STANDARDIZATION OF PHOTOGRAPHIC SILKSCREEN PRINTING PROCESS

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APPROVAL SHEET

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ABSTRACT

The study aims to standardize the Photographic Silkscreen Printing Process. The experimental research design was employed. Laboratory experiment was conducted and the data was carefully tallied and interpreted while choosing the best output to be rated by the respondents using hedonic scale through a survey questionnaire, treated and interpreted using parametric test to validate the results in laboratory experiment. The data shows that is higher acceptability rate when it comes to print quality of the proposed improved process and significant difference of printing quality when using variety of light exposure hence, from the existing process the researcher come up with improved and standardized photographic pattern development in sensitized emulsion that is mainly used in silkscreen printing as medium for transferring the image or pattern into a fabric. Ultraviolet light exposure unit box when it comes to pattern development in sensitized emulsion has more clarity and sharpness of the edges. Followed by warm light exposure and lastly by the daylight exposure box unit. That sensitized emulsion reacts or sets with a specific time frame, one procedure may not be suited using another steps or procedure using another type of emulsion, so this study specified the different factors to claim it as standard. For the recommendation, the improved and standardized process of photographic silkscreen printing must be patented.

TABLE OF CONTENTS

Chapter 1

THE PROBLEM AND ITS SETTING

Introduction

Places like mall, park, school, churches, bus terminal, and the likes there are several visual arts as graphical layout used in tarpaulin, billboard, and many form of print out are widely used as a means of communication for many purposes. One of which is predominantly made by the use of silkscreen film process under the use of photographic film development usually made out of mixture of chemical and photo emulsion by transferring the design through a process of light exposure.

However, this method is a laborious process in which a product of scientifically work, combination of physics and chemistry and a touch of patience and creativeness. This formula is a precise ingredient of having a quality print output for silkscreen printing.

Although, video tutorial and books with regards to silkscreen printing are already available using their own method. However the said available materials and methods are not standardized using different elements and factors that affect the quality of developed sensitized emulsion. And the aim of this study is to give exact information for specific procedure with respect to a particular type of

emulsion, type of light source and other factors in the whole silkscreen printing process.

According to the Lean Enterprise Institute (2015), Standardized Work is one of the most powerful but least-used lean tools. to know the importance of processes and by taking steps to identify and document best practices and to make communicate these to all there workers, Standardized Work has become a vital and influential part of their culture. Standardized Work consists of elements and procedures that are organized in a way that ensures to be easily understood, consistently followed, and constantly improved by the team members.

Hanley (2000) iterated the printed textile industry is massive: the total retail valued of printed textile worldwide, not including digital, is about $450 billion and the value of textile print services worldwide is approximately $38 billion which silkscreen are commonly used in printing method. According to Zoiz (2012), a screen printing was applied on cotton fabric or any planar surface, an aqueous printing paste was prepared from thickening and cross linking agents and an exposure to UV light with specific time. The development of ultraviolet light and addition of other chemicals into the corresponding formazans, which are insoluble in water, the printed designs were resistant to washing.

Dobric (2010) study stated that there is a significant decreased in volume of gamut by exposing the printed area using inkjet printer to mixed daylight and

artificial light through a glass window by 69.04% and a decrease of 90.23% when exposed to outdoor conditions. Such factors like color tonality and print quality has remarkably decreased, which most of the silkscreen products uses like rubbery substance both water based and none water based inks and pigments are more resisting characteristic's to such conditions. Standards provide people and organizations with a basis for mutual understanding, and are used as tools to facilitate communication, measurement, commerce and manufacturing. Standards are everywhere and play an important role in the economy, On the other hand, the availability of materials in the locality compromise the process of silkscreen printing in which the quality of print out is undetermined. In which the proposed procedure that is available are not standardize according specific factors such as chemical mixture, type of light source, curing time, exposure time, and the distance of sensitized emulsion from the light source relative to locally available material. This study aims for standardizations of the whole process of Photographic Silkscreen Printing using different factors that suites to the prefer materials in which the end user choose to have, and to endorse the exact process that is appropriate for its purpose.

Statement of the Problem

The study aims to standardize the Photographic Silkscreen Printing Process. Specifically, it sought to answer the following questions:

1. What are the existing Photographic Silkscreen Printing Process?

2. What are the key elements of existing photographic silkscreen printing process that affect the following:

2.1 Efficiency;

2.2 Printing quality; and

2.3 Durability?

3. Is there significant difference of the existing photographic silkscreen printing processes in terms of quality printing?

4. What is the improved process based on the existing photographic silkscreen printing process?

5. With the improved photographic silkscreen printing process, what standard process maybe developed to produce with efficiency and quality in terms of:

5.1 Light sources:

5.2 Curing time; and

5.3 Exposure time?

Hypothesis

1. There is no significant difference of the existing photographic silkscreen printing process in terms of:

1.1 Efficiency;

1.2 Printing quality; and

1.3 Durability

Theoretical Framework

To paraphrase, Printing press employs offset patterns which are also photographically prepared using screens for the primary black and white negatives. However the quality of print output defends on the quality of photographic film stencil pattern that is developed in sensitized emulsion. This study will revisit and discuss the literature related to photographic film development theory and their process in sensitized emulsion, as the beginning of silkscreen printing process.

Conceptual Framework

In order to fully anticipate the process flow of the desired outcome of this paper, the researcher was able to come up with a study which focuses on the existing process of photographic development and the standardization of photographic silkscreen process using various artificial light sources in respect to the local chemical mixture of sensitized emulsion found in the Philippines.

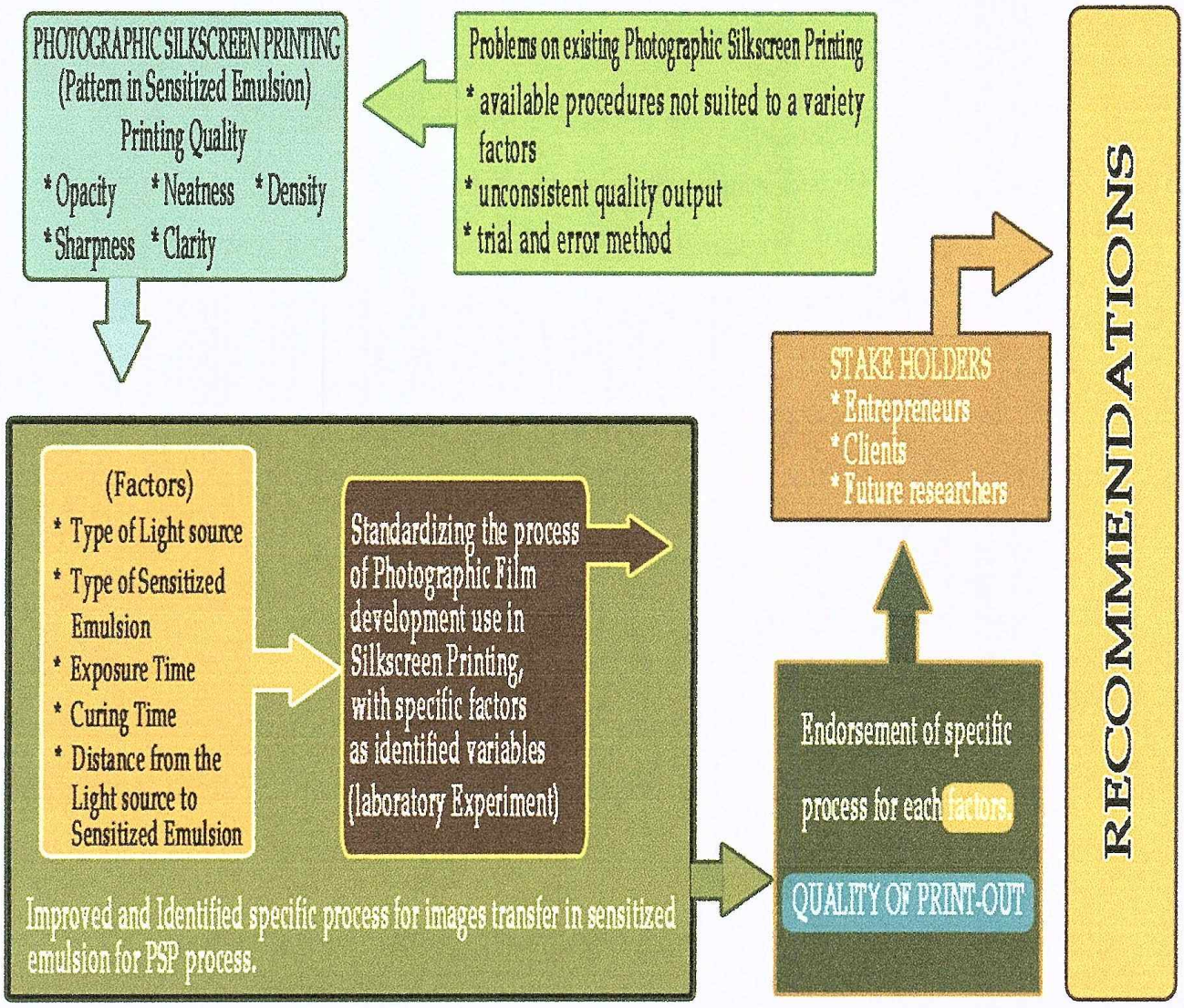

Figure1. (Conceptual Model of the Study)

Figure 1 Shows, the process flow of the study. beginning with the problems encountered in photographic silkscreen printing process. Wherein existing procedures that are available, are not suitable for every factors namely: type of light source for exposure (Ultra violet lamp, Daylight lamp and Warm light lamp), type of Sensitized emulsion (DIAZO, Local photo emulsion, Photo flush and Aqua sol ER), Exposure time, Curing time and Distance from the light source to the sensitized emulsion.

This factor directly affect the printing quality of silkscreen printing process as photographic film is the main medium used in silkscreen printing by transferring the image directly on sensitized emulsion coated on the silkscreen through a light exposure. However it is difficult to identify the specific of procedure in making this photographic film relative to a certain factors, which this study aims to standardize the whole process using this commonly used factors to answer the needs of achieving the quality of printing as identified: opacity, sharpness, clarity, neatness and density. In which the best output determined in a certain process conducted in the laboratory experiment will be repeatedly done to verify the same results and claim it as standard for Photographic silkscreen printing and endorsed to the stake holders to consume the result of the study.

Significance of the Study

The study focuses on providing the possible data for photographic silkscreen process for textile printing for accurate and precise output which can benefit the following stakeholders:

Entrepreneurs capable fully identifying themselves new economic role society. An entrepreneur is person who has enterprising quality eye opportunities uncanny vision, commercial acumen above all, person who willing take risks because adventurous skill within, Shruti Lathwal (2011).

Clients To the knowledge gainers that seeks for accurate or precise information needed for the specific task and later will become one of the enthusiast that engage into business of print making or a knowledge generator that can impart or improver of this study, Georgios Serafeim (2015).

Future researchers. This material can be used as a reference for future studies of similar line of interest or topic particularly on the effectiveness of standardized silkscreen printing process.

Scope and Delimitations

This study was limited only to the aspects of the process of the photographic silkscreen printing with particular specifications of materials and factors that has been used as to identify improved process.

Although, foreign authors who conducted the study on silkscreen process, are already available; But the standardized process is still unknown. On the other hand the study use survey questionnaire to validate the laboratory results based on the perception of the respondents. The scope of this study includes the specified factors that affect printing quality and other key elements the deals with the final output of the process. The proposed standardized photographic silkscreen printing process was conducted within the region of Western, Samar and was started and expected to be finished on the said school year 2017-2018.

Definition of Terms

To better understand the content of the study, some terms are conceptually and operationally defined to serve as a common form of reference for the readers.

Aquasol Emulsion. A ready mixed chemical compound, use as a film coating when hardened by exposing it to radiation. sensitized emulsion, caused photoexcitation dye aggregates through silver cluster centers, A. V. Tyurin (2008).

Color separation. This is a process in which individual color is separated using Computer Aided Drafting (CAD) Software to transfer it on a sensitized emulsion through static deformation analyzed optimal squeegee velocity formulated Taik-Min Lee,(2008).

Curing time. This refers to the time in which the chemical and materials are already set and ready to use. It provides mature cost-effective solution many problems where hazardous residue has treated stored under critical environmental conditions. certain mix compositions reaction conditions concentration, curing temperature curing time, Divya Khale (2007).

Dark room. A closed room intended for developing sensitized emulsion for photographic film development with a minimal lighting and usually using a low red light for dimming the surroundings to avoid over exposure of the materials. Darkroom implementations range applications, including camera pipeline, low-level feature detection algorithms, deblurring and high energy efficiency, James Hegarty (2015)

Daylight lamp. A white emitting color bulb, used by most of the building structure for its sunlight like of illumination.

Develop. This refers to the image developed or image transferred using light source at a specific time frame.

Durability. As used in this study this refer to the condition of the stencil of being strong or in good condition for a long period of time.

Efficiency. This refers to the cost effectiveness and time wise of the process.

Entrepreneur. A person who starts a business and willing to risk loss in order to make money.

Exposure box unit A device used to regulate artificial light source through a glass panel.

Future researcher A person who do a careful study that is done to find a report new knowledge about something.

Image development. A process of coming up with a graphical images after doing the exposure of sensitized emulsion to a exposure box which is almost the same as a photo copier.

Mesh . A term use to indicate the number of holes per inch in the silkscreen to be use.

Light exposure. A term use to identify the specific type of illumination to be used in exposing the negative film or the sensitized emulsion.

Photographic film A dried sensitized emulsion used for copying image by light exposure.

Photo hardener. A chemical compound which is intended for hardening the emulsion after the exposure and removing those unwanted parts of emulsion through a blast.

Photographic silkscreen printing A process of printing image on a fabric or surface using photographic film stencil by squeezing the ink to the offset part in which the ink may pass through screen mesh.

Quality of print. An indication of valued results based on the output.

Registration. This refers to the accurateness of graphical illustration that is transferred during exposure time particularly during color separation.

Silkscreen Exposure Calculator. A graphical design layout with varied line pattern printed on a translucent or clear sheet of paper used in determining the suited time exposure, through a trial and error method.

Standardized. A term used to indicated same results within the repeated process.

Stencil A offset image transferred in sensitized emulsion by exposing to light source and wash out to remove the unwanted part.

Tension. Refers to the strength of the stretched silkscreen within the frame.

Textile ink. An aqueous paste that is use for making the positive image in the silkscreen visible in the fabric or textile by passing through the silkscreen that is developed with sensitized emulsion and exposed through a light at exact curing time, and squeezing the ink using a rubber or plastic squeegee to press the ink into the fabric.

Ultraviolet rays. This is situated beyond the visible spectrum at its violet end and a kind of radiation having a wavelength shorter than wavelengths of visible light and longer than those of X-rays.

Warm light lamp. A yellowish color illumination of light same as incandescent bulb invented by Thomas alba Edison.

Washing out. The process of removing unwanted part of emulsion after exposing it to a specific light source using pressurized water to reveal its offset part.

Wedge step. A process of checking the exposure whether the desired image has developed by dividing the image to several time exposures.

Chapter 2

REVIEW OF RELATED LITERATURE AND STUDIES

This chapter consists of the related literature and studies. In the view of the researcher's desires that the study's novelty and importance be assured, literatures were read and reviewed. These resource materials will serve as the basis and guidance in the completion of this study.

The literature focuses on Photographic film development, related theories and their process. To answer the four research questions, an extensive search and review of the existing relevant literature was conducted. The sources reviewed in this paper come from four major sources: academic books from the library; peer-reviewed journal articles from digital databases including Emerald insight, Safety lit, and Google scholar; ProQuest and documents online; E-library U.S.A; and other online electronic resources.

Related Literature

It is known that in the silk screen process a relief image may be formed in a photographic emulsion layer on a special stripping film, the gelatin image transferred to the silk screen and the support of the original film stripped or peeled away.

Abernathy (2002).In recent years the apparel industry has undergone significant changes in terms of how clothing is distributed, forecasted and produced. Similar to other industries, product proliferation has drastically changed the apparel sector, meaning that retailers must supply more products on a frequent basis. Store like Sweden's H&M and Spain's Zara have pioneered this tactic. With more products to offer, demand is also spread across a larger number of goods with a lower average demand and higher levels of variability which one of the option is the silkscreen product that most of the apparel.

In this regard photographic silkscreen printing process still exists for its promising durability; however printing quality is hardly achieved for there is no standardized process available for every factor. This study gives focus on having the standardize photographic silkscreen printing process by comparing and analyzing varied result through repetition to validate it as to standard.

Yackel (1952) stressed that the relief image remaining on the silk screen forms a stencil for silk screen printing. In the stripping film used in this process the degree of adhesion between the light-sensitive emulsion and the film base is rather critical. It must be great enough when the film is dry to hold the emulsion through handling and cutting as well as keeping at low relative humidity. Adhesion should be sufficient to keep the exposed emulsion from washing off while the unexposed portions are being removed in the formation of the relief image to be used as the stencil.

However, the adhesion must not be so great that the base or support of the film cannot be removed after the gelatin stencil has been dried on the silk screen. At this point it is essential that separation between the relief image and the film support take place cleanly and easily so that portions of the stencil are not pulled off the silk when the film based is removed. This is especially important when the silk screen image consists of half-tone dots adhering to only one or two strands of the silk screen mesh.

It is therefore an object of the present invention to provide a novel subbing method for a stripping film to be used in the silk screen process. A further object is to provide a subbing technique which furnishes the proper degree of adhesion for use in a film for silk screen process. A still further object is to provide a subbed film base upon which the gelatin emulsion can be coated and easily removed by use of suitable solvent after formation of a relief image and transferred to a silk screen. Other objects will appear from the following description of my invention.

To produce the microfluidic chip of the channel can be created using any available CAD program such as Cadence, L-Edit AutoCAD. A set of test microfluidic channel has been designed using Cadence. The design was sent to Fine line imaging to obtain a Mylar high contrast image. Typically this image will be a negative image (dark field) of the channel design.

The Mylar mask was delivered to a local silkscreen manufacturing outlet called "Ink-plus" Using a photo exposure process, Ink-plus produces a

silkscreen. The silk screen is stretched on a metal frame that is attached to raise hinge. The hinge arrangement allows us to place a cleaned PMMA sheet below the screen and the image can be transferred by a pushing the printing ink using a squeegee.

Seymour stressed that the human skills and the capacity to acquire it have been fundamental throughout the progress of making. Skills are not innate but their acquisition is one feature that characterizes living things as opposed to non-living one in their capacity to learn.

According to Tugwell (1972), underscored that Drying speed improvement can be obtained by ink modification, usually by the inclusion of faster dryers there in, but care must be taken so that the resultant inks are compatible with each other, are compatible with the subsequent thermal processing, and produce sharp accurate images.

In order to reproduce the correct image and proper color after transfer is completed, it is necessary in multicolor printing to print the image in reverse and to reverse the normal sequence used in full color process printing. This is because the final will be viewed through the first layer 12, rather than from the side from which is applied. Complete printing freedom of choice is available for the application of the image of layer 14, and full color process is described because full color work cannot presently be satisfactorily applied to stretchable textile materials. However, line work in single or multicolor, or monochrome halftone can be employed.

Smith (1952) stressed that in the silk screen process a relief image may be formed in a photographic emulsion layer on a special stripping film, the gelatin image transferred to the silk screen and the support of the original film stripped or peeled away. The relief image remaining on the silk screen forms a stencil for silk screen printing.

According to Thomas (1981), screen printing of T-shirts and the like is typically carried out in the following manner. A printing screen is constructed by covering a frame with a screen of very fine mesh, usually constructed of silk, nylon or similar filament. The holes in the screen are selectively filled by well-known procedures so as to leave unfilled holes in the pattern of design to be printed. The T-shirt to be printed in placed on a table or shirt board and the screen placed on top of shirt. Suitable ink is then spread across the screen by use of a roller or squeegee which spreads the ink and also presses it through the holes in the screen. This leaves the desired ink pattern in the shirt.

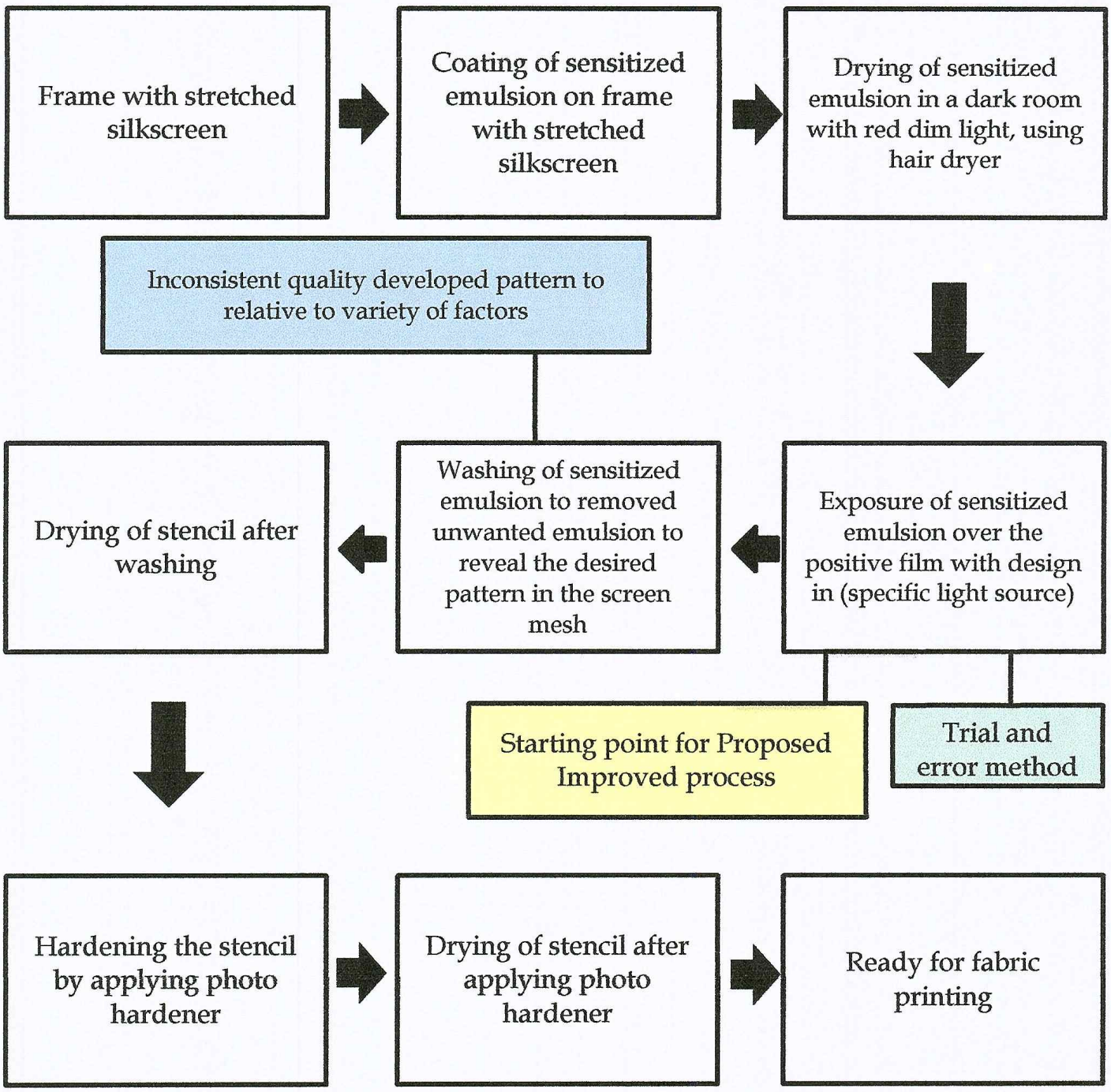

Figure 2 (Related literature of the study; Proposed PSP process)

Figure 2 shows that based on the existing photographic silkscreen printing process. Quality of developed pattern in sensitized emulsion has an inconsistent results due to the variety of factors that affects the final print out. However this study came up with the proposed additional process that may improve the quality of photographic film as a medium for photographic silkscreen printing process. To avoid trial and error results, which consume time and more expensive process due to wasted material during trial run method.

Related Studies

Degradation of dyes as it knowns depends on a wide variety Environmental parameters like temperature, humidity, light intensity and spectral distribution. Pigment based inks have better resistance to those factors have mention especially to gas and light and better water fastness.

According to Dobric[1], Mirkovic[2], Bolanca[3] (2010), silkscreen printing mostly uses this type of ink as their primary source of ink for its promising characteristics. Ink jet printer can handle a more liquefy substance for its coloring substance to fit into its fine head printer to produces images by spraying on contacting the surface. Even dye ink printer which is more aqueous in form when it comes to consistency has the big risk of having a clogged head printer and even its hose that is connected to the ink reservoir.

However silkscreen printing can do this task with less issue of having clogged portion that can hinder image transferring without compromising the

durability and print quality, for it is using a thick substance of ink that is more resistant to these negative factors that may affect its quality with a peace of mind not having this clogged issue.

Aminreza (2010) stated that silkscreen printing process is the most widely used image Transfer technique employed from textile industry to printed circuit board and thick-film technology. Silkscreen printing technology is fairly well advanced and interestingly enough there are plenty of silkscreen imaging outlets in most of the cities, even in developing countries. This demand is mainly due to the custom T-Shirt and business sign-board manufacturing industry. Most of the silkscreen imaging outlets accepts designs using the commonly used image formats such as jpeg, tiff, pdf as well as wmf. Further, the highest resolution silk Screen can produce an image registration as fine as 20um. The second most interesting as well as important parameter that encouraged us to explore this line of process for PMMA microfluidics is the ability of the printing ink to completely mask-out the 254nm radiation. Even the thinnest, uniform layer of dried printing ink is completely opaque to 254nm radiation and above all this dried ink can be readily dissolved using IPA-water mixture.

According to Hanley (2000) the printed textile industry is massive: the total retail valued of printed textile worldwide (not including digital) is about $450 billion, and the value of textile print services worldwide is approximately $38 billion.

Franklin (2007) stated that dye printer requires a disposable blotting paper for digital printing applied to fabric which is not water resistant and prone to print fading so fabric suppliers is beginning to offer a wide variety of fabrics and coatings just to address with those issues on digital dye printing and it add to cost of printing.

According to Locastro (2010), said that Proponents of digital printing tends to focus on the benefits of the technology, but rarely touch upon the issues and responsibilities that go along with it.

Ragsdale (2001) mention some of materials challenges on digital printing: the cost of inks and pre-treated fabric are still high, Fabrics are not always consistently pre-treated; there more than half dozen common types of synthetic and natural fibers, each with its own ink compatibility characteristic, The printer is dealing with a stretchable, highly porous and textured surface, and Inks clogging, color inconsistencies with the same roll of fabric and print heads that drip.

Abernathy (2004), underscored that Textile included those printed fabric used for three industries: apparel, home furnishing, and industrial uses. Home furnishing includes sheets, towels carpets, curtains and related product. That requires printing services with quality materials that with endure environmental factors and time for fading and corroding.

Ohtani (1990) stressed that the silk screen stretching on the silk screen printing frame has been performed manually. An empty frame is manually

cramped in a holder, and adhesive is applied on upper surface of the frame. Silk is cut to desired dimension and is stretched on the adhesive applied frame surface at a predetermined tension. The silk stretched frame is dried by natural drying in the tension applied state of the silk. All the process has been performed manually. The process is very cumbersome, and accuracy and efficiency of the operation depend on skills of operator. Thus, irregularity of stretching frequently occur an efficiency of the operation in normally very low.

The demand of silkscreen printing had been low enough to satisfy the demand by manually stretched silk screen. However, recently demands for many frames of many kinds are increasing. For such demands, manual stretching cannot satisfy. Automatic silk stretching apparatus is requested frequently.

The object of the present invention is to satisfy the request and to provide an automatic silk stretching method and apparatus for stretching silk on a silk screen printing frame efficiently.

Chapter 3

METHODOLOGY

This chapter presents and describes the research methodology applied to this study. It includes the research design, construction, laboratory test and trials, instrumentation, data gathering procedure, and data analysis employed in processing the gathered data. The results of the methods were used in presenting the standard process of photographic silkscreen printing process in respect with the key elements and locally available materials.

Research Design

The study utilized experimental research design, subdivided into three parts namely: Pre-experimental phase, Experimental phase and Post-experimental phase. Along with Pre-experimental phase is the actual development of photographic film which is available in existing process to identify some of the elements that affects the quality of image on sensitized emulsion. During experimental phase is the adjustment or modification of factors or variables to achieved the best output and being repeated to validate if the results is still the same to call it as standardized.

However during post experimental the best result came out from a repetition of process have been judge and evaluated based on the perception of the observer or the perception of the respondents using descriptive research design to compare and analyzed the final result relative to quality of print using

developed photographic film for silkscreen printing process. it sought to answer the following factors that affect the printing quality of silkscreen process particularly on the: light sources, distance from the light source to the sensitized emulsion, curing time and exposure time by adding of intervals of 20 to 30 seconds of exposure in specific light source. On how they are directly affecting by altering or adjusting the specified factors to the best output.

To improve some parts of the process by identifying specific key elements and factors to be considered to come up with the desired results. Supplies and materials, tools and equipment, construction procedure and testing and trials are included for it is very crucial part of the study since this about standardization of the process using different materials but same approach on the process.

This method addressed the collection of information base on the result of the experiments and revalidated, through standard scale that directly given to the stakeholders for acceptability of the improve Standardized Photographic Silkscreen Printing Process. Using the final output which is the actual print out on the fabric and to be rated by the Stakeholders. And final output base on the responds of the stake holders and the result of the laboratory experiments will compare and to be endorsed including the whole process as Standardize process.

Instrumentation

The acceptability of the standardized process, have been descriptive research process. The hedonic scale rating form was conducted in the first week of February upon securing approval from the concerned members of the stakeholders. Four stakeholders were considered, namely: the Entrepreneur, the Students, the clients, and the experts.

The researcher used Screen Exposure Calculator as main instrument in gathering the data and information on the laboratory experiments. While rerating form of questionnaire was employed to support the researcher in data gathering, administered to the selected respondents in the needs assessment interview.

In obtaining the perception of the respondents based on the final output of the improved and standardized photographic silkscreen process which is the developed pattern on sensitized emulsion and transferred to a fabric, in terms of quality and effectiveness of the proposed process.

The researcher employed a questionnaire that served as the main instrument of the research study and compare to the laboratory experiment using a standard Screen Exposure Calculator a graphical layout use to guide whether sections of exposed sensitized emulsion has a best development.

Questionnaire

The questionnaire of the respondents is composing of the perception of the stakeholder or the respondent to quality of print and its effectiveness as the whole process. Each area had specific items to be answered namely; 1) opacity, 2) sharpness, 3) clarity, 4) neatness and; 5) density, and to be rated using Hedonic Scale having a 5 point rating scale, where 5 is highly acceptable (HA), 4 is acceptable (AC), 3 average (AV), below average (BV) and; poor (P).

Sampling procedure

The study involved two groups of respondents for acceptability testing namely: the entrepreneur composed of businessmen and graphic artist who engaged in textile printing business and the clientele which composed of students and individual from outside community within Samar region. In the selection of respondents, total enumeration had been utilized in this study for the entrepreneur and drafting students due to limited number of silkscreen printing business within Catbalogan Samar.

Data gathering Procedure

Three data has been gathered: Data from the pre-experimental phase, experimental phase and post experimental phase. Utilizing laboratory results and through a survey questionnaire; Along with this the researcher conducted an experimental study that improves the process by adding some steps or procedures based on the existing Photographic Silkscreen Printing

Process as the pre experimental process, using premixed chemical solution that is newly available in the local market, together with the following additional factors such as Pre-curing time, distance from the light source meanwhile, these two factors is tested on both key elements and factors of the existing Photographic Silkscreen Printing Process to fulfilled the aim of this study for improved and standardized procedure of Photographic silkscreen Printing Process for each chemical solution and the kind of exposure box unit on the next table shows (2) the improve process using pre curing time; and distance from the light source.

After the trial-run in the laboratory is the post experimental phase in which the best output of every process must be carefully examine and selected and to be rated by respondents to have a comparison if the laboratory are reliable and if it matches the perception of the respondents then the result is valid and subject for endorsement of the studied to be pursued. The results revealed is subject for re-evaluation for some adjustment and the best consistent output that has gone modification was claim as standard process.

Statistical Treatment of Data

The data gathered from the group of respondents through utilization of the questionnaire during the observation evaluation phase carefully tallied, tabulated, interpreted and subject to statistical inferences. The results of the weighted responses from the respondents on specific variables, hedonic rating

scale and rank the final result for best option for factors and materials for standardization of silkscreen printing process.

F-test for independent variables

This was used in determining that there is a significant difference between 3 three light sources using different factors in terms of printing quality and effectiveness of the whole process of Photographic Silkscreen Printing.

Chapter 4

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This chapter presents the data to answer its specific questions. Such as the existing Photographic Silkscreen Printing Process, Key elements of existing PSP process towards: efficiency; printing quality and durability; significant difference of existing PSP process in terms of printing quality, what is the improved process based on the existing PSP process, With the improved photographic silkscreen printing process, what standard process maybe developed to produce with efficiency and quality in terms of: light sources; curing time; and exposure time. To analyzed and interpret the given data to endorse the desired outcome as a standardized process of photographic silkscreen printing process.

Figure and table are shown in this chapter to fully understand the presentation of analysis and interpretation of the data.

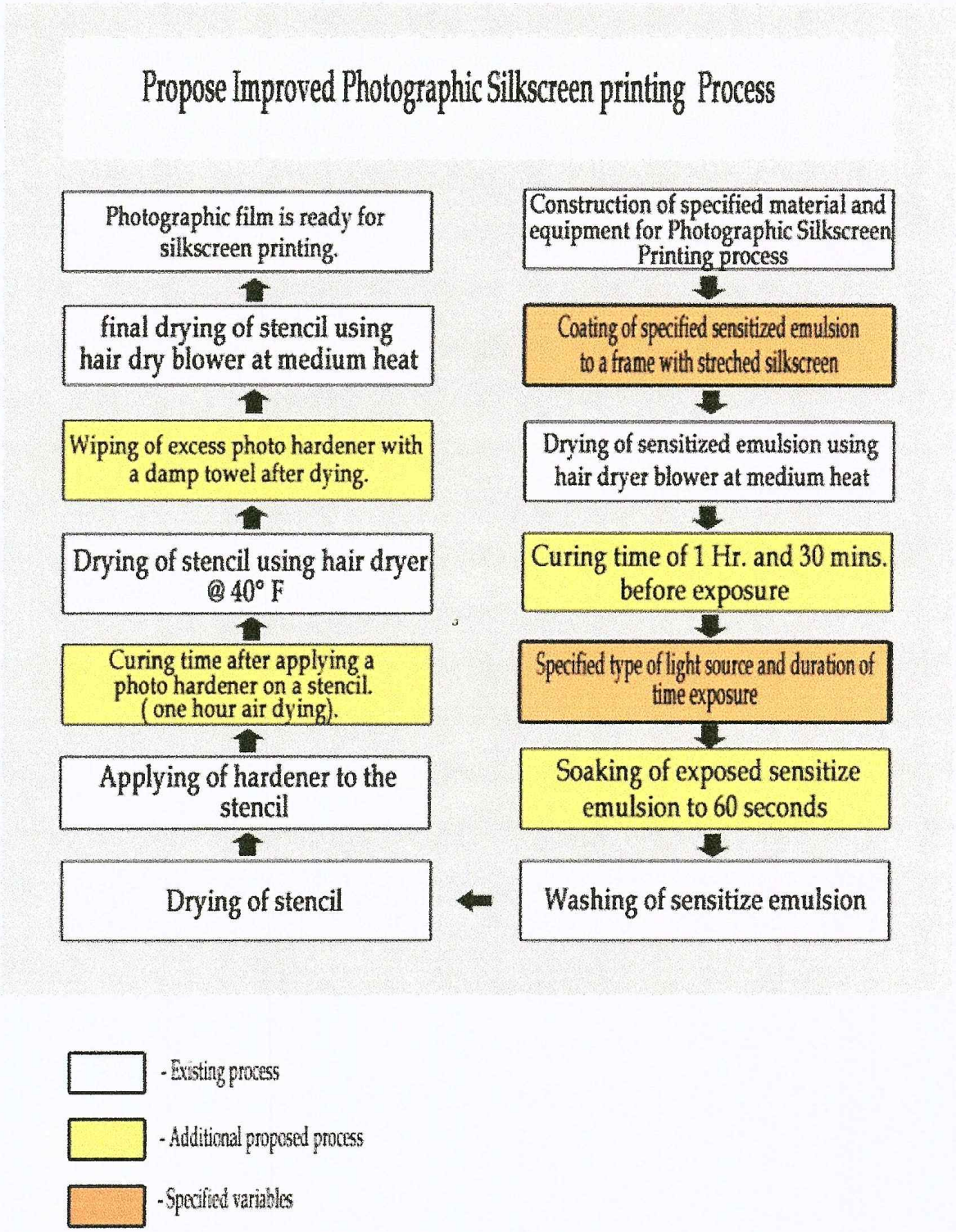

Figure 3. Existing photographic silkscreen printing process and proposed improved process

Figure 3 shows, the process flow of existing photographic silkscreen printing process and the proposed improved process with specified and identified variables to achieve a more consistent quality print. White boxes represents the existing available process, while yellow boxes are inserted as the new added procedure to improve the quality of print out or the image developed in the sensitized emulsion. Meanwhile orange boxes is identified as the focus variables.

Existing Photographic Silkscreen Process

The following are the existing photographic silkscreen process namely: Photographic silkscreen printing process using SF Diazo photo emulsion and AS Sensitizer, Photographic silkscreen printing process using Local Photo emulsion and sensitizer, and Photographic silkscreen printing process using Photo flush 300.and assessed the following Key elements of the existing photographic silkscreen printing process using a standard manual screen exposure calculator; a guiding graphical layout that is intended to be developed on the sensitized emulsion by transferring the gradation of line starting to 0.1 millimeter up to 3 millimeter line thickness and a variety of line form to verify the best result after washing out the desired pattern in the sensitized emulsion after exposure, and the best section that will appear to have better pattern is the best time exposure suited for the kind of emulsion the screen printer is using.

Along with this, the researcher wants to give an emphasis that the approach is still the same as stated below, but the result may differ along

changing the factors such as chemical solution and time exposure that may affect the result and durability of the developed design on sensitized emulsion. The steps stated below are the exact procedure of photographic silkscreen printing process.

Photographic Film Preparation

1. Use aluminum frame with dimension of 2 in. x 14 inches x 18 inches attached with # 120 silk screen meshes along diameter.
2. Apply sensitized emulsion using aluminum coater on stretched silkscreen.
3. Coating of sensitized emulsion must be done on a dark room having a dim red light as illumination.
4. Thin coating of around 1mm to 1.5 mm thick sensitized emulsion should be apply on the screen to avoid bubbles formation.
5. Then blow dry it with a medium heat using hair dry blower or heat gun wait until the entire film coating becomes translucent to identify as well cure.
6. Keep the frame with photographic film in a completely dark storage container or cabinet to avoid unwanted exposure before the actual testing.

Design Transfer

1. Prepare the design pattern to be transfer on sensitized emulsion by making the image on a paper more translucent by applying a little amount of kerosene on the paper with printed pattern.
2. Put the desired pattern on the glass panel of exposure box unit in a readable manner.
3. Place the dried sensitized emulsion on the top of the desired pattern in preparation of exposure.
4. Expose the sensitized photographic film on the desired time and kind of lights based on the proposed time exposure.
5. Wedge step process can be used to divide the design pattern into several parts for specific time exposure.
6. After exposing to desired time and light source, image must undergo blasting for removing unwanted emulsion or the negative parts after exposing to light.
7. Drying of developed sensitized photo emulsion on frame with stretched silkscreen using hair dry blower at medium heat.
8. Applying photo hardener on stencil to set the developed photographic film.

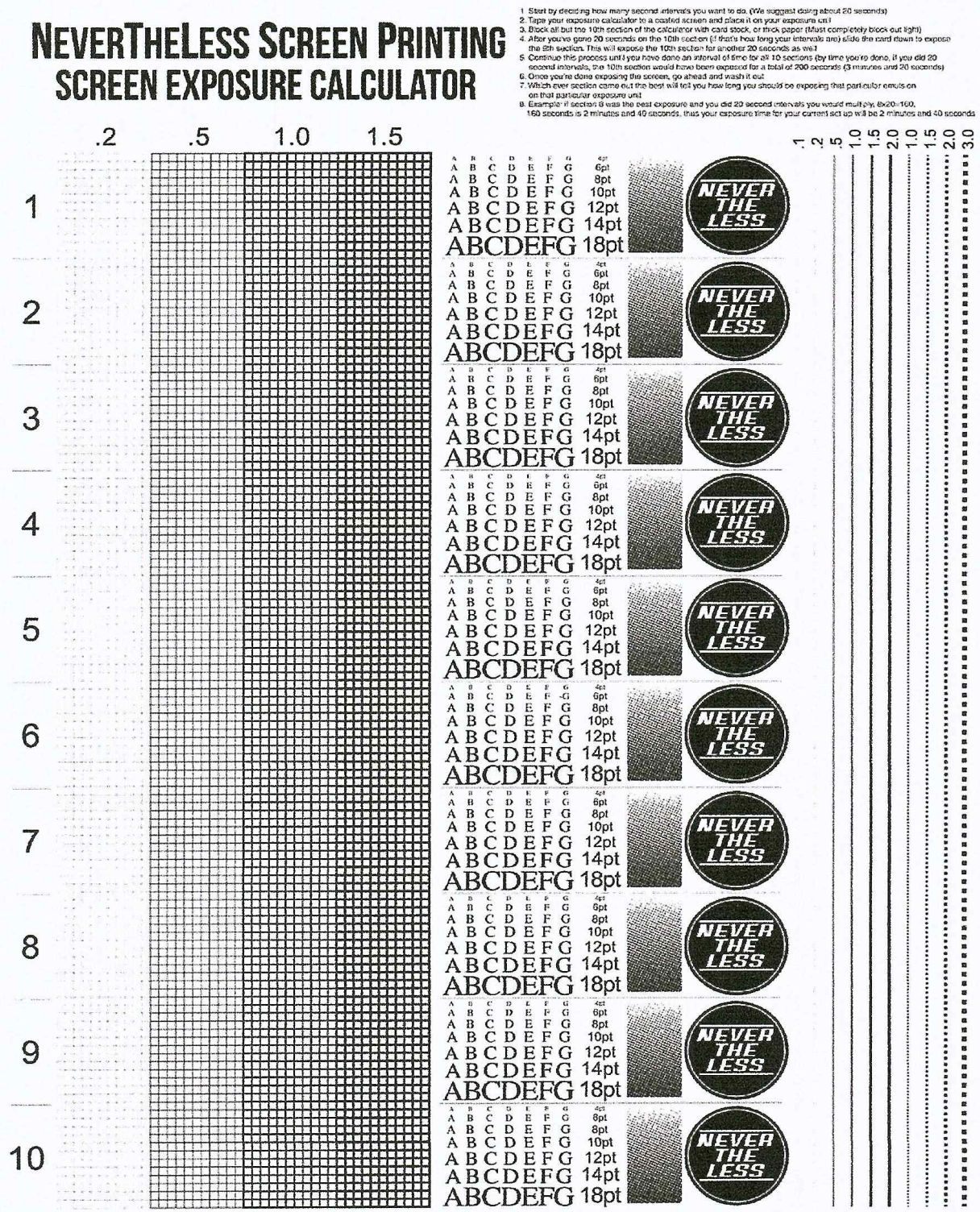

Figure 4. Screen Exposure Calculator

Try-out and evaluation

Figure 4 shows, a standard exposure calculator used to calculate the time of exposure.

1) Start by 20 seconds as interval per exposure 2) tape the exposure calculator to a coated screen and place it to an exposure unit 3) block all but the 10th section of the calculator with a card stock, or thick paper (must completely blackout of light) 4) after 20 seconds on the 10th section (interval period of exposure per section) slide the card down to expose the 9th section. This will expose the 10th section for another 20 seconds as well; 5) continue this process until you have done an interval of time for all 10 sections. (By the time you're done, if you did 20 seconds intervals, the 10th section have been exposed for a total of 200 seconds (3minutes and 20 seconds) 6) once you're done exposing the screen, go ahead and wash it out 7) which ever section came out the best will tell you how long you should be exposing that particular emulsion on that particular exposure unit.

Printing image on a plain fabric or paper to check whether the image has well developed on the specific given time on table 3, 4 and 5. Test will be repeated to verify the result of experiment.

Key elements of existing Photographic Silkscreen Printing Process

The researcher conducted the actual process of existing Photographic Silkscreen Printing Process as experimental assessment, to identify the relationships between the key elements namely as Efficiency, Quality and lastly; Durability between the factors such as Light sources, Chemical solution and the distance of the sensitized emulsion from the light source; within the whole process of existing Photographic Silkscreen Printing Process.

Table 1

Comparative analysis of existing Photographic Silkscreen Printing Process

Comparative analysis of existing Photographic Silk Screen Process by using the following premixed solution	*KEY ELEMENTS*		*PSP(1) PROCESS USING SF DIAZO AND (AS) SENSITIZER (250g)*	*PSP(2) PROCESS USING LOCAL PHOTO EMULSION AND SENSITIZER (250g)*	*PSP(3) PROCESS USING PHOTO FLUSH AND (300) SENSITIZER (250g)*	*PSP(4) PROCESS USING PREMIXED AQUASOL-ER SOLUTION (250g) Treated with Improve Process*
UV-LAMP 140 watts at 6 in.	**Efficiency (E)**	COST	P 450.00	P 210.00	P 370.00	P 250.00
Warm light Lamp 140 watts 6 in.			P 450.00	P 210.00	P 370.00	P 250.00
Daylight Lamp 140 watts 6 in			P 450.00	P 210.00	P 370.00	P 250.00
UV-LAMP 140 watts at 6 in.		EXPO-TIME	1 min. and 10 seconds	3 min.	1 min. and 50 seconds	40 seconds
Warm light Lamp 140 watts 6 in.			1 min. and 20 seconds	3 min. and 20 second	1 min. and 30 seconds	1 min
Daylight Lamp 140 watts 6 in			1 min. and 50 seconds	3 min. and 40 seconds	2 min. and 30 seconds	1 min. and 20 seconds
UV-LAMP 140 watts at 6 in.	**Printing Quality (Q)** None achieve line		None	1 millimeter	none	none
Warm light Lamp 140 watts 6 in.			None	1 millimeter	none	none
Daylight Lamp 140 watts 6 in			None	1 millimeter	none	none
UV-LAMP 140 watts at 6 in.	**Durability (D)** (Wash resistance)		Durability attained @1min. and 10 seconds	Durability attained @3mins.	Durability attained @1min. and 50 seconds	Durability attained @ 40 seconds
Warm light Lamp 140 watts 6 in.			Durability attained @1min. and 30 seconds	Durability attained @3min. and 20 seconds	Durability attained @1min. and 30 seconds	Durability attained @1min.
Daylight Lamp 140 watts 6 in			Durability attained @1min. and 50 seconds	Durability attained @3min. and 40 seconds	Durability attained @2min. and 30 seconds	Durability attained @1min. and 20 seconds
Quality			E Q D	E Q D	E Q D	E Q D
Interpretation Using Screen Exposure Calculator			ACCEPTABLE	AVERAGE	ACCEPTABLE	HIGHLY ACCEPTABLE

The data shows in table 1 are the results come up from laboratory experiment using Screen Exposure Calculator as an instrument for assessment of the final output, which is the pattern developed in sensitized emulsion by exposing it to a certain light source including other factors. Which is the intent of this experiment is to verify the key elements relation namely; Efficiency, which composed of cost and exposure time, Quality of Print; and Durability.

Efficiency of the process

Table 1 reflects the efficiency of the process, using (PSP 2) local photo emulsion and sensitized emulsion is much cheaper and time saver having a exposure of and durability rate of 3 minutes and 40 seconds using the existing process, however the quality of print does not developed well for there is a difference of 1 millimeter that has not appear and it is not suitable for textile of fabric printing with detailed pattern. The data given above in table 6 shows, that the existing process with cheaper cost of materials are not suited for developing images with higher resolution; while PSP 1 & PSP 4 gained their acceptability rate at specific exposure time but with higher cost of materials and irregular supply of the said materials for some of them are not locally produce and need to be purchase outside the country.

This only implies that process in PSP 1 & PSP 4 as shown in table 1. Directly affecting the key elements of the whole process as to price and the availability of the materials was unpredictable. However, there is no significant difference when it comes to acceptability rate for quality output, using those three existing Photographic Silkscreen Printing Process.

Quality of developed pattern and Durability

Table 1 presents that durability and quality of the developed pattern in sensitized emulsion is directly proportional to each other. Along the table lies the data that PSP 1 gained its durability and best pattern at 1 minute and 50 seconds, while PSP 2 has its durability and best pattern at 3 minutes and 40 seconds, PSP 3 achieved its durability and best image at 2 minutes and 30 seconds and lastly PSP 4 gained its durability and quality print at 1minute and 30 seconds. Both processes have an acceptable rating by using a Standard Screen Exposure Calculator.

Along with this Table 2, shows the improved process rating from the respondents showing the acceptability rate of the quality output of the improved Photographic Silkscreen Printing Process and the rates coming from the respondents in which the stake holders ratings using hedonic rating scale.

Table 2

Printing Quality

PROCESS	OPACITY	SHARPNESS	CLARITY	NEATNESS	DENSITY	MEAN	TOTAL	EXTENT OF ACCEPTABILITY	RANK
UV-LAMP 140 watts At 6 in.	4.80 (96)	4.75 (95)	4.85 (97)	4.9 (98)	4.9 (98)	4.84	21.09	HA	1
WARM Light Lamp 140 Watts 6 in.	4.6 (92)	4.5 (90)	4.45 (89)	4.65 (93)	4.55 (91)	4.55	19.73	HA	2
Daylight Lamp 140 Watts 6 in.	4.3 (86)	4.15 (83)	3.85 (77)	4.15 (83)	4.10 (82)	4.11	19.08	AC	3

LEGEND:

4.51 – 5.00	Highly Accepted	(HA)
3.51 – 4.50	Accepted	(AC)
2.51 – 3.50	Average	(AV)
1.51 – 2.50	below average	(BA)
1.00 – 1.50	Poor	(P)

In this table, 2 revealed the computed mean from 20 participants given a standard parametric test which is a hedonic scale rating form that will rate the following Quality of a Print outputs. It was found out that using Ultraviolet Exposure with improved PSP process has a weighted mean of 4.84; it is more than the average mean of 4.50 having a highly acceptable (H.A) rate when it comes to quality of developed pattern in the sensitized emulsion, meanwhile that using a warm light exposure of sensitized emulsion has gained a rate of 4.55 a highly acceptable rate for the quality print while using a Daylight exposure has a

weighted mean of 4.11 an average mean for acceptability, the null hypothesis which states that there is no significant difference between the laboratory experiment the responses of the stake holder relative to efficiency, quality of print, durability is prove to be true, and therefore the hypothesis accepted.

Significant difference of existing Photographic Silkscreen Printing Process

In this section revealed the significant level of developed pattern using improved Photographic Silkscreen Printing Process in sensitized emulsion as basis of final output of the study. table 3 shows, the variance of quality print using F – test.

Table 3
Analysis of Variance Table

Source of Variation	Degrees of Freedom	Sum of Squares	Mean of Squares	F-Value Computed	F-Value Tabular
Between Groups K-1	2	1.34	0.67	67	3.89
Within Groups (N-1)-(K-1)	12	0.14	0.01		
Total N-1	14	1.48			

The F-test shown in table 3 further shows the perception of the respondents to the quality of print, of improved photographic silkscreen printing process. These respondents had evaluated the outputs of the process, which is the developed pattern in sensitized emulsion, that most of the perceived

statement of quality print out of the improved and standardized process were rated by themselves as accepted, as reflected by the means and variance was pegged at value of .67 and .01 while the tabular value was 3.89 at *f*.05 level of significance with degrees of freedom of 2 and 12.

Since the F – computed value of 67 is greater than the F –tabular value of 3.89 at *f*.05 level of significance with 2 and 12 degrees of freedom, the null hypothesis is disconfirmed in favor of the research hypothesis which means that there is significant difference in the Printing quality using improved PSP process with 3 light sources.

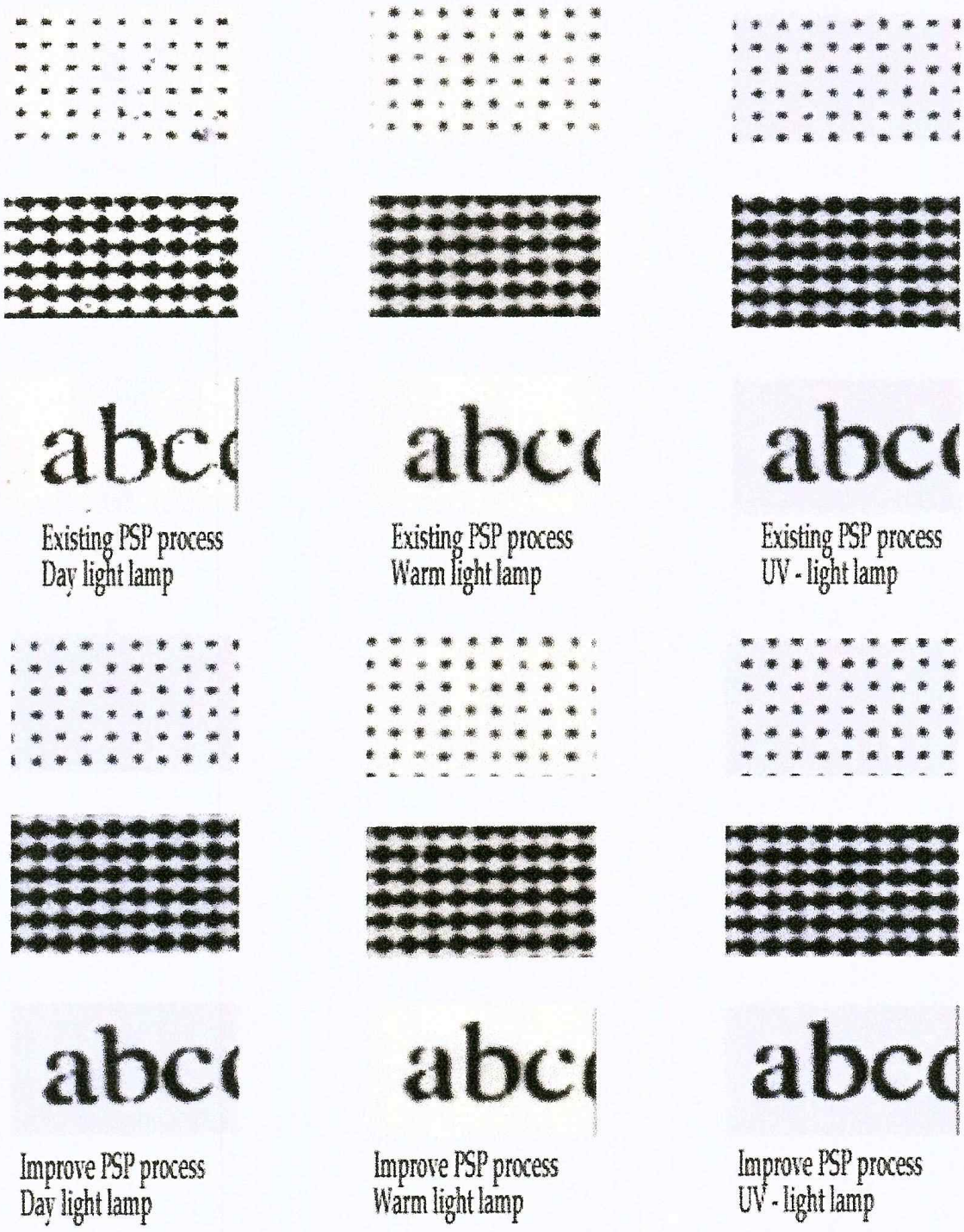

Figure 5. Quality of Print using Existing PSP and Improved process @ .1 millimeter line thickness

Improved process, based on the existing Photographic Silkscreen Printing Process

The F-test tells us that there is a significant difference in the average of printing quality of 3 light sources in PSP process but as to where the difference lies, it has to be tested further by another test, the Scheffe's test formula.

Table 4

Average printing quality of 3 light source of improved PSP process.

Between Light Source	F′	(f.05)(k-1) (3.89)(2)	Interpretation
UV-Light vs. Warm Light	21.02	7.78	Significant
UV-Light vs. Daylight	133.22	7.78	Significant
Warm light vs. Daylight	48.4	7.78	Significant

table (4) shows that there is a significant difference in the printing quality of PSP process between printing quality A and printing quality B, printing quality A and printing quality C, printing quality B and printing quality C. This implies that printing quality A has more detailed print-out in the development of pattern in sensitized emulsion.

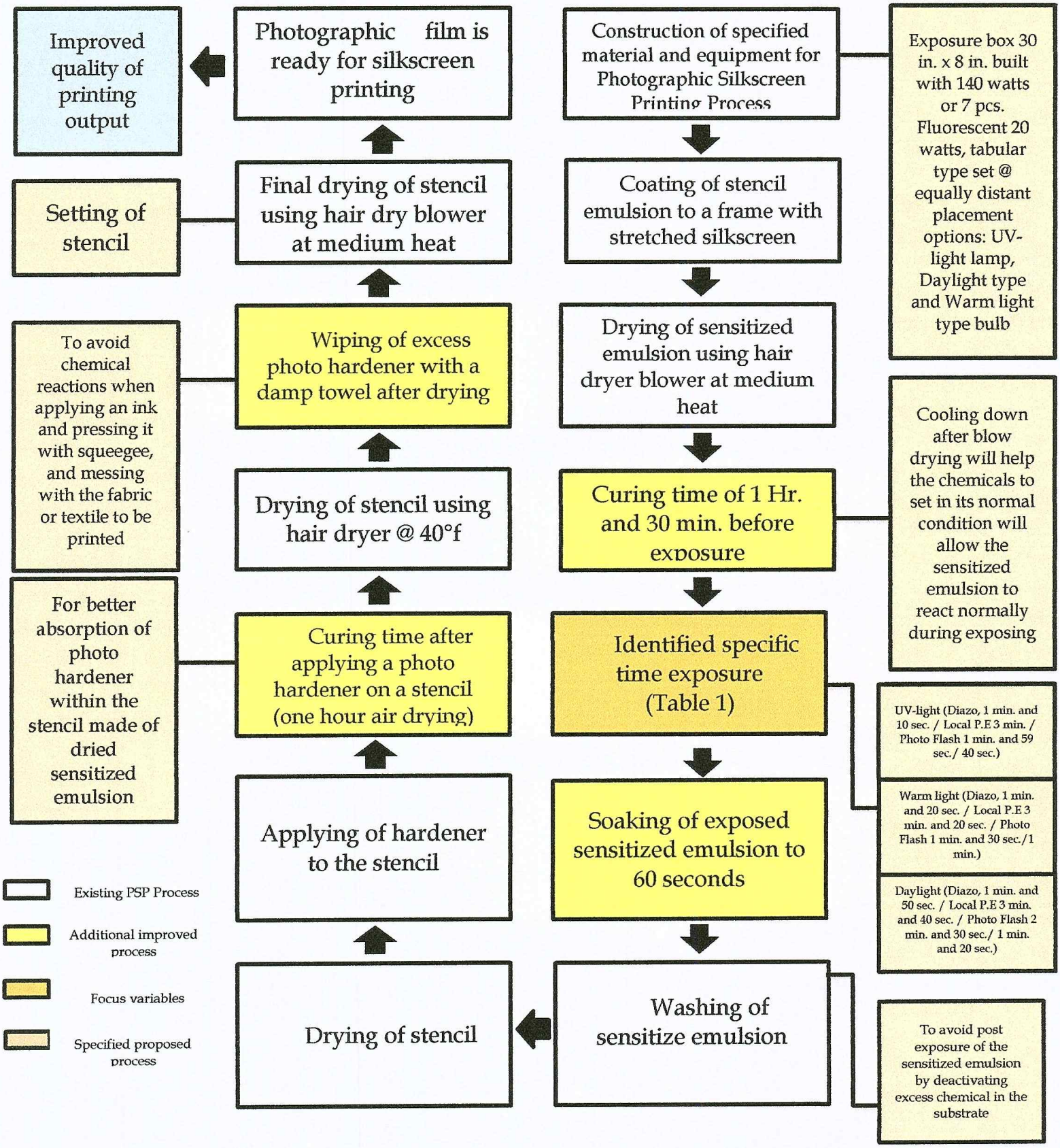

Figure 6 Standardized process of Photographic Silkscreen process

Standardized process of Photographic Silkscreen Printing Process

In this section stated the whole procedure of photographic silkscreen printing process, Based on the existing PSP process by comparing and analyzing the result gathered in the laboratory experiment and from the perceptions of the respondents which is the stake holders and come up with an improved process by giving emphasis on other factors such as pre- curing time, light sources to be used to produced quality and efficient screen printing. Figure 5 shows the arrangement of factors needed for quality output and can be used as a guide or module to conduct the actual screen printing with best output without hesitation to do so the trial and error method.

Exact specifications of the materials and equipment to be used for it is the standard medium to achieved the desired quality output illustrations such, diagrams, orthographic projection and isometric drawing to exactly construct at your own eased with the availability of your local materials which is the main intention of this study to reach out those individuals having an interest in textile printing business that promotes socio economic development of the locality or of the country. Table 10 shows the additional factors in improved process Photographic Silkscreen Printing process.

Table 5
Standardized Photographic Silkscreen Printing Process

Improved PSPP	Pre-curing time	Distance from light source 140 watts	Length of exposure per type of emulsion				Resolution silk-screen mesh no.
			DS	LPS	PF	AQP	
UV-Light	1 hour and 30 minutes	6 inches	1 min. - 10 secs.	3 min.	1 min. - 50 secs.	40 secs.	# 350 mesh and below.
Warm-Light	1 hour and 30 minutes	6 inches	1 min 20 secs.	3 min.- 20 secs.	1min. 30 secs	1min.	# 250 mesh and below.
Day-light	1 hour and 30 Minutes	6 inches	1 min. - 50 secs.	3 min. - 40 secs.	2 min. - 30 secs	1 min. - 20 secs.	# 220 mesh and below.

Legend:

(DS) - Diazo 300 and AS sensitizer

(LPS) - Local photo emulsion and sensitizer

(PF) - Photo Flush and (300) sensitizer

(AQP) - Premixed aqua sol ER

Table 5 presents, the proposed standardized process in developing the best pattern in sensitized emulsion that is mainly used in silkscreen printing process. Along with this it is stated the best time of exposure for UV-Light 140 watts or 7 pieces of black tubular light is as follows, (DS) - 1 minute and 30 seconds, (LPS) - 3 minutes, (PF) - 1 minute and 50 seconds and; (AQP) for 40

seconds of exposure with a distance of 6 inches from the light exposure having a pre-curing time period before the actual exposure of1 hour and 30 minutes to help the sensitized cool down and to set all the chemical solution. UV-Light process can developed an image, with higher resolution using no. 300 mesh silkscreen (very fine holes). Warm light exposure 140 watts or 7 pieces tubular light as follows, (DS) - 1 minute and 20 seconds (LPS) - 3 minutes and 30 seconds, (PF) - 1 minute and 30 seconds and; (AQP) for 1 minute of exposure with a distance of 6 inches from the light exposure having a pre-curing time period before the actual exposure of1 hour and 30 minutes, and capable of developing screen meshes of no. 250 (fine holes).

And; Daylight lamp exposure 140 watts or 7 pieces white tubular light as follows, (DS) - 1 minute and 50 seconds (LPS) - 3 minutes and 40 seconds, (PF) - 2 minute and 30 seconds and; (AQP) for 1 minute and 20 seconds of exposure with a distance of 6 inches from the light exposure having a pre-curing time period before the actual exposure of 1 hour and 30 minutes, and capable of developing screen meshes of no. 220 or medium fine to lower type of mesh.s

Proposed Standardized process of pattern development in sensitized emulsion of Photographic Silkscreen Printing Process

1. Use aluminum frame with dimension of 2 in. x 14 inches x 18 inches attached with # 120 silk screen meshes along diameter.
2. Apply emulsion (you can choose among 4 kinds of emulsion based on standard process using aluminum coater on stretched silkscreen.

3. Coating of sensitized emulsion can be done on a dark room having a dim red light as illumination.
4. Thin coating of around 1mm to 1.5 mm thick sensitized emulsion should be apply on the screen to avoid bubbles formation.
5. Then blow dry it with a medium heat using hair dry blower or heat gun wait until the entire film coating becomes translucent to identify as well cure.
6. Keep the frame with photographic film in a completely dark storage container or cabinet to avoid unwanted exposure before the actual testing
7. Pre-cure the dry sensitized emulsion by keeping it to a total dark room for about 1 hour and 30 minutes to help cool down after blow drying, to help set the chemical mixture of the sensitized emulsion before the actual exposure to light.

Design Transfer

8. Prepare the design pattern to be transfer on sensitized emulsion by making the image on a paper more translucent by applying a little amount of kerosene on the paper with printed pattern.
9. Put the desired pattern on the glass panel of exposure box unit on figure on readable manner.
10. Place the dried sensitized emulsion on the top of the desired pattern (b) in preparation of exposure.

11. Expose the pre-cured sensitized photographic film on the desired time exposure light please refer to table 1. Ex. You are using UV-Light 140 watts with sensitized emulsion of local photo emulsion you will need 3 minutes of exposure to avoid over and under burnt that affect the printing quality and durability of screen to be used in silkscreen printing process.
12. After exposing to desired time and light source, image must undergo washing for removing unwanted emulsion or the negative parts after exposing to light.
13. Drying of developed sensitized photo emulsion using heat gun or hair dry blower.
14. Applying photo hardener to set the developed photographic film.
15. Let it dry using heat gun or hair dryer and let to be exposed on sunlight for a couple of minutes to completely seat the remaining sensitizer

Test printing

16. Insert t-shirt on a platen or a board to completely spread the fabric to a Ply board to avoid crumpled part that may distort the image.
17. put the frame with developed sensitized emulsion to a fabric, Covering the board and put an adequate amount of an ink to a Squeegee then slowly press it to a frame with sensitized pattern on to Transfer the design for letting the ink to pass-through the holes which

Positive film (developed sensitized emulsion).

It is presented that the proposed process has more quality output when it comes to results on print out compared to the existing process, trial and error method is lessen due to this standardized process and help improved its durability and cost effectiveness.

Chapter 5

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents information gathered from laboratory experiment and perception of the respondents which is the stake holders who have a direct interest in the assessment of the laboratory experiment results for the developed pattern in sensitized emulsion that is use in silkscreen printing. The conclusion derived from the major findings and recommendations of the study based on the conclusion drawn.

Summary of Findings

Key elements and major factors are considered in this study to come up with improved standardized photographic silkscreen printing process, identified as to: efficiency, durability and printing quality whereas; factor such as the light sources, chemical solution, distance from the light source and time exposure are the major components that affect the whole process in which the come up with the conclusion based from the gathered data.

The data shows that there is higher acceptability rate when it comes to print quality of the proposed improved process and significant difference of printing quality when using variety of light exposure hence, the from the existing process the researcher come up with improved and standardized photographic pattern development in sensitized emulsion that is mainly used in silkscreen printing as medium for transferring the image or pattern into a fabric.

This implies that there is a direct relativeness of key elements and factors in achieving quality silkscreen printing.

Conclusions

On the basis of the findings, the following conclusions where formulated

1. Ultra violet light exposure unit box when it comes to pattern development in sensitized emulsion has more clarity and sharpness of the edges. Followed by warm light exposure and lastly by the daylight exposure box unit.
2. That sensitized emulsion reacts or sets with specific time frame, one procedure may not suited using another steps or procedure using another type of emulsion, so this study specified the different factors to claim it as standard.
3. Although having the same number of bulbs or wattage of light is considered as to guide for exposure this study also consider that the distance of sensitized emulsion has to be considered for it may direct the duration of time exposure, the nearer the distance of the sensitized emulsion the shorter duration it will have while being too far became too far the longer duration of time exposure.
4. That local photo emulsion is not ideal for developing higher resolution of pattern for a discrepancy of .1 millimeter of line thickness that is hard to achieve using 3 different methods of light source.
5. Both laboratory experiment and the perceptions of the respondents the final output of the improved process which is the developed pattern that is transferred to a fabric pegged a rating of "higher acceptability".

Recommendations

As a result of this study, the researcher would like to make the following recommendations:

1. The improved and standardized process of photographic silkscreen printing must be patented

2. Conduct Livelihood program on silkscreen printing process to uplift the socio-economic development nation.

3. To reproduce modules, manuals for interested parties that want to go on silkscreen printing business.

4. Promotions of standardized process.

5. To endorse the proposed improved standardized process to the end users.

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APPENDICES

Table 6

Bill of Supplies and Materials

The total cost of the supplies and materials as shown in Table 1 is nine thousand one hundred eighty pesos (P9180.00), broken down as follows: P3847.80 cost of supplies for Framing, Base, and Transparency plane assembly ; P1932 is for Electrical Component ; and P3507 for Other supplies for Photographic Silkscreen development.

Table 6
Bill of Supplies and Materials

A. Framing, Base, and Transparency Plane Assembly				
Qty.	**Unit**	**Description**	**Unit Cost**	**Total Cost**
1.5	Length	Aluminum bar,1 in. x 1 in. x 328 inches	P568.70	P 852.00
1.5	Length	Aluminum angle bar, ½ in. x ½ in. x 356 inches	P82.50	P 123.50
1	Length	Aluminum angle bar, ¾ in. x ¾ in. x 62 inches	P 190.30	P 190.30
1	Length	Aluminum bar, 1 in. x 2 in. x 62 inches	P 1,136.0	P 1,136.0
1	Sheet	Aluminum sheet, stucco, 4ft. x 8ft. x 62 inches	P 935.00	P 935.00
¼	Kilo	Aluminum Revit, 1/8 in.	P 185.00	P 185.00
User defined	Sheet	Glass clear ¼ in. thick, 20 in. x 31.75 inches	P 396.00	P 396.00
3	Pcs.	Hinges, 25.4 mm x 25.4 mm	P 10.00	P 30.00

Table 7

Electrical and other supplies

(continued table 6)		**B. Electrical Component**		
3	Pcs.	Ballast, 20 watts	P 105.00	P 315.00
3	Pcs.	Holder starter	P 11.00	P 33.00
6	Pcs.	Holder, Ultra lamp, Fluorescent, Warm lamp	P 55.00	P 330.00
3	Pcs.	Lamp, Ultraviolet 20 watts	P 165.00	P 495.00
3	Pcs.	Lamp, Florescent Daylight 20 watts	P 105.00	P 315.00
3	Pcs.	Lamp, Florescent Warm light 20 watts	P 105.00	P 315.00
1	Pcs.	Switch, toggle, (single- pole-single-throw), 10amps	P 35.00	P 35.00
1	Pcs.	Plug, male (heavy duty)	P 45.00	P 45.00
1	Length	Wire, stranded #20 x 5 meters	P 22.00	P 22.00
1	Length	Wire, Soldering	P 12.00	P 12.00
1	Length	Electrical tape, 1 inch wide	P 15.00	P 15.00
C. Other supplies for Photographic Silkscreen development				
1	Bottle.	Aqua sol ER, premix emulsion	P 275.00	P 275.00
1	Bottle.	Photo hardener	P 99.00	P 99.00
4	Meter.	Silkscreen, #120, #130 mesh	P 550.00	P 2,200.00
1	Pcs.	Emulsion Coater	P 535.00	P 535.00
2	Pcs.	Squeegee	P 120.00	P 240.00
1	Pack.	Cotton, balls	P 22.00	P 22.00
2	Pcs.	Spray bottle	P 35.00	P 70.00
1	Bottle	Rubber Contact cement	P 66.00	P 66.00
Total			**P 9180.00**	

Table 8

Tools and Equipment used and their functions

Item	Function
A. Tools	
Hacksaw	Cutting metal object.
Metal file	Smoothing sharp edges of the work piece.
Long nose plier	Holding or cutting excess wire.
Steel tape rule	Taking specific measurement.
Thinner snip	Cutting aluminum sheets.
6. Center punch	Setting marks on a layout.
7. Riveter	To fasten rivets on specific holes.
8. C-clamp	Holding a piece of metal stock while cutting and drilling.
9. Try-square	Testing the square of a work piece.
B. Equipment	
1. Electric hand drill	Drilling holes on metal frame.
2. Bender machine	Bending thin metal sheets and thin metal bars to its desired form.

Table 7 shows the tools and equipment used in construction of exposure box unit.

Construction Procedure

The Exposure box is composed of three major parts, namely: base and frame assembly; transparency plane assembly; and electrical system assembly. The silkscreen frame is a separate component to be used in the experiment.

The construction procedures for each part are the following:

Base, Frame, Plate Assembly

1) Read and interpret the working drawing assembly.

2) Cut a piece of aluminum stucco sheet using thinner snip measuring 31 inches x 19 inches.

3) Measure ½ inch on all sides of aluminum sheet then cut for bending preparation.

4) Using ½ inch x ½ inch aluminum angle bar measure 30 in. x 18 in. then attached to the cut aluminum sheet in procedure (2) & (3) using silicone adhesive.

5) Using 1 in. x 1 in. aluminum square bar measure 4 pcs. 1 in. x 1in. x 30 inches, 4pcs 1 in. x 1 in. x 7 inches, 1 in. x 1 in. x 18 inches, see Figure 1 for dimensions.

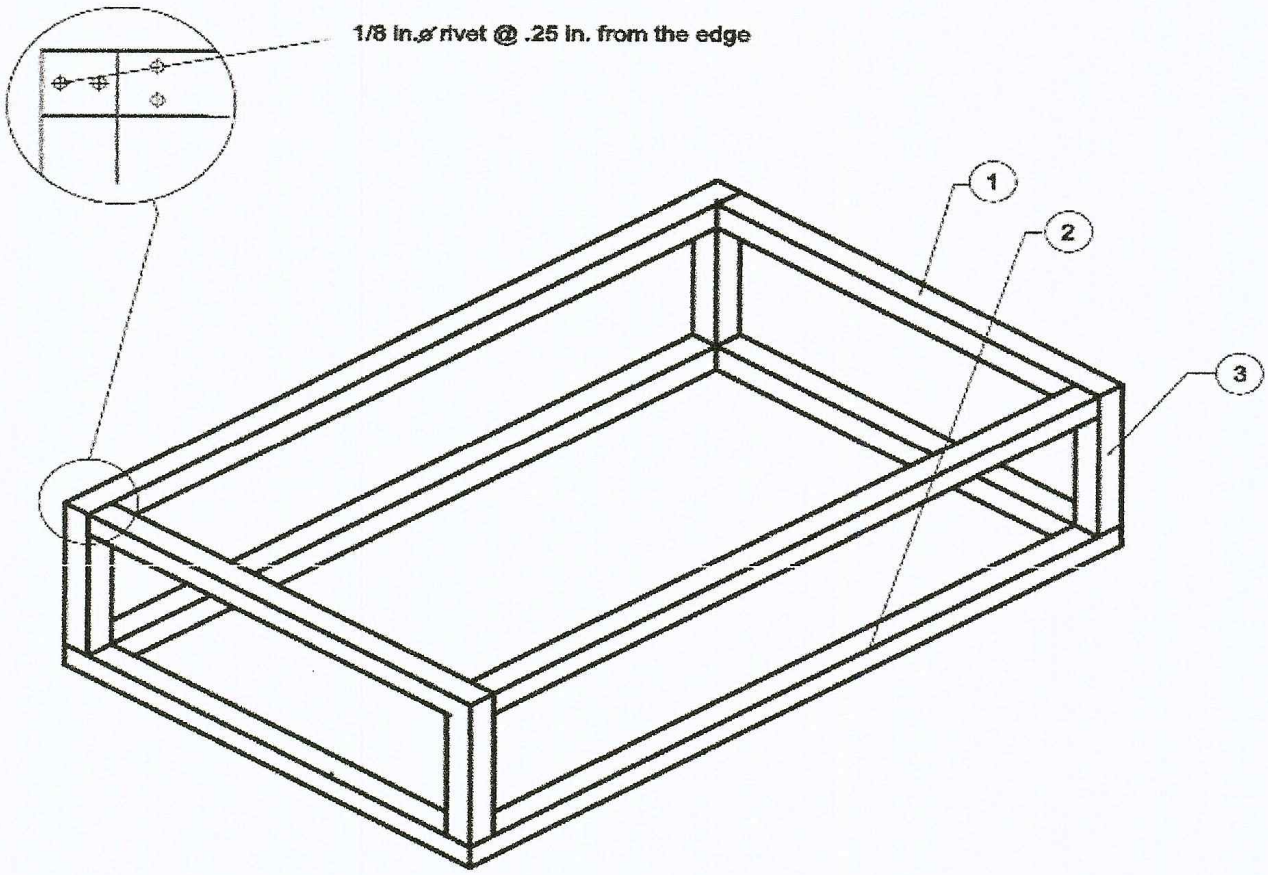
6) Then attached the following aluminum cut bars as shown in figure 2 to form its main frame for exposure box.

7) Attached the aluminum sheet in (4) under the main frame as the base for light fixtures.

   Drill two hole on each side of aluminum cut bars using 4mm diameter drill bit.

8) Completing the assembly of main frame using riveter measuring 1/8in. diameter as jointer of assembly using aluminum cut bars in (5).

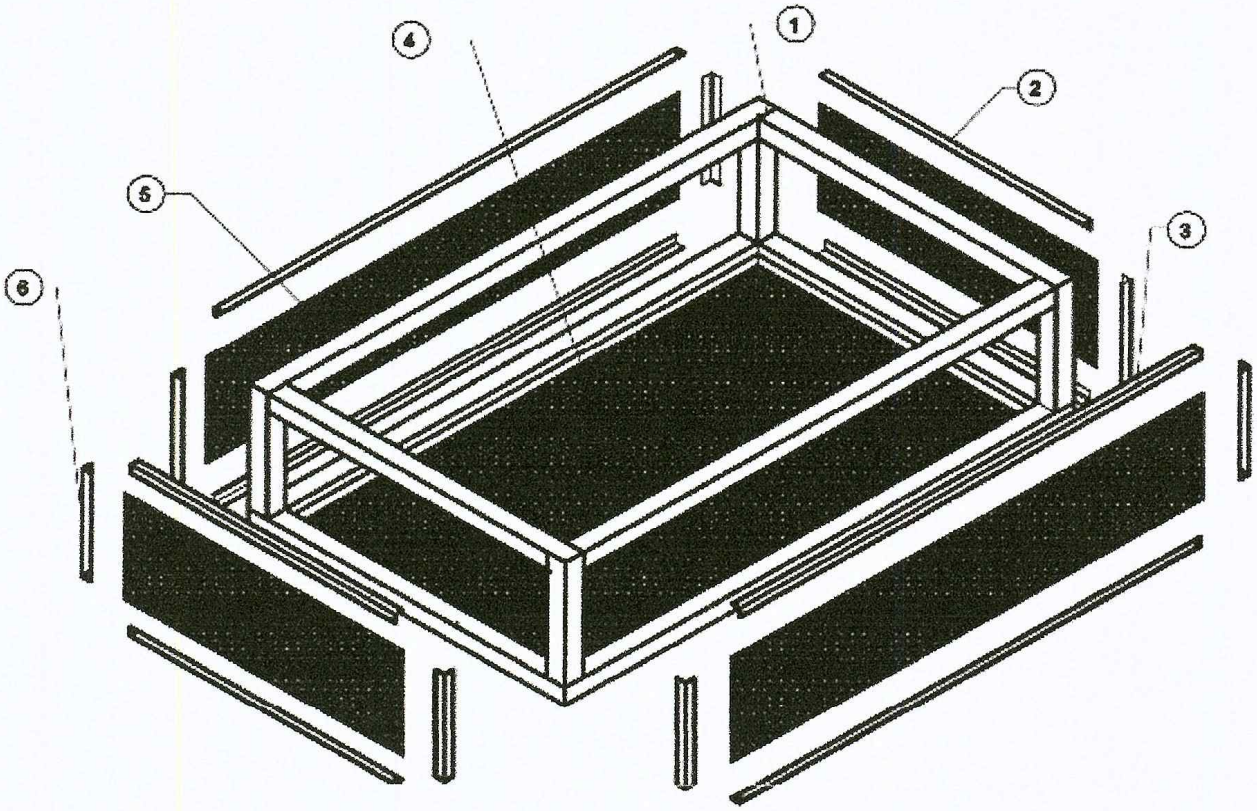
9) Attached side cover (Plate) from front, right side, left side and back using aluminum stucco sheet as shown in the exploded view in figure (3) using silicon adhesive and ½ x ½ aluminum angle bars.



LEGEND:

1. Aluminum square bar 1in. x 1in. x 20 inches
2. Aluminum square bar 1in. x 1in. x 32 inches
3. Aluminum square bar 1in. x 1in. x 7 inches

Figure 7 Main Frame Assembly of Exposure Box Unit



LEGEND:

1. Main Frame Assembly
2. Aluminum angle bar, 1/2in. x 1/2in. x 18 inches
3. Aluminum angle bar, 1/2in. x 1/2in. x 30 inches
4. BASE Aluminum sheet, .02in. x 30in. x 18 inches
5. Aluminum sheet, .02in. x 30in. x 8inches
6. Aluminum angle bar, 1/2in. x 1/2in. x 8 inches

Figure 8 Exploded view cover and main frame assembly

Transparency Plane Assembly

a) Read and interpret the working drawing transparency plane assembly as shown in figure 4.

b) Prepare ¼ inch thick glass measuring 20 inches x 32inches in rectangular form for direct contact of dried emulsion to be exposed.

c) Cut ½ inch x ½ inch of aluminum angle bar measuring 32 inches (1pc) to be place on the length of the glass and cut another aluminum angle bar measuring 20 inches (2pcs) to be attached on the width of the custom cut glass using silicone adhesive.

d) From the aluminum angle bar attached on the custom cut glass on (c) attached 2 pcs aluminum square bar having dimension of 1 inch x 2 inches x 20 inches parallel to the width of custom glass panel on (c) and attached another (1pc) aluminum square bar measuring 1 inch x 2 inches x 32 inches to be attached parallel to the length of custom glass panel to serve as based frame of hinges for the

purpose of opening and closing of glass panel to be attached on the main frame of exposure box on figure 1.

e) Attached 3 pcs. hinge to main frame and transparency assembly using electric hand drill press making holes according to the number of existing slots on your available hinges to serve its purpose.

f) Then fixed the hinges using riveter and rivet measuring 1/8 inch, insert rivets on each holes then fasten it using riveter.

g) Then attached the Transparency assembly to the Main frame assembly as shown in figure 5.

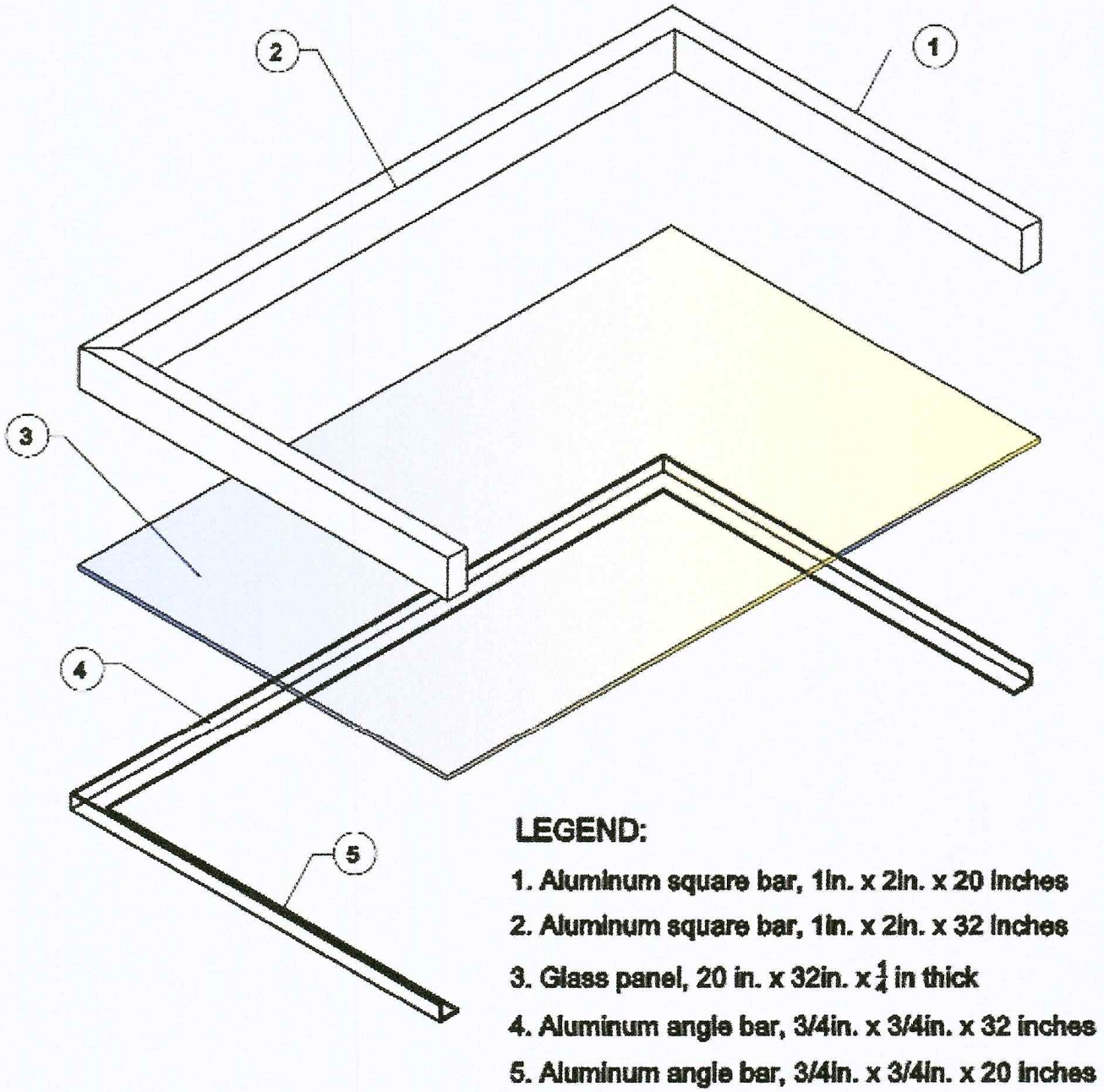


Figure 9 Exploded view transparency panel assembly

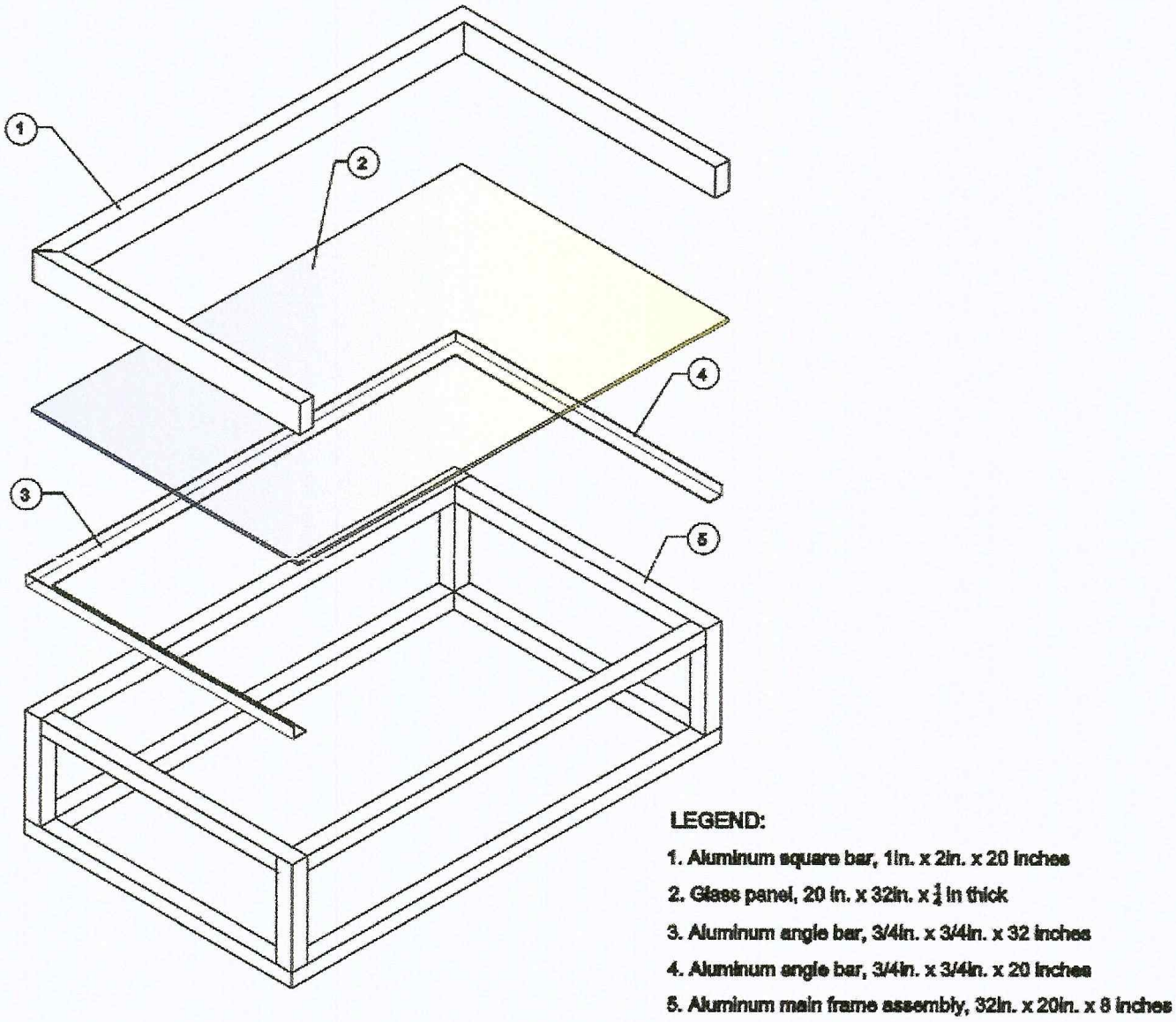


Figure 10 Exploded view of main frame and transparency panel assembly

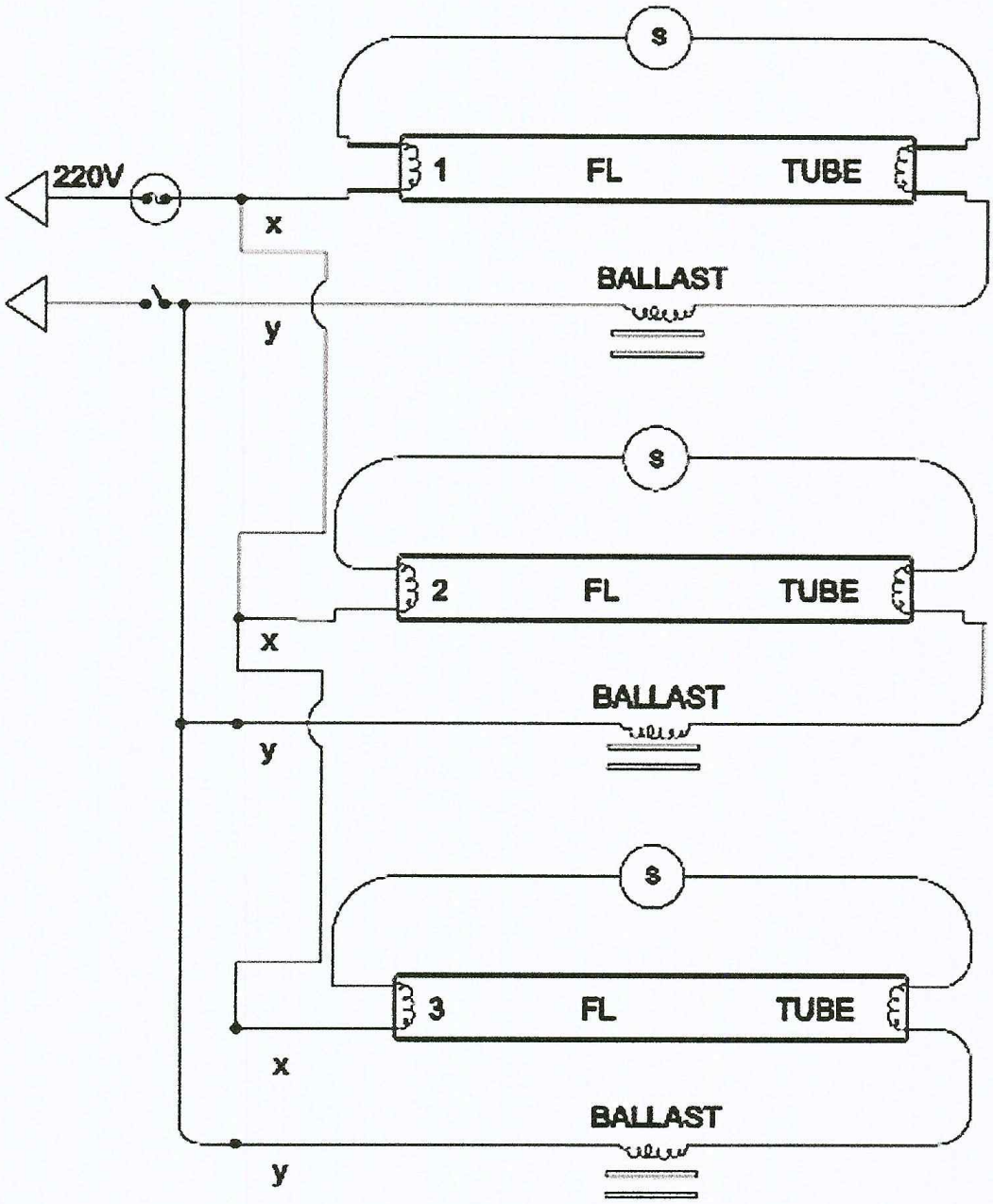


Figure 11 Schematic wiring diagram

Electrical System Assembly

a. Read and interpret the working drawing and diagram of the electrical system, refer to figure 6. for electrical details/-
b. Divide the base of exposure box on (2) from the center of its width having 18 inches, measure from the center 4.50 inches on both sides then marked it.(figure1)
c. Drill holes using electric hand drill press on (figure 1) for stabilizing the ballast from its marked position on (b).
d. Then from the center of the ballast measured half of the total length of the florescent light bulb for the preparation of attaching the florescent tube holder on both ends.
e. Drill holes according to the number of holes on the available tube holder on the locality.
f. Next is attaching the wire to the circuit, using # 20 stranded wire follow the working drawing and diagram on figure 5.
g. Lastly is attaching the other components like starter, fuse, switch and male plug as shown in figure 6 and table 2.

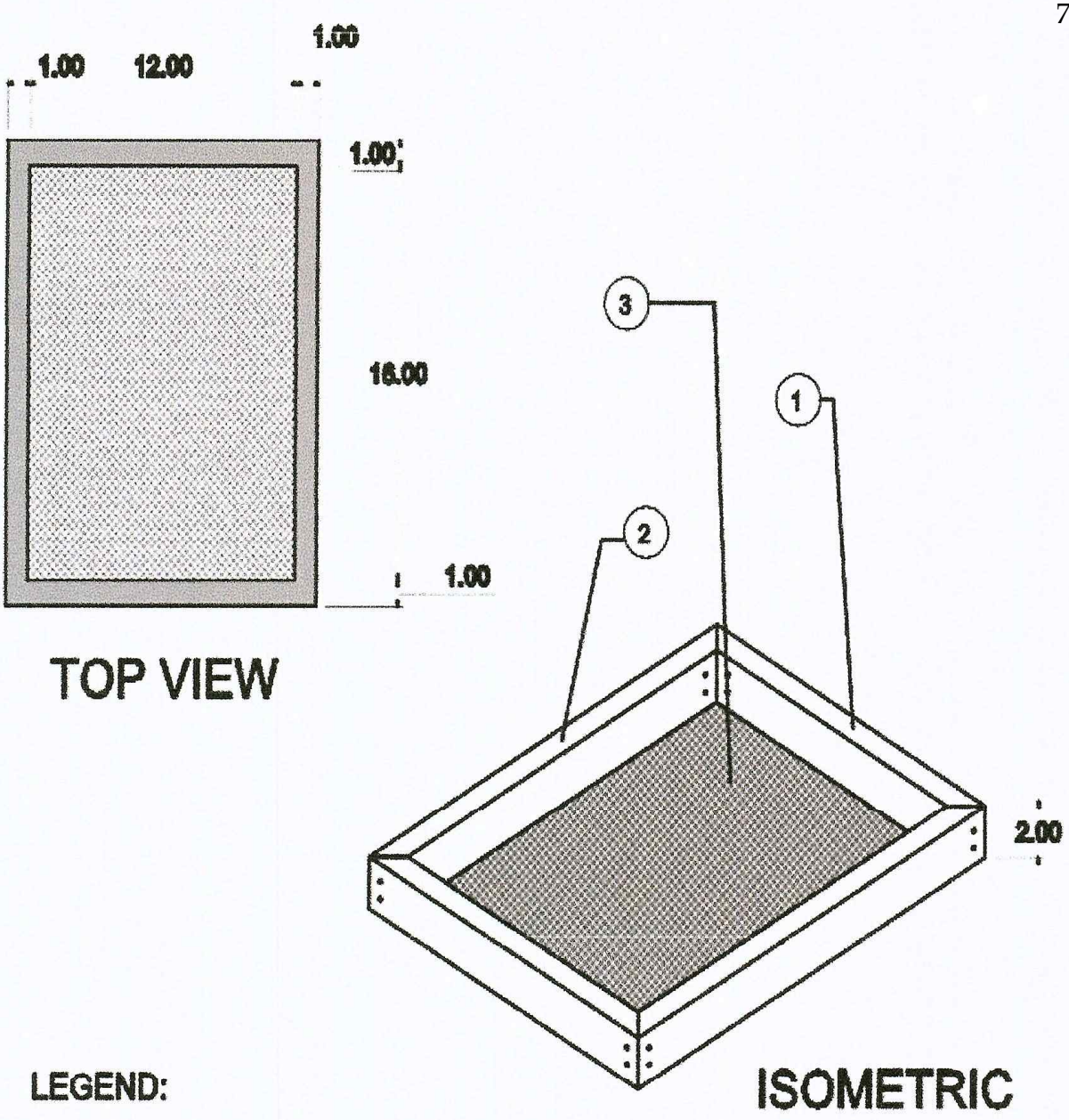


Figure 12 Aluminum Frame with Silkscreen Assembly

Aluminum Frame with Silkscreen Assembly

1. Read and interpret the working drawing of aluminum frame assembly with silkscreen refer to figure 7 for details.
2. Cut aluminum square bar measuring 2pcs 1 in. x 2 in. x18 inches and 2 pcs 1 in. x 2 in. x 14 inches for aluminum frame (figure 7).
3. Drill two holes with a distance of ½ in. from each end and 1in. distance between two holes.
4. Assemble it with rivets 1/8 in. diameter by using hand rivets.
5. Then cut 20 in. x 16 inches # 120 screen meshes.
6. Prepare the screen mesh for stretching preparation by pulling on opposite edges using clamp.
7. Then place the frame under the aluminum frame for attaching the silkscreen using contact cement the wait until dried.
8. Cut the excess silkscreen mesh on a frame using sharp cutter blade. See Figure 7.

4.Assembly of all Major Parts and Components

The parts were assembled in sequence as shown in figure 5 and 8.

Photographic Film Preparation

1. Use aluminum frame with dimension of 2 in. x 14 inches x 18 inches attached with # 120 silk screen meshes along diameter. (in figure 7)

2. Apply premixed sensitized emulsion (TULCO, Aqua-sol ER) using aluminum coater on stretched silkscreen on figure 7,
3. Coating of sensitized emulsion can be done on a dark room having a dim red light as illumination.
4. Thin coating of around 1mm to 1.5 mm thick sensitized emulsion should be apply on the screen to avoid bubbles formation.
5. Then blow dry it with a medium heat using hair dry blower or heat gun wait until the entire film coating becomes translucent to identify as well cure.
6. Keep the frame with photographic film in (5) a completely dark storage container or cabinet to avoid unwanted exposure before the actual testing

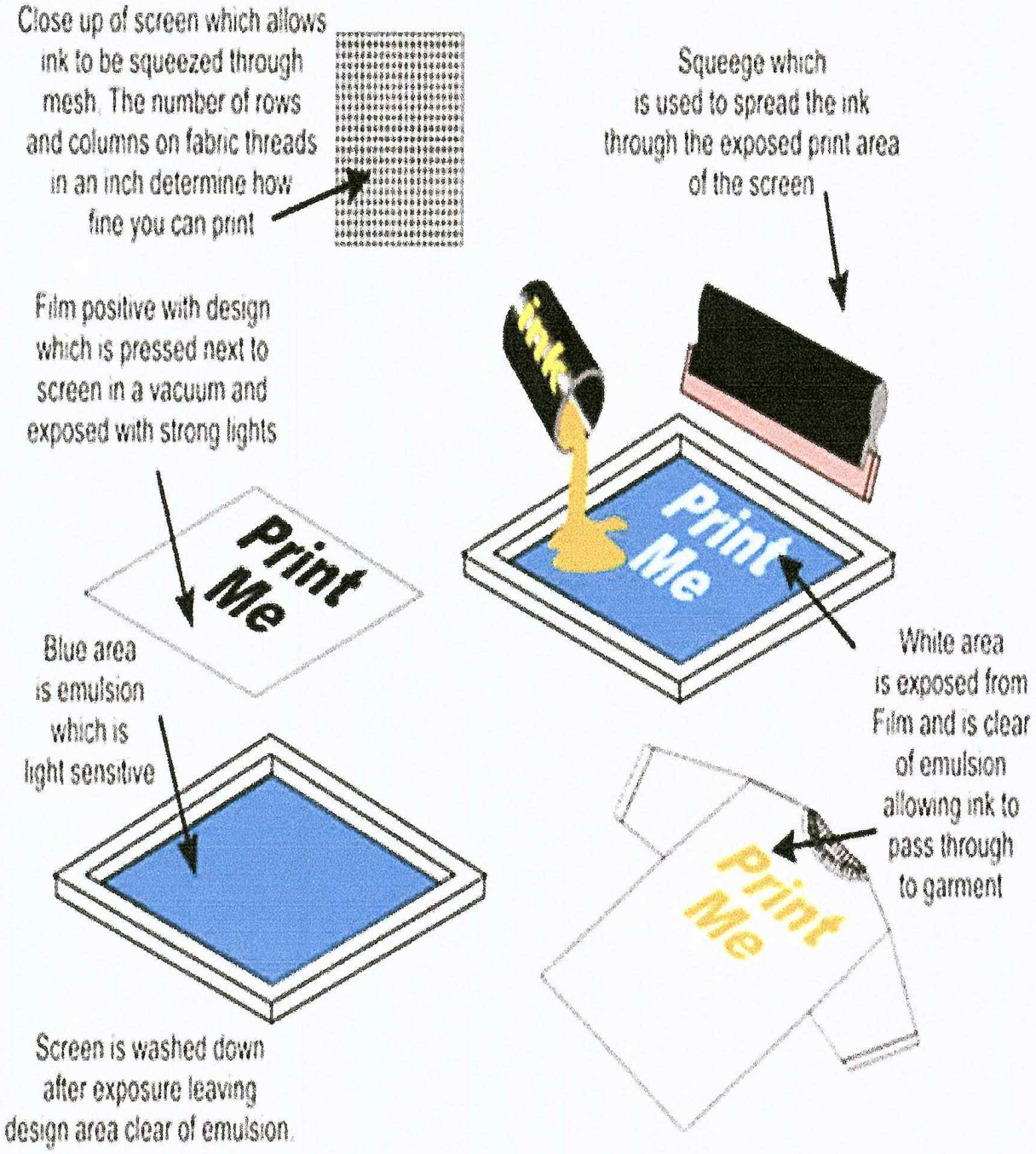


Figure 13 Process flow of textile printing

Design Transfer

1. Prepare the design pattern to be transfer on sensitized emulsion by making the image on a paper more translucent by applying a little amount of kerosene on the paper with printed pattern.
2. Put the desired pattern on the glass panel of exposure box unit on figure 8. On readable manner.
3. Place the dried sensitized emulsion on the top of the desired pattern on (b) in preparation of exposure.
4. Expose the sensitized photographic film on the desired time and kind of lights based on 1)table 3, 2)table 4, and 3) table 5.
5. Wedge step process can be used to divide the design pattern into several parts for specific time exposure.
6. After exposing to desired time and light source, image must undergo blasting for removing unwanted emulsion or the negative parts after exposing to light.
7. Drying of developed sensitized photo emulsion on (f) using heat gun or hair dry blower.
8. Applying photo hardener on (g) to set the developed photographic film.

Test print

1. Printing image on a plain fabric paper or paper using standard exposure time and curing time based on the result of this study.

Table 9
Experimentation

A. ULTRA VIOLET LAMP 20 watts at 8 inches distance from the light source.					
Emulsion (Aqua sol)	**No. of seconds**	**No. of lamps**	**No. of meshes #120**	**Screen exposure calculator (80 dots per cm)**	**Ranking of Output**
PREMIX (CONSISTENT MIXTURE	30	3	SILKSCREEN(#120 MESH)		
	60	3			
	90	3			
	120	3			
	150	3			
	180	3			
	210	3			
	240	3			
	270	3			
	300	3			
	330	3			
	360	3			
	390	3			
	410	3			

Table 10
Experimentation

B. FLORESCENT DAYLIGHT LAMP 20 watts at 8 inches distance from the light source.					
Emulsion (Aqua sol)	**No. of seconds**	**No. of lamps**	**No. of meshes #120**	**Screen exposure calculator (80 dots per cm)**	**Ranking of Output**
PREMIXED (CONSTANT MIXTURE)	30	3	SILK SCREEN, #120 MESH		
	60	3			
	90	3			
	120	3			
	150	3			
	180	3			
	210	3			
	240	3			
	270	3			
	300	3			
	330	3			
	360	3			
	390	3			
	410	3			

Table 11
Experimentation

C. FLORESCENT WARMLIGHT LAMP 20 watts at 8 inches distance from the light source.					
Emulsion (Aqua sol)	**No. of seconds**	**No. of lamps**	**No. of meshes #120**	**Screen exposure calculator (80 dots per cm)**	**Ranking of Output**
PREMIXED (CONSTANT MIXTURE)	30	3	SILK SCREEN, #120 MESH		
	60	3			
	90	3			
	120	3			
	150	3			
	180	3			
	210	3			
	240	3			
	270	3			
	300	3			
	330	3			
	360	3			
	390	3			
	410	3			

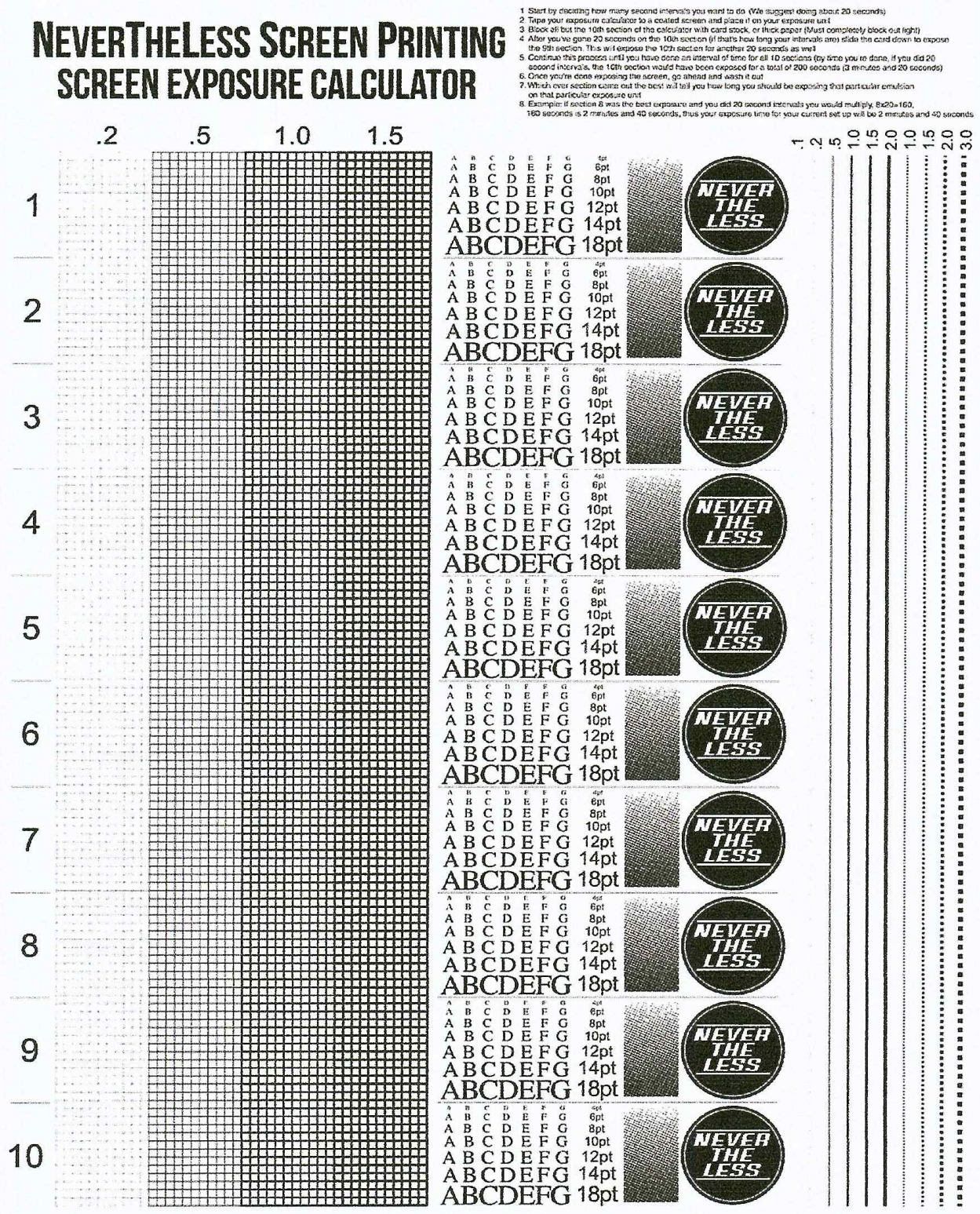


Figure 14 Screen Exposure Calculator

Analysis of Variance Table ANOVA ((quality print)

F-test one-way-analysis of variance

UV-light		Warm Light		Daylight	
4.8	23.04	4.6	21.16	4.3	18.49
4.75	22.56	4.5	20.25	4.15	17.22
4.85	23.52	4.45	19.80	3.38	14.82
4.9	24.01	4.65	21.62	4.15	17.22
4.9	24.01	4.55	20.70	4.10	16.81
$\sum x_1 = 24.2$ $n_1 = 5$ $\bar{x}_1 = 4.84$	$\sum x_1^2 = 117.14$	$\sum x_2 = 22.75$ $n_1 = 5$ $\bar{x}_2 = 4.55$	$\sum x_2^2 = 103.53$	$\sum x_3 = 20.55$ $n_1 = 5$ $\bar{x}_3 = 4.11$	$\sum x_3^2 = 84.56$

To get the F computed value, the following computation should be done. $CF \frac{(\sum x)^2}{n}$

$$CF = \frac{(\sum x_1 + \sum x_2 + \sum x_3)^2}{n_1 + n_2 + n_3} = \frac{(2.42 + 22.75 + 20.55)_2}{5 + 5 + 5} = \frac{(67.5)^2}{15} = 303.75$$

$$TSS = \sum x1^2 + \sum x2^2 + \sum x2^2 - CF$$

$$= 117.14 + 103.53 + 84.56 - 303.75$$

$$= 305.23 - 303.75$$

$$TSS = 1.48$$

$$BSS = \frac{(\sum x1)_2}{n_1} + \frac{(\sum x2)_2}{n_2} + \frac{(\sum x3)_2}{n_3} - 303.75$$

$$= \frac{(24.2)_2}{5} + \frac{(22.75)_2}{5} + \frac{(20.55)_2}{5} - 303.75$$

$$= 117.12 + 84.46 + 103.51 - 303.75$$

$$= 305.9 - 303.75$$

$$BSS = 1.34$$

$$WSS = TSS - BSS$$

$$= 1.48 - 1.34$$

$$WSS = 0.14$$

(A) UV-Light

(B) Warm Light

(C) Daylight

Scheffe's test Formula $F' = \dfrac{(\bar{x}1 - \bar{x}2)^2}{\dfrac{SW2\,(n1+n2)}{\overline{n1n2}}}$

Where:

F′ = Scheffe's test

$\bar{x}$ 1 = mean of group 1

$\bar{x}$ 1 = mean of group 2

$n1$ = number sample in group 1

$n2$ = number sample in group 2

$Sw2$= within mean squares

A vs. B

$$F' = \frac{(4.84 - 4.55)^2}{\dfrac{0.01\,(5+5)}{\overline{5(5)}}}$$

$$= \frac{0.0841}{\dfrac{0.1}{\overline{25}}}$$

$$= \frac{0.0841}{0.004}$$

F'= 21. 02

A vs. C

$$F' = \frac{(4.84 - 4.11)^2}{\dfrac{0.01\,(5+5)}{\overline{5(5)}}}$$

$$= \frac{0.5329}{\dfrac{0.1}{\overline{25}}}$$

$$= \frac{0.5329}{0.004}$$

$F' = 133.22$

B vs. C

$$F' = \frac{(4.55 - 4.11)^2}{\frac{0.01\ (5+5)}{5(5)}}$$

$$= \frac{0.1936}{\frac{0.1}{25}}$$

$$= \frac{0.1936}{0.004}$$

$F' = 48.4$

Figure 15 silkscreen stretching preparation

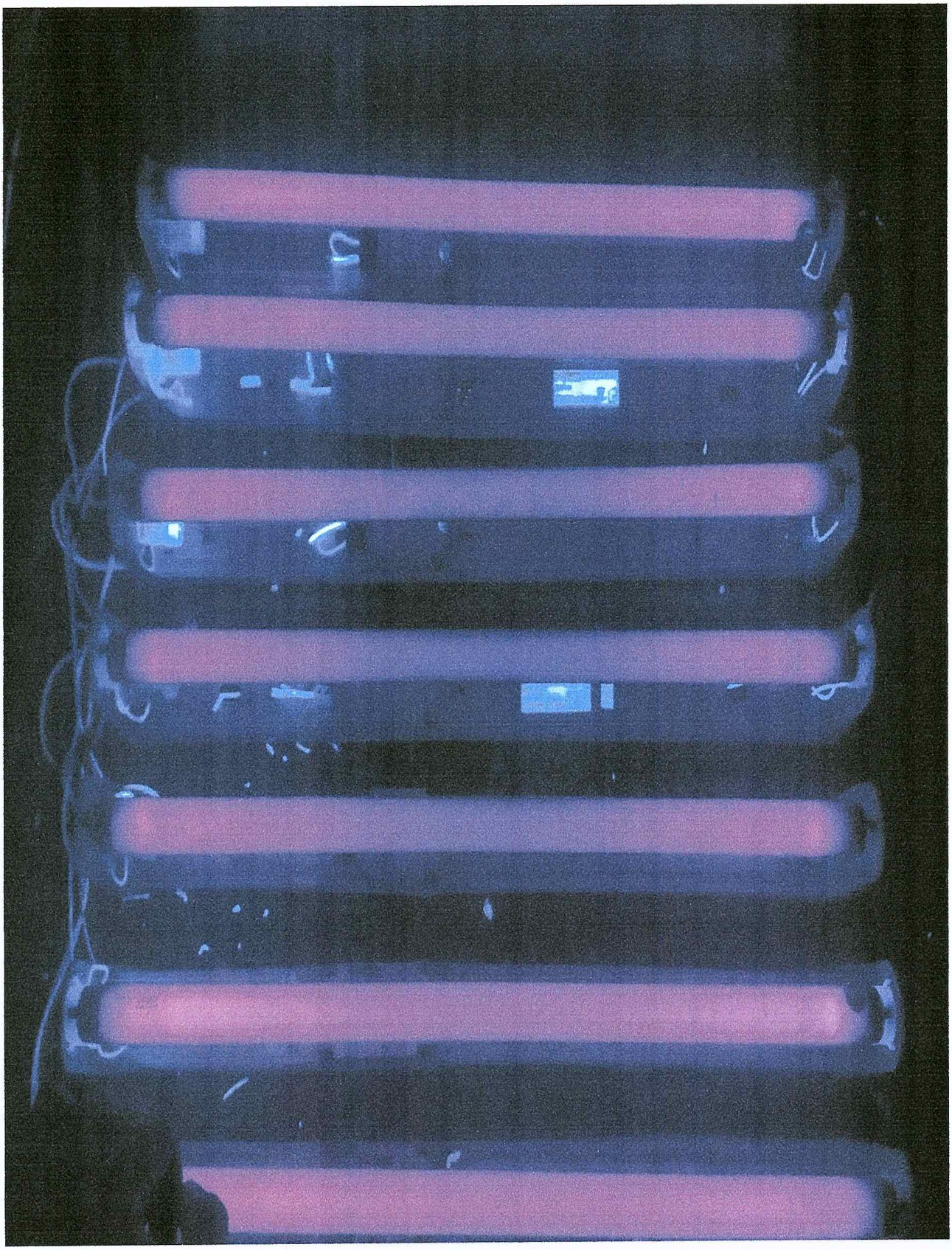


Figure 16 Exposure box Unit (UV- Light 140 watts)

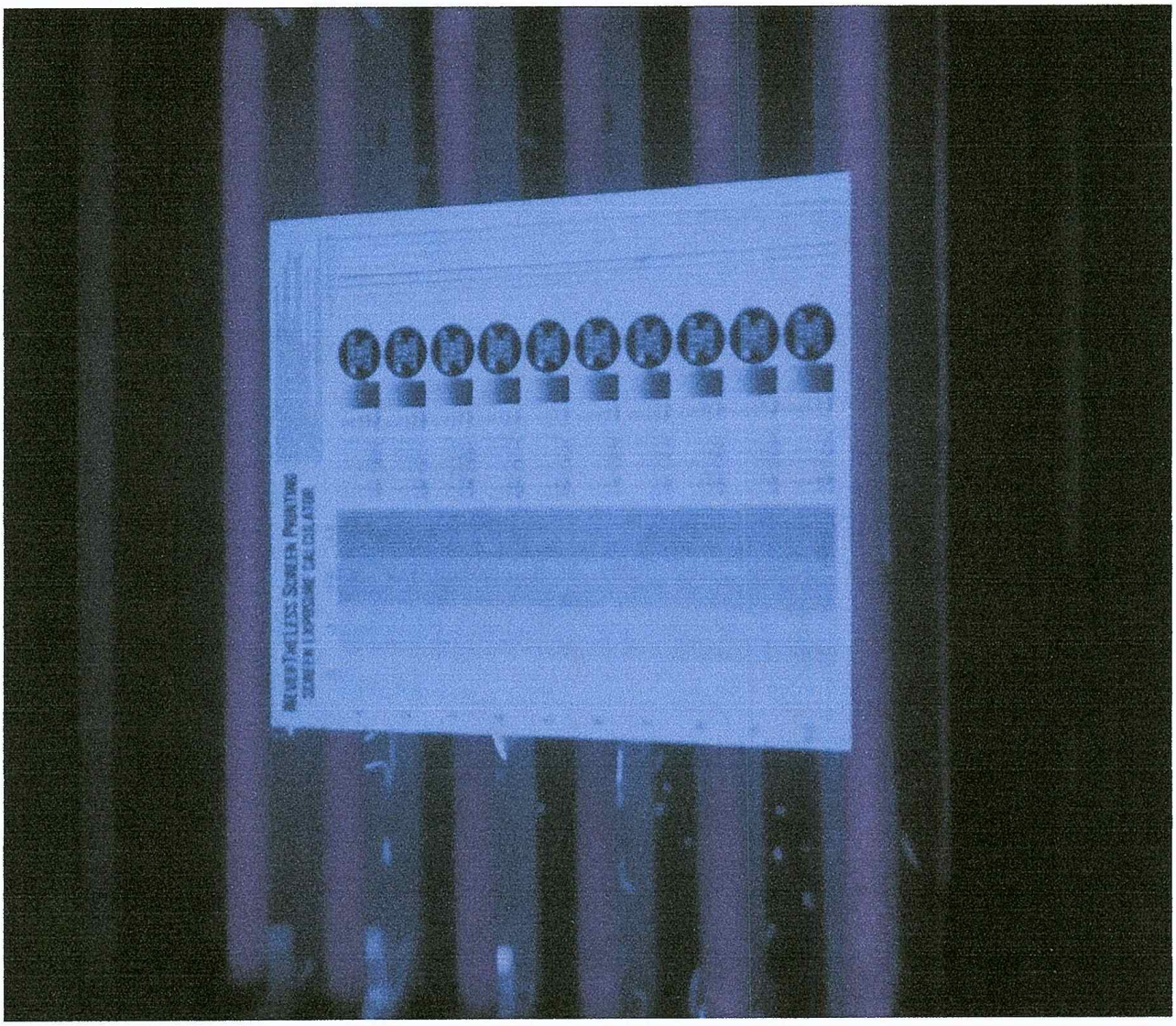


Figure 17 Actual exposure of sensitized emulsion

CURRICULUM VITAE

CURRICULUM VITAE

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LIST OF TABLES

Table **Page**

LIST OF FIGURES

Figure **Page**