# รายการอ้างอิง


## ภาษาไทย

ก่อเกียรติ เก่งสกุล, และ บุญเจริญ ศิริเนาวกุล, "ทฤษฎีและการประยุกต์ใช้งาน ปัญญาประดิษฐ์และระบบผู้เชี่ยวชาญ (Artificial Intellegence & Expert System)," ซีเอ็ดยูเคชั่น, 2534

มนตรี วงศ์ศรี, "ระบบฐานความรู้ : เครื่องมือใหม่สำหรับการแก้ไขปัญหาด้วยคอมพิวเตอร์," ว.ส.ท. เทคโนโลยี ปีที่ 45, เล่มที่ 11, 2535.

_____"ระบบฐานความรู้ : เครื่องมือใหม่สำหรับการแก้ไขปัญหาด้วยคอมพิวเตอร์," ว.ส.ท. เทคโนโลยี ปีที่ 46, เล่มที่ 1, 2536.

วิกรม วัชระคุปต์, "ตะกั่วบัดกรี", วารสารวิศวกรรมศาสตร์, กรกฎาคม, 2530.

## ภาษาอังกฤษ

ANSI/IPC - A - 600D, "Acceptability of Printed Boards," Institute of Interconnecting and Packaging Electronic Circuits, August, 1989.

____IPC-T-50D, "Term and Definitions for Interconnecting and Packaging Electronic Circuits", Institute of Interconnecting and Packaging Electronic Circuits, November, 1988.

Bean, Bob, "SMOBC : A Fabrication Point of View," Circuits Manufacturing, March, 1985.

Bello, David C., "Preventing Wave Solder Defects," Printed Circuit Fabrication, November, 1992.

Bernier, D., "The Effect of Metallic Impurities on the Wetting Properties of Solder," Technical Report of Kester Solder Company, Chicago, Illinois, USA.

Brous, Jack, "Detecting Flux Residues Caused by Electrochemical Migration," Electronic Engineer, March, 1993.

Bulwith, Ronald A., "The Rough or Grainy Solder Phenomenon," Printed Circuit Fabrication, October, 1986.

Bush, Gerry, "Selective Solder Coating and Hot Air Leveling: Mystery or Science?," Printed Circuit Fabrication, October, 1985.

Cardenas, Odi, "Solder Station One Incorporated," Printed Circuit Fabrication, October, 1989.

Coombs, Clyde F., Jr, "Printed Circuit Handbook," 2nd edition, McGraw - Hill Book Company, 1988.

Finney, Jame L., "3 Ways to Solder Level," Circuits Manufacturing, March, 1985.

Fishfeld, Albert, "Hot Air Leveling," Printed Circuit Fabrication, October, 1984.

Flatt, Michael, "Printed Circuit Board Basics," 2nd editor, Miller Freeman Inc., San Francisco & Atlanta, 1992.

Goodell, Sherry, "What's New in Solder Leveling," paper presented at IPC 31st Annual Meeting, Hollywood, Florida, April, 1988.

_____"Hot Air Leveling_Surface Mount Pads and Assembly Processes," paper presented at IPC Fall Meeting, San Diego, CA, October, 1990.

Green, Bruce, "Increasing PCB Solderability," Printed Circuit Fabrication, March, 1989.

Hagge, John K., and Gareth J. Devis, "Aging Solder Thickness and Solder Alloy Effects on Circuit Board Solderability," Printed Circuit Fabrication, 1984.

Hatfield, D., "Automation in Hot Air Leveling," Printed Circuit Fabrication, October, 1985.

IPC - R - 700C, " Suggested Guide - lines for Modification, Rework and Repair of Printed Boards and Assemblies," Institute of Interconnecting and Packaging Electronic Circuits, Lin Colnwood, Illinois.

IPC - TM - 650, "Test Methods Manual," Institute for Interconnecting and Packaging Electronic Circuits, 1973.

Keeler,Robert, "Solder Coating and Leveling Improves PC Board Solderability," Electronic Packaging & Production, February, 1985/79.

Langer, Theo, and Torsten Reckert, " A Solder Ball Study, Part 1," Printed Circuit Fabrication, November, 1992.

_____, and Torsten Reckert, " A Solder Ball Study, Part 2," Printed Circuit Fabrication, December, 1992.

_____, and Torsten Reckert, " A Solder Ball Study, Part 3," Printed Circuit Fabrication, January, 1993.

Leung, T.P., "Troubleshooting Guide Lines,", Presented at Elec & Eltek Multilayer PCB Ltd., Hong Kong, November,1990.

Liyanage, Nimal, "Surface Preparation for Selective Solder Coating," Printed Circuit Fabrication, October, 1984.

_____"Solder Leveling of Surface Mount Boards," Printed Circuit Fabrication, Vol. 10 no. 10, October, 1987.

_____"Hot - Air Leveling & Future Trend in Board Fabrication," Proceeding of the Technical Seminar "The Lastest Electronics and Surface Mount Soldering Technologies," jointly organized by Alpha Metals Ltd, and Better-Pro Co., Ltd., March, 1993.

Luger, George F., and William A. Stubblefield, "Artificial Intelligence and the Design of Expert System," Benjamin / Cummings Publishing, 1989.

Lund, Preben, " Quality Assessment of Printed Circuit Boards," Bishop Graphics Inc, 1985.

Manko, Howard H., "Soldering Troubleshooting and Corrective Measures," Solder Research and Development, Alpha Metals, Inc., Jersey city, New Jersey.

Maxwell, John, "Surface - Mount Zero Defect Design Check List,", Electronics Engineer, April, 1992.

McGregor, David R., Robert B. Huii, Jr., and Richard N. Petersen, "Solder Mask and SMT

Preben Lung, and Radiometer A/S, "Specification for Double - Sided Plated - Through Boards," Prepared by the danish PCB Users' Group, Teknisk Forlag A/S, 1989.

"Process Effects Handsbook Case Histories Manual," Developed by the Process Effects Committee of IPC, Institute of Printed Circuits, Evanston, Illinois.

"S.C.L. Process," P.C.B. Center (Thailand) Co, Ltd., Chonburi, Thailand, 1993.

Scarlett, J.A., "The Multilayer Printed Circuit Board Handbook," McGraw - Hill, 1985.

Schneider, Alvin F., "New - Wave Fluxes," Circuits Manufacturing, June, 1987.

_____"Wave Soldering Flux Developments and Trends," Printed Circuit Assembly, Vol. 2, no. 2, February, 1988.

Simmons, Mark, "Automated Hot - Air Leveling," Printed Circuit Fabrication Asia , vol 2, no. 3, Autumn, 1994.

"Solder Coated Leveling (S.C.L.)," Elec & Eltek (Thailand) Ltd., Pathumthani, Thailand, 1991

"Solder Coat Leveling," Manufacturing Standard Procedure, Elec & Eltek Multilayer PCB Ltd., Hong Kong, 1991.

Stone, Frank E., "Solder Stripping," Printed Circuit Fabrication, April, 1987.

Sulzberg, Theodore, Fred Shubert, and W. Darlene Brewster, "The Relationship of Cleaning Copper to Solder Leveling," Printed Circuit Fabrication, October, 1986.

The Staff of National Technology, "The Language of Printed Circuits," Printed Circuit Fabrication, July, 1982.

Thwaites, C.J., "Soft - Soldering Handbook," International Tin Research Institute, I.T.R.I. Publication no. 533, January, 1982.

"Troubleshooting Guide for Vertical Solder Coated Leveling Process," Elec & Eltek (Thailand) Ltd., Pathumthani, Thailand, 1991.

Waclawsky, Dan, "Building Solderability into PWBs," Printed Circuit Fabrication, October, 1985.

Woodgate, Ralph, " The Phantom Plague?," Printed Circuit Fabrication, December, 1992.

_____"A guide to Defect-Free Soldering," Miller Freeman Books, San Francisco, 1993.

Yin, Chan Chi, "Solder Coated Leveling in the Merit Plant," presented at, Elec & Eltek (Hong Kong) Co., Ltd, November, 1990.

# ภาคผนวก ก

# รายละเอียดของโปรแกรมระบบผู้เชี่ยวชาญ สำหรับการแก้ปัญหาของกระบวนการชุบเคลือบโลหะผสม ในแนวดิ่ง ของแผ่นวงจรพิมพ์

## ข้อมูลของไฟล์ข้อมูล VSCL.tkb

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        (@SUBCLASSES=
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        )
        (@PROPERTIES=
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)
(@CLASS=        The_hole_size_is_smaller_than_the_required_size_since_before_SCL_proc\
```

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ess
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ape_off
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ted_circuit_boaard_after_SCL
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```

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```

```
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ing_section_in_the_pretreatment_machine
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_solution
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```

```
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(@OBJECT=       The_clamp_of_guide_rail_is_improperly_locked_with_the_machine
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```

```
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(@OBJECT=    The_copper_thickness_in_hole_wall_is_very_thin
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(@OBJECT=    The_copper_thickness_of_this_lot_is_in_the_control_range
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```

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fication_of_machine
```

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ification_of_machine
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r
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                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_drilled_hole_is_smaller_than_the_required_size_before_pass_SCL_p\
rocess
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_dull_area_is_found_like_the_fog_after_pass_the_post_treatment_ma\
chine
        (@PROPERTIES=
```

```
                Value     @TYPE=Boolean;
        )
)

(@OBJECT=       The_fitting_between_air_knive_and_pipe_is_loosen
        (@PROPERTIES=
                Value     @TYPE=Boolean;
        )
)

(@OBJECT=       The_flux_density_is_not_in_its_required_specification_base_on_the_ty\
pe_of_flux_which_are_using
        (@PROPERTIES=
                Value     @TYPE=Boolean;
        )
)

(@OBJECT=       The_flux_density_is_not_in_their_required_specification_base_on_the_\
type_of_flux_that_using
        (@PROPERTIES=
                Value     @TYPE=Boolean;
        )
)

(@OBJECT=       The_flux_have_not_covered_all_the_melten_solder_surface
        (@PROPERTIES=
                Value     @TYPE=Boolean;
        )
)

(@OBJECT=       The_flux_pump_is_not_working_properly
        (@PROPERTIES=
                Value     @TYPE=Boolean;
        )
)
```

```
(@OBJECT=       The_free_distance_between_board_and_guide_rail_in_millimeter_for_eac\
h_side_is_larger_than_one_and_half_millimeter
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_glass_fiber_is_seperated_from_the_resin_at_the_weave_intersectio\
n_after_SCL
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_glass_fiber_is_seperated_from_the_resin_at_the_weave_intersectio\
n_after_SCL_process
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_glue_residues_still_remained_on_Gold_finger_area
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_hanger_and_guide_rail_is_loosen_or_warpage_or_twist
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_hanger_can_move_left_or_right_side_more_than_1_centimeter
```

```
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_height_of_Solder_on_SMT_pad_is_not_smooth_and_leveling_after_SCL
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_high_pressure_air_vessel_have_too_much_condensated_water
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_hole_is_dull_before_pass_through_the_SCL_process
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_hole_size_is_smaller_than_required_size_since_before_SCL_process
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_hole_void_have_been_found_after_the_1_time_pass_microetching_bef\
ore_SCL
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)
```

```
(@OBJECT=       The_hole_void_have_been_found_before_pass_the_microetching_solution
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_hole_wall_is_dull_after_SCL
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_hole_wall_of_plated_slot_is_peeled_off_after_SCL
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_inside_of_hole_is_not_changed_any_color_after_pass_the_pretreatm\
ent_process
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_layer_of_laminate_is_not_coated_with_the_flux_before_SCL_process
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_leveling_air_pressure_is_higher_than_3_kg_per_square_centimeter
        (@PROPERTIES=
                Value    @TYPE=Boolean;
```

```
        )
)

(@OBJECT=       The_leveling_air_pressure_is_more_4_kg_per_square_centimeter
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_leveling_of_solder_is_not_equal_in_all_areas_of_board
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_leveling_of_solder_is_not_equal_in_all_areas_of_board_after_SCL
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_locked_screw_for_the_air_knives_is_loosen
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_melten_solder_have_been_covered_with_the_old_flux
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_melten_solder_surface_have_been_blowed_with_the_high_pressure_ai\
r_for_too_long_time_which_oxidize_the_solder_with_air_created_the_solder_ball
```

```
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_microetching_solution_is_already_at_the_end_of_service_life
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_micro_etching_solution_cannot_clean_the_oxide_on_boards
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_molten_solder_has_coated_a_surface_and_then_receded_leaving_irre\
gularly_shaped_mounds_of_solder_seperated_by_areas_covered_with_a_thin_solder_fi\
lm_basis_metal_is_not_exposed
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_molten_solder_has_coated_a_surface_and_then_receded_leaving_irre\
gularly_shaped_mounds_of_solder_seperated_by_areas_covered_with_a_thin_solder_fi\
lm_basis_metal_is_not_exposed_after_SCL
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_operating_parameters_of_heat_sealing_machine_is_not_operated_acc\
ording_to_the_process_instruction
```

```
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_pad_surface_is_dull_after_SCL
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_pH_of_flux_is_changed
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_pH_of_flux_is_changed_from_its_specification_base_on_the_type_of\
_flux_which_is_using
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_ratio_of_Tin_and_Lead_is_not_in_the_ratio_of_63_and_37
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_red_tape_is_peel_off_during_air_leveling_blow
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)
```

```
(@OBJECT=       The_residue_of_flux_is_found_on_Gold_finger_area_after_peel_the_red_\
tape_off
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_resin_is_separated_from_the_glass_fiber_at_the_weave_intersectio\
n_position
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_sealing_machine_is_not_set_according_to_the_process_instruction
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_size_of_hole_is_smaller_than_the_required_size_after_SCL
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_small_sphere_of_solder_adhering_to_a_laminate_or_resist_or_condu\
ctor_surface
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_small_via_hole_is_blocked_with_the_ait_bubble
```

```
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_solder_circulating_pump_is_not_working_properly
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_solder_flow_at_the_solder_pot__is_not_smooth
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_solder_layer_is_very_thick
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_solder_level_is_thicker_than_the_requirment
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_solder_mask_ink_is_in_the_hole
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)
```

```
(@OBJECT=       The_solder_mask_surface_is_still_sticky
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_Solder_pot_has_a_lot_of_dross_on_the_Solder_surface
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_solder_pot_have_been_contained_with_the_other_metals_as_Gold_or_\
Nickel
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_solder_pot_temperature_is_higher_than_260
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_solder_pot_temperature_is_higher_than_260_c
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_solder_pot_temperature_is_lower_than_220_c
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
```

```
)

(@OBJECT=       The_solder_spread_across_the_board
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_solder_surface_is_not_rough
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_solder_surface_is_similar_as_the_water_tear
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_solder_surface_which_blocked_in_hole_is_not_rough
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_solder_temperature_is_higher_than_230_degree_centicate
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_solder_thickness_is_thicker_than_the_requirment
        (@PROPERTIES=
                Value    @TYPE=Boolean;
```

```
        )
)

(@OBJECT=       The_solder_thickness_is_thinner_than_the_requirment
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_solution_is_used_over_the_service_life
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_spacing_between_Board_and_air_knives_of_each_side_is_different
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_spray_bar_of_flux_is_blocked_in_some_section
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_squeegee_roller_is_not_rotated_during_the_board_passing_through_\
the_roller_gap
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_squeegee_roller_of_pretreatment_machine_is_not_properly_sit_in_t\
```

```
he_groove_position
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_surface_of_air_knives_is_not_smooth
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_tarnish_or_oxide_still_remain_after_pass_the_microetching_soluti\
on_section
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_Tin_content_is_lower_than_62_percent
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_tooling_hole_of_board_is_at_the_center_of_board
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_twist_board_in_percentage_for_double_side_board_is_more_than_one\
_and_half
        (@PROPERTIES=
                Value    @TYPE=Boolean;
```

```
        )
)

(@OBJECT=       The_uneven_solder_happen_in_the_same_location
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_uneven_solder_thickness_is_occured_in_the_same_direction
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_upward_speed_is_longer_than_four_and_half_second
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_upward_speed_is_set_faster_than_one_and_half_second
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_upward_time_is_shorter_than_one_and_half_second
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_using_flux_can_distort_the_solder_mask_surface_and_find_the_whit\
e_color_ring_around_the_pad
```

```
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_using_flux_is_the_strong_activity_type
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       The_white_strain_is_found_on_the_pad
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       Thick_solder_thickness
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       Thin_solder_thickness
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       Too_thick_solder_problem
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)
```

```
(@OBJECT=       Too_thick_solder_thickness_problem
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       Too_thin_solder_thickness_defect
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       Too_thin_solder_thickness_problem
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       Uneven_solder
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       We_can_see_the_copper_expose_on_pad
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       We_can_see_the_copper_expose_on_pad_or_ground_area_after_SCL
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)
```

```
(@OBJECT=       We_can_see_the_Copper_in_hole_after_SCL
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@OBJECT=       We_still_can_see_the_Copper_in_some_holes_after_SCL
        (@PROPERTIES=
                Value    @TYPE=Boolean;
        )
)

(@META=         All_area_or_some_area_of_board_are_dull.Value
        @PROMPT="Are all area or some area of board dull?";
        @QUESTWIN="Mahin1.win";
)

(@META=         All_holes_or_some_rows_of_holes_in_the_same_direction_are_dull.Value
        @PROMPT="Are all holes or some rows of hole in the same direction dull?";
        @QUESTWIN="Mahin1.win";
)

(@META=         All_or_some_slot_hole_walls_are_peel_off_after_SCL_process.Value
        @PROMPT="Are all or some slot hole wall peel off after SCL process?";
        @QUESTWIN="Mahin1.win";
)

(@META=         A_lot_of_glue_residue_remain_on_the_Gold_finger_after_peel_the_red_tap\
e_off.Value
        @PROMPT="Does a lot of glue residue remain on the Gold finger after peel off the red tape?";
        @QUESTWIN="Mahin1.win";
)

(@META=         Block_hole.Value
```

```
        @QUESTWIN="End.ConclusionField";
)

(@META=         Cu_expose_in_hole.Value
        @QUESTWIN="End.ConclusionField";
)

(@META=         Cu_expose_on_pad_or_ground_area.Value
        @QUESTWIN="Mahin1.win";
)

(@META=         Damage_board.Value
        @QUESTWIN="Mahin1.win";
)

(@META=         Decoloration_gold.Value
        @QUESTWIN="Mahin1.win";
)

(@META=         Delamination.Value
        @QUESTWIN="Mahin1.win";
)

(@META=         Dewetting.Value
        @QUESTWIN="Mahin1.win";
)

(@META=         Excess_solder.Value
        @QUESTWIN="Mahin1.win";
)

(@META=         Glue_residue_on_gold.Value
        @QUESTWIN="Mahin1.win";
)
```

```
(@META=        Have_the_grease_or_dirt_or_rainbow_on_the_board_after_pass_the_pretrea\
tment_process.Value
        @PROMPT="Do the grease or dirt or rainblow contamination remain on the board after pass the
pretreatment machine?";
        @QUESTWIN="Mahin1.win";
)

(@META=        Have_the_shine_copper_surface_on_that_area.Value
        @PROMPT="Doesn't the Copper surface has the Solder mask smear on that area and after pass the
pretreatment process that area isn't changed the color?";
        @QUESTWIN="Mahin1.win";
)

(@META=        Hole_undersize.Value
        @QUESTWIN="Mahin1.win";
)

(@META=        Hole_void.Value
        @QUESTWIN="End.ConclusionField";
)

(@META=        Inside_The_hole_we_can_find_the_same_color_as_solder_mask_ink_that_usi\
ng_in_the_plant.Value
        @PROMPT="Can we find the same color as Solder Mask ink that using in the plant inside the hole?";
        @QUESTWIN="Mahin1.win";
)

(@META=        Non_perpendicular_board_to_solder_pot.Value
        @PROMPT="Isn't the board perpendicular with the solder pot?";
        @QUESTWIN="Mahin1.Win";
)

(@META=        Non_wetting.Value
        @QUESTWIN="Mahin1.win";
)
```

```
(@META=         No_water_is_found_after_peel_the_red_tape_off.Value
        @PROMPT="Isn't the water found after peel the red tape off?";
        @QUESTWIN="Mahin1.win";
)

(@META=         On_Gold_finger_area_have_some_brown_or_white_residue_before_or_after_p\
assed_SCL_process.Value
        @PROMPT="Have the brown or white residue found on the Gold finger area before and/or after
passed SCL process?";
        @QUESTWIN="Mahin1.win";
)

(@META=         Plate_slot_peel_off.Value
        @QUESTWIN="Mahin1.win";
)

(@META=         Solder_ball.Value
        @QUESTWIN="Mahin1.win";
)

(@META=         Solder_ball_is_on_and_around_the_solder_pot.Value
        @PROMPT="Is Solder ballin or around the Solder pot?";
        @QUESTWIN="Mahin1.win";
)

(@META=         Solder_residue_inside_air_knives.Value
        @PROMPT="Have some solder residues inside the air knives?";
        @QUESTWIN="Mahin1.win";
)

(@META=         Solder_sticked_on_the_guide_rail.Value
        @PROMPT="Have any solder been sticked in the guide rail?";
        @QUESTWIN="mahin1.win";
)
```

```
(@META=          Some_area_of_pad_is_not_changed_to_the_pink_color_after_pass_the_pretr\
eatment_process.Value
        @PROMPT="Isn't any area of pad changed to the pink color after pass through the pretreatment
process?";
        @QUESTWIN="Mahin1.win";
)

(@META=          Some_area_on_board_still_remain_the_oxide.Value
        @PROMPT="Have some area remained the oxide after pass the pretreatment process?";
        @QUESTWIN="Mahin1.win";
)

(@META=          Some_spray_nozzless_have_not_the_same_pattern_flow_with_another.Value
        @PROMPT="Haven't some spray nozzles the same pattern flow with another?";
        @QUESTWIN="Mahin1.win";
)

(@META=          Some_spray_nozzles_have_been_blocked.Value
        @PROMPT="Have some spray nozzles in microetching section of pretreatment machine been
blocked?";
        @QUESTWIN="Mahin1.win";
)

(@META=          Some_spray_nozzle_are_not_the_FAN_type.Value
        @PROMPT="Aren't some spray nozzles the FAN type?";
        @QUESTWIN="Mahin1.win";
)

(@META=          The_air_knife_angle_of_pretreatment_section_is_not_correct.Value
        @PROMPT="Isn't the air knife angle of pretreatment section correct?";
        @QUESTWIN="Mahin1.win";
)

(@META=          The_air_knife_gap_is_not_enough.Value
```

```
        @PROMPT="Isn't the air knife gap equal?";
        @QUESTWIN="Mahin1.win";
)

(@META=     The_air_knives_angle_is_wrong_compare_with_the_specification_of_machin\
e.Value
        @PROMPT="Is the air knife angle set in the wrong angle, compare with the machine manual?";
        @QUESTWIN="Mahin1.win";
)

(@META=     The_air_knives_is_misalignment.Value
        @PROMPT="Is the air knives misalign compared with the original specification in the machine
manual?";
        @QUESTWIN="Mahin1.win";
)

(@META=     The_air_knives_is_too_dirty_with_flux_and_solder_residues.Value
        @PROMPT="Is the air knives too dirty by the flux or solder residues?";
        @QUESTWIN="Mahin1.win";
)

(@META=     The_air_pressure_is_set_lower_than_one_and_half_kg_per_squarecentimete\
r.Value
        @PROMPT="Is the air pressure set lower than 1.5 kg/cm^2?";
        @QUESTWIN="Mahin1.win";
)

(@META=     The_air_temperature_is_higher_than_220_c.Value
        @PROMPT="Is the air temperature higher than 240 c.?";
        @QUESTWIN="Mahin1.win";
)

(@META=     The_air_temperature_is_lower_than_190_c.Value
        @PROMPT="Is the air temperature lower than 190 c.?";
        @QUESTWIN="Mahin1.win";
```

```
)

(@META=        The_angle_of_air_knives_compare_with_the_board_is_less_than_the_specif\
ication_of_machine.Value
        @PROMPT="Is the angle of air knives less than the specification of machine?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_appearance_of_shape_of_solder_in_hole_is_random.Value
        @PROMPT="Is the appreance of solder found in the random shape?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_blocked_hole_happen_in_the_same_row_as_the_upward_direction.Value
        @PROMPT="Are the blocked holes found in the same direction of upward direction of board as the
row?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_blocked_hole_is_occured_in_the_random_area.Value
        @PROMPT="Is the blocked hole occured in the random area?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_board_after_pass_the_microetching_solution_is_still_remained_the_o\
xide.Value
        @PROMPT="Is the board after pass the microetching solution still remained the oxide?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_board_has_not_been_covered_with_the_flux_before_SCL_process.Value
        @PROMPT="Hasn't the board been coated with the flux before SCL process?";
        @QUESTWIN="Mahin1.win";
)
```

```
(@META=         The_board_is_kept_in_the_wet_or_high_humidity_area.Value
        @PROMPT="Are the boards kept in the wet or high humidity area?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_board_is_not_completely_dried_before_pass_through_the_flux_coverin\
g_section_in_the_pretreatment_machine.Value
        @PROMPT="Isn't the board completely dried before pass through the flux coating section in the
pretreatment machine?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_board_is_not_flat_when_it_lay_on_the_smooth_table.Value
        @PROMPT="Isn't the board flat when it lay on the smooth table?";
        @QUESTWIN="mahin1.win";
)

(@META=         The_board_is_not_hot_after_pass_this_machine.Value
        @PROMPT="Isn't the board hot after pass this machine?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_board_is_reworked_the_SCL_process_by_pass_again_the_microetching_s\
olution.Value
        @PROMPT="Is the reworking board passed through the microetching solution again?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_board_is_reworked_without_let_the_temperature_of_board_cool_down_t\
o_the_normal_temperature.Value
        @PROMPT="Is the board reworked without let it cool down to the normal temperature?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_board_warpage_is_more_than_one_and_half_percentage.Value
```

```
        @PROMPT="Is the board warpage more than 1.5 %?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_burnt_flux_have_flood_over_the_solder_pot.Value
        @PROMPT="Have the burnt flux flooded over the solder pot?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_clamp_of_guide_rail_is_improperly_locked_with_the_machine.Value
        @PROMPT="Is the clamp of guide rail improperly locked with the machine?";
        @QUESTWIN="Mahin1.Win";
)

(@META=        The_color_of_flux_is_changed_from_its_specification_base_on_the_type_o\
f_flux_which_is_using.Value
        @PROMPT="Is the using color of flux changed from the original color?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_color_of_hole_is_black_after_pass_through_the_pretreatment.Value
        @PROMPT="Is the color of hole black after pass through the pretreatment?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_copper_is_blocked_in_the_hole_Before_do_SCL.Value
        @PROMPT="Is the copper blocked the hole befor SCL?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_copper_thickness_in_hole_wall_is_very_thin.Value
        @PROMPT="Is the copper thickness in hole very thin?";
        @QUESTWIN="Mahin1.win";
)
```

```
(@META=        The_copper_thickness_of_this_lot_is_in_the_control_range.Value
        @PROMPT="Is the copper thickness of this lot in the control range?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_dipping_time_for_the_board_which_has_the_small_via_hole_is_less_th\
an_one_and_half_second.Value
        @PROMPT="Is the dipping time of the small via hole board set less than 1.5 sec.?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_dipping_time_in_the_solder_pot_is_longer_than_6_seconds.Value
        @PROMPT="Is the dipping time of board in the Solder pot longer than 6.0 sec.?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_dipping_time_is_longer_than_6_seconds.Value
        @PROMPT="Is the dipping time longer than 6 sec.?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_dipping_time_is_shorter_than_1_second.Value
        @PROMPT="Is the dipping time shorter than 1 sec.?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_direction_of_board_which_is_loaded_in_to_the_machine_is_arranged_T\
he_Gold_finger_row_in_parallel_line_with_the_air_knives.Value
        @PROMPT="Is the Gold finger row of board loaded in the direction which parallel with the air
knives?";
        @QUESTWIN="Mahin1.Win";
)

(@META=        The_distance_between_gold_finger_row_to_the_solder_pad_is_less_than_4_\
millimeter.Value
```

```
        @PROMPT="Is the distance between the Gold finger row and Solder pads less than 4.0 m.m.?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_distance_between_the_board_and_air_knives_is_less_than_the_specifi\
cation_of_machine.Value
        @PROMPT="Is the distance between the board and air knives less than the specification of machine?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_distance_between_the_board_and_air_knives_is_wider_than_the_specif\
ication_of_machine.Value
        @PROMPT="Is the distance between the board and air knives wider than the machine specification?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_distance_of_the_board_and_air_knives_is_larger_than_3_millimeter.V\
alue
        @PROMPT="Is the distance of board and air knives larger than 3 mm. for both sides?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_distance_of_the_board_and_air_knives_is_smaller_than_3_millimeter.\
Value
        @PROMPT="Is the distance of board and air knives smaller than 3 mm?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_drilled_hole_is_smaller_than_the_required_size_before_pass_SCL_pro\
cess.Value
        @PROMPT="Is the drilled hole smaller than the required size before pass SCL process?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_dull_area_is_found_like_the_fog_after_pass_the_post_treatment_mach\
```

```
ine.Value
        @PROMPT="Is the dull area found like the fog after pass the post treatment machine?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_fitting_between_air_knive_and_pipe_is_loosen.Value
        @PROMPT="Is the fitting which used to lock the air knives and air pipe loosen?";
        @QUESTWIN="Mahin1.Win";
)

(@META=         The_flux_density_is_not_in_its_required_specification_base_on_the_type\
_of_flux_which_are_using.Value
        @PROMPT="Isn't the density of flux in its operating range, base on the using flux specification?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_flux_density_is_not_in_their_required_specification_base_on_the_ty\
pe_of_flux_that_using.Value
        @PROMPT="Isn't the flux density in its required specification, based on the type of using flux?";
        @QUESTWIN="Mahin1.win";
        @FORMAT="Isn't the flux density in its required specification, based on the type of using flux?";
)

(@META=         The_flux_have_not_covered_all_the_melten_solder_surface.Value
        @PROMPT="Hasn't the flux covered all melten Solder surface?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_flux_pump_is_not_working_properly.Value
        @PROMPT="Isn't the flux pump working properly?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_free_distance_between_board_and_guide_rail_in_millimeter_for_each_\
side_is_larger_than_one_and_half_millimeter.Value
```

```
        @PROMPT="Is the free distance between the edge of board to each side of guide rail more than 1.5
m.m.?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_hanger_and_guide_rail_is_loosen_or_warpage_or_twist.Value
        @PROMPT="Have the hanger and/or guide rail the problem ; Looseness, Warpage or Twist?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_hanger_can_move_left_or_right_side_more_than_1_centimeter.Value
        @PROMPT="Can the hanger swing from the left to right side more than 1 cm.?";
        @QUESTWIN="Mahin1.Win";
)

(@META=         The_high_pressure_air_vessel_have_too_much_condensated_water.Value
        @PROMPT="Is the condensated water inside the high pressure air vessel higher than 1/5 of the
capacity of vessel?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_hole_is_dull_before_pass_through_the_SCL_process.Value
        @PROMPT="Are the holes dull before pass through the pretreatment machine or SCL machine?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_hole_size_is_smaller_than_required_size_since_before_SCL_process.V\
alue
        @PROMPT="Has the hole size is smaller than the requied size been found since before SCL
process?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_hole_void_have_been_found_after_the_1_time_pass_microetching_befor\
e_SCL.Value
```

```
        @PROMPT="Is the hole void found after pass through the microetching solution at first round before
SCL?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_hole_void_have_been_found_before_pass_the_microetching_solution.Va\
lue
        @PROMPT="Is the hole void found before pass the microetching solution?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_inside_of_hole_is_not_changed_any_color_after_pass_the_pretreatmen\
t_process.Value
        @PROMPT="Isn't the inside of hole changed any color after pass the pretreatment process?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_laminate_is_still_wet.Value
        @PROMPT="Is the laminate still wet?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_layer_of_laminate_is_not_coated_with_the_flux_before_SCL_process.V\
alue
        @PROMPT="Isn't the layer og board coated with the flux before SCL process?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_leveling_air_pressure_is_higher_than_3_kg_per_square_centimeter.Va\
lue
        @PROMPT="Is the leveling air pressure higher than 3 kg/cm^2?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_leveling_air_pressure_is_more_4_kg_per_square_centimeter.Value
```

```
        @PROMPT="Is the leveling air pressure set higher than 4 kg/cm^2?";
        @QUESTWIN="Mahin1.win";
)

(@META=     The_locked_screw_for_the_air_knives_is_loosen.Value
        @PROMPT="Is the locked screws for the air knives loosen?";
        @QUESTWIN="Mahin1.Win";
)

(@META=     The_melten_solder_have_been_covered_with_the_old_flux.Value
        @PROMPT="Have the melten Solder surface been covered with the old flux?";
        @QUESTWIN="Mahin1.win";
)

(@META=     The_melten_solder_surface_have_been_blowed_with_the_high_pressure_air_\
for_too_long_time_which_oxidize_the_solder_with_air_created_the_solder_ball.Valu\
e
        @PROMPT="Have the melten Solder surface been blown with the high pressure air for too long time
during idle time?";
        @QUESTWIN="Mahin1.win";
)

(@META=     The_microetching_solution_is_already_at_the_end_of_service_life.Value
        @PROMPT="Is the microetching solution already at the end of the service life?";
        @QUESTWIN="Mahin1.win";
)

(@META=     The_micro_etching_solution_cannot_clean_the_oxide_on_boards.Value
        @PROMPT="Cann't the microetching solution totally clean the oxide on board at the normal operation
of the process?";
        @QUESTWIN="Mahin1.win";
)

(@META=     The_operating_parameters_of_heat_sealing_machine_is_not_operated_accor\
ding_to_the_process_instruction.Value
```

```
        @PROMPT="Aren't the operating parameters of heat sealing machine operated according to the
process instruction?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_pH_of_flux_is_changed.Value
        @PROMPT="Is the pH of flux changed from its operating specification";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_pH_of_flux_is_changed_from_its_specification_base_on_the_type_of_f\
lux_which_is_using.Value
        @PROMPT="Is the pH of flux changed and out of the operating control range?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_ratio_of_Tin_and_Lead_is_not_in_the_ratio_of_63_and_37.Value
        @PROMPT="Isn't the ratio of  Tin/Lead in the ratio of 63/37?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_red_tape_is_peel_off_during_air_leveling_blow.Value
        @PROMPT="Is the red tape peeled off during the board is processing in the hot air leveling blow?";
        @QUESTWIN="Mahin1.Win";
)

(@META=         The_residue_of_flux_is_found_on_Gold_finger_area_after_peel_the_red_ta\
pe_off.Value
        @PROMPT="Is the flux residue found on Gold finger area after peel off the red tape?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_resin_is_separated_from_the_glass_fiber_at_the_weave_intersection_\
position.Value
        @PROMPT="Is the resin separated from the glass fibre at the weave intersection position?";
```

```
        @QUESTWIN="Mahin1.win";
)

(@META=         The_sealing_machine_is_not_set_according_to_the_process_instruction.Va\
lue
        @PROMPT="Isn't the sealing machine operated under the operating parameter of process
instruction?";
        @QUESTWIN="Mahin1.Win";
)

(@META=         The_small_via_hole_is_blocked_with_the_ait_bubble.Value
        @PROMPT="Is the small via hole blocked with the air bubble?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_solder_circulating_pump_is_not_working_properly.Value
        @PROMPT="Isn't the solder circulating pump working properly?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_solder_flow_at_the_solder_pot__is_not_smooth.Value
        @PROMPT="Isn't the solder flow in the solder pot smooth?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_solder_layer_is_very_thick.Value
        @PROMPT="Is the solder layer very thick?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_solder_mask_ink_is_in_the_hole.Value
        @PROMPT="Has the solder mask ink blocked in the hole before SCL?";
        @QUESTWIN="Mahin1.win";
)
```

```
(@META=        The_solder_mask_surface_is_still_sticky.Value
        @PROMPT="Is the solder mask still sticky?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_solder_mask_surface_is_still_wet.Value
        @PROMPT="Is the Solder Mask surface still wet?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_Solder_pot_has_a_lot_of_dross_on_the_Solder_surface.Value
        @PROMPT="Does the Solder pot have a lot of dross on the Solder surface?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_solder_pot_have_been_contained_with_the_other_metals_as_Gold_or_Ni\
ckel.Value
        @PROMPT="Have the solder pot been contained with the other metals such as Gold , Nickel or etc.?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_solder_pot_temperature_is_higher_than_260.Value
        @PROMPT="Is the solder pot temperature higher than 260 c.?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_solder_pot_temperature_is_higher_than_260_c.Value
        @PROMPT="Is the solder pot temperature higher than 260 c.?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_solder_pot_temperature_is_lower_than_220_c.Value
        @PROMPT="Is the solder pot temperature lower than 220 c.?";
        @QUESTWIN="Mahin1.win";
)
```

```
(@META=         The_solder_spread_across_the_board.Value
        @PROMPT="Do the solder spread across the board?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_solder_surface_is_not_rough.Value
        @PROMPT="Isn't the solder surface rough?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_solder_surface_is_similar_as_the_water_tear.Value
        @PROMPT="Is the solder surface similar as the water tear?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_solder_surface_which_blocked_in_hole_is_not_rough.Value
        @PROMPT="Isn't the solder surface which blocked in hole rough?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_solder_temperature_is_higher_than_230_degree_centicate.Value
        @PROMPT="Is the solder temperature higher than 230 c?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_solution_is_used_over_the_service_life.Value
        @PROMPT="Is the microetching solution used over the service life?";
        @QUESTWIN="Mahin1.Win";
)

(@META=         The_spacing_between_Board_and_air_knives_of_each_side_is_different.Val\
ue
        @PROMPT="Is the spacing between the boards and each side of air knives different?";
        @QUESTWIN="Mahin1.win";
```

```
)

(@META=          The_speed_of_the_pretreatment_machine_is_higher_than_the_process_instr\
uction.Value
        @PROMPT="Is the speed of pretreatment machine set higher than the process instruction?";
        @QUESTWIN="Mahin1.win";
)

(@META=          The_spray_bar_of_flux_is_blocked_in_some_section.Value
        @PROMPT="Is the spray bar of flux blocked in any section?";
        @QUESTWIN="Mahin1.win";
)

(@META=          The_squeegee_roller_is_not_rotated_during_the_board_passing_through_th\
e_roller_gap.Value
        @PROMPT="Isn't the squeegee roller rotated during the board passing through the roller gap?";
        @QUESTWIN="Mahin1.win";
)

(@META=          The_squeegee_roller_of_pretreatment_machine_is_not_properly_sit_in_the\
_groove_position.Value
        @PROMPT="Isn't the squeegee roller of pretreatment machine sit properly in the groove position?";
        @QUESTWIN="Mahin1.win";
)

(@META=          The_surface_is_still_have_some_oxide_or_contaminant_on_board.Value
        @PROMPT="Is some Copper surface still remain some oxide or contamination on board after pass the
pretreatment process?";
        @QUESTWIN="Mahin1.win";
)

(@META=          The_surface_of_air_knives_is_not_smooth.Value
        @PROMPT="Isn't the surface of air knives smooth?";
        @QUESTWIN="Mahin1.win";
)
```

```
(@META=        The_tarnish_or_oxide_still_remain_after_pass_the_microetching_solution\
_section.Value
        @PROMPT="Is the tarnish or oxide still remain after pass through the microetching solution section?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_Tin_content_is_lower_than_62_percent.Value
        @PROMPT="Is the % Tin content in the solder pot lower than 62%?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_tooling_hole_of_board_is_at_the_center_of_board.Value
        @PROMPT="Isn't the tooling hole at the edge of board at the center location?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_twist_board_in_percentage_for_double_side_board_is_more_than_one_a\
nd_half.Value
        @PROMPT="Is the board warpage more than 1.5 %?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_uneven_solder_happen_in_the_same_location.Value
        @PROMPT="Do the uneven solder happen in the same location?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_uneven_solder_thickness_is_occured_in_the_same_direction.Value
        @PROMPT="Is the uneven solder thickness occured in the same location or side of boards?";
        @QUESTWIN="Mahin1.win";
)

(@META=        The_upward_speed_is_longer_than_four_and_half_second.Value
        @PROMPT="Is the upward time longer than 4.5 sec.?";
```

```
        @QUESTWIN="Mahin1.win";
)

(@META=         The_upward_speed_is_set_faster_than_one_and_half_second.Value
        @PROMPT="Is the upward time of board set faster than 1.5 sec.?";
        @QUESTWIN="mahin1.win";
)

(@META=         The_upward_time_is_shorter_than_one_and_half_second.Value
        @PROMPT="Is the upward speed shorter than 1.5 sec.?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_using_flux_can_distort_the_solder_mask_surface_and_find_the_white_\
color_ring_around_the_pad.Value
        @PROMPT="Can the flux distort the Solder Mask surface and find the white color ring around the
pad?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_using_flux_is_the_strong_activity_type.Value
        @PROMPT="Is the using flux the strong activity type?";
        @QUESTWIN="Mahin1.win";
)

(@META=         The_white_strain_is_found_on_the_pad.Value
        @PROMPT="Is the white strain found on the pad?";
        @QUESTWIN="Mahin1.win";
)

(@META=         Thick_solder_thickness.Value
        @QUESTWIN="Mahin1.win";
)

(@META=         Thin_solder_thickness.Value
```

```
        @QUESTWIN="Mahin1.win";
)

(@META=         Uneven_solder.Value
        @QUESTWIN="Mahin1.win";
)

(@META=         Webbing_solder.Value
        @QUESTWIN="Mahin1.win";
)
(@METHOD=       IfChange
        (@ATOMID=Damage_board;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("End.ConclusionField")      (@TYPE=FRM;@WAIT=TRUE;))
        )
)
(@METHOD=       Suggest
        (@ATOMID=Block_hole;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession")
        (@WAIT=TRUE;@ATOMID=SELF;@STRING="@SUGGEST";))
        )
)
(@METHOD=       Suggest
        (@ATOMID=Micro_etching_solution;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession") (@WAIT=TRUE;@STRING="@SUGGEST";))
        )
)
(@METHOD=       Suggest
        (@ATOMID=Cu_expose_on_pad_or_ground_area;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
```

```
        (@RHS=
                (Execute ("ControlSession") (@WAIT=TRUE;@STRING="@SUGGEST";))
        )
)
(@METHOD=    Suggest
        (@ATOMID=Cu_expose_in_hole;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession")
        (@WAIT=TRUE;@ATOMID=SELF;@STRING="@SUGGEST";))
        )
)
(@METHOD=    Suggest
        (@ATOMID=Damage_board;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession")
        (@WAIT=TRUE;@ATOMID=SELF;@STRING="@SUGGEST";))
        )
)
(@METHOD=    Suggest
        (@ATOMID=Decoloration_gold;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession") (@WAIT=TRUE;@STRING="@SUGGEST";))
        )
)
(@METHOD=    Suggest
        (@ATOMID=Delamination;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession") (@WAIT=TRUE;@STRING="@SUGGEST";))
        )
)
(@METHOD=    Suggest
```

```
        (@ATOMID=Dewetting;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession") (@WAIT=TRUE;@STRING="@SUGGEST";))
        )
)
(@METHOD=    Suggest
        (@ATOMID=Dull_hole;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession") (@WAIT=TRUE;@STRING="@SUGGEST";))
        )
)
(@METHOD=    Suggest
        (@ATOMID=Solder_ball;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession")
        (@WAIT=TRUE;@ATOMID=SELF;@STRING="@SUGGEST";))
        )
)
(@METHOD=    Suggest
        (@ATOMID=Excess_solder;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession")
        (@WAIT=TRUE;@ATOMID=SELF;@STRING="@SUGGEST";))
        )
)
(@METHOD=    Suggest
        (@ATOMID=Glue_residue_on_gold;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession") (@WAIT=TRUE;@STRING="@SUGGEST";))
        )
```

```
)
(@METHOD=     Suggest
        (@ATOMID=Hole_undersize;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession") (@WAIT=TRUE;@STRING="@SUGGEST";))
        )
)
(@METHOD=     Suggest
        (@ATOMID=Hole_void;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession")
        (@WAIT=TRUE;@ATOMID=SELF;@STRING="@SUGGEST";))
        )
)
(@METHOD=     Suggest
        (@ATOMID=Measling;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession")
        (@WAIT=TRUE;@ATOMID=SELF;@STRING="@SUGGEST";))
        )
)
(@METHOD=     Suggest
        (@ATOMID=Non_wetting;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession")
        (@WAIT=TRUE;@ATOMID=SELF;@STRING="@SUGGEST";))
        )
)
(@METHOD=     Suggest
        (@ATOMID=Plate_slot_peel_off;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
```

```
        (@RHS=
                (Execute ("ControlSession") (@WAIT=TRUE;@STRING="@SUGGEST";))
        )
)
(@METHOD=    Suggest
        (@ATOMID=Solder_on_Gold;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession")
        (@WAIT=TRUE;@ATOMID=SELF;@STRING="@SUGGEST";))
        )
)
(@METHOD=    Suggest
        (@ATOMID=Tarnish_pad;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession")
        (@WAIT=TRUE;@ATOMID=SELF;@STRING="@SUGGEST";))
        )
)
(@METHOD=    Suggest
        (@ATOMID=Thick_solder_thickness;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession")
        (@WAIT=TRUE;@ATOMID=SELF;@STRING="@SUGGEST";))
        )
)
(@METHOD=    Suggest
        (@ATOMID=Thin_solder_thickness;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession") (@WAIT=TRUE;@STRING="@SUGGEST";))
        )
)
```

```
(@METHOD=     Suggest
        (@ATOMID=Uneven_solder;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession") (@WAIT=TRUE;@STRING="@SUGGEST";))
        )
)
(@METHOD=     Suggest
        (@ATOMID=Webbing_solder;@TYPE=OBJECT;)
        (@FLAGS=PUBLIC;)
        (@RHS=
                (Execute ("ControlSession")
        (@WAIT=TRUE;@ATOMID=SELF;@STRING="@SUGGEST";))
        )
)


(@RULE=         R_1
        @INFCAT=100;
        (@LHS=
                (Yes    (The_appearance_of_shape_of_solder_in_hole_is_random))
                (Yes    (The_copper_is_blocked_in_the_hole_Before_do_SCL))
        )
        (@HYPO=         Block_hole)
        (@RHS=
                (Execute ("BlockHole.R_1")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Feedback the information to the plating pr\
ocess to take the corrective action,@OK";))
        )
)

(@RULE=         R_10
        @INFCAT=1000;
        (@LHS=
                (Yes    (The_air_temperature_is_lower_than_190_c))
```

```
            (Yes     (The_blocked_hole_is_occured_in_the_random_area))
        )
        (@HYPO=          Block_hole)
        (@RHS=
            (Execute ("BlockHole.R_10")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust the air temperature into the range \
190 - 220 c,@OK";))
        )
)

(@RULE=          R_10__1
        @INFCAT=1000;
        (@LHS=
            (Yes     (The_locked_screw_for_the_air_knives_is_loosen))
        )
        (@HYPO=          Improper_alignment_of_air_knives)
        (@RHS=
            (Execute ("BlockHole.R_5_10")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Retighten the locked screws after realignm\
ent the air knives angle,@OK";))
        )
)

(@RULE=          R_10__10
        @INFCAT=1000;
        (@LHS=
            (Yes     (All_holes_or_some_rows_of_holes_in_the_same_direction_are_dull))
            (Yes     (Some_spray_nozzle_are_not_the_FAN_type))
            (Yes     (Some_spray_nozzless_have_not_the_same_pattern_flow_with_another))
        )
        (@HYPO=          Dull_hole)
        (@RHS=
            (Execute ("DullHole.R_10") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Check
 the spray rinsing condition of the p\
 ost-treatmen machine.,@OK";))
```

```
        )
)

(@RULE=         R_10__11
        @INFCAT=1000;
        (@LHS=
                (Yes    (The_high_pressure_air_vessel_have_too_much_condensated_water))
        )
        (@HYPO=         Solder_ball)
        (@RHS=
                (Execute ("ExcessSD.R_9_10")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Drain the condensated water in the high pr\
essure air vessel for every 4 hours,@OK";))
        )
)

(@RULE=         R_10__12
        @INFCAT=1000;
        (@LHS=
                (Yes    (The_leveling_air_pressure_is_more_4_kg_per_square_centimeter))
                (Yes    (The_solder_spread_across_the_board))
        )
        (@HYPO=         Excess_solder)
        (@RHS=
                (Execute ("ExcessSD.R_10")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Reduce the leveling air pressure into the \
range 1.5 - 4.0 kg/cm^2,@OK";))
        )
)

(@RULE=         R_10__13
        @INFCAT=1000;
        (@LHS=
                (Yes
        (The_operating_parameters_of_heat_sealing_machine_is_not_operated_according_to_th\
```

```
e_process_instruction))
        )
        (@HYPO=         Glue_residue_on_gold)
        (@RHS=
                (Execute ("GlueonGold.R_10")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust the oprating parameters according t\
o the process instruction.,@OK";))
        )
)

(@RULE=         R_10__14
        @INFCAT=1000;
        (@LHS=
                (Yes    (The_upward_time_is_shorter_than_one_and_half_second))
                (Yes    (The_leveling_air_pressure_is_higher_than_3_kg_per_square_centimeter))
        )
        (@HYPO=         Hole_undersize)
        (@RHS=
                (Execute ("Undersize.R_10")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjut the upward time into the range 1.5 -\
 4.5 second,@OK";))
        )
)

(@RULE=         R_10__15
        @INFCAT=1000;
        (@LHS=
                (Yes
        (The_speed_of_the_pretreatment_machine_is_higher_than_the_process_instruction))
        )
        (@HYPO=         Hole_void)
        (@RHS=
                (Execute ("HoleVoid.R_10")(@TYPE=FRM;@WAIT=TRUE;))
        )
)
```

```
(@RULE=         R_10__16
        @INFCAT=1000;
        (@LHS=
                (Yes
        (The_board_is_reworked_without_let_the_temperature_of_board_cool_down_to_the_norm\
al_temperature))
        )
        (@HYPO=         Measling)
        (@RHS=
                (Execute ("Measling.R_10") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Let the
board cool down to the normal temp\
erature before rework for every case,@OK";))
        )
)

(@RULE=         R_10__17
        @INFCAT=1000;
        (@LHS=
                (Yes
        (The_tarnish_or_oxide_still_remain_after_pass_the_microetching_solution_section))
                (Yes    (The_microetching_solution_is_already_at_the_end_of_service_life))
        )
        (@HYPO=         Non_wetting)
        (@RHS=
                (Execute ("Nonwet.R_10")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Decrease the speed of microetching solutio\
n around 0.5 - 1.0 m/min.,@OK";))
        )
)

(@RULE=         R_10__18
        @INFCAT=1000;
        (@LHS=
                (Yes    (All_or_some_slot_hole_walls_are_peel_off_after_SCL_process))
```

```
        )
        (@HYPO=     Plate_slot_peel_off)
        (@RHS=
                (Execute ("SlotPeel.R_10")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Feedback the information to the plating pr\
ocess to take the corrective action.,@OK";))
        )
)

(@RULE=         R_10__19
        @INFCAT=1000;
        (@LHS=
                (Yes
        (The_direction_of_board_which_is_loaded_in_to_the_machine_is_arranged_The_Gold_fi\
nger_row_in_parallel_line_with_the_air_knives))
                (Yes    (The_leveling_air_pressure_is_higher_than_3_kg_per_square_centimeter))
        )
        (@HYPO=         Solder_on_Gold)
        (@RHS=
                (Execute ("SDonGold.R_10")          (@TYPE=FRM;@WAIT=TRUE;))
        )
)

(@RULE=         R_10__2
        @INFCAT=1000;
        (@LHS=
                (Yes    (Non_perpendicular_board_to_solder_pot))
                (Yes    (The_clamp_of_guide_rail_is_improperly_locked_with_the_machine))
        )
        (@HYPO=         Loosen_guide_rail)
        (@RHS=
                (Execute ("BlockHole.R_3_10")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Replace the clamp or Retighten the locked \
screws of clamp,@OK";))
        )
```

```
)

(@RULE=         R_10__20
        @INFCAT=1000;
        (@LHS=
                (Yes    (All_area_or_some_area_of_board_are_dull))
                (Yes    (The_dull_area_is_found_like_the_fog_after_pass_the_post_treatment_machine))
        )
        (@HYPO=         Tarnish_pad)
        (@RHS=
                (Execute ("Tarnish.R_10")  (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Check
the spray rinsing condition of the p\
ost-treatment machine.,@OK";))
        )
)

(@RULE=         R_10__21
        @INFCAT=1000;
        (@LHS=
                (Yes    (The_dipping_time_is_longer_than_6_seconds))
                (Yes    (The_solder_temperature_is_higher_than_230_degree_centicate))
        )
        (@HYPO=         Thick_solder_thickness)
        (@RHS=
                (Execute ("ThickSD.R_10") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the dipping time into the range 1.0\
 - 6.0 seconds,@OK";))
        )
)

(@RULE=         R_10__22
        @INFCAT=1000;
        (@LHS=
                (Yes    (The_air_temperature_is_higher_than_220_c))
                (Yes    (The_leveling_air_pressure_is_higher_than_3_kg_per_square_centimeter))
```

```
        )
        (@HYPO=         Thin_solder_thickness)
        (@RHS=
                (Execute ("ThinSD.R_10")  (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the air temperature into the range \
190 - 220 C.,@OK";))
        )
)

(@RULE=         R_10__23
        @INFCAT=1000;
        (@LHS=
                (Yes    (Solder_residue_inside_air_knives))
                (Yes    (The_solder_surface_is_not_rough))
        )
        (@HYPO=         Uneven_solder)
        (@RHS=
                (Execute ("UnevenSD.R_10")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Clean the air knives with the shim to remo\
ve the solder residues out,@OK";))
        )
)

(@RULE=         R_10__24
        @INFCAT=1000;
        (@LHS=
                (Yes    (The_solder_mask_surface_is_still_wet))
                (Yes    (The_solder_mask_surface_is_still_sticky))
        )
        (@HYPO=         Webbing_solder)
        (@RHS=
                (Execute ("WebSD.R_10")  (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Check
the curing condition at the Solder M\
ask process and Feedback the information to the Solder Mask process to take the \
corrective action.,@OK";))
```

```
        )
)

(@RULE=         R_10__25
        @INFCAT=1000;
        (@LHS=
                (Yes    (The_color_of_Gold_finger_changed_after_SCL))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign (Decoloration_gold)         (Decoloration_gold))
        )
)

(@RULE=         R_10__3
        @INFCAT=1000;
        (@LHS=
                (Yes
        (Have_the_grease_or_dirt_or_rainbow_on_the_board_after_pass_the_pretreatment_proc\
ess))
                (Yes
        (Some_area_of_pad_is_not_changed_to_the_pink_color_after_pass_the_pretreatment_pr\
ocess))
        )
        (@HYPO=         Cu_expose_on_pad_or_ground_area)
        (@RHS=
                (Execute ("CuExonPad.R_10")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Clean the board with the solvent or deterg\
ent and rinse with DI water before pass through the pretreatment process,\
@OK";))
        )
)

(@RULE=         R_10__4
        @INFCAT=1000;
```

```
        (@LHS=
                (Yes    (Some_spray_nozzles_have_been_blocked))
        )
        (@HYPO=         Micro_etching_solution)
        (@RHS=
                (Execute ("CuExonPad.R_8_10")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Clean_the_spray_nozzle,\
@OK";))
        )
)

(@RULE=         R_10__5
        @INFCAT=1000;
        (@LHS=
                (Yes
        (The_dipping_time_for_the_board_which_has_the_small_via_hole_is_less_than_one_and\
_half_second))
                (Yes    (The_small_via_hole_is_blocked_with_the_ait_bubble))
        )
        (@HYPO=         Cu_expose_in_hole)
        (@RHS=
                (Execute ("CuExinHole.R_10")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Increase the dipping time around 1.0 - 1.5\
 seconds.,@OK";))
        )
)

(@RULE=         R_10__6
        @INFCAT=1000;
        (@LHS=
                (Yes    (The_tooling_hole_of_board_is_at_the_center_of_board))
        )
        (@HYPO=         Damage_board)
        (@RHS=
```

```
                (Execute ("Damage.R_10") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Redrill
the new tooling hole at the center\
 of the edge of board with the drill bit 3.2 m.m. diameter,\
@OK";))
        )
)

(@RULE=         R_10__7
        @INFCAT=1000;
        (@LHS=
                (Yes
        (On_Gold_finger_area_have_some_brown_or_white_residue_before_or_after_passed_SCL_\
process))
                (Yes    (No_water_is_found_after_peel_the_red_tape_off))
        )
        (@HYPO=         Decoloration_gold)
        (@RHS=
                (Execute ("DecolorGold.R_10")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Feedback the information to the Gold plati\
ng process to take the corrective action.,\
@OK";))
        )
)

(@RULE=         R_10__8
        @INFCAT=1000;
        (@LHS=
                (Yes    (The_solder_pot_temperature_is_higher_than_260))
                (Yes    (The_layer_of_laminate_is_not_coated_with_the_flux_before_SCL_process))
        )
        (@HYPO=         Delamination)
        (@RHS=
                (Execute ("Delam.R_10")
        (@TYPE=FRM;@WAIT=FALSE;@STRING="@TEXT=Adjust the solder pot temperature into 22\
0 - 255 C,@OK";))
```

```
        )
)

(@RULE=         R_10__9
        @INFCAT=1000;
        (@LHS=
                (Yes    (The_board_after_pass_the_microetching_solution_is_still_remained_the_oxide))
                (Yes    (The_solder_surface_is_similar_as_the_water_tear))
        )
        (@HYPO=         Dewetting)
        (@RHS=
                (Execute ("Dewetting.R_10")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Reduce the speed of pre-treatment machine \
around 0.5 - 1.0 m/min.,@OK";))
        )
)

(@RULE=         R_11
        @INFCAT=1100;
        (@LHS=
                (Yes    (The_blocked_hole_happen_in_the_same_row_as_the_upward_direction))
                (Yes    (The_solder_surface_which_blocked_in_hole_is_not_rough))
        )
        (@HYPO=         Block_hole)
        (@RHS=
                (Execute ("BlockHole.R_11")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Clean the air knives gap with shim and cle\
an it for every 25 boards.,@OK";))
        )
)

(@RULE=         R_12
        @INFCAT=1200;
        (@LHS=
                (Yes    (The_glue_residues_still_remained_on_Gold_finger_area))
```

```
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign  (Glue_residue_on_gold)     (Glue_residue_on_gold))
        )
)

(@RULE=         R_14
        @INFCAT=1400;
        (@LHS=
                (Yes
        (A_continuous_film_or_curtain_of_solder_parallel_to_but_not_necessarilly_adhering\
_to_and_a_surface_that_should_be_free_of_Solder))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign  (Webbing_solder)  (Webbing_solder))
        )
)

(@RULE=         R_16
        @INFCAT=1600;
        (@LHS=
                (Yes
        (Have_a_void_in_the_metallic_deposit_of_a_plated_through_hole_exposing_the_base_m\
aterial))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign  (Hole_void)        (Hole_void))
        )
)

(@RULE=         R_18
        @INFCAT=1800;
```

```
        (@LHS=
                (Yes    (The_height_of_Solder_on_SMT_pad_is_not_smooth_and_leveling_after_SCL))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign  (Excess_solder)    (Excess_solder))
        )
)

(@RULE=         R_2
        @INFCAT=200;
        (@LHS=
                (Yes
        (The_pH_of_flux_is_changed_from_its_specification_base_on_the_type_of_flux_which_\
is_using))
                (Yes
        (The_color_of_flux_is_changed_from_its_specification_base_on_the_type_of_flux_whi\
ch_is_using))
        )
        (@HYPO=         Block_hole)
        (@RHS=
                (Execute ("BlockHole.R_2") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Renew
the flux,\
@OK";))
        )
)

(@RULE=         R_20
        @INFCAT=2000;
        (@LHS=
                (Yes    (The_pad_surface_is_dull_after_SCL))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign  (Tarnish_pad)      (Tarnish_pad))
```

```
        )
)

(@RULE=         R_22
        @INFCAT=2200;
        (@LHS=
                (Yes    (The_hole_wall_is_dull_after_SCL))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign (Dull_hole)     (Dull_hole))
        )
)

(@RULE=         R_24
        @INFCAT=2400;
        (@LHS=
                (Yes
        (The_glass_fiber_is_seperated_from_the_resin_at_the_weave_intersection_after_SCL))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign (Measling)      (Measling))
        )
)

(@RULE=         R_26
        @INFCAT=2600;
        (@LHS=
                (Yes
        (A_separation_between_plies_within_a_base_material_or_between_a_base_material_and\
_a_conductive_foil_or_any_planer_separation_within_a_multilayer_printed_circuit_\
boaard_after_SCL))
        )
        (@HYPO=         Major_Problem)
```

```
        (@RHS=
                (Assign  (Delamination)     (Delamination))
        )
)

(@RULE=         R_28
        @INFCAT=2800;
        (@LHS=
                (Yes     (The_board_is_damaged_or_broken_after_SCL))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign  (Damage_board)   (Damage_board))
        )
)

(@RULE=         R_3
        @INFCAT=300;
        (@LHS=
                (Yes     (The_hanger_and_guide_rail_is_loosen_or_warpage_or_twist))
        )
        (@HYPO=         Block_hole)
        (@RHS=
                (Strategy (@PWTRUE=TRUE;))
                (Assign  (Loosen_guide_rail)          (Loosen_guide_rail))
        )
)

(@RULE=         R_30
        @INFCAT=3000;
        (@LHS=
                (Yes     (We_can_see_the_copper_expose_on_pad_or_ground_area_after_SCL))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
```

```
                (Assign  (Cu_expose_on_pad_or_ground_area) (Cu_expose_on_pad_or_ground_area))
        )
)

(@RULE=         R_32
        @INFCAT=3200;
        (@LHS=
                (Yes     (We_still_can_see_the_Copper_in_some_holes_after_SCL))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign  (Cu_expose_in_hole)      (Cu_expose_in_hole))
        )
)

(@RULE=         R_34
        @INFCAT=3400;
        (@LHS=
                (Yes
        (Have_a_condition_whereby_a_surface_contacted_molten_Solder_but_the_Solder_has_no\
t_adhere_at_all_of_the_surface_basis_metal_remains_exposed))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign  (Non_wetting)    (Non_wetting))
        )
)

(@RULE=         R_36
        @INFCAT=3600;
        (@LHS=
                (Yes
        (The_molten_solder_has_coated_a_surface_and_then_receded_leaving_irregularly_shap\
ed_mounds_of_solder_seperated_by_areas_covered_with_a_thin_solder_film_basis_met\
al_is_not_exposed_after_SCL))
```

```
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign  (Dewetting)        (Dewetting))
        )
)

(@RULE=         R_4
        @INFCAT=400;
        (@LHS=
                (Yes     (The_board_warpage_is_more_than_one_and_half_percentage))
                (Yes     (The_board_is_not_flat_when_it_lay_on_the_smooth_table))
        )
        (@HYPO=         Block_hole)
        (@RHS=
                (Execute ("BlockHole.R_4") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Bake
the boards at the temperature  130 C \
which is sandwiched in the rigid flat plate which have loaded the weight on the \
top plate at least 5 kg.,@OK";))
        )
)

(@RULE=         R_40
        @INFCAT=4000;
        (@LHS=
                (Yes     (The_leveling_of_solder_is_not_equal_in_all_areas_of_board_after_SCL))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign  (Uneven_solder)   (Uneven_solder))
        )
)

(@RULE=         R_42
        @INFCAT=4200;
```

```
        (@LHS=
                (Yes    (The_solder_thickness_is_thinner_than_the_requirment))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign (Thin_solder_thickness)     (Thin_solder_thickness))
        )
)

(@RULE=         R_44
        @INFCAT=4400;
        (@LHS=
                (Yes    (The_solder_thickness_is_thicker_than_the_requirment))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign (Thick_solder_thickness)    (Thick_solder_thickness))
        )
)

(@RULE=         R_46
        @INFCAT=4600;
        (@LHS=
                (Yes    (Have_solder_bonded_on_the_Gold_finger_after_SCL))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign (Solder_on_Gold) (Solder_on_Gold))
        )
)

(@RULE=         R_48
        @INFCAT=4800;
        (@LHS=
                (Yes    (The_size_of_hole_is_smaller_than_the_required_size_after_SCL))
```

```
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign  (Hole_undersize)  (Hole_undersize))
        )
)

(@RULE=         R_5
        @INFCAT=500;
        (@LHS=
                (Yes     (The_air_knives_is_misalignment))
        )
        (@HYPO=         Block_hole)
        (@RHS=
                (Strategy (@PWTRUE=TRUE;))
                (Assign  (Improper_alignment_of_air_knives)  (Improper_alignment_of_air_knives))
        )
)

(@RULE=         R_50
        @INFCAT=5000;
        (@LHS=
                (Yes     (Some_holes_are_blocked_with_Solder_after_SCL))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign  (Block_hole)       (Block_hole))
        )
)

(@RULE=         R_5__1
        @INFCAT=500;
        (@LHS=
                (Yes
        (The_resin_is_separated_from_the_glass_fiber_at_the_weave_intersection_position))
```

```
        )
        (@HYPO=         Measling)
        (@RHS=
                (Execute ("Measling.R_5")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Feedback the information to the laminate s\
upplier to take the corrective action.,@OK";))
        )
)

(@RULE=         R_5__2
        @INFCAT=500;
        (@LHS=
                (Yes
        (The_angle_of_air_knives_compare_with_the_board_is_less_than_the_specification_of\
_machine))
        )
        (@HYPO=         Thin_solder_thickness)
        (@RHS=
                (Execute ("ThinSD.R_5")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Readjust the angle of air knives to the re\
commended angle according to the machine manual.,\
@OK";))
        )
)

(@RULE=         R_6
        @INFCAT=600;
        (@LHS=
                (Yes
        (The_flux_density_is_not_in_its_required_specification_base_on_the_type_of_flux_w\
hich_are_using))
                (Yes    (The_pH_of_flux_is_changed))
        )
        (@HYPO=         Block_hole)
        (@RHS=
```

```
                (Execute ("BlockHole.R_6") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the flux density into its specifica\
tion or renew the flux,@OK";))
        )
)

(@RULE=         R_6__1
        @INFCAT=600;
        (@LHS=
                (Yes
        (The_squeegee_roller_of_pretreatment_machine_is_not_properly_sit_in_the_groove_po\
sition))
                (Yes
        (The_squeegee_roller_is_not_rotated_during_the_board_passing_through_the_roller_g\
ap))
        )
        (@HYPO=         Cu_expose_in_hole)
        (@RHS=
                (Execute ("CuExinHole.R_6")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust the squeegee roller into the proper\
 position,@OK";))
        )
)

(@RULE=         R_6__2
        @INFCAT=600;
        (@LHS=
                (Yes    (The_board_is_kept_in_the_wet_or_high_humidity_area))
        )
        (@HYPO=         Measling)
        (@RHS=
                (Execute ("Measling.R_6")  (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Cure
 the boards in the oven at 130 c. for \
 3 hr. and keep the board in the dry area.,\
 @OK";))
```

```
        )
)

(@RULE=         R_6__3
        @INFCAT=600;
        (@LHS=
                (Yes
        (The_distance_between_the_board_and_air_knives_is_less_than_the_specification_of_\
machine))
                (Yes    (The_distance_of_the_board_and_air_knives_is_smaller_than_3_millimeter))
        )
        (@HYPO=         Thin_solder_thickness)
        (@RHS=
                (Execute ("ThinSD.R_6")   (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the distance between the board and \
air knives to the recommended distance according to the machine manual,\
@OK";))
        )
)

(@RULE=         R_7
        @INFCAT=700;
        (@LHS=
                (Yes    (Solder_sticked_on_the_guide_rail))
        )
        (@HYPO=         Block_hole)
        (@RHS=
                (Execute ("BlockHole.R_7") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Clean
the guide rail,\
@OK";))
        )
)

(@RULE=         R_7__1
        @INFCAT=700;
```

```
        (@LHS=
                (Yes    (The_solution_is_used_over_the_service_life))
        )
        (@HYPO=         Micro_etching_solution)
        (@RHS=
                (Execute ("CuExonPad.R_8_7")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Renew the micro etching solution,\
@OK";))
        )
)

(@RULE=         R_7__10
        @INFCAT=700;
        (@LHS=
                (Yes    (The_Tin_content_is_lower_than_62_percent))
        )
        (@HYPO=         Tarnish_pad)
        (@RHS=
                (Execute ("Tarnish.R_7")    (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the % Tin content in the Solder pot\
 into the 63% of Tin and 37% of Lead,@OK";))
        )
)

(@RULE=         R_7__11
        @INFCAT=700;
        (@LHS=
                (Yes    (The_solder_pot_temperature_is_higher_than_260_c))
        )
        (@HYPO=         Thin_solder_thickness)
        (@RHS=
                (Execute ("ThinSD.R_7")    (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the solder pot temperature into the\
 range 220 - 255 C,@OK";))
        )
```

```
)

(@RULE=         R_7__12
        @INFCAT=700;
        (@LHS=
                (Yes    (The_surface_of_air_knives_is_not_smooth))
                (Yes    (The_uneven_solder_happen_in_the_same_location))
        )
        (@HYPO=         Uneven_solder)
        (@RHS=
                (Execute ("UnevenSD.R_7")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Replace the new set of air knives or regri\
nd the surface of air knives.,@OK";))
        )
)

(@RULE=         R_7__13
        @INFCAT=700;
        (@LHS=
                (Yes
        (The_using_flux_can_distort_the_solder_mask_surface_and_find_the_white_color_ring\
_around_the_pad))
        )
        (@HYPO=         Webbing_solder)
        (@RHS=
                (Execute ("WebSD.R_7")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Change the new flux which has the low acti\
vity than the present flux.  ,@OK";))
        )
)

(@RULE=         R_7__2
        @INFCAT=700;
        (@LHS=
                (Yes    (The_solder_mask_ink_is_in_the_hole))
```

```
            (Yes
        (The_inside_of_hole_is_not_changed_any_color_after_pass_the_pretreatment_process))
        )
        (@HYPO=         Cu_expose_in_hole)
        (@RHS=
            (Execute ("CuExinHole.R_7")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Feedback the information to the solder mas\
k process to take the corrective action,@OK";))
        )
)

(@RULE=         R_7__3
        @INFCAT=700;
        (@LHS=
            (Yes
        (The_solder_pot_have_been_contained_with_the_other_metals_as_Gold_or_Nickel))
        )
        (@HYPO=         Dewetting)
        (@RHS=
            (Execute ("Dewetting.R_7") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Renew
the Solder.,\
@OK";))
        )
)

(@RULE=         R_7__4
        @INFCAT=700;
        (@LHS=
            (Yes
        (Inside_The_hole_we_can_find_the_same_color_as_solder_mask_ink_that_using_in_the_\
plant))
        )
        (@HYPO=         Dull_hole)
        (@RHS=
```

```
                (Execute ("DullHole.R_7")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Feedback the information to the solder mas\
k process to take the corrective action.,\
@OK";))
        )
)

(@RULE=         R_7__5
        @INFCAT=700;
        (@LHS=
                (Yes    (The_flux_have_not_covered_all_the_melten_solder_surface))
        )
        (@HYPO=         Excess_solder)
        (@RHS=
                (Execute ("ExcessSD.R_7") (@TYPE=FRM;@WAIT=FALSE;@STRING="@TEXT=Clean
the melten solder surface for every\
 25 boards are proceeded and cover with the soldering oil or flux after clean ev\
ery cycle,@OK";))
        )
)

(@RULE=         R_7__6
        @INFCAT=700;
        (@LHS=
                (Yes    (The_hole_size_is_smaller_than_required_size_since_before_SCL_process))
                (Yes    (The_drilled_hole_is_smaller_than_the_required_size_before_pass_SCL_process))
        )
        (@HYPO=         Hole_undersize)
        (@RHS=
                (Execute ("Undersize.R_7")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Feedback the information to the drilling p\
rocess to take the corrective action,@OK";))
        )
)
```

```
(@RULE=         R_7__7
        @INFCAT=700;
        (@LHS=
                (Yes    (The_hole_void_have_been_found_before_pass_the_microetching_solution))
        )
        (@HYPO=         Hole_void)
        (@RHS=
                (Execute ("HoleVoid.R_7")  (@TYPE=FRM;@WAIT=TRUE;))
        )
)

(@RULE=         R_7__8
        @INFCAT=700;
        (@LHS=
                (Yes    (The_board_has_not_been_covered_with_the_flux_before_SCL_process))
        )
        (@HYPO=         Measling)
        (@RHS=
                (Execute ("Measling.R_7")  (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Ensure
that every board has been coated wi\
th the flux before proceed through the SCL process,\
@OK";))
        )
)

(@RULE=         R_7__9
        @INFCAT=700;
        (@LHS=
                (Yes
        (The_distance_between_gold_finger_row_to_the_solder_pad_is_less_than_4_millimeter))
        )
        (@HYPO=         Solder_on_Gold)
        (@RHS=
                (Execute ("SDonGold.R_7") (@TYPE=FRM;@WAIT=TRUE;))
        )
```

```
)

(@RULE=         R_8
        @INFCAT=800;
        (@LHS=
                (Yes    (The_upward_speed_is_set_faster_than_one_and_half_second))
                (Yes    (The_solder_layer_is_very_thick))
        )
        (@HYPO=         Block_hole)
        (@RHS=
                (Execute ("BlockHole.R_8") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the upward speed into the range 1.5\
 - 4.0 sec.,@OK";))
        )
)

(@RULE=         R_8__1
        @INFCAT=800;
        (@LHS=
                (Yes    (The_surface_is_still_have_some_oxide_or_contaminant_on_board))
        )
        (@HYPO=         Cu_expose_on_pad_or_ground_area)
        (@RHS=
                (Assign  (Micro_etching_solution)    (Micro_etching_solution))
        )
)

(@RULE=         R_8__10
        @INFCAT=800;
        (@LHS=
                (Yes    (The_air_knives_is_too_dirty_with_flux_and_solder_residues))
        )
        (@HYPO=         Hole_undersize)
        (@RHS=
```

```
                (Execute ("Undersize.R_8") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Clean
the air knives with shim to remove t\
he solder which obstructed the air way,@OK";))
        )
)

(@RULE=         R_8__11
        @INFCAT=800;
        (@LHS=
                (Yes
        (The_hole_void_have_been_found_after_the_1_time_pass_microetching_before_SCL))
                (Yes    (The_copper_thickness_of_this_lot_is_in_the_control_range))
        )
        (@HYPO=         Hole_void)
        (@RHS=
                (Execute ("HoleVoid.R_8")  (@TYPE=FRM;@WAIT=TRUE;))
        )
)

(@RULE=         R_8__12
        @INFCAT=800;
        (@LHS=
                (Yes    (The_solder_pot_temperature_is_higher_than_260_c))
        )
        (@HYPO=         Measling)
        (@RHS=
                (Execute ("Measling.R_8")  (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the Solder pot temperature into the\
 range 220 - 255 c.,@OK";))
        )
)

(@RULE=         R_8__13
        @INFCAT=800;
        (@LHS=
```

```
            (Yes     (The_red_tape_is_peel_off_during_air_leveling_blow))
        )
        (@HYPO=      Solder_on_Gold)
        (@RHS=
            (Execute ("SDonGold.R_8")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Replace the new lot of red tape and feedba\
ck the information to the supplier to take the corrective action,\
@OK";))
        )
)

(@RULE=      R_8__14
        @INFCAT=800;
        (@LHS=
            (Yes     (The_using_flux_is_the_strong_activity_type))
        )
        (@HYPO=      Tarnish_pad)
        (@RHS=
            (Execute ("Tarnish.R_8")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Change the new type of flux which is not t\
oo strong activity flux type.,@OK";))
        )
)

(@RULE=      R_8__15
        @INFCAT=800;
        (@LHS=
            (Yes     (The_air_knives_angle_is_wrong_compare_with_the_specification_of_machine))
        )
        (@HYPO=      Thick_solder_thickness)
        (@RHS=
            (Execute ("ThickSD.R_8")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Readjust the air knife angle according to \
the recommended angle, based on the machine manual.,\
@OK";))
```

```
        )
)

(@RULE=         R_8__16
        @INFCAT=800;
        (@LHS=
                (Yes    (The_upward_speed_is_longer_than_four_and_half_second))
        )
        (@HYPO=         Thin_solder_thickness)
        (@RHS=
                (Execute ("ThinSD.R_8")   (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the upward time into the range 1.5 \
- 3.0 seconds.,@OK";))
        )
)

(@RULE=         R_8__17
        @INFCAT=800;
        (@LHS=
                (Yes    (The_uneven_solder_thickness_is_occured_in_the_same_direction))
        )
        (@HYPO=         Uneven_solder)
        (@RHS=
                (Execute ("UnevenSD.R_8")(@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Check
and clean the air knives.,\
@OK";))
        )
)

(@RULE=         R_8__18
        @INFCAT=800;
        (@LHS=
                (Yes    (The_Solder_pot_has_a_lot_of_dross_on_the_Solder_surface))
        )
        (@HYPO=         Webbing_solder)
```

```
        (@RHS=
                (Execute ("WebSD.R_8")    (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Clean
the melten Solder surface to remove \
the dross and old flux out and cover with the soldering oil or flux for every ti\
me.,@OK";))
        )
)

(@RULE=         R_8__19
        @INFCAT=800;
        (@LHS=
                (Yes     (The_hole_wall_of_plated_slot_is_peeled_off_after_SCL))
        )
        (@HYPO=         Major_Problem)
        (@RHS=
                (Assign  (Plate_slot_peel_off)        (Plate_slot_peel_off))
        )
)

(@RULE=         R_8__2
        @INFCAT=800;
        (@LHS=
                (Yes     (Some_area_on_board_still_remain_the_oxide))
        )
        (@HYPO=         Micro_etching_solution)
        (@RHS=
                (Execute ("CuExonPad.R_8_8")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Reduce the micro etching speed of pretreat\
ment machine around 0.5 - 1.0 m/min,@OK";))
        )
)

(@RULE=         R_8__3
        @INFCAT=800;
        (@LHS=
```

```
                (Yes    (The_flux_pump_is_not_working_properly))
                (Yes    (The_spray_bar_of_flux_is_blocked_in_some_section))
        )
        (@HYPO=         Cu_expose_in_hole)
        (@RHS=
                (Execute ("CuExinHole.R_8")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Check and repair the flux pump,\
@OK";))
        )
)

(@RULE=         R_8__4
        @INFCAT=800;
        (@LHS=
                (Yes
        (The_twist_board_in_percentage_for_double_side_board_is_more_than_one_and_half))
        )
        (@HYPO=         Damage_board)
        (@RHS=
                (Execute ("Damage.R_8")   (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Bake
the board at the temperature 130 C wh\
ich is sandwiched in the rigid flat plate which have loaded the weight on the to\
p plate at least 5 kg.,@OK";))
        )
)

(@RULE=         R_8__5
        @INFCAT=800;
        (@LHS=
                (Yes
        (The_residue_of_flux_is_found_on_Gold_finger_area_after_peel_the_red_tape_off))
        )
        (@HYPO=         Decoloration_gold)
        (@RHS=
```

```
                (Execute ("DecolorGold.R_8")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Check the operating parameters of the heat\
sealing machine.,@OK";))
        )
)

(@RULE=         R_8__6
        @INFCAT=800;
        (@LHS=
                (Yes    (The_ratio_of_Tin_and_Lead_is_not_in_the_ratio_of_63_and_37))
        )
        (@HYPO=         Dewetting)
        (@RHS=
                (Execute ("Dewetting.R_8")
        (@TYPE=FRM;@WAIT=FALSE;@STRING="@TEXT=Readjust the Tin/Lead ratio by partially \
drain and add the same volume  of solder into the solder pot to keep the Tin/Lea\
d ratio back to 63/37,@OK";))
        )
)

(@RULE=         R_8__7
        @INFCAT=800;
        (@LHS=
                (Yes    (The_hole_is_dull_before_pass_through_the_SCL_process))
        )
        (@HYPO=         Dull_hole)
        (@RHS=
                (Execute ("DullHole.R_8")
        (@TYPE=FRM;@WAIT=FALSE;@STRING="@TEXT=Feedback the information to the Tin strip\
ping process to take the corrective action. Make up the 10% HCl solution and dip\
 the defected board which is found before pass the SCL process into this solutio\
n under the oscillating condition for 30 seconds maximum for rework,\
 after that proceed the board through the SCL process.,\
@OK";))
        )
```

```
)

(@RULE=         R_8__8
        @INFCAT=800;
        (@LHS=
                (Yes
        (The_melten_solder_surface_have_been_blowed_with_the_high_pressure_air_for_too_lo\
ng_time_which_oxidize_the_solder_with_air_created_the_solder_ball))
        )
        (@HYPO=         Solder_ball)
        (@RHS=
                (Execute ("ExcessSD.R_9_8")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Close or half reduce the flow rate of the \
high pressure air during the idle time,@OK";))
        )
)

(@RULE=         R_8__9
        @INFCAT=800;
        (@LHS=
                (Yes    (The_melten_solder_have_been_covered_with_the_old_flux))
        )
        (@HYPO=         Excess_solder)
        (@RHS=
                (Execute ("ExcessSD.R_8") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Clean
and remove out the old flux from the\
 melten solder surface and cover with the new flux on the melten solder surface,\
@OK";))
        )
)

(@RULE=         R_9
        @INFCAT=900;
        (@LHS=
                (Yes    (The_air_pressure_is_set_lower_than_one_and_half_kg_per_squarecentimeter))
```

```
        )
        (@HYPO=         Block_hole)
        (@RHS=
                (Execute ("BlockHole.R_9") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the air pressure in to the range of\
 1.5 - 4.0 kg/cm^2,@OK";))
        )
)

(@RULE=         R_9__1
        @INFCAT=900;
        (@LHS=
                (Yes    (The_fitting_between_air_knive_and_pipe_is_loosen))
        )
        (@HYPO=         Improper_alignment_of_air_knives)
        (@RHS=
                (Execute ("BlockHole.R_5_9")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Retighten the fitting of inlet air pipe ,\
@OK";))
        )
)

(@RULE=         R_9__10
        @INFCAT=900;
        (@LHS=
                (Yes    (Solder_ball_is_on_and_around_the_solder_pot))
        )
        (@HYPO=         Excess_solder)
        (@RHS=
                (Strategy (@PWTRUE=TRUE;))
                (Assign  (Solder_ball)      (Solder_ball))
        )
)

(@RULE=         R_9__11
```

```
        @INFCAT=900;
        (@LHS=
                (Yes
        (A_lot_of_glue_residue_remain_on_the_Gold_finger_after_peel_the_red_tape_off))
        )
        (@HYPO=         Glue_residue_on_gold)
        (@RHS=
                (Execute ("GlueonGold.R_9")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Change the new lot of red tape and feedbac\
k the information to the supplier to take the corrective action.,\
@OK";))
        )
)

(@RULE=         R_9__12
        @INFCAT=900;
        (@LHS=
                (Yes    (The_burnt_flux_have_flood_over_the_solder_pot))
        )
        (@HYPO=         Hole_undersize)
        (@RHS=
                (Execute ("Undersize.R_9") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Clean
the melten Solder surface for every \
25 boards that are proceeded through and cover with the new soldering oil or flu\
x on the melten solder surface for every time,\
@OK";))
        )
)

(@RULE=         R_9__13
        @INFCAT=900;
        (@LHS=
                (Yes
        (The_board_is_reworked_the_SCL_process_by_pass_again_the_microetching_solution))
                (Yes    (The_copper_thickness_in_hole_wall_is_very_thin))
```

```
        )
        (@HYPO=         Hole_void)
        (@RHS=
                (Execute ("HoleVoid.R_9") (@TYPE=FRM;@WAIT=TRUE;))
        )
)

(@RULE=         R_9__14
        @INFCAT=900;
        (@LHS=
                (Yes    (The_dipping_time_in_the_solder_pot_is_longer_than_6_seconds))
        )
        (@HYPO=         Measling)
        (@RHS=
                (Execute ("Measling.R_9") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the dipping time into the range 1.0\
- 6.0 sec.,@OK";))
        )
)

(@RULE=         R_9__15
        @INFCAT=900;
        (@LHS=
                (Yes    (The_solder_pot_temperature_is_lower_than_220_c))
        )
        (@HYPO=         Non_wetting)
        (@RHS=
                (Execute ("Nonwet.R_9")   (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the solder pot temperature in the r\
ange 220 - 255 C.,@OK";))
        )
)

(@RULE=         R_9__16
        @INFCAT=900;
```

```
        (@LHS=
                (Yes    (The_sealing_machine_is_not_set_according_to_the_process_instruction))
                (Yes    (The_board_is_not_hot_after_pass_this_machine))
        )
        (@HYPO=         Solder_on_Gold)
        (@RHS=
                (Execute ("SDonGold.R_9") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the operating condition of sealing \
machine acorrding to the process instruction,\
@OK";))
        )
)

(@RULE=         R_9__17
        @INFCAT=900;
        (@LHS=
                (Yes    (The_white_strain_is_found_on_the_pad))
        )
        (@HYPO=         Tarnish_pad)
        (@RHS=
                (Execute ("Tarnish.R_9")    (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Clean
the melten Solder surface to remove \
the dross and old flux out and cover with the new soldering oil or flux.,\
@OK";))
        )
)

(@RULE=         R_9__18
        @INFCAT=900;
        (@LHS=
                (Yes
        (The_distance_between_the_board_and_air_knives_is_wider_than_the_specification_of\
_machine))
                (Yes    (The_distance_of_the_board_and_air_knives_is_larger_than_3_millimeter))
        )
```

```
        (@HYPO=         Thick_solder_thickness)
        (@RHS=
                (Execute ("ThickSD.R_9")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Readjust the distance between the board an\
d the air knives according to the machine manual to the recomended distance.,\
@OK";))
        )
)

(@RULE=         R_9__19
        @INFCAT=900;
        (@LHS=
                (Yes    (The_dipping_time_is_shorter_than_1_second))
        )
        (@HYPO=         Thin_solder_thickness)
        (@RHS=
                (Execute ("ThinSD.R_9")   (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the dipping time into the range 1.0\
- 6.0 seconds.,@OK";))
        )
)

(@RULE=         R_9__2
        @INFCAT=900;
        (@LHS=
                (Yes    (The_hanger_can_move_left_or_right_side_more_than_1_centimeter))
        )
        (@HYPO=         Loosen_guide_rail)
        (@RHS=
                (Execute ("BlockHole.R_3_9")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Retighten the locked screws of hanger,\
@OK";))
        )
)
```

```
(@RULE=        R_9__20
        @INFCAT=900;
        (@LHS=
                (Yes    (The_spacing_between_Board_and_air_knives_of_each_side_is_different))
                (Yes    (The_air_knife_gap_is_not_enough))
        )
        (@HYPO=         Uneven_solder)
        (@RHS=
                (Execute ("UnevenSD.R_9")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Readjust the spacing between the air knive\
s and board to equal for both sides of air knives,\
@OK";))
        )
)

(@RULE=        R_9__21
        @INFCAT=900;
        (@LHS=
                (Yes    (The_laminate_is_still_wet))
        )
        (@HYPO=         Webbing_solder)
        (@RHS=
                (Execute ("WebSD.R_9")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Feedback the information to the laminate s\
upplier to take the corrective action.,@OK";))
        )
)

(@RULE=        R_9__3
        @INFCAT=900;
        (@LHS=
                (Yes    (Have_the_shine_copper_surface_on_that_area))
        )
        (@HYPO=         Cu_expose_on_pad_or_ground_area)
        (@RHS=
```

```
                (Execute ("CuExonPad.R_9")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Feedback the information to the solder mas\
k process to take the corrective action,@OK";))
        )
)

(@RULE=         R_9__4
        @INFCAT=900;
        (@LHS=
                (Yes    (The_micro_etching_solution_cannot_clean_the_oxide_on_boards))
        )
        (@HYPO=         Micro_etching_solution)
        (@RHS=
                (Execute ("CuExonPad.R_8_9")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Recheck the activity of the micro etching \
solution and adjust the activity to the control range,\
@OK";))
        )
)

(@RULE=         R_9__5
        @INFCAT=900;
        (@LHS=
                (Yes    (The_solder_circulating_pump_is_not_working_properly))
                (Yes    (The_solder_flow_at_the_solder_pot__is_not_smooth))
        )
        (@HYPO=         Cu_expose_in_hole)
        (@RHS=
                (Execute ("CuExinHole.R_9")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Check and repair the solder circulating pu\
mp,@OK";))
        )
)

(@RULE=         R_9__6
```

```
        @INFCAT=900;
        (@LHS=
                (Yes
        (The_free_distance_between_board_and_guide_rail_in_millimeter_for_each_side_is_la\
rger_than_one_and_half_millimeter))
        )
        (@HYPO=         Damage_board)
        (@RHS=
                (Execute ("Damage.R_9")   (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the free distance of the board to g\
uide rail to have the range within  1.0 - 1.5 m.m. for each side.,\
@OK";))
        )
)

(@RULE=         R_9__7
        @INFCAT=900;
        (@LHS=
                (Yes
        (The_flux_density_is_not_in_their_required_specification_base_on_the_type_of_flux\
_that_using))
        )
        (@HYPO=         Dewetting)
        (@RHS=
                (Execute ("Dewetting.R_9") (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the flux density into their require\
d specification.,@OK";))
        )
)

(@RULE=         R_9__8
        @INFCAT=900;
        (@LHS=
                (Yes    (The_Tin_content_is_lower_than_62_percent))
                (Yes    (The_color_of_hole_is_black_after_pass_through_the_pretreatment))
```

```
        )
        (@HYPO=         Dull_hole)
        (@RHS=
                (Execute ("DullHole.R_9")  (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Adjust
the % Tin content in the solder pot\
 into the 63% of Tin and 37% of Lead,@OK";))
        )
)

(@RULE=         R_9__9
        @INFCAT=900;
        (@LHS=
                (Yes
        (The_board_is_not_completely_dried_before_pass_through_the_flux_covering_section_\
in_the_pretreatment_machine))
                (Yes    (The_air_knife_angle_of_pretreatment_section_is_not_correct))
        )
        (@HYPO=         Solder_ball)
        (@RHS=
                (Execute ("ExcessSD.R_9_9")
        (@TYPE=FRM;@WAIT=TRUE;@STRING="@TEXT=Check the dring section of pretreatment ma\
chine is working properly and the recommended temperature is more than 90 C with\
 the air knives pressure,@OK";))
        )
)

(@GLOBALS=
        @INHVALUP=FALSE;
        @INHVALDOWN=TRUE;
        @INHOBJUP=FALSE;
        @INHOBJDOWN=FALSE;
        @INHCLASSUP=FALSE;
        @INHCLASSDOWN=TRUE;
        @INHBREADTH=TRUE;
        @INHPARENT=FALSE;
```

```
@PWTRUE=TRUE;
@PWFALSE=TRUE;
@PWNOTKNOWN=TRUE;
@EXHBWRD=FALSE;
@PTGATES=TRUE;
@PFACTIONS=TRUE;
@SOURCESON=TRUE;
@CACTIONSON=TRUE;
@VALIDUSER=FALSE;
@VALIDENGINE=FALSE;
@PFEACTIONS=FALSE;
@PFMACTIONS=GLOBAL;
@PFMEACTIONS=FALSE;
@SUGLIST=Major_Problem;
)
```

# ภาคผนวก ข

# กระบวนการผลิตแผ่นวงจรพิมพ์โดยย่อ

กระบวนการผลิตแผ่นวงจรพิมพ์ ประกอบด้วยกระบวนการผลิตย่อยๆ ทั้งสิ้น 14 กระบวนการ ดังนี้ :-

**1. กระบวนการตัดบอร์ด (Board Cutting Process)**

เป็นกระบวนการตัดแผ่นบอร์ดจากที่มีขนาดใหญ่ ให้ได้ขนาดที่เหมาะสมตามที่ต้องการ โดยขนาดของแผ่นบอร์ด จะขึ้นอยู่กับ ความสามารถของกระบวนการผลิตในแต่ละกระบวนการ

**2. กระบวนการเจาะรู (Drilling Process)**

เป็นกระบวนการเจาะรู ขนาดต่างๆ ตามที่ลูกค้ากำหนด เพื่อทำให้แผ่นบอร์ดทั้ง 2 ด้านทะลุถึงกัน เพื่อใช้สำหรับใส่ตัวอุปกรณ์ต่างๆ ที่จะประกอบเข้ากับแผ่นบอร์ดนี้ หลังจากเสร็จสิ้นกระบวนการ

**3. กระบวนการชุบโลหะทองแดงในรู (Plated Through Hole Process)**

เป็นกระบวนการชุบโลหะทองแดงในรู โดยวิธีการใช้สารเคมีเพียงอย่างเดียว ไม่มีการใช้กระแสไฟฟ้าในการชุบ เพื่อเชื่อมต่อลายวงจรทั้ง 2 ด้านของแผ่นบอร์ดให้ต่อถึงกัน โดยทองแดงที่ชุบจะเชื่อมต่อวงจรโดยผ่านรูที่เจาะ ในกระบวนการก่อนหน้านี้ เพื่อให้กระแสไฟฟ้าไหลผ่านถึงกันได้ทั้ง 2 ด้าน

**4. กระบวนการชุบโลหะทองแดง (Copper Plating Process)**

เป็นกระบวนการชุบโลหะทองแดง โดยวิธีการใช้กระแสไฟฟ้า เพื่อเพิ่มความหนาของชั้นทองแดงบนแผ่นบอร์ด และโดยเฉพาะความหนาของชั้นทองแดงในรู ให้ได้ตามมาตรฐานที่กำหนดไว้

**5. กระบวนการถ่ายลายวงจร (Image Transfer Process)**

เป็นกระบวนการถ่ายลายวงจร จากต้นแบบที่ต้องการลงบนแผ่นบอร์ด โดยผ่านสารตัวกลาง ที่เป็นสารโมโนเมอร์ที่มีคุณสมบัติ ไวต่อลำแสงอุลตราไวโอเลต (Ultra-Violet Beam) เมื่อสารโมโนเมอร์โดนแสงอุลตราไวโอเลตแล้วจะเกิดปฏิกิริยาโพลีเมอร์ไรเซชั่นขึ้น และส่วนที่ถูกลำแสงจะกลายเป็นสารโพลีเมอร์ เพื่อทำให้เกิดลายวงจรพิมพ์ (Printed Circuit) ขึ้น

**6. กระบวนการชุบโลหะทองแดงบนส่วนที่เป็นลายวงจร (Pattern Plating Process)**

เป็นกระบวนการชุบโลหะทองแดง โดยวิธีการใช้กระแสไฟฟ้า เพื่อเพิ่มความหนาของชั้นทองแดงตามลายวงจรที่เกิดขึ้น โดยส่วนที่ถูกชุบทองแดงจะมีความหนาเพิ่มขึ้น ส่วนพื้นที่

ที่ถูกปกปิดด้วยสารโพลีเมอร์ จะไม่เกิดการชุบใดๆ ความหนาของการชุบจะขึ้นอยู่กับความต้องการที่ลูกค้ากำหนดหรือค่ามาตรฐานที่กำหนดไว้ และทำการชุบดีบุกด้วยกระแสไฟฟ้า เพื่อปกปิดชั้นของทองแดงที่ต้องการให้เป็นลายวงจรไว้ ด้านบนสุดของแผ่นบอร์ด โดยดีบุกจะมีหน้าที่ป้องกันการกัดคลุมลายวงจร ในกระบวนการถัดไป

**7. กระบวนการกัดลายวงจร (Etching Process)**

เป็นกระบวนการกัดลายวงจร ของแผ่นบอร์ดที่ได้ทำการสร้างลายวงจรขึ้นแล้ว จากกระบวนการก่อน โดยก่อนที่จะทำการกัดลายวงจร จะต้องทำการลอกเอาส่วนที่เป็นสารโพลีเมอร์ ที่ทำหน้าป้องกันไม่ให้เกิดการชุบทองแดง ด้วยกระแสไฟฟ้าออกก่อน ซึ่งหลังจากทำการลอกเอาสารโพลีเมอร์ออก จะพบผิวของทองแดงอยู่ด้านล่าง ในกระบวนการกัดลายวงจรนี้ ดีบุกจะถูกใช้เป็นสารปกป้องหรือต่อต้านการกัด (ดีบุกจะถูกใช้ ในกรณีที่กระบวนการกัดลายวงจร เป็นกระบวนการที่ใช้สารเคมีที่มีค่าเป็นด่าง ในการกัดเท่านั้น) ส่วนที่ถูกคลุมด้วยชั้นของดีบุกจะเป็นส่วนที่ไม่ถูกกัด ซึ่งหลังกระบวนการ จะเกิดลายวงจรพิมพ์ (Printed Circuit) ขึ้นบนแผ่นบอร์ด

**8. กระบวนการลอกดีบุก (Tin Stripping Process)**

เป็นกระบวนการลอกดีบุก ที่ใช้เป็นสารปกป้องหรือต่อต้านการกัดออก ซึ่งหลังจากที่ชั้นของดีบุกถูกลอกออกแล้วออก จะพบผิวของทองแดงอยู่ด้านล่างที่เป็นลายวงจรพิมพ์ (Printed Circuit) ที่ถูกกัดแล้วขึ้นมา

**9. กระบวนการพิมพ์หมึกปกปิดโลหะผสมโซลเดอร์ (Solder Mask Printing Process)**

เป็นกระบวนการพิมพ์หมึกปกปิดโลหะผสมโซลเดอร์ เพื่อปกคลุมส่วนที่เป็นลายวงจรพิมพ์ (Printed Circuit) ที่ไม่ต้องการให้ถูกชุบเคลือบด้วยโลหะผสมโซลเดอร์ ซึ่งแผ่นบอร์ดหลังผ่านกระบวนการ จะมีแต่ผิวของทองแดงที่ต้องการที่จะทำการชุบเคลือบด้วยโลหะผสมโซลเดอร์ปรากฏอยู่เท่านั้น

**10. กระบวนการทองบนขาเชื่อมต่อ (Gold Plating Process)**

เป็นกระบวนการชุบโลหะทอง โดยวิธีการใช้กระแสไฟฟ้า เพื่อเพิ่มความทนทานต่อการสวมใส่ (Wear Resistance) ของขาเชื่อมต่อของแผ่นบอร์ดนั้นๆ และทองยังมีส่วนช่วยให้บริเวณผิวสัมผัสมีการไหลของกระแสไฟฟ้าได้ดีอีกด้วย

**11. กระบวนการชุบเคลือบโลหะผสมโซลเดอร์ (Solder Coated Leveling Process)**

เป็นกระบวนการชุบเคลือบโลหะผสมโซลเดอร์ โดยวิธีการใช้ลมร้อนเป่าให้เรียบ เพื่อให้โลหะผสมทำหน้าที่ป้องกันผิวทองแดงจากการเกิดออกไซด์ และช่วยในขั้นตอนของการประกอบอุปกรณ์เข้ากับแผ่นวงจรพิมพ์ รายละเอียดของกระบวนการผลิตนี้ได้เขียนไว้ในรายงานเล่มนี้โดยละเอียดแล้ว

**12. กระบวนการพิมพ์หมึกระบุตำแหน่งอุปกรณ์ (Component Mark Printing Process)**

เป็นกระบวนการพิมพ์หมึกระบุตำแหน่งชิ้นส่วนอุปกรณ์ ลงบนแผ่นบอร์ดหลังผ่านกระบวนการชุบเคลือบโลหะผสม เพื่อเป็นการง่ายในการนำเอาแผ่นบอร์ดไปใช้งานต่อไป ในกระบวนการประกอบอุปกรณ์

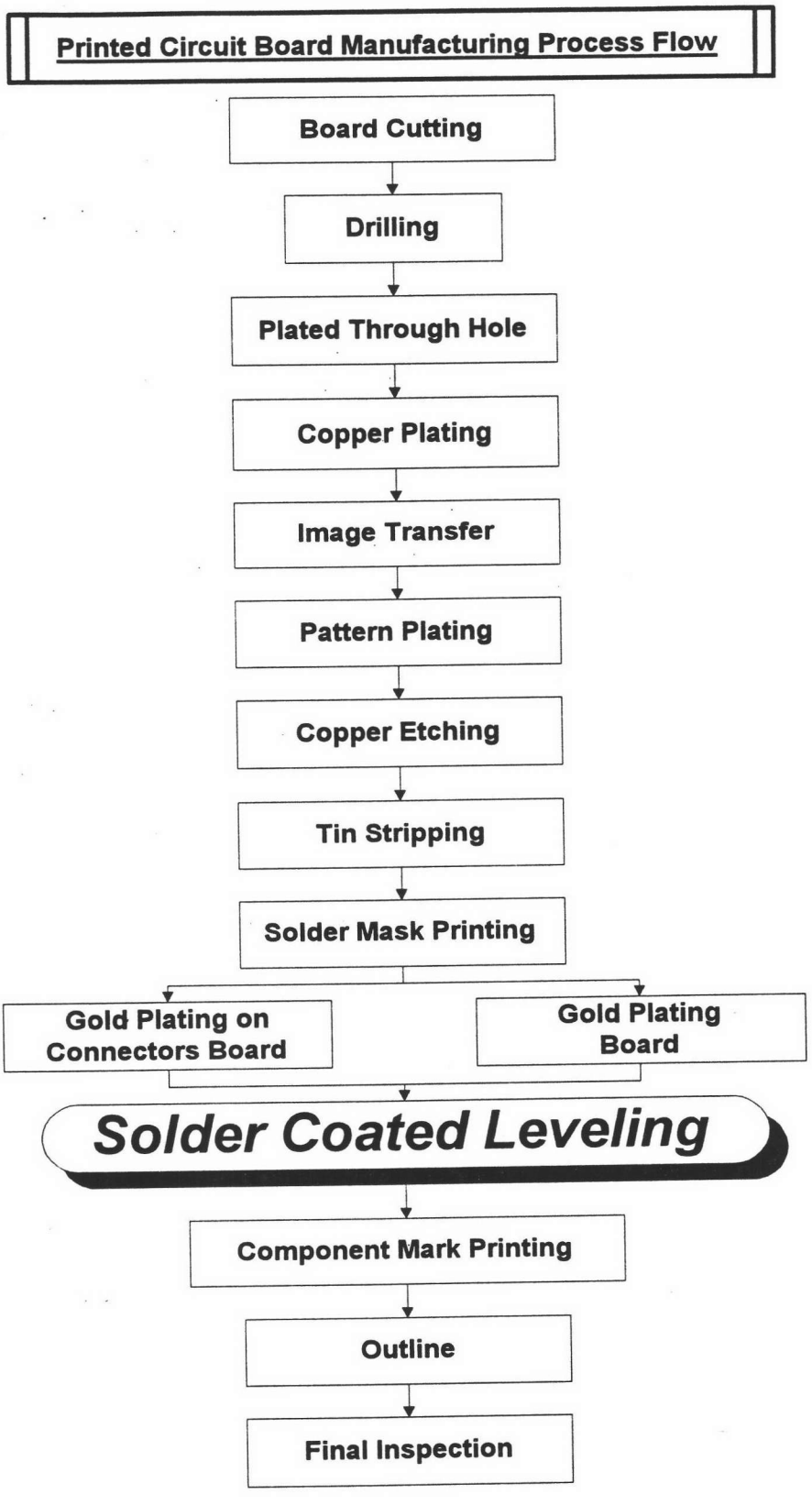
**13. กระบวนการตัดขึ้นรูปชิ้นงาน (Outline Process)**

เป็นกระบวนการตัดขึ้นรูปชิ้นงานให้มีขนาดและ/หรือรูปร่างตามที่ลูกค้าต้องการ

**14. กระบวนการตรวจสอบขั้นสุดท้าย (Final Inspection)** ฃ

เป็นกระบวนการตรวจสอบคุณภาพขั้นสุดท้าย ของแผ่นวงจรพิมพ์ ก่อนที่จะทำการจัดส่งไปให้ลูกค้าหรือนำแผ่นบอร์ดไปใช้งานจริง

กระบวนการผลิตดังกล่าวสามารถในรูปแผนผังง่ายๆ ได้ดังรูปที่ ข.1 นี้ :-




รูปที่ ข.1 กระบวนการผลิตแผ่นวงจรพิมพ์

# ประวัติผู้เขียน

นายสมควร อติเรกลาภวโรดม เกิดเมื่อวันที่ 26 มีนาคม พ.ศ. 2507 ที่จังหวัดราชบุรี สำเร็จการศึกษาระดับชั้นมัธยมศึกษาปีที่ 5 โรงเรียนเบญจมราชูทิศ ราชบุรี เมื่อปีการศึกษา 2524 สำเร็จการศึกษาระดับปริญญาตรี วิศวกรรมศาสตร์บัณฑิต สาขาวิศวกรรมเคมี จากมหาวิทยาลัยสงขลานครินทร์ เมื่อปีการศึกษา 2528

ปัจจุบันทำงานอยู่ที่ บริษัท รีท - ไรท์ (ประเทศไทย) จำกัด ในตำแหน่ง วิศวกรกระบวนการอาวุโส ฝ่ายวิศวกรรม TPC โรงงานส่วนผลิต Slider Fab