Apqp matrix pdf

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By this article i will try to explain step by step process of product development, will explain about activities and support from different concern person for product development. So before start we should have basic knowledge of quality tools. APQP: - Advance Product Quality Planning. PPAP: - Production Part Approval Process FMEA: - Failure mode and effect analysis SPC: - Statistical Process Control MSA: - Measurement System Analysis Here I will only talk about APQP in detailed. Definition: - APQP is a framework of procedures and techniques used to develop products in industry, particularly in the automotive industry. The goal of advanced product quality planning (APQP) is to establish new products and processes that are successful in meeting customer requirements. The production part approval process (PPAP) is an output of APQP processes and techniques. PPAP highlights the evidence established through the APQP. I have separated APQP in two words- Advance + Product Quality Planning To understand the meaning of advance in APQP see the word framework (Timing plan) of activities to be done for new part development. To understand meaning of Product Quality Planning we will do planning to sustain Quality throughout product life. For more clarity see this picture:- For Quality Planning we follow PDCA chart. Well PDCA Stand for Plan-Do-Check-Act. We make a plan -We work on that plan-We check are we ok or not-We take some corrective action that is called Act. So overall we can say APQP based upon PDCA. First 4 phase of APQP are PDC and last Phase is Act. To understand see the picture in very detail. APQP establishes clear lines of communication between customers and suppliers to define project specifications that translate into more comprehensive deliverables such as: Robust product design Lean manufacturing process to produce part within cost and on-time Design Validation Plan to ensure customer satisfaction using product testing Ensure supplier preparedness before start of production Finished products received are of high quality Speeds up new product to market time Establish transparent communication with the supplier. Establish confidence in a supplier's delivery. Ensures client satisfaction Creates structure for standardized systems and processes Early detection of problems before they get out of hand Better communication across the supply chain throughout the product development process. Remember few points related to APQP:- Activities of APQP and PPAP submission can be different, depend upon Customer to customer. Provides guidelines to produce a Product Quality Plan which will support the development of a product/service that will satisfy the customer. APQP is Customer focused process approach; APQP emphasize process control rather than product control. APQP target is always continual Improvement. What do you understand by below picture? Just see this picture very clearly and think about it before reading further. First phase is planning; side by side we start both activity of product/process development. Process design & development is long activity as compare to product design & development. After all product/process development we start production (Mass Production), we do close monitoring for some period, and check what is customer feedback. If No problem then continue & if found, we do assessment and take corrective action. Each phase of APQP has an objective. To understand the customer requirement & expectation accordingly draw up a plan about how we can meet that expectation & requirement. Basically when we received a project, we do a kick off meeting. Under that meeting we call CFT, which come put some input here, inputs are like voice of customer. In that meeting we try to compile all input through the voice of customer. Supply Chain:- Will explain about project, customer need, like annual volume, required documentation, profit, market research, Business plan, future forecast, competitors product information. Product Development team:- Will discuss product drawing spec, dimensions, appearance, Benchmark study, Any requirement for product development like new machine, new material ,Design change request, etc. Purchase team:- Will discuss about requirement of new sources, new purchase of R/M, Machines, Equipment, material availability, Regulatory requirements concerns. Quality team: - Will discuss over past trouble/Quality concern in that type of project, and will discuss required testing for project, Rejection level, inspection method, Quality Resolution. Production Team: - Will discuss over machine availability, Production capacity, Inventory, Daily supply, required manpower & machine. Over that discuss we try to figure out input. The output will be answer of the input. Marketing team: - Profit forecast, Quotation, Business Plan and BOM, product reliability study. Purchase Team: - Suppliers Confirmation, Raw material availability with grade. Development: - Design goals, Preliminary process flow chart, Benchmark Study of process/Product. Quality Team: - Past quality problems and countermeasures, testing equipment details. Production team: - Plant capacity and Man/Machine availability. OK, we have obtained output from answer of inputs. Just check is it the planning? Well, not exactly - we have to do lot of work for planning, like we have to make development timing plan, when we can finish event activities of product development, for that we make APQP matrix (which will have time plan for manufacturing process design and development). A Special characteristics matrix to be made for Product/Process. Along with this we have to make a product assurance plan, for that we will make preliminary control plan by using FMEA, will identify product reliability and durability requirement. Also we will do assessment for new process & technology. To develop design features and characteristics & ensure feasibility of drawing from all prospective. How we ensure feasibility of drawing? Well this is little tough, for this we go through the drawing in very details, check which parameter, statement created problem in past, whether we have facilities to meet that points, or is there any other option. A feasible design must permit meeting production volumes & schedules along with quality, reliability, investment cost, weight, and unit cost and timing objectives. Input for Phase 2 will be output of Phase 1 Feedback from quality team :-This test cannot be done, this dimension cannot be check. (For Example) Feedback from purchase team: - This material is not available in country –so take deviation on material (For Example) Product Development team:-DFMEA, Design verification, Design Review, Engineering drawing & spec. APQP Team: - Requirement of new equipment, tooling, facilities & gauges, Finalize of special product / process characteristics, material specification, team feasibility & management support. These outputs of phase 2 will become input of phase 3. Finally product development team will make Design change request to get approval for design change before mass production. Now you must have thinking why change request in design phase why not in planning phase. Well here you are right. We have to request for drawing change in planning phase but only on special time and on special meeting. Because in design phase (Phase 2) we will do design. Here DFMEA which is output is an analytical technique to identify possible design failure in product. This DFMEA should be prepared after getting DFMEA check, in which we first verify what we have or what we don't have. We will also make Prototype Control plan which will include dimensional description, dimensional requirement, material and functional test. Responsibility for protype control plan will be under product development team. "One wrong perception or understandings always lead us to do mistakes". Here as I said we will decide the design concern and will request DCR in planning phase. Well here this thing not always apply, it depend case to case situation/condition. When we have to design a component either it is functional or non functional, we can discuss all design related concern with customer in phase 2 (Product design and development) and we can request Design change request from customer. So it depend upon our component which design we are developing. Also remember there is difference between design and drawing. Well you know difference very well. So we also consider the followings things while designing the component:- Manufacturing and assembly process Dimensional tolerances Number of component Performance Requirement Process Adjustment Design, concept, function and sensitivity to manufacturing variation Special Characteristics must be identified in drawing Material Handling, Etc We not only design component also design its fixture for inspection, in which we define datum surface. All change in drawing through ECN has to be documented and need to be communicated to team. All special characteristics have to be address in drawing. We do verification of design on the basis of input of phase-1. While product design development, supplier has to be in regular review meeting with management and customers, so we can short out all possible design concern from smooth mass production condition and can get approval from customer. After all reviews, we do design simulation by using computer software and we do verification of test result done under design bench testing. All related activities is recorded in APQP matrix on documented form. To develop comprehensive and effective manufacturing system in line with customer need and expectation. So far now we have lean output of phase 2 will become input for phase 3. Product Development team:- Product Drawing and dimensions, Prototype control plan, Product & process specification, Special Characteristics of product and process. APQP Team: - Requirement of new equipment, tooling, facilities & gauges, material specification, team feasibility & management support (Staffing, Operator training). Process Flow Chart, PFMEA, Prelaunch Control Plan, Product/Process Quality Review, Flow plan Layout, Packing standard, Process Instruction, Process Capability Study (SPC) and MSA plan. Here I have to design a process and have to develop a process. Two words- Process Design and other process Develop. Process Design – I will make a Process Flow chart in which i have to show systematic flow of manufacturing process. Systematic means process operation will be done in required sequence. This sequence is decided after some simulation or on the basis of similar part history. Sequence of process play a vast role in effective manufacturing. We can also check source of variation in that Process flow chart. For process design we also prepared a floor plan layout (a systematic diagram showing material flow, inspection stations, rework stations, NG part storage area, dispatch area. Here from design prospect we check how much this space can be optimize. For process design, may be industries use some advance software, you have to search and tell me on my mail I.D. Next step we do, we make PFMEA well, this is joint activity. We have to do brain storming as well as have to consider as possible failure mode with past troubles. So for PFMEA a separate article can be written, I will write it later. And then we make control plan by using PFMEA as an input. Describe each operation with product /process parameters and also add quality review check points in that Control plan. So here what exactly I have done, I have design a process by creating some live documents like PFD, PFMEA, Control plan. The control plan I am making here is prelaunch control plan, different from prototype CP, in this CP I have to add process and product characteristics along with their control method. Also checking will be different from Proto Based Control plan, In Proto based CP checking frequency for each dimension is kept 100%. And then SOP and Process inspection check sheet are made as per Control plan. Remember I have design a process but its validation is pending. Further I have to develop a process, for which I have to optimize a process. A process which will give a zero rejection/Rework and process variation will be very less or dimensions will on mean. To develop such process I have to do some trials and have to do analytical study. Process development is long term activity. Because lot of parts will be made for long time on the basis of that process. Poor process development could lead organization to failure. So process development or we can say Phase 3 is main pillar of APQP. Top priority or expectation of customer is Process development. Expectation here- Part should be received without any failure on line. For Development prospect we make MSA plan of all checking aid being used for the project, also we make calibration plan along with MSA plan. We have to do SPC of all special characteristics dimensions, which are mention in CP. By SPC I will check process behavior and process capability. For SPC I have written a separate article which explains SPC topic properly. By SPC I will try to identify cause of variation in particular process and will eliminate that cause to make process more accurate. SPC is done in trails, done many times in this phase; purpose is to set a parameter of process on which we obtain best optimum value. Most of company brings this activity under some Audit or by specific requirement (Say Honda PAC-V report). So you can consider SPC is tool for process development. You can understand this in my article written on Honda part Development. For process development training play a vital role. Management support is required here for training of all staff and operator level person who will work on that process. Operator skill to be monitor and deployment of operator will be done on the basis of skill level. So some activity in process development takes time that is why it is a lengthy phase. To validate the product /manufacturing process and identify any concern for resolution before mass production (evaluation of significant production run). Same Input for phase 4 is output of phase 3 Process Flow Chart, PFMEA, Prelaunch Control Plan, Product/Process Quality Review, Floor plan Layout, Packing standard, Process Instruction (SPC) and MSA plan and Operator Training. Production run trial, Process Capability study, Production part Approval, Production validation testing, Production control plan, Packing standard. Here requirement is validation, first we have to understand meaning of validation. Validation meaning is checking whether a component is OK or not, or we can say we verify accuracy. 2 words :- 1) Product Validation 2) Process Validation Let first talk about product validation: - I have to check product, for that I will do a layout inspection, I will verify material laboratory test reports, I will do all drawing test and verify test reports, I will be endurance test & will verify product reliability, Also I will check profile on gauge if required and will make an appearance test report and I will also make master sample for Mass production as well as will make limit samples. Well here just think, this output which I have obtained from product validation, does it matches with above mentioned output checkpoints. Well yes these reports will be link with Production Part approval process (PPAP). Without these report customer can not approve your production Part. It will be consider only sample. Now let's talk about Process Validation: - Here I will check my process, verify all process parameters whether are they giving correct value. I can intentionally put wrong process parameter to check they show NG spec or not. For process validation, machine pressure values, sensors, PLC, tools life, Gauge calibration, to be verify. These values are not new, we have decided in phase 3 of process development. Here we have to check significant production run. Some company calls this event by Pilot trial, PPVT trial, HPVT trial. Honda verify through audit name QAV2 Step-5. For this we have to make 200 parts or have to run production for 2 hours whichever is later. Under that trial we also check rejection rate, it should not be higher, if it go high pilot trial will be consider NG. For PPVT trial or Pilot trial I have written separate article. MSA to be done for process validation, here MSA is tool of validation. MSA study is done for gauges (Variable or Attribute). Production control plan is made as all product and process parameters verified and tested. In last we prepared PPAP, a process which will provide the evidence that all engineering requirement has been understood and manufacturing process has potential to produce part consistently meeting requirement of customer in mass production. For this will add one document in PPAP called PSW (part submission warrant). All required documents are reviewed and compiled, added in PPAP file to get approval of production part. Quality planning is sign off internally by Departments. To improve the product/process in line with feedback after the validation & to evaluate the effectiveness of APQP process. So here Input for Phase 5 will be input of phase 4. Input for APQP phase-5:- Production run Rate, Process Capability study, Production part Approval, Production validation testing, Production control plan, Packing standard. Output from APQP phase 5:- Improve customer satisfaction; improve delivery and services, Corrective action on any defect observed in initial stage of part, reduced variations. We will try to sustain all product/process parameters which we have set, anything beyond that spec will lead to variations and NG. Here we have to do assessment- for that we will do a PSO (part sign off) process in which a management audit will be done to review Product development as per Production Control Plan. All Ng points or suggestion from Management side is considered for Corrective action. Now I will wait for feedback from customer while delivery parts for certain period under special control. Feedback is taken on priority and corrective action is taken for sustaining zero defect quality throughout mass production. Remember if you work on APQP, then your PPAP work will be like a clerical (which is very easy). But if you don't work on APQP then PPAP will be your Job. So we have understood one important core tool of QMS. Activities of APQP and PPAP submission can be different, depend upon Customer to customer. I hope you have understood and working on APQP. If you want to suggest or have any question please send me mail. For training related help, visit on AIAG-official website. Mail Address:- jewsfamily01@gmail.com

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