

Optimization of the Welding Process Parameters in Using the SPSS Method

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Abstract. Welding parameters should be selected to achieve the lowest heat input practical to minimize distortion. Thermal deflection is high enough to overheat the base material causing stress cracking. Important welding parameters, which include arc current, twine feed fee, workpiece thickness, welding pace and geometry, and varieties of metal alloy used for wire and workpiece, were applied as adjustable parameters, carrying the right attire is very important for welders. Any exposed skin to infrared and ultraviolet rays is susceptible to dangerous consequences, therefore welders should always ensure them. Maybe completely protected. To ensure that a weld is made to specification, it is necessary to measure and document the parameters used routinely. The main parameters for arc welding are welding current arc voltage travel speed. Research significance: this research deals with welding process parameters welding (wpp) process performance and its application in composite material with analysis of weld strength. To ensure that the welding process is under control a test of welds is used. Weld test, although not required by the specifications, welders allow them to test and improve their technique. Tensile yield power mpa, ultimate tensile power mpa, shear power mpa, elongation in % of 50mm gauge period, hardness exams at zero.05 kg load hv tensile and bending assessments are executed on specimens of distinct form and dimensions. Welding is a vital part of the automotive enterprise, construction enterprise, aviation enterprise, and lots of different industries. Without this form of metalwork, many stuff could no longer exist, which includes many buildings, gates and fences, small kitchen home equipment, automobiles - and even space travel. Method: "statistical package for social sciences" or "spss" for quick. In the 80s and 90s, application of bundles to the social sciences extends beyond the commercial sector; the old call turned into dropped and the name was shortened to "spss". Several attempts had been made to introduce a word that suits the acronym "spss", but they have got frequently failed. For some years in the early 2000s, we used "statistical packages and software services", however that became eventually dropped, and "spss" turned into just a name and no longer brief for something... Starting place story. Yet there is a detailed history of spss from 1968 to 2009, to be had to everybody involved. Evaluation parameters: tensile yield strength mpa, ultimate tensile strength mpa, shear strength mpa, elongation in 50mm gauge length %, hardness at 0.05 kg of load hv. Result: the cronbach's alpha reliability result. The overall cronbach's alpha value for the model is .845 which indicates 85% reliability. From the literature review, the above 50% cronbach's alpha value model can be considered for analysis. Conclusion: welding process parametersthe cronbach's alpha reliability result. The overall cronbach's alpha value for the model is .845 which indicates 85% reliability. From the literature review, the above 50% cronbach's alpha value model can be considered for analysis.

Keywords: spss, tensile yield strength mpa, ultimate tensile strength mpa, shear strength mpa, elongation in 50mm gauge length %, hardness at 0.05 kg of load hv.

1. Introduction

Process welding (WPP) is a version of the linear technique in which the material is welded without melting the whole. Tool rotation speed, plunging charge, plunging depth, and Reside The parameters including time are the currents of the joints that play an important role in detection. test Four elements and five to narrow down the range of situations an important composite rotating design with stages selected. Independently controllable FSSW Friction stir by combining system parameters Tensile strength of spot-welded AA2024 aluminum alloy an empirical dating to predict shear fracture load fitted. High lap cut of spot weld FSSW parameters to achieve power Response Surface Methodology (RSM) is used for optimization [39]. Welding procedure; Therefore, welding may be considered as a couple of input and output methods. However, a common problem faced with the aid of the producer is the manipulation of input method parameters to obtain a good welded joint with required bead geometry and weld pleasant with minimal harmful residual stresses, distortion, and maximum tensile energy. However, it's miles vital to decide the weld input parameters as a way to gain a welding joint with the specified specs for every newly welded product [21]. Common affects the required output welding

Process parameters process Welding speed, arc voltage, welding current, etc length of the arc, angle, handling, speed. A variety of selected Weld for welding processes Process parameters vary. These welding parameters are welding current, welding voltage, gas flow rate, wire feed rate, welding strength; Steel weld pool geometry when material [36]. Affects method, and parameters Use it for optimization and target quality May have a better mix. The top welding parameters to consider during arc welding are amperage, voltage, and wire feed speed [37]. In most welding processes, if these welding parameters are not set correctly, all of them can affect the finished weld, P number, F number, number PWHT, and thickness (outside the specified range) is an essential variable in the welding process specification [38]. Welding process parameters are Necessary for penetration to reach depth and HAZ width. According to RSM in plate welding tests Design suggested by Pete Matrix was carried out. Numerical and graphical optimization using RSM Required depth of penetration and desired HAZ width Gets the attitude. of the GA-based model Process using generated data for development with parameters Weld bead shape parameters First, multiple regression models for correlation were created [40]. Then regression models are optimized Process parameters were used in GA. In a GA-based model, the process is different and their performance is evaluated. The models suggested several solutions and Through tests of identified solutions Verified Performances of models later 9Cr-1Mo steel A-TIG welding process parameters were compared to optimize [23]. Welding process parameters are more available beneficial welding pool geometry Generally, preferred welding process parameters are decided empirically or by a mentor. However, selected Welding technique parameters specific to welding are The gold standard for gadgets and the environment or superior weld pool geometry It does not guarantee that it can be created. Ultimate weld pool geometry is mentioned [25]. The pulsed GTAW process is lean and meant for bonding with thick materials Appropriately, A.G. Stainless steel sheets and weld metal Metallurgical manipulation of important compositions Mechanized welding, welding process of parameters and welding With advanced users the choice of process is to be more specific Need, accurate fine weld bead parameters Minimum charge and excess again Make sure that repeats are done. [27]. They have a look at the simplest analysis that the purpose of the failure became a result of the extraction etching quarter with excessive attention to phosphorus masking the pipeline, and did not analyze the purpose of its formation within the welding process and welding parameters [29]. Welding procedure parameters are essential to acquire the best weld bead geometry Usually, defining the For newly welded items Weld input parameters are specific Time consuming with specifications take a look at regarding blunders correction attempt and Accurate welding input parameters Choosing a welding engineer or Skill of welding system operator [34]. Close friction stir welding method parameters Traction power and very efficient by evaluating the position was optimal the systems become observed. The most fulfilling degrees [35]. The surface finish parameters of welding and welding rail should be modified. Railway evaluation of an FBW joint of U75V type steel Fatigue fracture technique according to repeated fatigue failure. FBW parameters are mainly welded Fatigue performance of rail they found that affect Investigated the causes of Welded repaired failure of rails and Residual in crack propagation Rolling pressures [28]. The intention of the existing research became to improve the best homes. Welds are made the usage of the greatest circumstance obtained and those welds are subjected to a bloodless flashing procedure. Roll blasting is a useful manner in which the weld is for two steel rolls There is more in the middle. Glowing During operation, internal pressures prompted for the duration of Welding relief and grain are destroyed. Hence, the machining of welds Properties is improved [32]. Increases welding parameters. Exploring the special feature of orthogonal arrays Defined using format with numerical tests Full parameter space to solve this problem for improving welding parameters Simple and strong Subtly detected [26]. The residences of welded joints are suffering from a big quantity of Welding parameters. Weld to predict the goodness of welds Modelling of the beat pattern is important. Welding The bead parameters of joints (bead geometry parameters also known as) to model the predictive welding method in practice, Tungsten Inert Gas (TIG) welding Modelling bell parameters in practice and Upgrades are prizes Attempts have been made in the work [22]. Welding method parameters and bead performance, welding-bead laser welding Reaction to study the influence of parameters Site technique (RSM) is used. Artificial Neural Networks (ANN) have been used by many researchers for various material geometries in different joint structures while optimizing [24]. Relatively simple principle and cost-effective Such as automobile bodies due to facilities Assembly proceedings. Determines welding quality Factors, however, resistance spot welding Each other even in an easy-to-use practice Influences heavily, it is satisfactory welding Getting quality is difficult. Trial and error desired weld quality using the method it is inefficient to set the conditions necessary to obtain is the task. So, using the welding process model, by exposing the welding to produce the desired weld quality It is necessary to decide the quality of the optimal condition through a limited number of tests [30]. The direction of welding is to the rolling course Changed normally. Joints Unmarried pass welding system to create was used. Non-consumable Threaded cylindrical pin profile products of excessive carbon metallic become used to put together Joints. Domestically Designed and developed gadgets [31]. Friction welding is a solid accession process This is in recent times Widely used blessing that includes low warmness input, high productiveness, Ease of manufacture, and

Environment-friendly Available items are hard to weld by friction welding through fusion welding techniques and Can weld effectively. Tensile friction welded by an experiential bond that anticipates power an attempt was made to increase the great effect on joint energy. The response floor method used welding 543 for fabricated joints under the circumstances MPa ultimate tensile strength was obtained 6 2nd friction time and six seconds forging time, [33].

2. Materials And Method

Tensile yield strength (MPa): Tensile strength is commonly the amount of pressure in kilos in line with square inch (psi) or megapascals (mpa) a model for fabric failure factor to pull this check is executed by placing a dumbbell-formed specimen inside the grips or jaws of a torsometer. As with tensile strength, the yield strength is pascal (pa) or measured in megapascals (mpa). A milder metal with a yield strength of approximately 250mpa has strength. Is there not any formula for calculating yield pressure? The yield strain of fabric is decided with the aid of checking out. A material specimen is loaded with an axial force and the ensuing deformation is recorded. The implemented pressure and deformation values are normalized to strain and stress, respectively. The compressive electricity become calculated using the equation $f = p/a$, in which f is the compressive energy of the specimen in megapascals, p is the most implemented load in newton and a is the go-sectional location estimate.

Ultimate tensile strength (MPa): Tensile energy, also referred to as ultimate tensile electricity, is the burden at failure divided with the aid of the original pass-sectional location, where ultimate tensile strength (u.t.s.), $\sigma_{max} = p_{max} / a_0$, in which p_{max} = maximum load, a_0 = authentic cross-sectional area. Tensile energy is normally measured as the quantity of pressure in kilos according to rectangular inch (psi) or megapascals (mpa) required to tug a pattern to fabric failure. The si unit of remaining tensile strength is n/m² or pascal, in which large numbers are expressed in megapascals. The ultimate tensile electricity of structural metallic stages is from 485 - 650n/mm² or 70000 - 95000 psi. It can also be measured in an si unit called grade 250, that's a slight structural steel grade with a nominal yield energy of 250 mpa. It is used in an extensive range of common packages. Grade 250 is easily welded and formed and can be processed through laser, hello-def plasma, or oxy machines.

Shear strength (MPa): The allowable shear stress is the value obtained from the test data of the spring. Additionally, the value for each item is slightly different. For example, 50% for piano wire and hard-drawn steel wire, 55% for oil tempered wire, and 40% for stainless steel wire. Studies have shown that the theoretical shear strengths of polycrystalline metals are much higher than those observed from mechanical testing. For example, the differences for copper are about 35 times (7.7 gpa vs. 220 mpa), and for iron about 44 times (12.8 gpa vs. Shear strength of a slab resisting flexural forces in two orthogonal directions around a column. Footings and pile caps), from the column face. The shear strength of a prism located at half the slab depth d is evaluated.

Elongation in 50-mm gauge length (%): The overall length is measured from the beginning of deformation to the beginning of fracture. Two extensometer gauge lengths are normally used: a50 (50mm or 2 inches) and a80 (80 mm). Gauge length is the reference period used in period calculations. Depending on the check general, the gauge period is 2 inches, eighty mm, or 50 mm. Multiplying the width and thickness instances the music duration determines the initial go-sectional vicinity earlier than trying out. Elongation at break is a measure of how much a material can withstand bending and deformation without breaking. Elongation measured in interval values indicates the ductility of a polymer. Interspaced elongation is important in components that absorb energy through plastic deformation. Such proportional dimensional change (magnitude or amount of deformation) is called strain unit length due to some applied stress.

Hardness at 0.05kg of load (Hv): To calculate the rockwell hardness c wide variety: multiply the dimensions thing, 500, through the intensity of penetration, and subtract the product from the dimensions thing of hundred to get the rockwell hardness (hrc) quantity. Rockwell [hrc/hrb/hra] is one of the common gadgets used to list the hardness of machined materials. The intensity of penetration of a sphere beneath a huge load is tested by comparing it with the penetration made by a reference preload. They stay sharp for a long time but are difficult to sharpen. 60-62 hrc: blades stay sharp longer but are more prone to becoming brittle. Sharpening is difficult, and quality depends on the production. Often used in japanese knives.

Method: spss through basics of spss of students using the publications introductory statistics and research methods strategies the use of step-via-step explanations affords statistical strategies and methods for undertaking statistical analysis, and statistics all common in the analysis how to avoid defects explains that in elements. The development of easy- to use statistical software including spss, records are taught and discovered has changed. Students can perform transformations of variables, graphs of distributions of variables can be constructed, and with the click of a button select from statistical analysis. Spss statistics is information control, advanced analytics, multivariate analytics, commercial enterprise intelligence, and Ocriminal investigation evolved with the aid of ibm is a statistical software program package deal. Long time, spa inc. Was created through, ibm and

acquired in 2009. The logo calls for the maximum latest variations in ibm spss information. The " statistical package deal for the social sciences " (spss), a hard and fast software program gear for changing, analyzing, and displaying information, is normally used. Multiple formats are to be had for spss. Numerous upload-on modules can be purchased to increase the software's statistics entry, statistical, or reporting abilities. The core software is referred to as an spss base. The spss advanced models and spss regression version's add-on modules are, in our opinion, the most essential of those for statistical analysis. Additionally, independent programs that connect to spss are available from spas inc. Spss is available in versions for windows (98, 2000, me, nt, and xp), supported by windows 2000 running spss version 11.0.1. Although further versions of the spss will most likely be available by the time this book is released, we are certain that the spss instructions provided in each chapter will still apply to the studies outlined.

3. Results And Discussion

TABLE 1. Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation	Variance	Skewness		Kurtosis	
Tensile yield strength MPa	25	4	1	5	72	2.88	.247	1.236	1.527	.390	.464	-.530	.902
Ultimate tensile strength MPa	25	4	1	5	77	3.08	.305	1.525	2.327	.007	.464	-1.461	.902
Shear strength MPa	25	4	1	5	68	2.72	.292	1.458	2.127	.269	.464	-1.267	.902
Elongation in 50mm gauge length %	25	4	1	5	75	3.00	.306	1.528	2.333	.152	.464	-1.449	.902
Hardness at 0.05 kg of load Hv	25	4	1	5	76	3.04	.286	1.428	2.040	.204	.464	-1.120	.902
Valid N (listwise)	25												

Table 1 shows the descriptive statistics values for analysis in welding process parameters N, range, minimum, maximum, Sum, mean, standard deviation, Variance, Skewness, KurtosisTensile yield strength MPa, Ultimate tensile strength MPa, Shear strength MPa, Elongation in 50mm gauge length %, Hardness at 0.05 kg of load Hvthis also using.

TABLE 2. Frequencies Statistics

		Tensile yieldstrength MPa	Ultimate tensile strength MPa	Shear strength MPa	Elongation in 50mm gauge length%	Hardness at 0.05kg of load Hv
N	Valid	25	25	25	25	25
	Missing	0	0	0	0	0
Mean		2.88	3.08	2.72	3.00	3.04
Std. Error of Mean		.247	.305	.292	.306	.286
Median		3.00	3.00	3.00	3.00	3.00
Mode		3	5	1	5	3
Std. Deviation		1.236	1.525	1.458	1.528	1.428
Variance		1.527	2.327	2.127	2.333	2.040
Skewness		.390	.007	.269	.152	.204
Std. Error of Skewness		.464	.464	.464	.464	.464
Kurtosis		-.530	-1.461	-1.267	-1.449	-1.120
Std. Error of Kurtosis		.902	.902	.902	.902	.902
Range		4	4	4	4	4
Minimum		1	1	1	1	1
Maximum		5	5	5	5	5
Sum		72	77	68	75	76
Percentile s	25	2.00	2.00	1.00	2.00	2.00
	50	3.00	3.00	3.00	3.00	3.00
	75	3.50	5.00	4.00	5.00	5.00

Table 2 Show the Frequency Statistics in analysis welding process parameters Tensile yield strength MPa, Ultimate tensile strength MPa, Shear strength MPa, Elongation in 50mm gauge length %, Hardness at 0.05 kg of load Hvcurve values are given

TABLE 3. Reliability Statistics

Cronbach's Alpha Based on Standardized Items	N of Items
.845	5

Table 3 shows the Cronbach's Alpha Reliability result. The overall Cronbach's Alpha value for the model is .845 which indicates 85% reliability. From the literature review, the above 50% Cronbach's Alpha value model can be considered for analysis.

TABLE 4. Reliability Statistic individual

	Cronbach's Alpha if Item Deleted
Tensile yield strength MPa	.887
Ultimate tensile strength MPa	.819
Shear strength MPa	.785
Elongation in 50mm gauge length %	.784
Hardness at 0.05 kg of load Hv	.807

Table 4 Shows the Reliability Statistic individual parameter Cronbach's Alpha Reliability results. The Cronbach's Alpha value for Tensile yield strength MPa -.887, Ultimate tensile strength MPa - .819, Shear strength MPa -.785, Elongation in 50mm gauge length % - .784, Hardness at 0.05 kg of load Hv - .807This indicates all the parameter can be considered for analysis.

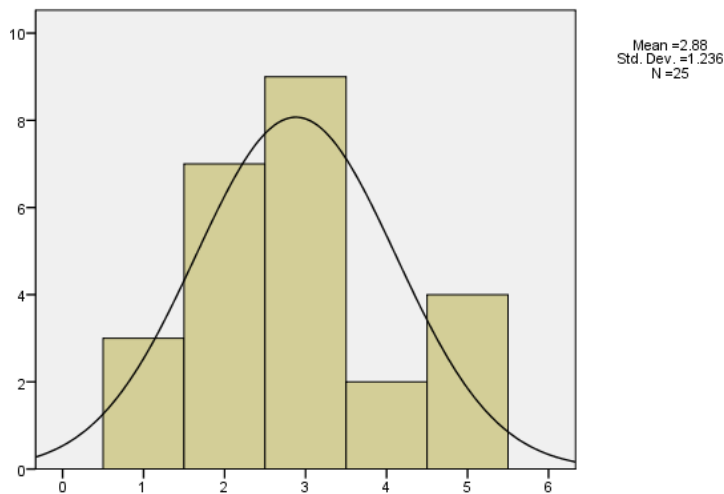


FIGURE 1. Tensile yield strength MPa

Figure 1 shows the histogram plot for Tensile yield strength MPa from the figure it is clearly seen that the data are slightly Right skewed due to more respondent chosen 3 for Tensile yield strength MPa except the 2 value all other values are under the normal curve shows model is significantly following normal distribution.

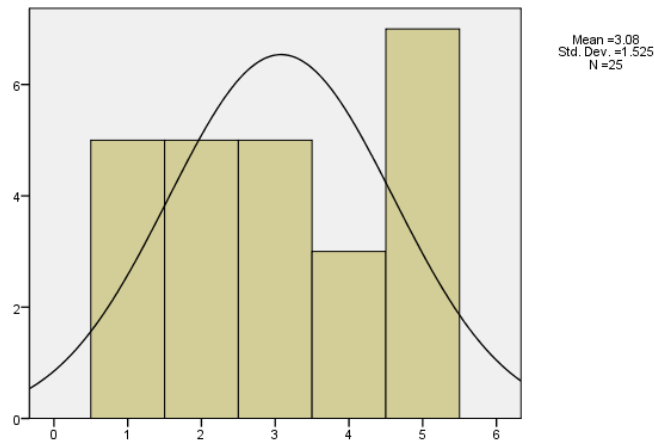


FIGURE 2. Ultimate tensile strength MPa

Figure 2 shows the histogram plot for Ultimate tensile strength MPa from the figure it is clearly seen that the data are slightly Right skewed due to more respondent chosen 5 for Ultimate tensile strength MPa except the 2 value all other values are under the normal curve shows model is significantly following normal distribution.



FIGURE 3. Shear strength MPa

Figure 3 shows the histogram plot for Shear strength MPa from the figure it is clearly seen that the data are slightly Left skewed due to more respondent chosen 1 for Shear strength MPa except the 3 value all other values are under the normal curve shows model is significantly following normal distribution.

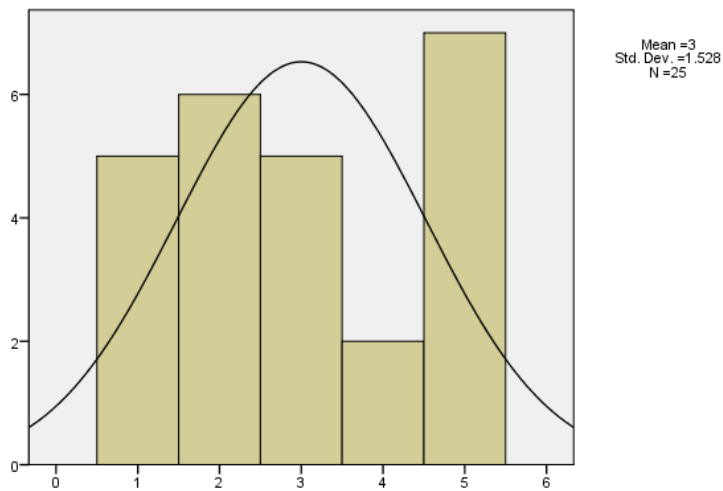


FIGURE 4. Elongation in 50mm gauge length %

Figure 4 shows the histogram plot for Elongation in 50mm gauge length % from the figure it is clearly seen that the data are slightly Right skewed due to more respondent chosen 5 for Elongation in 50mm gauge length % except the 4 value all other values are under the normal curve shows model is significantly following normal distribution.

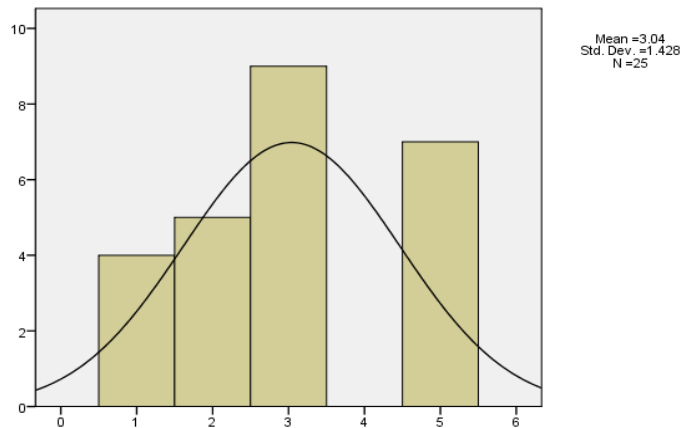


FIGURE 5. Hardness at 0.05 kg of load Hv

Figure 5 shows the histogram plot for Hardness at 0.05 kg of load Hv from the figure it is clearly seen that the data are slightly Right skewed due to more respondent chosen 3 for Hardness at 0.05 kg of load Hv except the 3 value all other values are under the normal curve shows model is significantly following normal distribution.

TABLE 5. Correlations

	Tensile yield strength MPa	Ultimate tensile strength MPa	Shear strength MPa	Elongation in 50mm gauge length %	Hardness at 0.05kg of load Hv
Tensile yield strength MPa	1	.271	.351	.353	.263
Ultimate tensile strength MPa	.271	1	.629**	.662**	.553**
Shear strength MPa	.351	.629**	1	.729**	.726**
Elongation in 50mm gauge length %	.353	.662**	.729**	1	.688**
Hardness at 0.05kg of load Hv	.263	.553**	.726**	.688**	1

** . Correlation is significant at the 0.01 level (2-tailed).

Table 5 shows the correlation between motivation parameters for Tensile yield strength MPa for Elongation in 50mm gauge length % is having highest correlation with Hardness at 0.05kg of load Hv and having lowest correlation. Next the correlation between motivation parameters for Ultimate tensile strength MPa for Elongation in 50mm gauge length % is having highest correlation with Tensile yield strength MPa and having lowest correlation. Next the correlation between motivation parameters for Shear strength MPa for Elongation in 50mm gauge length % is having highest correlation with Tensile yield strength MPa and having lowest correlation. Next the correlation between motivation parameters for Elongation in 50mm gauge length % for Shear strength MPa is having highest correlation with Tensile yield strength MPa and having lowest correlation. Next the correlation between motivation parameters for Hardness at 0.05kg of load Hv for Shear strength MPa is having highest correlation with Tensile yield strength MPa and having lowest correlation.

4. Conclusion

Welding parameters should be selected to achieve the lowest heat input practical to minimize distortion. Thermal deflection is high enough to overheat the base material causing stress cracking. Important welding parameters include arc current, twine feed fee, workpiece thickness, welding pace and geometry, and varieties of metal alloy used. Process welding (wpp) is a version of the linear technique in which the material is welded without melting the whole. Tool rotation speed, plunging charge, plunging depth, and reside the parameters

including time are the currents of the joints that play an important role in detection. Test four elements and five to narrow down the range of situations an important composite rotating design with stages selected. Independently controllable fssw friction stir by combining system parameters tensile strength of spot-welded aa2024 aluminum alloy an empirical dating to predict shear fracture load fitted. Tensile strength is commonly the amount of pressure in kilos in line with square inch (psi) or megapascals (mpa) a model for fabric failure factor to pull this check is executed by placing a dumbbell-formed specimen inside the grips or jaws of a torsometer. The allowable shear stress is the value obtained from the test data of the spring. Additionally, the value for each item is slightly different. For example, 50% for piano wire and hard-drawn steel wire, 55% for oil tempered wire, and 40% for stainless steel wire. To calculate the rockwell hardness c wide variety: multiply the dimensions thing, 500, through the intensity of penetration, and subtract the product from the dimensions thing of hundred to get the rockwell hardness (hrc) quantity. Rockwell [hrc/hrb/hra] is one of the common gadgets used to list the hardness of machined materials. Spss through basics of spss of students using the publications introductory statistics and research methods strategies the use of step-via-step explanations affords statistical strategies and methods for undertaking statistical analysis, and statistics all common in the analysis how to avoid defects explains that in elements. The development of easy- to use statistical software including spss, records are taught and discovered has changed. "statistical package for social sciences" or "spss" for quick. In the 80s and 90s, the application of bundles to the social sciences extends beyond the commercial sector; the old call turned into dropped and the name was shortened to "spss". Several attempts had been made to introduce a word that suits the acronym "spss", but they have got frequently failed. For some years in the early 2000s, we used "statistical packages and software services", however that became eventually dropped, and "spss" turned into just a name and no longer brief for something... Starting place story. Yet there is a detailed history of spss from 1968 to 2009, to be had to everybody involved. Tensile yield strength mpa, ultimate tensile strength mpa, shear strength mpa, elongation in 50mm gauge length %, hardness at 0.05 kg of load hv. The cronbach's alpha reliability result. The overall cronbach's alpha value for the model is .845 which indicates 85% reliability. From the literature review, the above 50% cronbach's alpha value model can be considered for analysis.

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