (\$ MILLIONS).....	110
CONDUCTIVE PAINTS.....	110
TABLE 41 U.S. DEMAND FOR CONDUCTIVE PAINTS IN EMI SHIELDING, THROUGH 2008 (MILLIONS).....	110
FIGURE 4 U.S. DEMAND FOR CONDUCTIVE PAINTS IN EMI SHIELDING, 2002, 2003, AND 2008 (\$ MILLIONS).....	111
LAMINATES AND TAPES.....	111
TABLE 42 U.S. DEMAND FOR LAMINATES AND TAPES IN EMI SHIELDING, THROUGH 2008 (MILLIONS).....	112
FIGURE 5 U.S. DEMAND FOR LAMINATES AND TAPES IN EMI SHIELDING, 2002, 2003, AND 2008 (\$ MILLIONS).....	112
CONDUCTIVE PLASTICS AND ELASTOMERS.....	113
TABLE 43 U.S. DEMAND FOR CONDUCTIVE PLASTICS AND ELASTOMERS IN EMI/RFI SHIELDING, THROUGH 2008 (MILLIONS).....	114
FIGURE 6 U.S. DEMAND FOR CONDUCTIVE PLASTICS AND ELASTOMERS IN EMI/RFI SHIELDING, 2002, 2003, AND 2008 (\$ MILLIONS).....	114
ARC SPRAY.....	114
MISCELLANEOUS SHIELDING.....	115

TABLE 44 U.S. DEMAND FOR MISCELLANEOUS EMI/RFI SHIELDING, THROUGH 2008 (MILLIONS).....	116
FIGURE 7 U.S. DEMAND FOR MISCELLANEOUS EMI/RFI SHIELDING, 2002, 2003, AND 2008 (\$ MILLIONS)	116
INDUSTRY/EMI SHIELDING INTERFACE	117
ELECTRONICS INDUSTRY.....	117
OVERVIEW	117
TABLE 45 TYPICAL FIELD LEVELS AND FREQUENCIES.....	117
TABLE 46 SOURCES OF EMI.....	118
TABLE 47 EXAMPLES OF COMPONENTS WITH EMI/RFI AND ESD PROBLEMS AND INDUSTRIES INVOLVED.....	118
GENERAL ELECTRONICS INDUSTRY GROWTH	119
Trends	119
Components	120
Computers and EMI	120
Cellular Phones	121
Pagers.....	121
TV Receivers	121
Cable TV.....	122
VCRs.....	123
Stereo Components.....	123
New Developments	123
Owens Corning's New Shielding System	123
New RTP Product	124
Cabot Develops Conductive Tapes	124
Recent ESD Activities in the Electronics Industry.....	124
Background	124
Protecting PCBs from ESD.....	125
TRANSPORTATION INDUSTRY.....	125
OVERVIEW	125
AUTOS.....	125
Background.....	125
Future Possibilities.....	126
AIRCRAFT.....	127
HEALTHCARE INDUSTRY	128
OVERVIEW	128
WIRELESS ELECTRONIC EQUIPMENT EFFECTS IN HOSPITALS.....	129
Background.....	129
Wireless Phones and Hearing Aids.....	129
Wireless Phones and Cardiac Pacemakers.....	129
Wireless Phones and ICDs	130
MANAGING HOSPITAL EMC.....	130
NEW EMC STANDARDS FOR MEDICAL DEVICES.....	131
USE OF CONDUCTIVE POLYMERS IN HEALTHCARE.....	131

Conductive Plastics	131
Conductive Films.....	132
USE OF CONDUCTIVE POLYURETHANES IN MEDICAL APPLICATIONS—A RECENT DEVELOPMENT	132
OTHER TECHNOLOGIES IMPACTING EMI/RFI MARKETS	133
FIBER OPTICS.....	133
OVERVIEW	133
TECHNOLOGY	133
PERFORMANCE	134
<i>TABLE 48 COMPARATIVE CHARACTERISTICS OF LAN MEDIA</i>	135
MARKETS	136
Overview	136
Telephone-Based.....	136
Cable TV.....	136
Internet	136
Lighting.....	136
Automotive.....	136
Aircraft.....	137
MARKET SIZE.....	137
BLUETOOTH TECHNOLOGY	137
OVERVIEW	137
MEDICAL APPLICATIONS.....	138
ABSORPTIVE EMI TECHNOLOGIES	138
OVERVIEW	138
MARKETS	139
Markets (Continued)	140
RECENT PATENTS	141
PATENT SEARCH RESULTS	141
EMI SHIELDING—MATERIALS, FIBERS & METHOD OF PREPARATION	141
EMI SHIELDING AND ESD DEGRADABLE POLYMERS.....	141
CORROSION-RESISTANT EMI SHIELDING	142
FABRICATION OF CONDUCTIVE ELASTOMERS.....	142
EMI SHIELDING STRUCTURE FOR NOTEBOOK COMPUTERS	142
EMI SHIELDING FABRICS	142
EMI SHIELDING.....	142
SUPERPLASTIC ALLOY-CONTAINING CONDUCTIVE PLASTIC PART FOR EMI SHIELDING.....	143
GEL STRUCTURE FOR COMBINED EMI SHIELDING	143
PROCESS AND APPARATUS FOR MAKING ALUMINUM FOIL-FILLED PLASTIC PELLETS FOR EMI SHIELDING.....	143

MANUFACTURE OF FLAME-RETARDANT EMI SHIELDING	
MATERIALS	143
MULTI-WALLED ELECTROMAGNETIC INTERFERENCE	
SHIELD	144
EMI/RFI PROTECTION OF AIRBORNE MISSILE	
ELECTRONICS USING CONDUCTIVE PLASTICS	144
EMI GASKET	144
PTFE SEAL WITH EMI SHIELDING	144
FLAME RETARDANT EMI SHIELDING GASKET	145
INTUMESCENT, FLAME RETARDANT PRESSURE	
SENSITIVE COMPOSITION FOR EMI SHIELDING	
APPLICATIONS	145
ELECTROMAGNETIC COMPLIANCE (EMC) STANDARDS	146
BACKGROUND	146
SOME BASIC CONCEPTS.....	146
UNITED STATES REQUIREMENTS	146
OVERVIEW	146
FCC PART 15 UPDATES	147
SUBASSEMBLIES.....	148
WHAT MAY BE UPCOMING	148
FOOD AND DRUG ADMINISTRATION.....	148
<i>TABLE 49 ELECTRONIC PRODUCTS SUBJECT TO THE RADIATION CONTROL</i>	
<i>FOR HEALTH AND SAFETY ACT OF 1968</i>	149
AMERICAN NATIONAL STANDARDS INSTITUTE	150
MILITARY SPECIFICATIONS	150
INTERNATIONAL REGULATIONS	151
OVERVIEW	151
EU REQUIREMENTS	152
Overview	152
Details on EEC Directive	152
COMPARISON BETWEEN U.S. AND EU EMC	
REGULATIONS.....	152
<i>TABLE 50 COMPARISON OF FCC AND EU EMC REGULATIONS</i>	153
THE CONCEPT OF EMC STANDARDS	153
<i>TABLE 51 ELECTROMAGNETIC CONTROLS IN SELECTED ENVIRONMENTAL</i>	
<i>AREAS</i>	154
LEGAL AND REGULATORY SITES	154
MEDICAL EMC: A SPECIAL CASE	155
COMPANY PROFILES	156
COMPANIES INVOLVED IN EMI SHIELDING	156
<i>TABLE 52 SELECTED MAJOR COMPANIES INVOLVED IN EMI/RFI SHIELDING</i>	156
<i>TABLE 52 (CONTINUED)</i>	157
<i>TABLE 52 (CONTINUED)</i>	158
A.K. STAMPING COMPANY	158

ALCO TECHNOLOGIES	158
AMPHENOL CANADA.....	159
ADVANCED PERFORMANCE MATERIALS.....	159
AVX CORPORATION	159
BMI, INC.	160
CHOMERICS (DIVISION OF PARKER HANNIFIN CORPORATION)	160
COILCRAFT, INC.	161
COMPOSITE MATERIALS LLC.....	161
CYBERSHIELD, INC.	161
DEXTER CORPORATION	162
ENTHONE-OMI, INC.....	162
ETS-LINDGREN	162
FERRISHIELD, INC.....	162
FERRONICS, INC.....	163
FUJIPOLY AMERICA CORPORATION	163
GREENE RUBBER COMPANY.....	163
LAIRD TECHNOLOGIES	164
MAGNETIC SHIELD CORPORATION.....	164
THE MuSHIELD COMPANY.....	165
NEXTECH, INTERNATIONAL	165
OMEGA SHIELDING PRODUCTS, INC.	165
ORION INDUSTRIES, INC.....	165
PANASHIELD, INC.....	166
PRESSCUT INDUSTRIES	166
RTP, INC.	167
SCHAFFNER EMC, INC.....	167
SCHLEGEL CORPORATION	167
SILVER CLOUD MANUFACTURING COMPANY.....	168
SPECTRUM CONTROL	168
STEWART, INC.	168
STOCKWELL RUBBER COMPANY, INC.	169
TDK CORPORATION OF AMERICA	169
TECH-ETCH, INC.....	170
TECKNIT, INC.....	170
3M ELECTRICAL SPECIALTIES DIVISION.....	171
TUSONIX, INC.....	172
VANGUARD PRODUCTS CORPORATION.....	172
VTI VACUUM TECHNOLOGIES	172
ZIPPERTUBING COMPANY, INC.	173
APPENDIX	174
MAJOR PROFESSIONAL SOCIETIES	174
IEEE EMC SOCIETY	174
SOCIETY OF AUTOMOTIVE ENGINEERS.....	175

GLOSSARY OF TERMS.....	175
GLOSSARY OF TERMS (CONTINUED).....	176
GLOSSARY OF TERMS (CONTINUED).....	177
GLOSSARY OF TERMS (CONTINUED).....	178
GLOSSARY OF TERMS (CONTINUED).....	179
GLOSSARY OF TERMS (CONTINUED).....	180