

ISO 10303-214:2003-12 (E)

Industrial automation systems and integration - Product data representation and exchange - Part 214: Application protocol: Core data for automotive mechanical design processes

Contents		Page
1	Scope	1
2	Normative references	3
3	Terms, definitions, abbreviations, and symbols	7
3.10	Terms defined in ISO 13584-42	11
3.11	Other terms and definitions	12
3.12	Symbols and abbreviations	12
4	Information requirements	15
4.1	Units of functionality	15
4.1.1	surface_condition (C1)	17
4.1.2	explicit_draughting (D1)	18
4.1.3	associative_annotation (D2)	19
4.1.4	external_reference_mechanism (E1)	19
4.1.5	user_defined_feature (FF1)	22
4.1.6	included_feature (FF2)	22
4.1.7	generative_featured_shape (FF3)	29
4.1.8	wireframe_model_2d (G1)	30
4.1.9	wireframe_model_3d (G2)	31
4.1.10	connected_surface_model (G3)	32
4.1.11	faceted_b_rep_model (G4)	34
4.1.12	b_rep_model (G5)	35
4.1.13	compound_model (G6)	37
4.1.14	csg_model (G7)	39
4.1.15	geometrically_bounded_surface_model (G8)	41
4.1.16	kinematics (K1)	43
4.1.17	measured_data (MD1)	45
4.1.18	item_property (PR1)	45
4.1.19	geometric_presentation (P1)	47
4.1.20	annotated_presentation (P2)	48
4.1.21	shaded_presentation (P3)	49
4.1.22	product_management_data (S1)	50
4.1.23	element_structure (S2)	52
4.1.24	item_definition_structure (S3)	54
4.1.25	effectivity (S4)	55
4.1.26	work_management (S5)	56
4.1.27	classification (S6)	57
4.1.28	specification_control (S7)	58
4.1.29	process_plan (S8)	61
4.1.30	dimension_tolerance (T1)	62
4.1.31	geometric_tolerance (T2)	64
4.2	Application objects	65
4.3	Application assertions	515
5	Application interpreted model	815
5.1	Mapping table	815
5.2	AIM EXPRESS short listing	1966
5.2.1	Fundamental concepts and assumptions	1983

5.2.2	automotive_design types	2013
5.2.3	automotive_design entities	2036
5.2.4	automotive_design rule definitions	2272
5.2.5	automotive_design function definitions	2525
6	Conformance requirements	2543
6.1	Conformance Class for component design with 3D shape representation (CC1)	2544
6.2	Conformance Class for assembly design with 3D shape representation (CC2)	2544
6.3	Conformance Class for component drawings with wireframe or surface shape representation (CC3)	2546
6.4	Conformance Class for assembly drawings with wireframe, surface or solid shape representation (CC4)	2546
6.5	Conformance Class for styling data (CC5)	2547
6.6	Conformance Class for product data management without shape representation (CC6)	2548
6.7	Conformance Class for product data management with 3D shape representation (CC7)	2548
6.8	Conformance Class for configuration controlled design without shape representation (CC8)	2549
6.9	Conformance Class for configuration controlled design with 3D shape representation (CC9)	2549
6.10	Conformance Class for configuration controlled design with shape representation and draughting data (CC10)	2550
6.11	Conformance Class for process planning of components (CC11)	2551
6.12	Conformance Class for process planning of components with form feature and tolerance data (CC12)	2551
6.13	Conformance Class for effectivity controlled process planning of assemblies (CC13)	2552
6.14	Conformance Class for feature based design (CC14)	2553
6.15	Conformance Class for feature based design with flexible feature placement (CC15)	2554
6.16	Conformance Class for kinematic simulations for components and assemblies with 3D shape representation (CC16)	2554
6.17	Conformance Class for measured data (CC17)	2555
6.18	Conformance Class for configuration controlled process planning of components and assemblies with 3D shape representation and kinematic data (CC18)	2556
6.19	Conformance Class for configuration controlled process planning of components and assemblies with 3D shape representation including form features and kinematic data (CC19)	2556
6.20	Conformance Class for data storage and retrieval systems (CC20)	2557
	Annex A (normative) AIM EXPRESS expanded listing	2588
	Annex B (normative) AIM short names	3041
	Annex C (normative) Implementation method-specific requirements	3076
	Annex D (normative) Protocol Implementation Conformance Statement (PICS) proforma 3078 D.1	
	General conformance statements	3079
D.1.1	Protocol implementation identification	3079
D.1.2	Implementation method	3079
D.1.3	Implemented conformance classes	3079
D.2	Conformance statements for UoF C1	3080
D.3	Conformance statements for UoF D1	3080
D.4	Conformance statements for UoF D2	3080
D.5	Conformance statements for UoF E1	3080
D.6	Conformance statements for UoF FF1	3081
D.7	Conformance statements for UoF FF2	3081
D.8	Conformance statements for UoF G1	3082
D.9	Conformance statements for UoF G2	3082
D.10	Conformance statements for UoF G3	3082
D.11	Conformance statements for UoF G4	3082
D.12	Conformance statements for UoF G5	3083
D.13	Conformance statements for UoF G6	3083

D.14	Conformance statements for UoF G7	3083
D.15	Conformance statements for UoF G8	3084
D.16	Conformance statements for UoF K1	3084
D.17	Conformance statements for UoF MD1	3084
D.18	Conformance statements for UoF PR1	3085
D.19	Conformance statements for UoF P1	3085
D.20	Conformance statements for UoF P2	3085
D.21	Conformance statements for UoF P3	3085
D.22	Conformance statements for UoF S1	3086
D.23	Conformance statements for UoF S2	3086
D.24	Conformance statements for UoF S4	3087
D.25	Conformance statements for UoF S5	3087
D.26	Conformance statements for UoF S6	3087
D.27	Conformance statements for UoF S7	3088
D.28	Conformance statements for UoF S8	3088
D.29	Conformance statements for UoF T1	3088
D.30	Conformance statements for UoF T2	3089
 Annex E (normative) Information object registration		3090
E.1	Document identification	3090
E.2	Schema identification	3090
 Annex F (informative) Application activity model		3095
F.1	Application activity model definitions and abbreviations	3095
F.2	Application activity model diagrams	3101
 Annex G (informative) Application reference model		3112
 Annex H (informative) AIM EXPRESS-G		3202
 Annex J (informative) Computer interpretable listing		3340
 Annex K (informative) ARM EXPRESS listing		3342
 Bibliography		3343
 Index		3345
 Figures Figure 1 Automotive mechanical design processes		xxi
Figure 2 Data planning model		xxii
Figure 3 Features for solid-type parts		24
Figure 4 Features for sheet-type parts		25
Figure 5 Interdependencies among UoFs		53
Figure 6 UoF S7: ARM structure		59
Figure 7 Form features in panel defined by target boundaries and wall angles		81
Figure 8 Parameters defining an Angle_taper		81
Figure 9 Parameters defining an Angular_location_dimension		84
Figure 10 Angular_location_dimension versus Angular_size_dimension		85
Figure 11 Annotation_subfigure for a hole on a technical drawing		87

Figure 12 Parameters defining a Bead_feature	101
Figure 13 Parameters defining a Chamfer	109
Figure 14 Parameters defining a Circular_boss	112
Figure 15 Definition of a Circular_closed_profile	113
Figure 16 Parameters defining an offset in a circular pattern	114
Figure 17 Parameters defining an omission in a circular pattern	114
Figure 18 Circular_pattern with rotation of base feature	117
Figure 19 Definition of a Complete_circular_path	131
Figure 20 Usage of compound datums	136
Figure 21 Configuration inheritance scheme	144
Figure 22 Parameters defining an edge round with constant radius by offsets	147
Figure 23 Parameters defining a fillet with a constant radius by offsets	148
Figure 24 Pre-defined colours	154
Figure 25 Predefined curve fonts	154
Figure 26 Draughting callouts on a drawing	165
Figure 27 Datum targets on a drawing	166
Figure 28 Definition of a taper by two diameters	181
Figure 29 Components of a dimension in a drawing	184
Figure 30 Predefined dimension symbols	185
Figure 31 Edge transition	212
Figure 32 Fill area styles	232
Figure 33 Parameters defining a Flat_slot_end_type	235
Figure 34 Panel feature with the shape of a 'stairstep'	239
Figure 35 Boundary of a General_boss	241
Figure 36 Definition of a General_closed_profile	245
Figure 37 Definition of a General_open_profile	250
Figure 38 Definition of a General_path	252
Figure 39 Placement of additional instances in a General_pattern	253
Figure 40 Theoretical wheelbase of a truck	254
Figure 41 General_tolerances	258
Figure 42 Predefined geometrical tolerance symbols	268

Figure 43 Application of a Geometrical_relationship	269
Figure 44 Hardness	274
Figure 45 Cross sections of holes	277
Figure 46 Parameters defining a Joggle_feature	295
Figure 47 Placement relationships kinematic pair frames and mating links	303
Figure 48 Definition of a Linear_path	312
Figure 49 Parameters defining a Locator_feature	314
Figure 50 Definition of a Ngon_profile	331
Figure 51 Parameters defining a Panel_hole_with_barring	339
Figure 52 Definition of a Partial_circular_path	341
Figure 53 Definition of a Partial_circular_profile	342
Figure 54 Sweep path for pocket features	361
Figure 55 Predefined point markers	366
Figure 56 Position tolerancing with affected planes	369
Figure 57 Example structure of Product_class objects in a hierarchy	385
Figure 58 Shape of a slot with radiused end	411
Figure 59 Rectangular_closed_pocket in a part	412
Figure 60 Definition of a Rectangular_closed_profile	413
Figure 61 Parameters defining an offset in a rectangular pattern	415
Figure 62 Parameters defining a Rectangular_pattern	418
Figure 63 Parameters defining a Rib_feature	426
Figure 64 Right_angular_wedge and its attributes	427
Figure 65 Definition of a Rounded_u_profile	429
Figure 66 Same_time_machining_relationship	430
Figure 67 Shape_element on a shaft	438
Figure 68 various shapes of slots	443
Figure 69 Definition of a Square_u_profile	457
Figure 70 Pre-defined surface condition symbols	467
Figure 71 Definition of a Tee_profile	478
Figure 72 Predefined terminator symbols	480
Figure 73 Text appearance and rotation	481

Figure 74 Screw with thread	482
Figure 75 Tolerance_zone	487
Figure 76 Value terminated joggle feature	498
Figure 77 Definition of a Vee_profile	501
Figure 78 Parameters defining a Woodruff_slot_end_type	511
Figure 79 Example instantiation for specified_higher_usage_occurrence	1989
Figure 80 Example for usage of product_definition_occurrence_relationship	1991
Figure 81 Main concepts of specification control	2000
Figure 82 Example instantiation package_product_concept_feature	2002
Figure 83 Use of common_datum	2010
Figure 84 Use of viewing planes	2011
Figure 85 Use of multi_language_string	2012
Figure 86 Interdependencies among UoFs	2545
Figure F.1 AAM diagram of node A-0: Core data for automotive mechanical design processes ..	3103
Figure F.2 AAM diagram of node A0: Develop product and tool	3104
Figure F.3 AAM diagram of node A1: Develop product	3105
Figure F.4 AAM diagram of node A12: Style product	3106
Figure F.5 AAM diagram of node A13: Design product	3107
Figure F.6 AAM diagram of node A14: Evaluate product	3108
Figure F.7 AAM diagram of node A2: Develop Tool	3109
Figure F.8 AAM diagram of node A22: Design tool	3110
Figure F.9 AAM diagram of node A23: Manufacture production tools	3111
Figure G.1 ARM diagram in EXPRESS_G: 1 of 89	3113
Figure G.2 ARM diagram in EXPRESS_G: 2 of 89	3114
Figure G.3 ARM diagram in EXPRESS_G: 3 of 89	3115
Figure G.4 ARM diagram in EXPRESS_G: 4 of 89	3116
Figure G.5 ARM diagram in EXPRESS_G: 5 of 89	3117
Figure G.6 ARM diagram in EXPRESS_G: 6 of 89	3118
Figure G.7 ARM diagram in EXPRESS_G: 7 of 89	3119
Figure G.8 ARM diagram in EXPRESS_G: 8 of 89	3120
Figure G.9 ARM diagram in EXPRESS_G: 9 of 89	3121

Figure G.10 ARM diagram in EXPRESS_G: 10 of 89	3122
Figure G.11 ARM diagram in EXPRESS_G: 11 of 89	3123
Figure G.12 ARM diagram in EXPRESS_G: 12 of 89	3124
Figure G.13 ARM diagram in EXPRESS_G: 13 of 89	3125
Figure G.14 ARM diagram in EXPRESS_G: 14 of 89	3126
Figure G.15 ARM diagram in EXPRESS_G: 15 of 89	3127
Figure G.16 ARM diagram in EXPRESS_G: 16 of 89	3128
Figure G.17 ARM diagram in EXPRESS_G: 17 of 89	3129
Figure G.18 ARM diagram in EXPRESS_G: 18 of 89	3130
Figure G.19 ARM diagram in EXPRESS_G: 19 of 89	3131
Figure G.20 ARM diagram in EXPRESS_G: 20 of 89	3132
Figure G.21 ARM diagram in EXPRESS_G: 21 of 89	3133
Figure G.22 ARM diagram in EXPRESS_G: 22 of 89	3134
Figure G.23 ARM diagram in EXPRESS_G: 23 of 89	3135
Figure G.24 ARM diagram in EXPRESS_G: 24 of 89	3136
Figure G.25 ARM diagram in EXPRESS_G: 25 of 89	3137
Figure G.26 ARM diagram in EXPRESS_G: 26 of 89	3138
Figure G.27 ARM diagram in EXPRESS_G: 27 of 89	3139
Figure G.28 ARM diagram in EXPRESS_G: 28 of 89	3140
Figure G.29 ARM diagram in EXPRESS_G: 29 of 89	3141
Figure G.30 ARM diagram in EXPRESS_G: 30 of 89	3142
Figure G.31 ARM diagram in EXPRESS_G: 31 of 89	3143
Figure G.32 ARM diagram in EXPRESS_G: 32 of 89	3144
Figure G.33 ARM diagram in EXPRESS_G: 33 of 89	3145
Figure G.34 ARM diagram in EXPRESS_G: 34 of 89	3146
Figure G.35 ARM diagram in EXPRESS_G: 35 of 89	3147
Figure G.36 ARM diagram in EXPRESS_G: 36 of 89	3148
Figure G.37 ARM diagram in EXPRESS_G: 37 of 89	3149
Figure G.38 ARM diagram in EXPRESS_G: 38 of 89	3150
Figure G.39 ARM diagram in EXPRESS_G: 39 of 89	3151
Figure G.40 ARM diagram in EXPRESS_G: 40 of 89	3152

Figure G.41 ARM diagram in EXPRESS_G: 41 of 89	3153
Figure G.42 ARM diagram in EXPRESS_G: 42 of 89	3154
Figure G.43 ARM diagram in EXPRESS_G: 43 of 89	3155
Figure G.44 ARM diagram in EXPRESS_G: 44 of 89	3156
Figure G.45 ARM diagram in EXPRESS_G: 45 of 89	3157
Figure G.46 ARM diagram in EXPRESS_G: 46 of 89	3158
Figure G.47 ARM diagram in EXPRESS_G: 47 of 89	3159
Figure G.48 ARM diagram in EXPRESS_G: 48 of 89	3160
Figure G.49 ARM diagram in EXPRESS_G: 49 of 89	3161
Figure G.50 ARM diagram in EXPRESS_G: 50 of 89	3162
Figure G.51 ARM diagram in EXPRESS_G: 51 of 89	3163
Figure G.52 ARM diagram in EXPRESS_G: 52 of 89	3164
Figure G.53 ARM diagram in EXPRESS_G: 53 of 89	3165
Figure G.54 ARM diagram in EXPRESS_G: 54 of 89	3166
Figure G.55 ARM diagram in EXPRESS_G: 55 of 89	3167
Figure G.56 ARM diagram in EXPRESS_G: 56 of 89	3168
Figure G.57 ARM diagram in EXPRESS_G: 57 of 89	3169
Figure G.58 ARM diagram in EXPRESS_G: 58 of 89	3170
Figure G.59 ARM diagram in EXPRESS_G: 59 of 89	3171
Figure G.60 ARM diagram in EXPRESS_G: 60 of 89	3172
Figure G.61 ARM diagram in EXPRESS_G: 61 of 89	3173
Figure G.62 ARM diagram in EXPRESS_G: 62 of 89	3174
Figure G.63 ARM diagram in EXPRESS_G: 63 of 89	3175
Figure G.64 ARM diagram in EXPRESS_G: 64 of 89	3176
Figure G.65 ARM diagram in EXPRESS_G: 65 of 89	3177
Figure G.66 ARM diagram in EXPRESS_G: 66 of 89	3178
Figure G.67 ARM diagram in EXPRESS_G: 67 of 89	3179
Figure G.68 ARM diagram in EXPRESS_G: 68 of 89	3180
Figure G.69 ARM diagram in EXPRESS_G: 69 of 89	3181
Figure G.70 ARM diagram in EXPRESS_G: 70 of 89	3182
Figure G.71 ARM diagram in EXPRESS_G: 71 of 89	3183

Figure G.72 ARM diagram in EXPRESS_G: 72 of 89	3184
Figure G.73 ARM diagram in EXPRESS_G: 73 of 89	3185
Figure G.74 ARM diagram in EXPRESS_G: 74 of 89	3186
Figure G.75 ARM diagram in EXPRESS_G: 75 of 89	3187
Figure G.76 ARM diagram in EXPRESS_G: 76 of 89	3188
Figure G.77 ARM diagram in EXPRESS_G: 77 of 89	3189
Figure G.78 ARM diagram in EXPRESS_G: 78 of 89	3190
Figure G.79 ARM diagram in EXPRESS_G: 79 of 89	3191
Figure G.80 ARM diagram in EXPRESS_G: 80 of 89	3192
Figure G.81 ARM diagram in EXPRESS_G: 81 of 89	3193
Figure G.82 ARM diagram in EXPRESS_G: 82 of 89	3194
Figure G.83 ARM diagram in EXPRESS_G: 83 of 89	3195
Figure G.84 ARM diagram in EXPRESS_G: 84 of 89	3196
Figure G.85 ARM diagram in EXPRESS_G: 85 of 89	3197
Figure G.86 ARM diagram in EXPRESS_G: 86 of 89	3198
Figure G.87 ARM diagram in EXPRESS_G: 87 of 89	3199
Figure G.88 ARM diagram in EXPRESS_G: 88 of 89	3200
Figure G.89 ARM diagram in EXPRESS_G: 89 of 89	3201
Figure H.1 AIM diagram in EXPRESS_G: 1 of 137	3203
Figure H.2 AIM diagram in EXPRESS_G: 2 of 137	3204
Figure H.3 AIM diagram in EXPRESS_G: 3 of 137	3205
Figure H.4 AIM diagram in EXPRESS_G: 4 of 137	3206
Figure H.5 AIM diagram in EXPRESS_G: 5 of 137	3207
Figure H.6 AIM diagram in EXPRESS_G: 6 of 137	3208
Figure H.7 AIM diagram in EXPRESS_G: 7 of 137	3209
Figure H.8 AIM diagram in EXPRESS_G: 8 of 137	3210
Figure H.9 AIM diagram in EXPRESS_G: 9 of 137	3211
Figure H.10 AIM diagram in EXPRESS_G: 10 of 137	3212
Figure H.11 AIM diagram in EXPRESS_G: 11 of 137	3213
Figure H.12 AIM diagram in EXPRESS_G: 12 of 137	3214
Figure H.13 AIM diagram in EXPRESS_G: 13 of 137	3215

Figure H.14 AIM diagram in EXPRESS_G: 14 of 137	3216
Figure H.15 AIM diagram in EXPRESS_G: 15 of 137	3217
Figure H.16 AIM diagram in EXPRESS_G: 16 of 137	3218
Figure H.17 AIM diagram in EXPRESS_G: 17 of 137	3219
Figure H.18 AIM diagram in EXPRESS_G: 18 of 137	3220
Figure H.19 AIM diagram in EXPRESS_G: 19 of 137	3221
Figure H.20 AIM diagram in EXPRESS_G: 20 of 137	3222
Figure H.21 AIM diagram in EXPRESS_G: 21 of 137	3223
Figure H.22 AIM diagram in EXPRESS_G: 22 of 137	3224
Figure H.23 AIM diagram in EXPRESS_G: 23 of 137	3225
Figure H.24 AIM diagram in EXPRESS_G: 24 of 137	3226
Figure H.25 AIM diagram in EXPRESS_G: 25 of 137	3227
Figure H.26 AIM diagram in EXPRESS_G: 26 of 137	3228
Figure H.27 AIM diagram in EXPRESS_G: 27 of 137	3229
Figure H.28 AIM diagram in EXPRESS_G: 28 of 137	3230
Figure H.29 AIM diagram in EXPRESS_G: 29 of 137	3231
Figure H.30 AIM diagram in EXPRESS_G: 30 of 137	3232
Figure H.31 AIM diagram in EXPRESS_G: 31 of 137	3233
Figure H.32 AIM diagram in EXPRESS_G: 32 of 137	3234
Figure H.33 AIM diagram in EXPRESS_G: 33 of 137	3235
Figure H.34 AIM diagram in EXPRESS_G: 34 of 137	3236
Figure H.35 AIM diagram in EXPRESS_G: 35 of 137	3237
Figure H.36 AIM diagram in EXPRESS_G: 36 of 137	3238
Figure H.37 AIM diagram in EXPRESS_G: 37 of 137	3239
Figure H.38 AIM diagram in EXPRESS_G: 38 of 137	3240
Figure H.39 AIM diagram in EXPRESS_G: 39 of 137	3241
Figure H.40 AIM diagram in EXPRESS_G: 40 of 137	3242
Figure H.41 AIM diagram in EXPRESS_G: 41 of 137	3243
Figure H.42 AIM diagram in EXPRESS_G: 42 of 137	3244
Figure H.43 AIM diagram in EXPRESS_G: 43 of 137	3245
Figure H.44 AIM diagram in EXPRESS_G: 44 of 137	3246

Figure H.45 AIM diagram in EXPRESS_G: 45 of 137	3247
Figure H.46 AIM diagram in EXPRESS_G: 46 of 137	3248
Figure H.47 AIM diagram in EXPRESS_G: 47 of 137	3249
Figure H.48 AIM diagram in EXPRESS_G: 48 of 137	3250
Figure H.49 AIM diagram in EXPRESS_G: 49 of 137	3251
Figure H.50 AIM diagram in EXPRESS_G: 50 of 137	3252
Figure H.51 AIM diagram in EXPRESS_G: 51 of 137	3253
Figure H.52 AIM diagram in EXPRESS_G: 52 of 137	3254
Figure H.53 AIM diagram in EXPRESS_G: 53 of 137	3255
Figure H.54 AIM diagram in EXPRESS_G: 54 of 137	3256
Figure H.55 AIM diagram in EXPRESS_G: 55 of 137	3257
Figure H.56 AIM diagram in EXPRESS_G: 56 of 137	3258
Figure H.57 AIM diagram in EXPRESS_G: 57 of 137	3259
Figure H.58 AIM diagram in EXPRESS_G: 58 of 137	3260
Figure H.59 AIM diagram in EXPRESS_G: 59 of 137	3261
Figure H.60 AIM diagram in EXPRESS_G: 60 of 137	3262
Figure H.61 AIM diagram in EXPRESS_G: 61 of 137	3263
Figure H.62 AIM diagram in EXPRESS_G: 62 of 137	3264
Figure H.63 AIM diagram in EXPRESS_G: 63 of 137	3265
Figure H.64 AIM diagram in EXPRESS_G: 64 of 137	3266
Figure H.65 AIM diagram in EXPRESS_G: 65 of 137	3267
Figure H.66 AIM diagram in EXPRESS_G: 66 of 137	3268
Figure H.67 AIM diagram in EXPRESS_G: 67 of 137	3269
Figure H.68 AIM diagram in EXPRESS_G: 68 of 137	3270
Figure H.69 AIM diagram in EXPRESS_G: 69 of 137	3271
Figure H.70 AIM diagram in EXPRESS_G: 70 of 137	3272
Figure H.71 AIM diagram in EXPRESS_G: 71 of 137	3273
Figure H.72 AIM diagram in EXPRESS_G: 72 of 137	3274
Figure H.73 AIM diagram in EXPRESS_G: 73 of 137	3275
Figure H.74 AIM diagram in EXPRESS_G: 74 of 137	3276
Figure H.75 AIM diagram in EXPRESS_G: 75 of 137	3277

Figure H.76 AIM diagram in EXPRESS_G: 76 of 137	3278
Figure H.77 AIM diagram in EXPRESS_G: 77 of 137	3279
Figure H.78 AIM diagram in EXPRESS_G: 78 of 137	3280
Figure H.79 AIM diagram in EXPRESS_G: 79 of 137	3281
Figure H.80 AIM diagram in EXPRESS_G: 80 of 137	3282
Figure H.81 AIM diagram in EXPRESS_G: 81 of 137	3283
Figure H.82 AIM diagram in EXPRESS_G: 82 of 137	3284
Figure H.83 AIM diagram in EXPRESS_G: 83 of 137	3285
Figure H.84 AIM diagram in EXPRESS_G: 84 of 137	3286
Figure H.85 AIM diagram in EXPRESS_G: 85 of 137	3287
Figure H.86 AIM diagram in EXPRESS_G: 86 of 137	3288
Figure H.87 AIM diagram in EXPRESS_G: 87 of 137	3289
Figure H.88 AIM diagram in EXPRESS_G: 88 of 137	3290
Figure H.89 AIM diagram in EXPRESS_G: 89 of 137	3291
Figure H.90 AIM diagram in EXPRESS_G: 90 of 137	3292
Figure H.91 AIM diagram in EXPRESS_G: 91 of 137	3293
Figure H.92 AIM diagram in EXPRESS_G: 92 of 137	3294
Figure H.93 AIM diagram in EXPRESS_G: 93 of 137	3295
Figure H.94 AIM diagram in EXPRESS_G: 94 of 137	3296
Figure H.95 AIM diagram in EXPRESS_G: 95 of 137	3297
Figure H.96 AIM diagram in EXPRESS_G: 96 of 137	3298
Figure H.97 AIM diagram in EXPRESS_G: 97 of 137	3299
Figure H.98 AIM diagram in EXPRESS_G: 98 of 137	3300
Figure H.99 AIM diagram in EXPRESS_G: 99 of 137	3301
Figure H.100 AIM diagram in EXPRESS_G: 100 of 137	3302
Figure H.101 AIM diagram in EXPRESS_G: 101 of 137	3303
Figure H.102 AIM diagram in EXPRESS_G: 102 of 137	3304
Figure H.103 AIM diagram in EXPRESS_G: 103 of 137	3305
Figure H.104 AIM diagram in EXPRESS_G: 104 of 137	3306
Figure H.105 AIM diagram in EXPRESS_G: 105 of 137	3307
Figure H.106 AIM diagram in EXPRESS_G: 106 of 137	3308

Figure H.107 AIM diagram in EXPRESS_G: 107 of 137	3309
Figure H.108 AIM diagram in EXPRESS_G: 108 of 137	3310
Figure H.109 AIM diagram in EXPRESS_G: 109 of 137	3311
Figure H.110 AIM diagram in EXPRESS_G: 110 of 137	3312
Figure H.111 AIM diagram in EXPRESS_G: 111 of 137	3313
Figure H.112 AIM diagram in EXPRESS_G: 112 of 137	3314
Figure H.113 AIM diagram in EXPRESS_G: 113 of 137	3315
Figure H.114 AIM diagram in EXPRESS_G: 114 of 137	3316
Figure H.115 AIM diagram in EXPRESS_G: 115 of 137	3317
Figure H.116 AIM diagram in EXPRESS_G: 116 of 137	3318
Figure H.117 AIM diagram in EXPRESS_G: 117 of 137	3319
Figure H.118 AIM diagram in EXPRESS_G: 118 of 137	3320
Figure H.119 AIM diagram in EXPRESS_G: 119 of 137	3321
Figure H.120 AIM diagram in EXPRESS_G: 120 of 137	3322
Figure H.121 AIM diagram in EXPRESS_G: 121 of 137	3323
Figure H.122 AIM diagram in EXPRESS_G: 122 of 137	3324
Figure H.123 AIM diagram in EXPRESS_G: 123 of 137	3325
Figure H.124 AIM diagram in EXPRESS_G: 124 of 137	3326
Figure H.125 AIM diagram in EXPRESS_G: 125 of 137	3327
Figure H.126 AIM diagram in EXPRESS_G: 126 of 137	3328
Figure H.127 AIM diagram in EXPRESS_G: 127 of 137	3329
Figure H.128 AIM diagram in EXPRESS_G: 128 of 137	3330
Figure H.129 AIM diagram in EXPRESS_G: 129 of 137	3331
Figure H.130 AIM diagram in EXPRESS_G: 130 of 137	3332
Figure H.131 AIM diagram in EXPRESS_G: 131 of 137	3333
Figure H.132 AIM diagram in EXPRESS_G: 132 of 137	3334
Figure H.133 AIM diagram in EXPRESS_G: 133 of 137	3335
Figure H.134 AIM diagram in EXPRESS_G: 134 of 137	3336
Figure H.135 AIM diagram in EXPRESS_G: 135 of 137	3337
Figure H.136 AIM diagram in EXPRESS_G: 136 of 137	3338
Figure H.137 AIM diagram in EXPRESS_G: 137 of 137	3339

Tables Table 1 Logical grouping of UoFs	16
Table 2 Mapping table surface_condition UoF (C1)	818
Table 3 Mapping table explicit_draughting UoF (D1)	835
Table 4 Mapping table associative_annotation UoF (D2)	850
Table 5 Mapping table external_reference_mechanism UoF (E1)	856
Table 6 Mapping table user_defined_feature UoF (FF1)	929
Table 7 Mapping table included_feature UoF (FF2)	937
Table 8 Mapping table generative_featured_shape UoF (FF3)	1108
Table 9 Mapping table wireframe_model_2d UoF (G1)	1111
Table 10 Mapping table wireframe_model_3d UoF (G2)	1115
Table 11 Mapping table connected_surface_model UoF (G3)	1119
Table 12 Mapping table faceted_b_rep_model UoF (G4)	1135
Table 13 Mapping table b_rep_model UoF (G5)	1140
Table 14 Mapping table compound_model UoF (G6)	1155
Table 15 Mapping table csg_model UoF (G7)	1171
Table 16 Mapping table geometrically_bounded_surface_model UoF (G8)	1202
Table 17 Mapping table kinematics UoF (K1)	1205
Table 18 Mapping table measured_data UoF (MD1)	1225
Table 19 Mapping table geometric_presentation UoF (P1)	1227
Table 20 Mapping table annotated_presentation UoF (P2)	1261
Table 21 Mapping table shaded_presentation UoF (P3)	1276
Table 22 Mapping table item_property UoF (PR1)	1279
Table 23 Mapping table product_management_data UoF (S1)	1343
Table 24 Mapping table element_structure UoF (S2)	1526
Table 25 Mapping table item_definition_structure UoF (S3)	1588
Table 26 Mapping table effectivity UoF (S4)	1618
Table 27 Mapping table work_management UoF (S5)	1702
Table 28 Mapping table classification UoF (S6)	1765
Table 29 Mapping table specification_control UoF (S7)	1788
Table 30 Mapping table process_plan UoF (S8)	1857
Table 31 Mapping table dimension_tolerance UoF (T1)	1903

Table 32 Mapping table geometric_tolerance UoF (T2)	1932
Table 33 Usage of UoFs in Conformance Classes CC1-CC5 for CAD/CAM data exchange and sharing	2558
Table 34 Usage of UoFs in Conformance Classes CC6-CC10 for product structure and configuration management data exchange and sharing	2559
Table 35 Usage of UoFs in Conformance Classes CC11-CC15 for process planning and feature based design data exchange and sharing	2560
Table 36 Usage of UoFs in Conformance Classes CC16-CC20 for simulation, quality control, and complete data storage and retrieval	2561
Table 37 Usage of AIM elements in Conformance Classes	2562
Table B.1 AIM short names of entities	3041
Table F.1 The AAM-data classes	3102