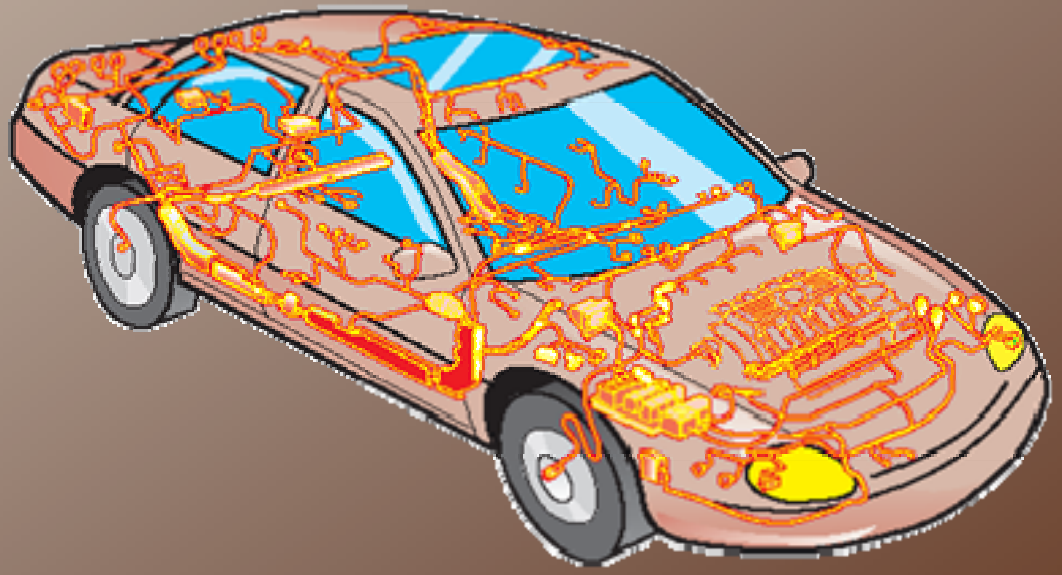
Harness CAD System

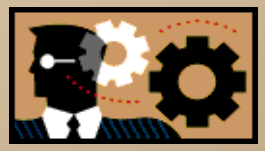
Design & Simulation (DNS)



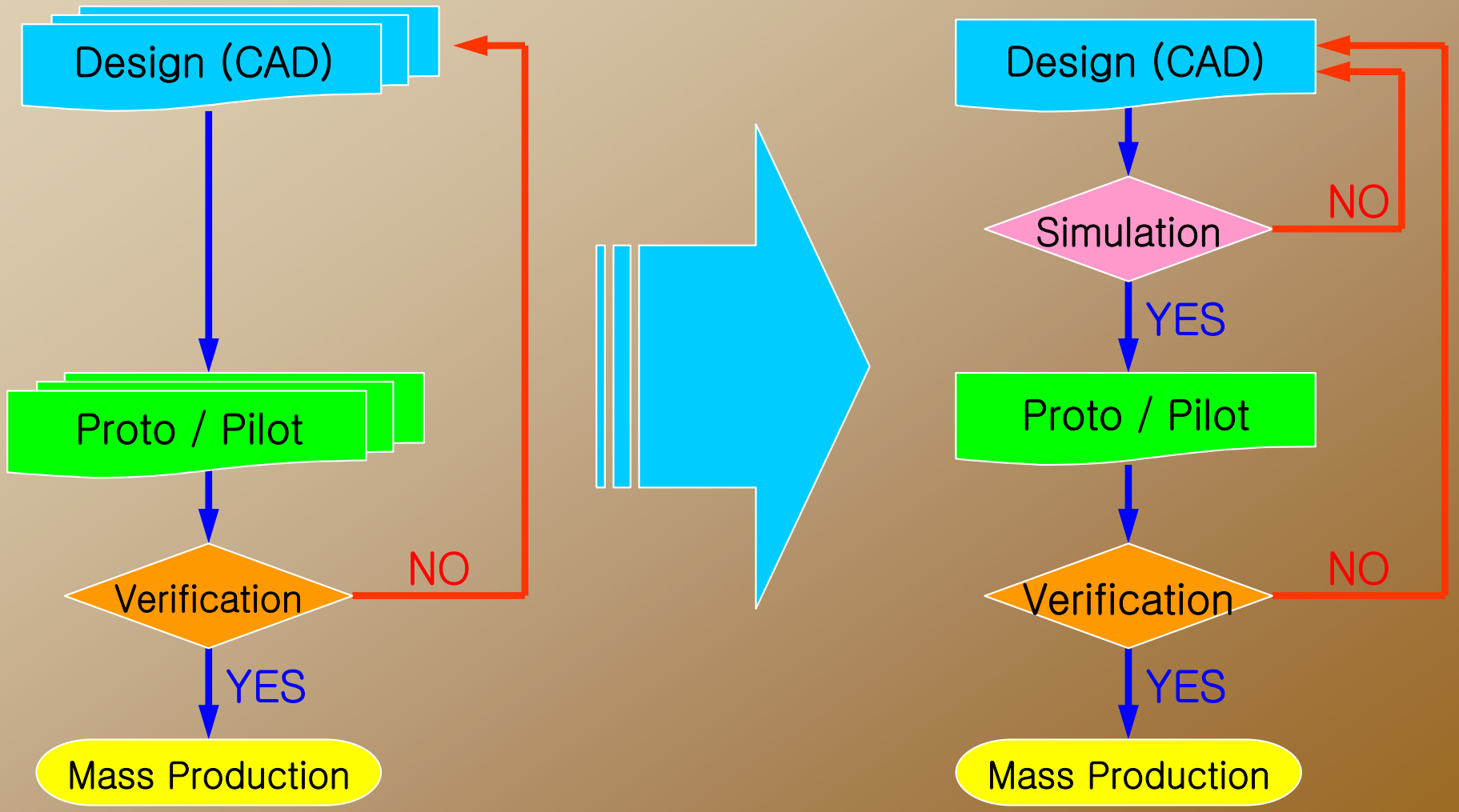
Dae-Shin Engineering

Overview of H-CAD DNS System

H-CAD DNS is an innovative system in automotive wiring harness industry, which is capable of minimizing the development time by analyzing the electrical performance in advance during the design phases through automation of wiring design and simulation and is capable of supporting the product development and manufacturing by focusing on low cost and high quality through the qualified drawing.



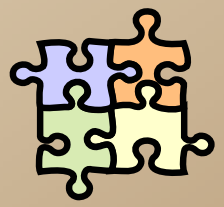
Paradigm Change of New Product Development

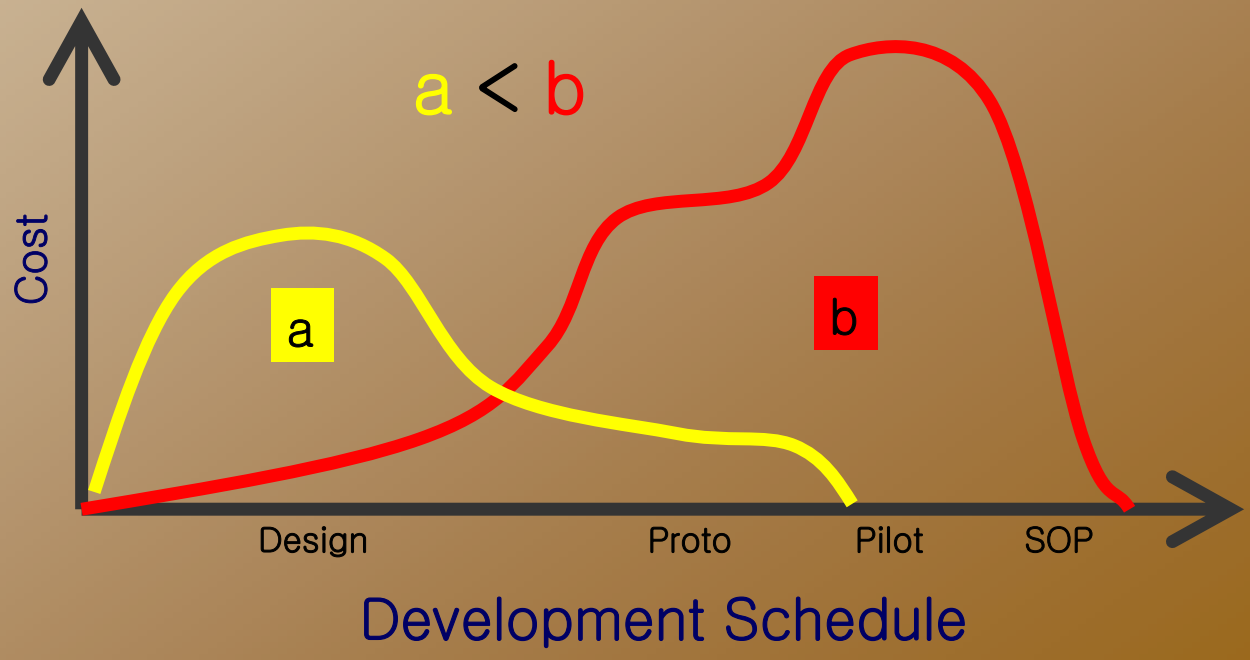


Effectiveness From In-Process of DNS System

- Standardization of Design
- Simplification of Procedure
- Speed-Up of Processing
- Integration of Data

- Reliability Enhancement of Design & Data
- Accurate Design Verification Capability
- Development Time Reduction
- Development Cost Reduction





Overall Configuration of H-CAD DNS System

Vehicle Information

Component Information

Design STD

Circuit Design CD

- Power Distribution And Verification
- Matching Fuse versus Wire
- Circuit Configuration Evaluation
- Protection Circuit Evaluation
- Voltage Drop Evaluation

Layout Design LD

- Product breakdown/structure review
- Calculation of bundle size
- Calculation of circuit number on layout
- Analysis of Product Specification

Product Design PD

- Product Drawing Generation using circuit diagram and layout diagram
- Calculation of inner diameter of tube
- Productivity Evaluation

MFG Design MD

- Generation of Assembly Drawing per part number
- Crimping process document per part number
- Productivity Evaluation

Automatic Design And Verification Program for Automotive Wire Harness

(H-CAD Design & Simulation System)

Power Distribution Diagram

Electrical Circuit Diagram

Performance Evaluation Document

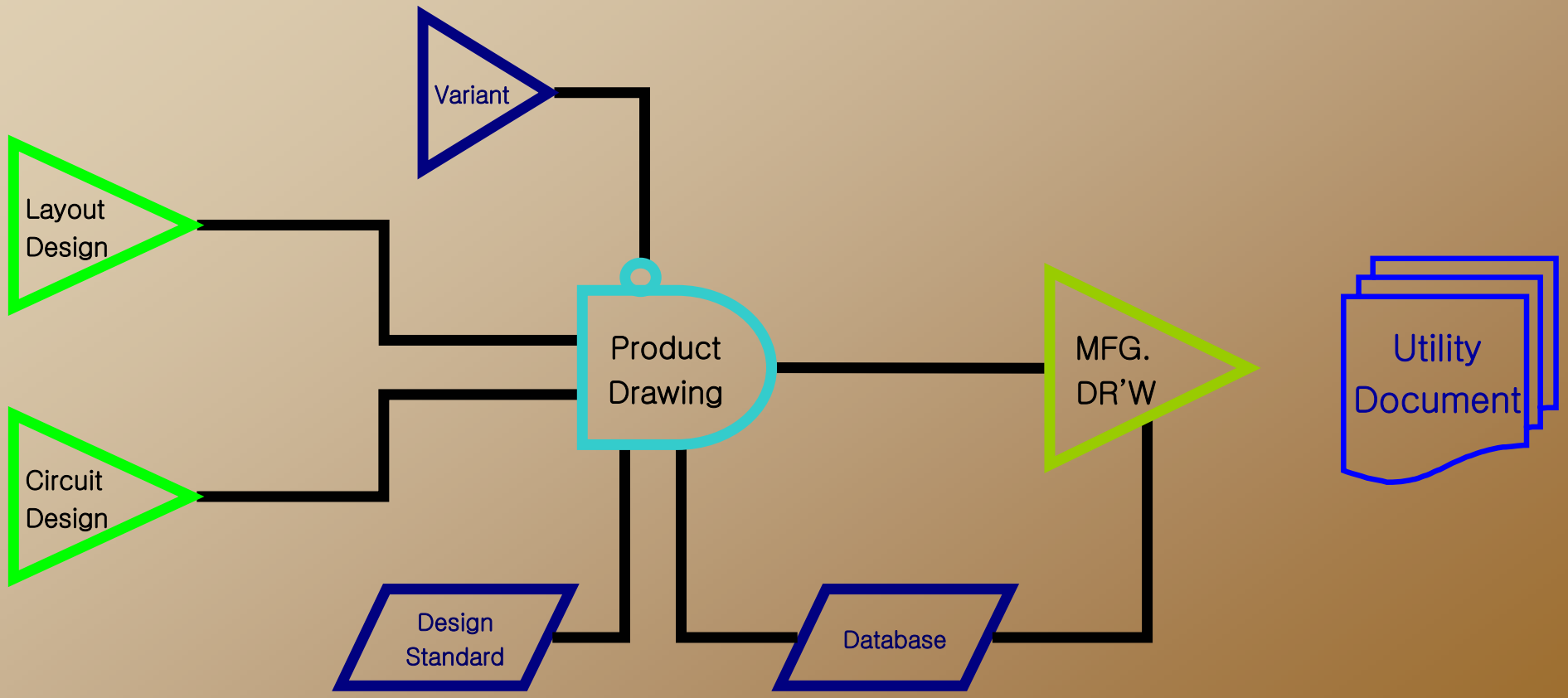
Product Drawing

Specification Analysis Table

Manufacturing Specification Document

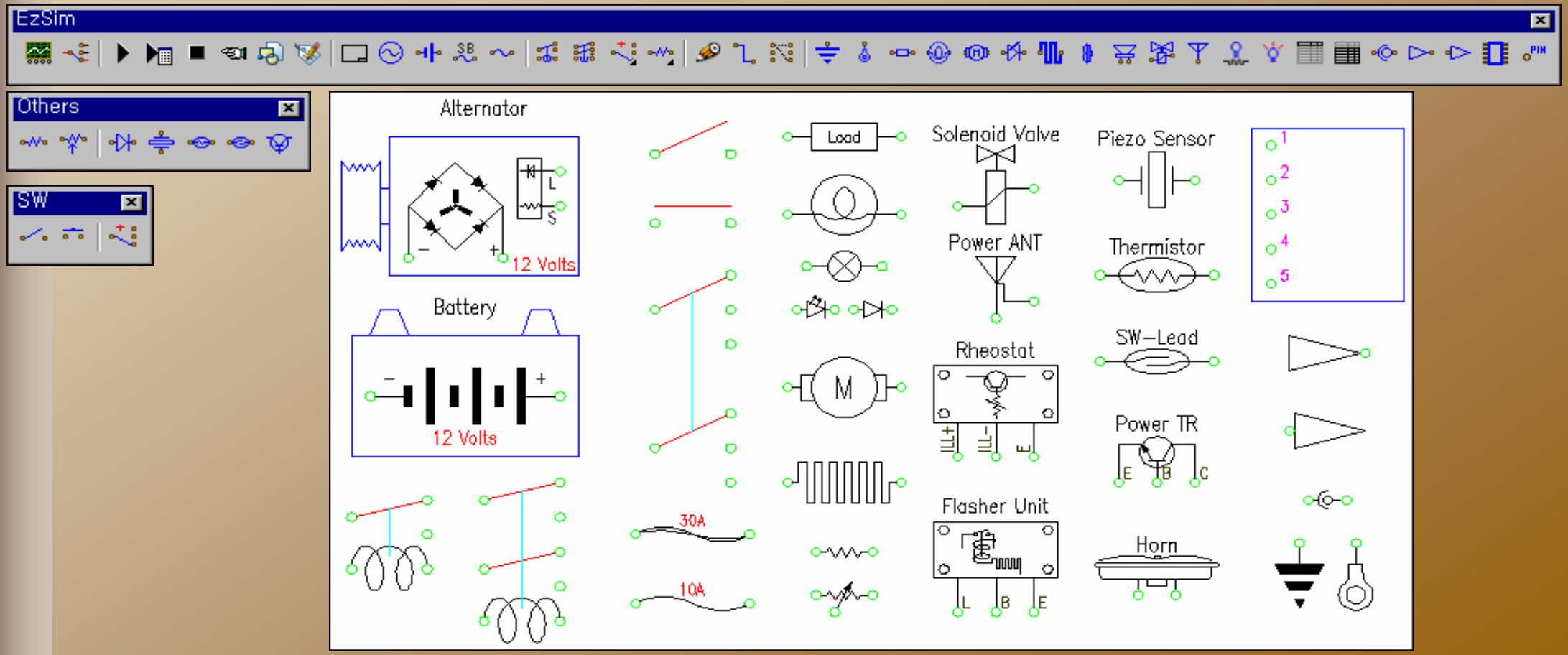
Raw Material Cost Analysis Table

Flowchart of H-CAD DNS System



Function Description – Circuit Design

- Circuit Diagram Data Input
  - ✓ Speedy and Accurate Data Input based on the symbol library database of wire harness
  - ✓ Easy revision of drawing thanks to the concurrent linkage of symbol and wire already entered
  - ✓ Capable of verification of operational characteristic in advance for logical circuit inside ECU when entry
  - ✓ Matching Evaluation of Fuse versus Wire



Function Description – Circuit Design

- Power Distribution Drawing Generation and Verification
  - ✓ Evaluation of Circuit Configuration
  - ✓ Evaluation of Fuse melting TC characteristics
  - ✓ Evaluation of Protection Circuit
  - ✓ Matching Evaluation of Fuse versus Wire

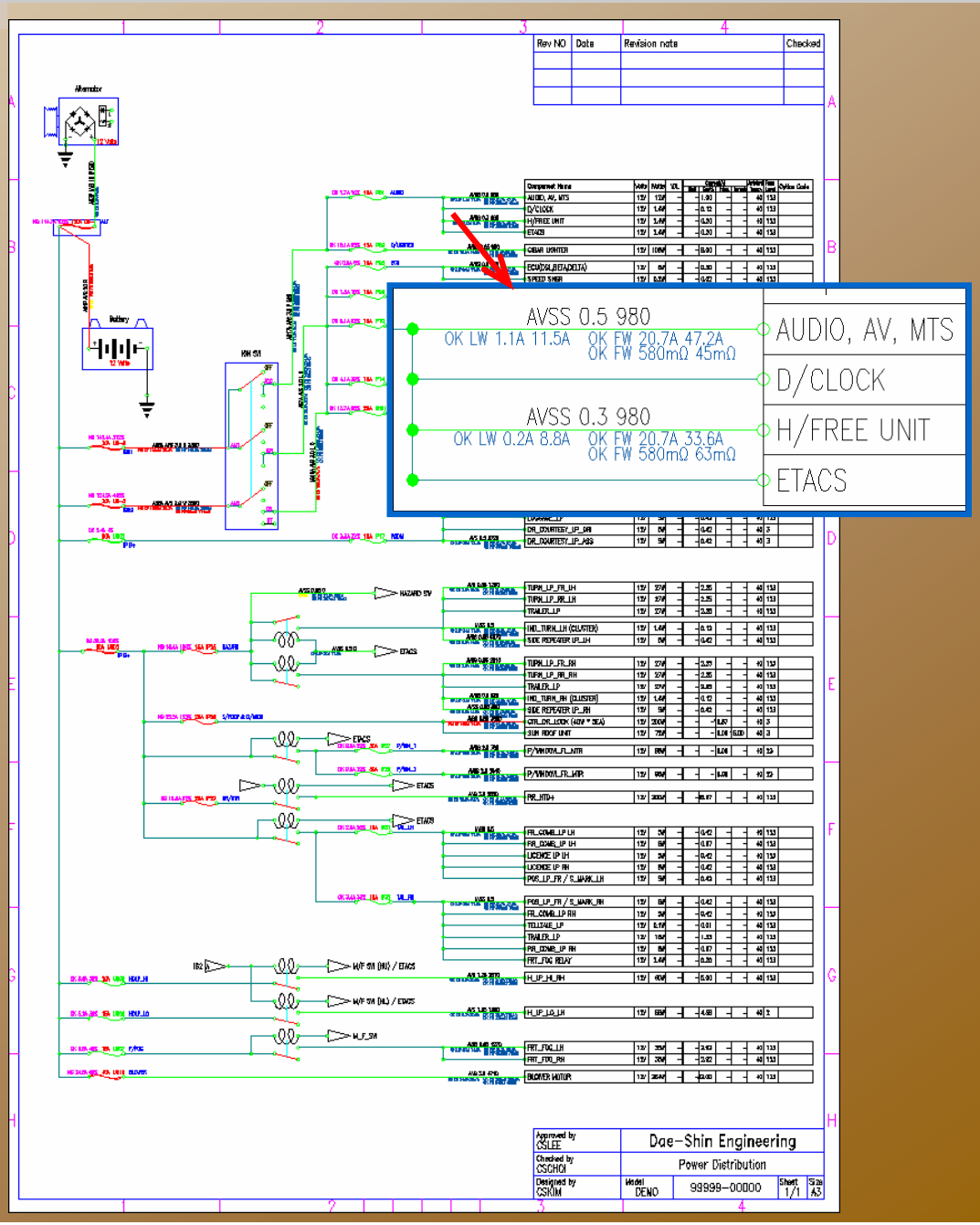
$$I^2 r = \frac{T_1 - T_2}{R\,(I - e^{-at})}$$

$$R = R_1 + R_2$$

$$R_1 = \left(\frac{P_1}{2\pi}\right) \log_e \left(\frac{d_2}{d_1}\right)$$

$$R_2 = 10\,P_2 / \pi\, d_2$$

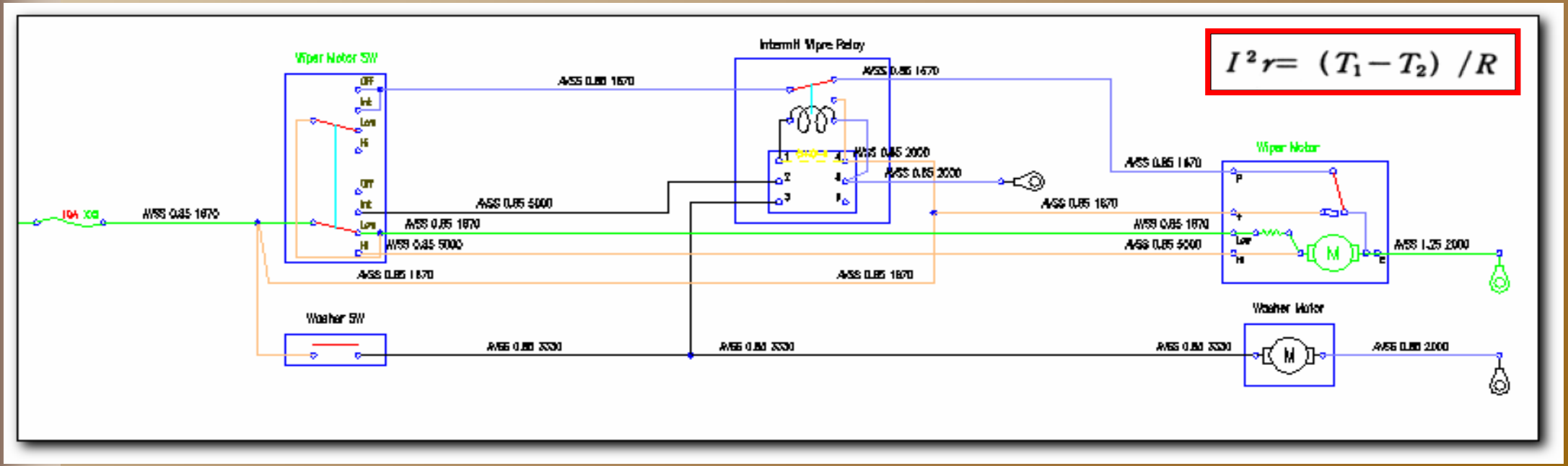
$$a = \frac{1}{R}\,(0.39\,W_{cu} + 1.43\,w_{puc})$$



Function Description – Circuit Design

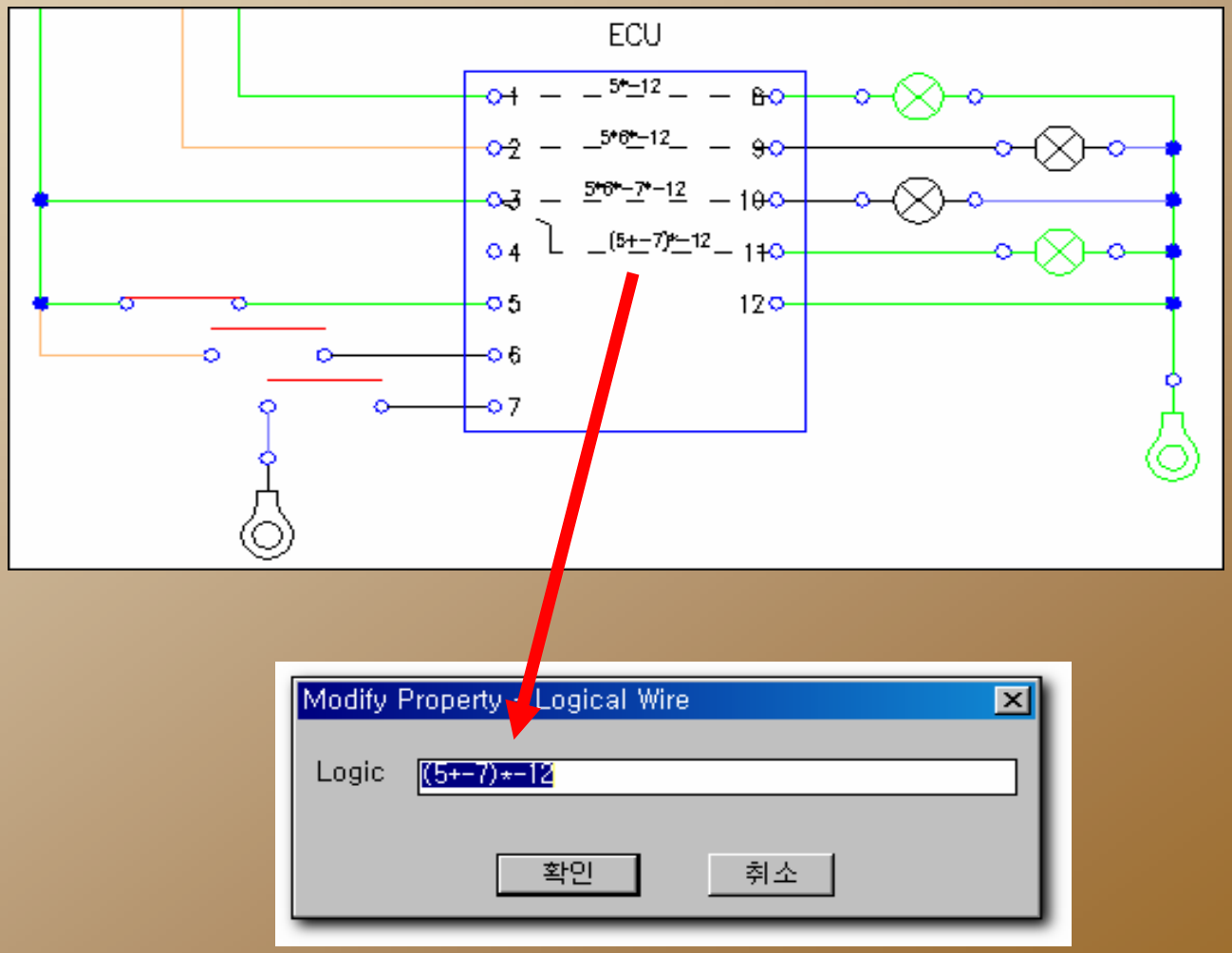
- Circuit Configuration Design and Verification

  - ✓ Evaluation of suitability for Circuit Configuration
  - ✓ Evaluation of Voltage Drop for specific load
  - ✓ Verification of load malfunction by current loop when fuse opens
  - ✓ Capable of verification of operational characteristics in advance for logical circuit inside ECU
  - ✓ Evaluation of Wire Color Allocation (Duplication or Minimizing)
  - ✓ Availability of Standard Compliance for number of wire and color of wire per circuit
  - ✓ Evaluation of integration or separation (independency) of specific circuit
  - ✓ Review of Circuit Configuration connected to SW selected



Function Description – Circuit Design

- Circuit Configuration Design and Verification
  - ✓ Capable of verification of operational characteristics in advance for logical circuit inside ECU



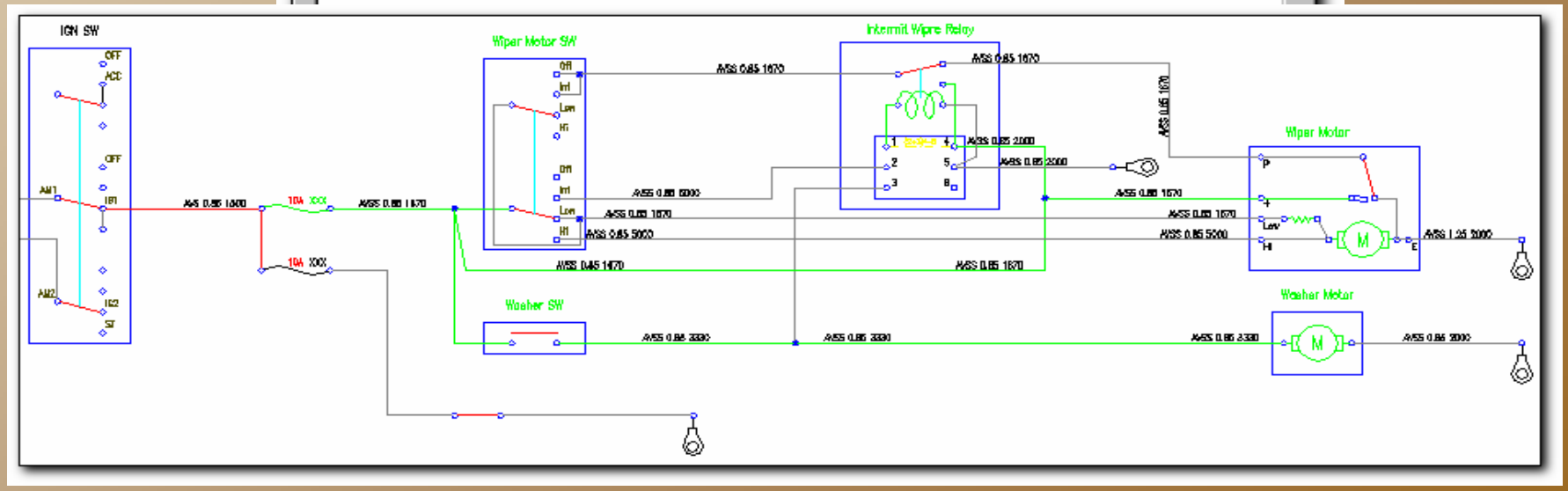
Function Description – Circuit Design

- Circuit Configuration Design and Verification
  - ✓ Identify the wire harness component connected to SW selected and then indicate the marking on diagram and the list on a pane

Identification of component connected to SW

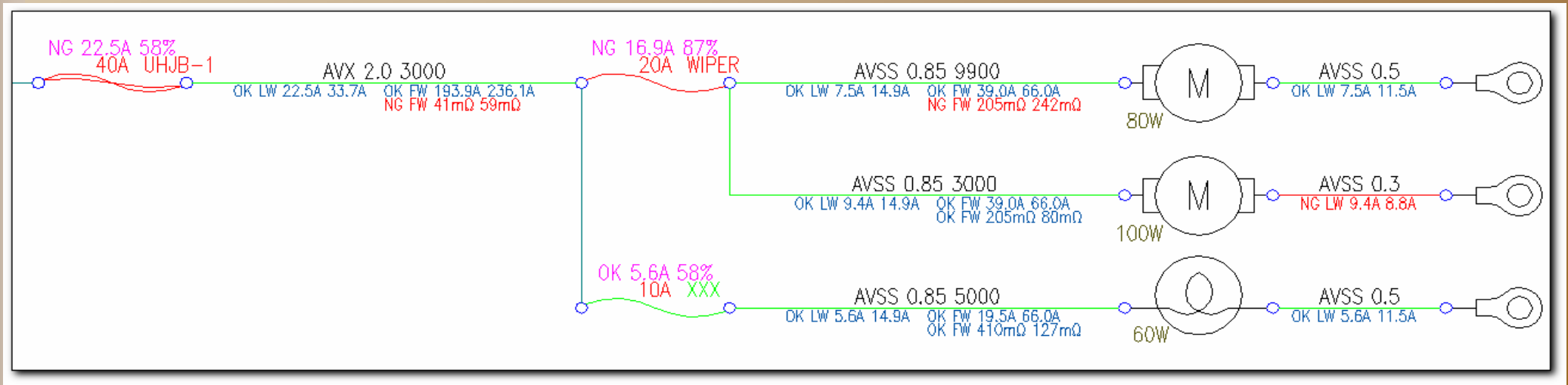
스위치 연결 부품 확인

스위치 (Switch)	SEQ	부하 (Load)
IGN SW	1	Wiper Motor
	2	Washer Motor
	3	Intermit Wipre Relay



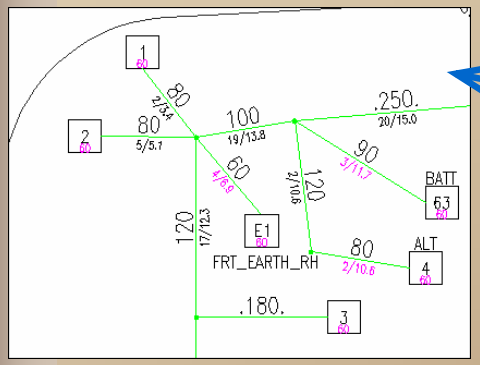
Function Description – Circuit Design

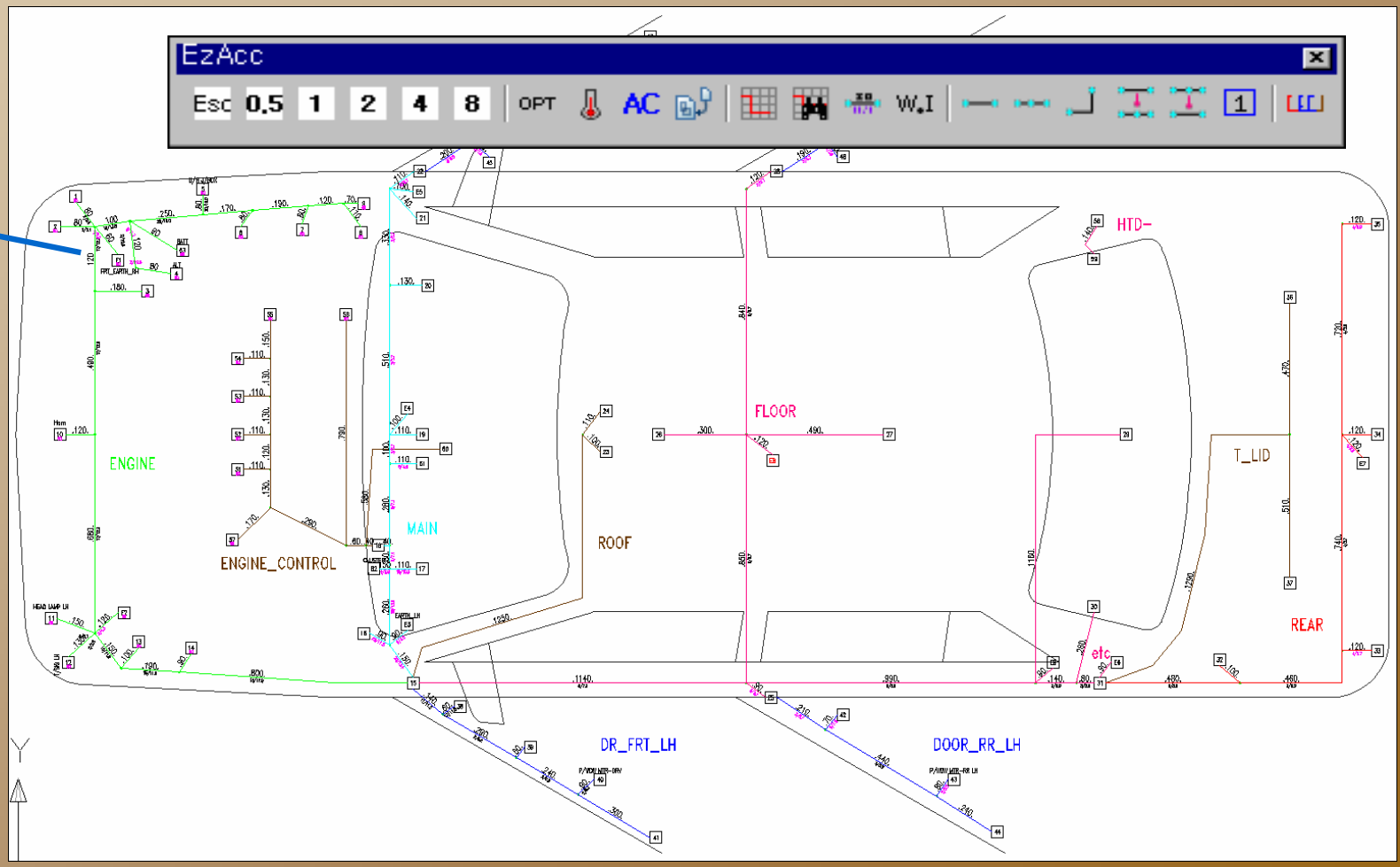
- Circuit Configuration Design and Verification
  - ✓ Record the result of simulation on Fuse and Wire
    - Load rate / Load ratio loaded on Fuse
    - Suitability of Load versus Wire at Normal Current
    - Suitability of Fuse versus Wire at Normal Current
    - Suitability of Fuse versus Wire at Absolute Over current



Function Description – Layout Design

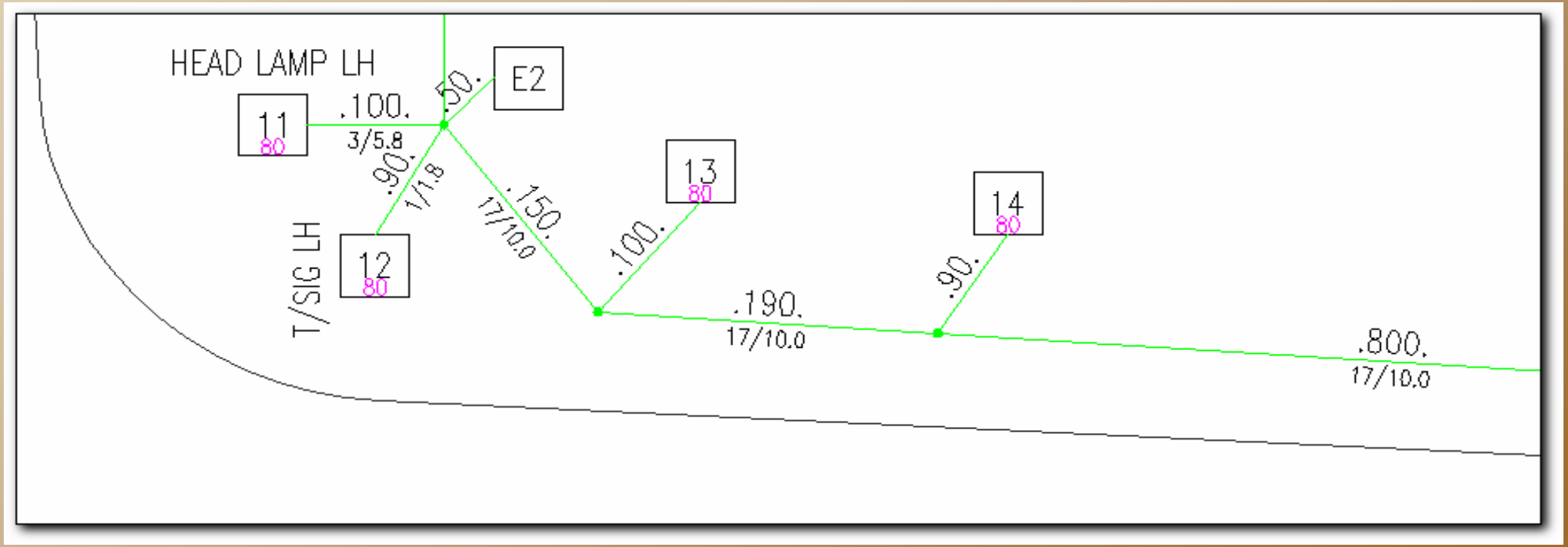
- Review of Layout Allocation and Layout Separation Location of Wire Harness
- Calculation of bundle size and display of number of circuit per route of layout
- Coloring identification for the layout corresponded to wire information of circuit diagram imported





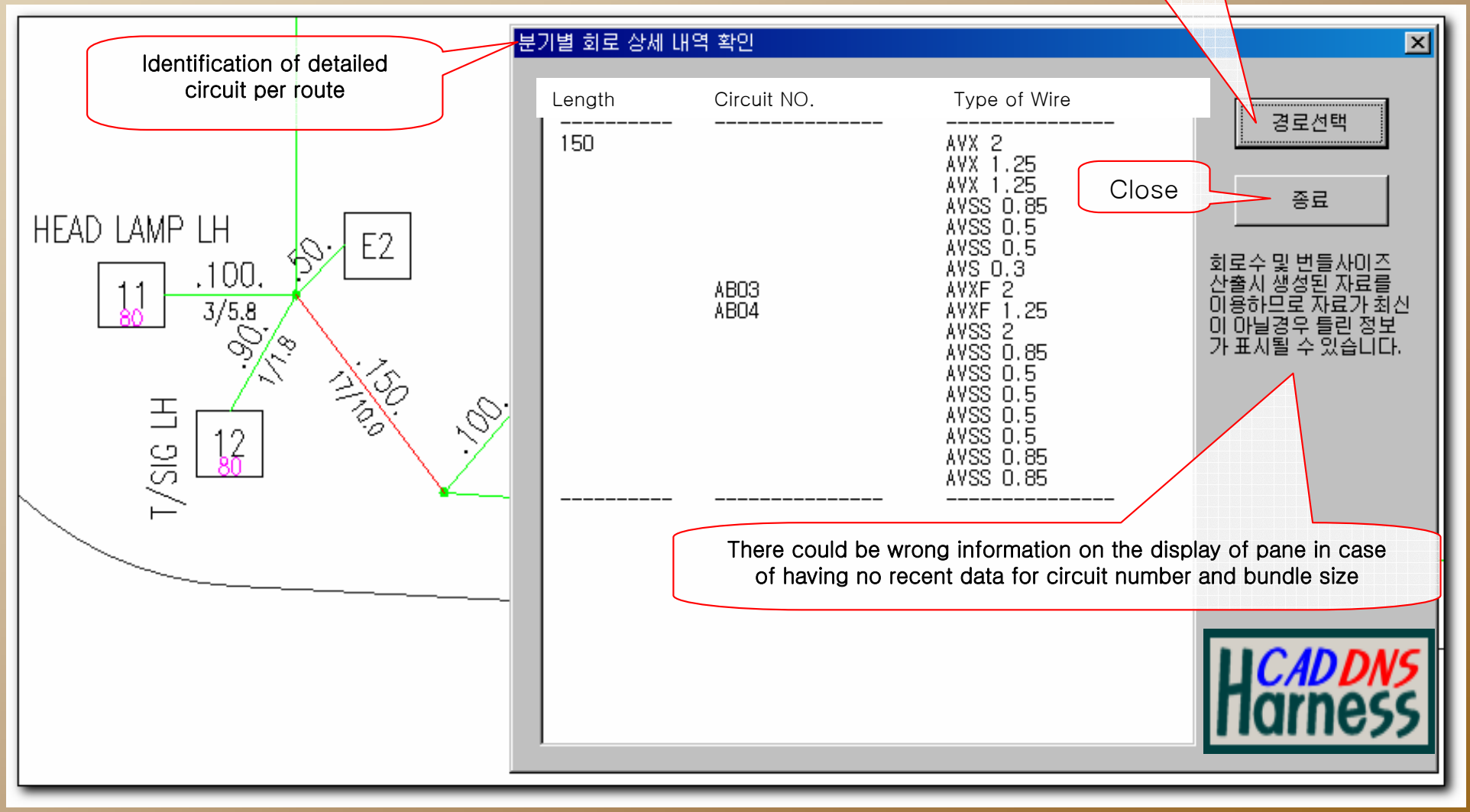
Function Description – Layout Design

- Calculation of bundle size and display of number of circuit per route of layout



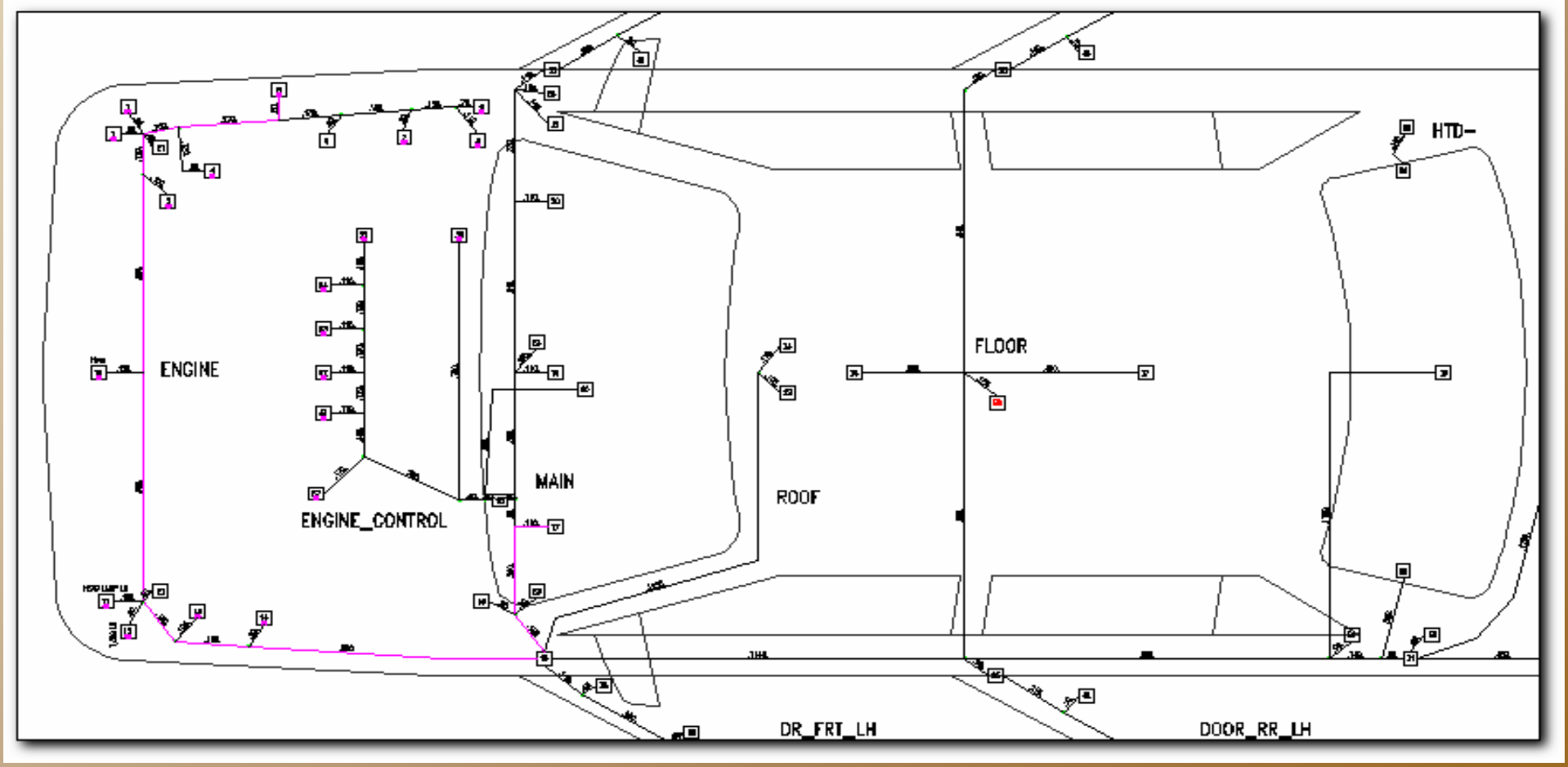
Function Description – Layout Design

- Display of wire information per route of layout



Function Description – Layout Design

- Coloring identification for the layout corresponded to wire information of circuit diagram imported



Function Description – DNS Report

Design Verification

- ✓ Suitability of Fuse rating selection
- ✓ Evaluation of Protection Circuit
- ✓ Matching Evaluation of Fuse versus Wire
- ✓ Evaluation of Voltage Drop value of specific load
- ✓ Suitability evaluation of circuit configuration
- ✓ Generation of 'FROM/TO' table of wire
- ✓ Generation of table of wire bundle size and circuit number per route
- ✓ Generation of tables for Wire to Wire connector number and circuit number
- ✓ Collection and summary of usage status per component type (Fuse, Wire and CONN)

CD-Demo-Wiper Motor_Report.xls

Design Verification

차종 : 도면 : CD-Demo-Wiper Motor.dwg 작성일자 : 2004년 06월 22일

FROM(휴즈)				전선					TO(부하)			부하 vs 휴즈			부하 vs 전선(허용전류)			휴즈 vs 전선(한계전류)			휴즈 vs 전선(저항)			
ID	용량 [A]	구분	주위온도 [℃]	순서	ID	전선종류	길이 [mm]	주위온도 [℃]	ID	용량 [A]	구분	기준 [%]	적용 [%]	판정	부하소비 [A]	전선허용 [A]	판정	휴즈용단 [A]	전선한계 [A]	판정	휴즈 [mΩ]	전선 [mΩ]	접점 [mΩ]	판정
FA-01	70	S/B	40							0.00	합계	50%	0.0%	Good				339.3			0			
				1	9EA9	AVSS 0.85	3,000	40	*	*	Open				*	*	*		84.22	Bad		70	10	Bad
FA-02	30	S/B	40							15.23	합계	50%	52.4%	Bad				145.4			0			
				1	9E9B	AVSS 2	1,500	40							15.23	25.99	Good		184.0	Good		-	-	-
				2	ACB3	AVS 0.85	1,500	40							15.23	16.19	Good		103.8	Bad		-	-	-
									FB-01	15.23	Fuse											49	40	Bad
				2	ACB3	AVS 0.85	1,500	40							15.23	16.19	Good		103.8	Bad		-	-	-
									FB-01	15.23	Fuse											49	40	Bad
FA-03	30	S/B	40							15.23	합계	50%	52.4%	Bad				145.4			0			
				1	9EF0	AEXF 8	3,000	40	*	*	ALT				15.23	89.68	Good		823.5	Good		8	10	Bad
FB-01	10	Blade	40							15.23	합계	70%	156.2%	Bad				19.5			0			
				1	ACC1	AVSS 0.85	1,670	40							15.23	14.91	Bad		66.0	Good		-	-	-
				2	AA6A	AVSS 0.85	5,000	40	*	*	Open				*	*	*		66.0	Good		156	40	Bad
				2	AE26	AVSS 0.85	1,670	40							11.25	14.91	Good		66.0	Good		-	-	-
									L-001	11.25	Load											78	60	Bad
				3	AE34	AVSS 0.85	5,000	40							0.00	14.91	Good		66.0	Good		-	-	-
				2	AE34	AVSS 0.85	5,000	40							11.25	14.91	Good		66.0	Good		-	-	-
									L-001	11.25	Load											156	40	Bad
				2	A87B	AVSS 0.85	3,330	40							3.75	14.91	Good		66.0	Good		-	-	-

Sheet1

Function Description – DNS Report

- Design Verification
  - ✓ Save the result of Open/Short circuit as MS Excel file after simulation

CD_FAM II_C100_Report.xls

#. Open Circuit List

휴즈번호	휴즈명	휴즈용량	종류	순번	회로번호	전선종류
AF3		30	S/B			
				1	E6548	AVSSX 2
				2	B6548	AVSS 2
				3	C6548	AVSS 2
AF4		30	S/B			
				1	E6553	AVSSX 2
				2	B6553	AVSS 2
				3	C6553	AVSS 2
AF5		30	S/B			
				1	E7089	AVSSX 2
				2	B7089	AVSS 0,85
				3	C7089	AVSS 2
EF2		40	S/B			
				1	B240	FLY 4
F1		20	S/B			
				1	B580	AVSS 1,25
				2	D580	AVSS 1,25
				3	D580	AVSS 1,25
F29		10	Blade			
				1	B541C	AVSS 0,5
F22		15	Blade			
				1	C41B	AVSS 0,5
F5		15	Blade			
				1	C1140	AVSS 0,85
F7		15	Blade			
				1	B1340	AVSS 0,5
F9		10	Blade			
				1	B1540	AVSS 0,5
F11		10	Blade			
				1	C1740	AVSS 0,3
				2	C39	AVSS 0,3

#. Short Circuit List

휴즈번호	휴즈명	휴즈용량	종류	순번	회로번호	전선종류
EF8		20	Blade			
				1	B2240	AVSS 1,25 RW
				2	X2240	AVSS 1,25 RW
				3	G2240	AVSS 1,25 RW
				4	G650C	AVSS 1,25 B
				5	G650A	AVSS 1,25 B

Sheet1 / 오픈_쇼트 / 부품리스트

Function Description – DNS Report

- Analysis of Component Specification
  - ✓ Save the component status as MS Excel file after simulation

제원분석표.xls

▶ Summarized table of Component - Fuse

Type	QTY	Device Name
Fuse Blade 10A	4	H/LP RLY
		IPJB-1 SIDE MIRROR
		T/SIG
		HARZARD
Fuse Blade 15A	3	FUSE_2 HDLP LO
		FUSE_12 HDLP HI
		TAIL
Fuse Blade 20A	1	FUSE_27 WIPER
Fuse Blade 30A	2	IP-2 P/WINDOW REAR
		IP-1 P/WINDOW FRT
Fuse S/B 120A	1	ALT
Fuse S/B 30A	6	IG1
		IG2
		LIGHT
		ALT
		UHJB-2 B+
		HARZARD
Fuse S/B 40A	1	P/WDW
합 계	18	

▶ Summarized table of Component - Relay

Type	QTY	Device Name
Relay	5	P/WINDOW
		TAIL LAMP RELAY
		HEAD LAMP LOW RELAY
		HEAD LAMP HI RELAY
		Intermit Wipre Relay

Component status | Wire status

Function Description – DNS Report

- Analysis of Wire Specification
  - ✓ Save the usage status of wire as MS Excel file after simulation

자원분석표.xls

▶ Summarized table of wire usage status per harness item

No.	Harness name	NO. of Circuit	Wire length	Wire weight	Wire cost
1	MAIN	62	34,370	459.5	3,764
2	ENGINE	30	45,950	1,068.1	8,392
3	DOOR_FRT_LH	21	7,370	110.8	928
4	FLOOR	9	18,370	312.9	2,785
5	REAR	9	10,100	83.4	630
6	DOOR_FRT_RH	8	3,560	56.0	472
7	ENGINE_CONTROL	5	4,500	97.8	798
8	DOOR_RR_LH	5	2,020	45.6	404
9	DOOR_RR_RH	5	1,940	43.7	388
합 계		154	128,180	2,277.6	18,561

Component status | Wire status | Sheet1

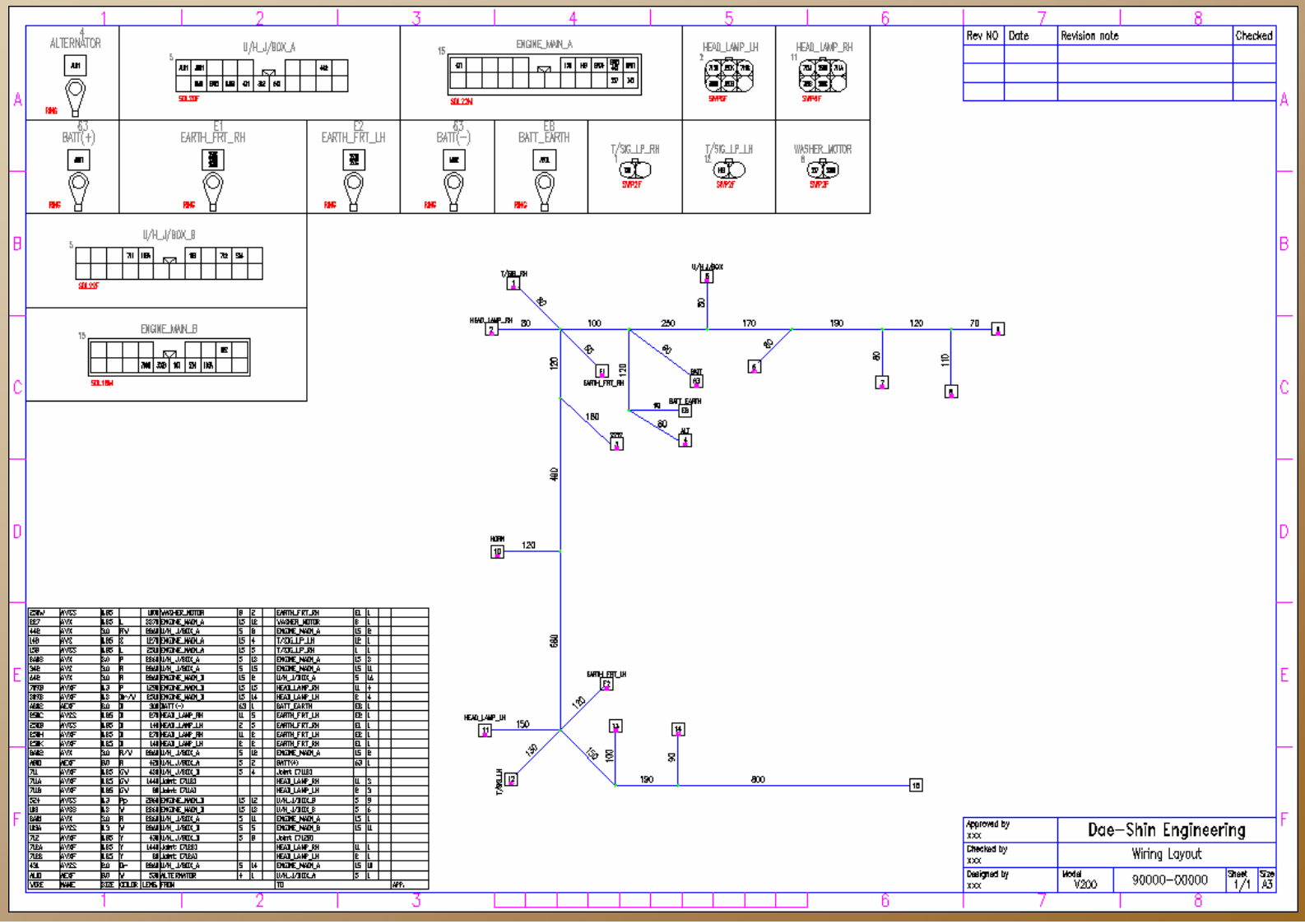
자재소요량-전선.xls

하네스명	선종	1	색상	가닥수	길이
DOOR_FRT_LH	AEXF	2	P	5	800
DOOR_FRT_LH	AEXF	2	B	2	200
DOOR_FRT_LH	AEXF	2	S	2	200
DOOR_FRT_LH	AEXF	2	T	2	200
DOOR_FRT_LH	AEXF	2	L	3	400
DOOR_FRT_LH	AEXF	2	G	2	200
DOOR_FRT_LH	AEXF	2	Lg	2	200
DOOR_FRT_LH	AVSS	2	L	2	650
DOOR_FRT_LH	AVSS	2	Br	2	1240
DOOR_FRT_RH	AEXF	2	S	2	290
DOOR_FRT_RH	AEXF	2	T	2	290
DOOR_FRT_RH	AEXF	2	L	2	290
DOOR_FRT_RH	AVSS	2	L	2	610
DOOR_FRT_RH	AVSS	2	Br	2	610
DOOR_RR_LH	AEXF	2	G	2	280
DOOR_RR_LH	AEXF	2	P	2	280
DOOR_RR_LH	AVSS	2	L	3	870
DOOR_RR_LH	AVSS	2	Br	2	590
DOOR_RR_RH	AEXF	2	L	2	260
DOOR_RR_RH	AEXF	2	Lg	2	260
DOOR_RR_RH	AEXF	2	P	2	260
DOOR_RR_RH	AVSS	2	L	2	580
DOOR_RR_RH	AVSS	2	Br	2	580
ENGINE	AEXF	8	W	2	750
ENGINE	AEXF	8	R	2	440
ENGINE	AEXF	8	B	2	340
ENGINE	AVS	0.85	S	2	1230
ENGINE	AVSS	0.5	P	2	2980
ENGINE	AVSS	0.5	Br/W	2	2980
ENGINE	AVSS	0.5	B	2	280
ENGINE	AVSS	0.85	L	2	2610
ENGINE	AVSS	0.85	B	2	290
ENGINE	AVX	3	R	3	5960
ENGINE	AVX	3	R/W	2	2980
ENGINE	AVX	3	P	2	2980
ENGINE	AVXF	0.3	S	2	2980
ENGINE	AVXF	0.3		4	6470
ENGINE	AVXF	0.3	P	2	1940
ENGINE	AVXF	0.3	Br/W	2	530
ENGINE	AVXF	0.5	Br	2	2980
ENGINE	AVXF	0.5	Or	2	2980
ENGINE	AVXF	0.85	Y	4	2020
ENGINE	AVXF	0.85	G/W	4	2020
ENGINE	AVXF	0.85	B	3	290
ENGINE	AVXF	2		2	2980
ENGINE	AVXF	3	Or	2	2980
FLOOR	AVSS	0.5	P	2	2350
FLOOR	AVSS	0.85	L	2	2350
FLOOR	AVSS	0.85	S	2	2350

집계 | 자재소요량-전선

Function Description – Product Design

- Automatic Generation of Product Drawing
  - ✓ Automatically generate the product drawing using the data of circuit diagram and layout diagram



Function Description – Library Manager

- Conn. Library

Connecter Master

Connector Master

Yes No Save Cancel 1295 Record

IDNO	Pole
HAP03MSWD6BS	3
HAP03MSWD6GR	3
HAP03TPMS6B0	3
HAP0402502B0	4
HAP0402502Y0	4
HAP0402512Y0	4
HAP0407001W0	4
HAP0407002W0	4
HAP0407QJ2W0	
HAP0409031B0	4
HAP0425002B0	4
HAP0425002W0	4
HAP0425012W0	4
HAP0428005B0	4
HAP0431252W0	4
HAP04DWP06W0	4
HAP04JPT06B0	4
HAP04JPT06GR	4
HAP04MSWD5B0	4
HAP04MSWD6B0	4
HAP04MSWD6GR	4
HAP04MSWP6B0	4
HAP0528005B0	5
HAP05JPTA2B0	5
HAP05JPTI2B0	5
HAP05MIC01W0	5
HAP05MIC02B0	5
HAP05MIC02G0	5
HAP05MIC02L0	5
HAP05MIC02W0	5
HAP05MIC02Y0	5
HAP05SLB04B0	5
HAP05SLB14B0	5
HAP0607001W0	6
HAP0607002W0	6

HSG

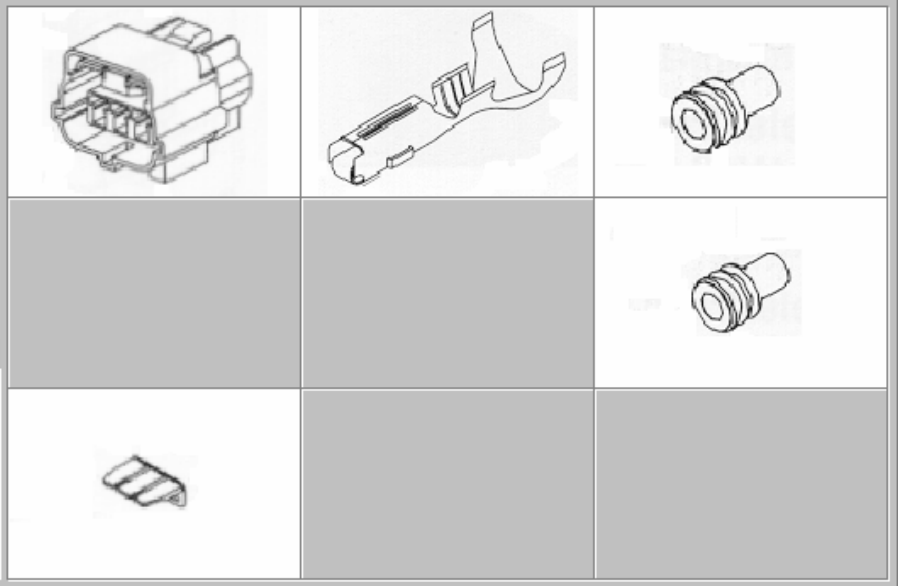
+ DIM	− DIM	Plate Low	Plate High	W/P	Blanking	Vender NO	Description	Vender Name	OEM1 NO	OEM2 NO
20	0	T	G	W	JAP01MSWD4B0	368523-1	R-E J MII 3F(B) AMP	한국에이엠피		MS-WD-3F(B)

Terminal NO.

Terminal NO.	Strip	SQ-L	SQ-H	Wire	Plate
TAP12MSWD6SN	4.00	0.30	0.50	1	T
TAP34MSWD6SN	4.00	0.55	1.25	1	T
TAP12MSWD6AU	4.00	0.30	0.50	1	G

Wire Seal

Wire Seal	AVSS Low	AVSS High	AV Low	AV High	DIA Low	DIA High
JAP12MSWD0L0	0.30	0.50	0.30	0.30		
JAP12MSWD1B0	0.85	0.85	0.50	0.50		
JAP35MSWD1GR	1.25	1.25	0.85	0.85		



Others

RAP03MSWD2Y0

Sponge

Cover

Terminal | Wire Seal | .Etc

NO	Vender NO	Description	Vender Name	OEM1 NO	OEM2 NO
1	171630-1	R-E J MII 0.3-0.5 SN AMP	한국에이엠피		ECR-002
2	171662-1	R-E J MII (M) SN AMP	한국에이엠피		ECR-102
3	171630-5	R-E J MII 0.3-0.5 AU AMP	AMP JAPAN		ECR-002AU
4					
5					
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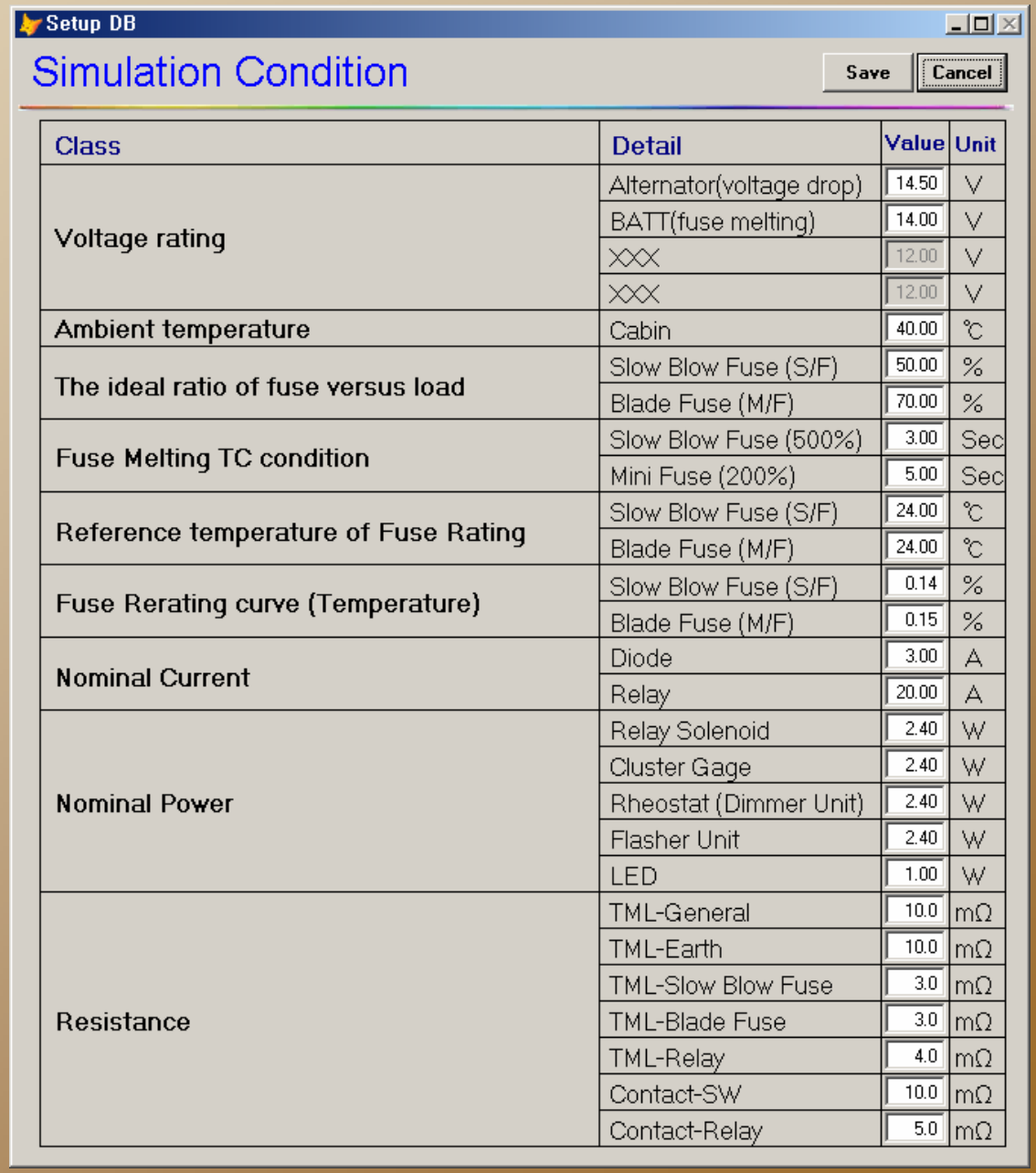
10					

Function Description – Library Manager

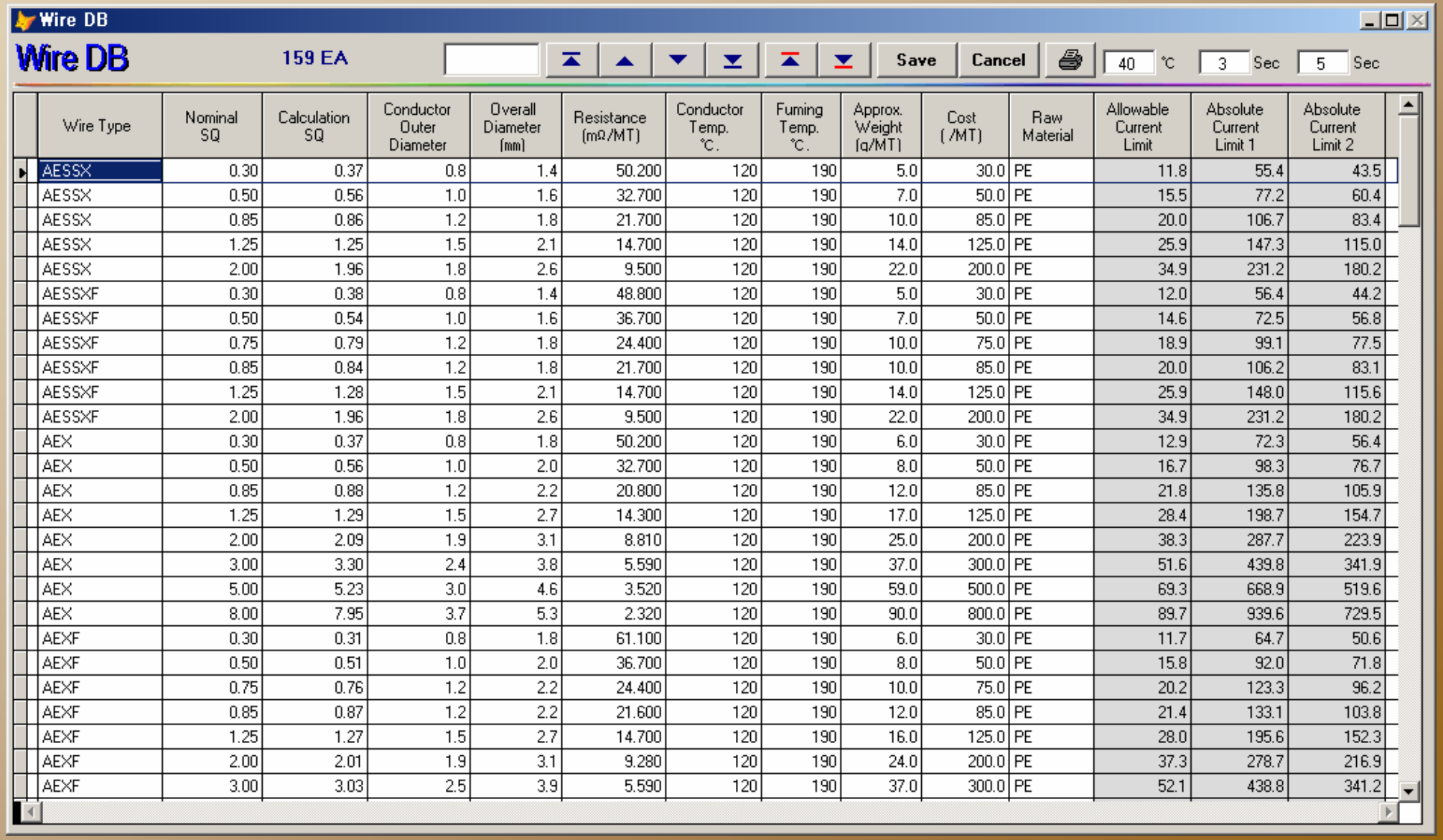
- Simulation Condition



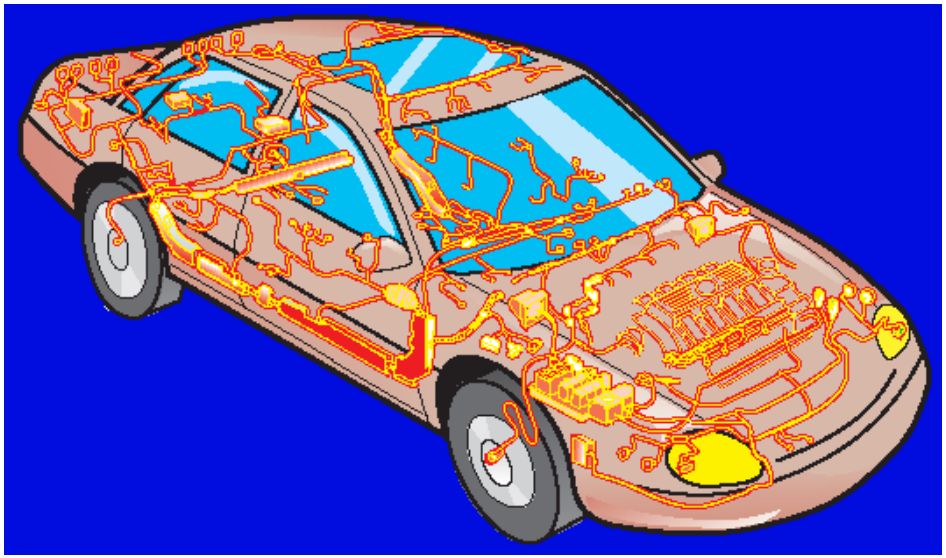
Class	Detail	Value	Unit
Voltage rating	Alternator(voltage drop)	14.50	V
	BATT(fuse melting)	14.00	V
	XXX	12.00	V
	XXX	12.00	V
Ambient temperature	Cabin	40.00	℃
The ideal ratio of fuse versus load	Slow Blow Fuse (S/F)	50.00	%
	Blade Fuse (M/F)	70.00	%
Fuse Melting TC condition	Slow Blow Fuse (500%)	3.00	Sec
	Mini Fuse (200%)	5.00	Sec
Reference temperature of Fuse Rating	Slow Blow Fuse (S/F)	24.00	℃
	Blade Fuse (M/F)	24.00	℃
Fuse Rerating curve (Temperature)	Slow Blow Fuse (S/F)	0.14	%
	Blade Fuse (M/F)	0.15	%
Nominal Current	Diode	3.00	A
	Relay	20.00	A
Nominal Power	Relay Solenoid	2.40	W
	Cluster Gage	2.40	W
	Rheostat (Dimmer Unit)	2.40	W
	Flasher Unit	2.40	W
	LED	1.00	W
Resistance	TML-General	10.0	mΩ
	TML-Earth	10.0	mΩ
	TML-Slow Blow Fuse	3.0	mΩ
	TML-Blade Fuse	3.0	mΩ
	TML-Relay	4.0	mΩ
	Contact-SW	10.0	mΩ
	Contact-Relay	5.0	mΩ

Function Description – Library Manager

- Wire Database



Wire Type	Nominal SQ	Calculation SQ	Conductor Outer Diameter	Overall Diameter (mm)	Resistance (mΩ/MT)	Conductor Temp. ℃.	Fuming Temp. ℃.	Approx. Weight (g/MT)	Cost (/MT)	Raw Material	Allowable Current Limit	Absolute Current Limit 1	Absolute Current Limit 2
AESSX	0.30	0.37	0.8	1.4	50.200	120	190	5.0	30.0	PE	11.8	55.4	43.5
AESSX	0.50	0.56	1.0	1.6	32.700	120	190	7.0	50.0	PE	15.5	77.2	60.4
AESSX	0.85	0.86	1.2	1.8	21.700	120	190	10.0	85.0	PE	20.0	106.7	83.4
AESSX	1.25	1.25	1.5	2.1	14.700	120	190	14.0	125.0	PE	25.9	147.3	115.0
AESSX	2.00	1.96	1.8	2.6	9.500	120	190	22.0	200.0	PE	34.9	231.2	180.2
AESSXF	0.30	0.38	0.8	1.4	48.800	120	190	5.0	30.0	PE	12.0	56.4	44.2
AESSXF	0.50	0.54	1.0	1.6	36.700	120	190	7.0	50.0	PE	14.6	72.5	56.8
AESSXF	0.75	0.79	1.2	1.8	24.400	120	190	10.0	75.0	PE	18.9	99.1	77.5
AESSXF	0.85	0.84	1.2	1.8	21.700	120	190	10.0	85.0	PE	20.0	106.2	83.1
AESSXF	1.25	1.28	1.5	2.1	14.700	120	190	14.0	125.0	PE	25.9	148.0	115.6
AESSXF	2.00	1.96	1.8	2.6	9.500	120	190	22.0	200.0	PE	34.9	231.2	180.2
AEX	0.30	0.37	0.8	1.8	50.200	120	190	6.0	30.0	PE	12.9	72.3	56.4
AEX	0.50	0.56	1.0	2.0	32.700	120	190	8.0	50.0	PE	16.7	98.3	76.7
AEX	0.85	0.88	1.2	2.2	20.800	120	190	12.0	85.0	PE	21.8	135.8	105.9
AEX	1.25	1.29	1.5	2.7	14.300	120	190	17.0	125.0	PE	28.4	198.7	154.7
AEX	2.00	2.09	1.9	3.1	8.810	120	190	25.0	200.0	PE	38.3	287.7	223.9
AEX	3.00	3.30	2.4	3.8	5.590	120	190	37.0	300.0	PE	51.6	439.8	341.9
AEX	5.00	5.23	3.0	4.6	3.520	120	190	59.0	500.0	PE	69.3	668.9	519.6
AEX	8.00	7.95	3.7	5.3	2.320	120	190	90.0	800.0	PE	89.7	939.6	729.5
AEXF	0.30	0.31	0.8	1.8	61.100	120	190	6.0	30.0	PE	11.7	64.7	50.6
AEXF	0.50	0.51	1.0	2.0	36.700	120	190	8.0	50.0	PE	15.8	92.0	71.8
AEXF	0.75	0.76	1.2	2.2	24.400	120	190	10.0	75.0	PE	20.2	123.3	96.2
AEXF	0.85	0.87	1.2	2.2	21.600	120	190	12.0	85.0	PE	21.4	133.1	103.8
AEXF	1.25	1.27	1.5	2.7	14.700	120	190	16.0	125.0	PE	28.0	195.6	152.3
AEXF	2.00	2.01	1.9	3.1	9.280	120	190	24.0	200.0	PE	37.3	278.7	216.9
AEXF	3.00	3.03	2.5	3.9	5.590	120	190	37.0	300.0	PE	52.1	438.8	341.2



Dae-Shin Engineering

Address : 182-5, Nowon-3ga,
Buk-gu, Taegu-city, Korea

TEL : 031-353-8017

H.P : 011-530-6982

Email : cad4wire@chol.com